

Table 1: Associations between Prior Year's Dispensary Counts and Yearly Opioid-Related Deaths, County-level

VARIABLES	(1) All opioid types	(2) Prescription opioids	(3) Heroin	(4) Synthetic non-methadone
Dispensary count, all types (ln)	-0.17**†† (-0.23 to -0.11)	-0.08**† (-0.13 to -0.03)	-0.08**† (-0.13 to -0.02)	-0.21**†† (-0.27 to -0.14)
Unemployment rate	0.02 (-0.01 to 0.04)	0.01 (-0.01 to 0.03)	-0.01 (-0.03 to 0.01)	0.00 (-0.02 to 0.02)
Average per capita income (ln)	0.20 (-0.17 to 0.57)	0.33* (0.03 to 0.63)	0.27 (-0.09 to 0.63)	0.49** (0.12 to 0.86)
GDP (ln)	-0.14* (-0.27 to -0.02)	-0.09* (-0.17 to -0.02)	-0.04 (-0.18 to 0.10)	-0.05 (-0.16 to 0.06)
Proportion white	0.86** (0.43 to 1.28)	0.50** (0.15 to 0.84)	-0.00 (-0.41 to 0.40)	0.78** (0.36 to 1.20)
Total population 21 and older (ln)	-0.21 (-0.53 to 0.12)	-0.30* (-0.55 to -0.06)	-0.18 (-0.47 to 0.11)	-0.05 (-0.33 to 0.24)
Proportion college educated	0.86 (-0.01 to 1.74)	0.16 (-0.57 to 0.90)	0.56 (-0.20 to 1.32)	0.67 (-0.13 to 1.46)
Proportion male	1.31 (-1.27 to 3.89)	1.67 (-0.56 to 3.90)	-0.98 (-2.91 to 0.94)	-1.38 (-3.61 to 0.84)
Population with disability (ln)	0.78** (0.47 to 1.09)	0.70** (0.46 to 0.94)	0.53** (0.28 to 0.78)	0.44** (0.17 to 0.71)
Naloxone access law	-0.21 (-0.48 to 0.05)	-0.29* (-0.53 to -0.05)	-0.07 (-0.26 to 0.12)	-0.16 (-0.38 to 0.06)
Pharmacist patient id. law	-0.39** (-0.53 to -0.26)	-0.28** (-0.40 to -0.17)	-0.18** (-0.31 to -0.06)	-0.29** (-0.45 to -0.13)
Pain management clinic oversight	-0.26** (-0.41 to -0.11)	0.01 (-0.13 to 0.14)	-0.47** (-0.62 to -0.33)	-0.00 (-0.15 to 0.14)
Recreational legal	-0.37** (-0.47 to -0.26)	-0.26** (-0.35 to -0.16)	-0.20** (-0.31 to -0.09)	-0.52** (-0.65 to -0.40)
Constant	-3.75 (-7.77 to 0.27)	-4.50** (-7.83 to -1.17)	-3.18 (-6.88 to 0.51)	-6.35** (-10.33 to -2.36)

NOTE: Robust CI in parentheses. ** p<0.01, * p<0.05. †† indicates significance at the 0.01 level and † at the 0.05 level from Romano and Wolf (2005) joint tests. Dispensary Count, all types estimated effect of log transformed county-level count of all storefront dispensaries (medical + recreational) from the prior year on log transformed yearly age-adjusted mortality rates for each type of opioid among individuals 21 years and older. Regression models specify random effects at the county level, with controls for county-level demographic and economic characteristics, yearly indicator variables, whether recreational sales were legally sanctioned, and several opioid-related laws in the state the county was located within. Models are estimated with robust standard errors on 812 counties in the 23 states with legal, operating storefront dispensaries by the end of 2017 and D.C.

Table 2: Associations between Prior Year's Medical and Recreational Dispensary Counts and Yearly Opioid-Related Deaths, County-level

VARIABLES	(1) All opioid types	(2) Prescription opioids	(3) Heroin	(4) Synthetic non-methadone
Medical dispensary count (ln)	-0.15**†† (-0.21 to -0.09)	-0.06* (-0.11 to -0.00)	-0.12**†† (-0.18 to -0.06)	-0.14**†† (-0.21 to -0.07)
Recreational dispensary count (ln)	-0.11**†† (-0.17 to -0.04)	-0.05 (-0.11 to 0.02)	0.03 (-0.03 to 0.10)	-0.21**†† (-0.29 to -0.13)
Unemployment rate	0.02 (-0.01 to 0.04)	0.01 (-0.01 to 0.03)	-0.01 (-0.03 to 0.01)	0.00 (-0.02 to 0.02)
Average per capita income (ln)	0.20 (-0.17 to 0.57)	0.33* (0.03 to 0.64)	0.26 (-0.10 to 0.63)	0.49** (0.12 to 0.86)
GDP (ln)	-0.15* (-0.27 to -0.02)	-0.09* (-0.17 to -0.02)	-0.03 (-0.18 to 0.11)	-0.06 (-0.16 to 0.05)
Proportion white	0.86** (0.44 to 1.29)	0.50** (0.16 to 0.84)	-0.04 (-0.45 to 0.37)	0.82** (0.41 to 1.24)
Total population 21 and older (ln)	-0.20 (-0.52 to 0.13)	-0.30* (-0.55 to -0.05)	-0.17 (-0.46 to 0.11)	-0.04 (-0.32 to 0.24)
Proportion college educated	0.86 (-0.01 to 1.74)	0.15 (-0.58 to 0.89)	0.56 (-0.21 to 1.32)	0.68 (-0.12 to 1.47)
Proportion male	1.27 (-1.31 to 3.86)	1.65 (-0.58 to 3.88)	-0.98 (-2.91 to 0.95)	-1.43 (-3.66 to 0.81)
Population with disability (ln)	0.77** (0.46 to 1.07)	0.70** (0.45 to 0.94)	0.52** (0.27 to 0.78)	0.43** (0.16 to 0.70)
Naloxone access law	-0.21 (-0.48 to 0.05)	-0.29* (-0.53 to -0.05)	-0.07 (-0.26 to 0.12)	-0.16 (-0.38 to 0.06)
Pharmacist patient id. law	-0.39** (-0.53 to -0.25)	-0.28** (-0.40 to -0.17)	-0.16* (-0.29 to -0.03)	-0.31** (-0.47 to -0.15)
Pain management clinic oversight	-0.25** (-0.40 to -0.11)	0.01 (-0.13 to 0.15)	-0.48** (-0.63 to -0.34)	0.02 (-0.13 to 0.17)
Recreational legal	-0.37** (-0.48 to -0.27)	-0.26** (-0.36 to -0.17)	-0.20** (-0.31 to -0.09)	-0.53** (-0.65 to -0.40)
Constant	-3.72 (-7.75 to 0.31)	-4.50** (-7.83 to -1.16)	-3.20 (-6.90 to 0.50)	-6.29** (-10.27 to -2.30)

NOTE: Robust CI in parentheses. ** p<0.01, * p<0.05. †† indicates significance at the 0.01 level and † at the 0.05 level from Romano and Wolf (2005) joint tests. Effects of log transformed county-level Medical and Recreational storefront dispensaries counts from prior year estimated simultaneously on log transformed yearly age-adjusted mortality rates for each type of opioid among individuals 21 years and older. Regression models specify random effects at the county level, with controls for county-level demographic and economic characteristics, yearly indicator variables, whether recreational sales were legally sanctioned, and several opioid-related laws in the state the county was located within. Models are estimated with robust standard errors on 812 counties in the 23 states with legal, operating storefront dispensaries by the end of 2017 and D.C.

Table 3: Associations between Prior Year's County-level Storefront Dispensary Counts and Yearly Opioid-Related Deaths, All Counties in U.S.

VARIABLES	(1) All opioid types	(2) Prescription opioids	(3) Heroin	(4) Synthetic non-methadone
Dispensary count, all types (ln)	-0.17**†† (-0.22 to -0.11)	-0.08**† (-0.13 to -0.03)	-0.05*† (-0.11 to -0.00)	-0.19**†† (-0.25 to -0.13)
Unemployment rate	0.04** (0.03 to 0.05)	0.02** (0.01 to 0.03)	0.03** (0.02 to 0.03)	0.02** (0.01 to 0.03)
Average per capita income (ln)	0.38** (0.15 to 0.60)	0.02 (-0.17 to 0.21)	0.74** (0.57 to 0.91)	0.67** (0.47 to 0.87)
GDP (ln)	-0.13** (-0.17 to -0.09)	-0.06** (-0.09 to -0.03)	-0.06** (-0.10 to -0.03)	-0.10** (-0.13 to -0.06)
Proportion white	1.27** (1.04 to 1.50)	1.03** (0.83 to 1.22)	0.38** (0.21 to 0.55)	0.82** (0.63 to 1.02)
Total population 21 and older (ln)	0.05 (-0.11 to 0.21)	-0.17* (-0.31 to -0.03)	0.28** (0.16 to 0.40)	0.09 (-0.04 to 0.23)
Proportion college educated	-0.20 (-0.72 to 0.31)	0.27 (-0.14 to 0.69)	-0.34 (-0.74 to 0.06)	-0.28 (-0.74 to 0.18)
Proportion male	0.38 (-0.90 to 1.65)	0.26 (-0.80 to 1.31)	-0.66 (-1.55 to 0.22)	-0.31 (-1.39 to 0.77)
Population with disability (ln)	0.55** (0.40 to 0.71)	0.56** (0.43 to 0.70)	0.08 (-0.04 to 0.19)	0.38** (0.25 to 0.51)
Naloxone access law	0.16** (0.08 to 0.25)	0.18** (0.11 to 0.25)	0.15** (0.09 to 0.21)	-0.08** (-0.14 to -0.02)
Pharmacist patient id. law	0.04 (-0.03 to 0.11)	0.08** (0.03 to 0.13)	-0.02 (-0.07 to 0.04)	-0.04 (-0.11 to 0.02)
Pain management clinic oversight	-0.03 (-0.09 to 0.04)	0.01 (-0.04 to 0.06)	-0.04 (-0.10 to 0.01)	0.06 (-0.01 to 0.12)
Recreational legal	0.04 (-0.05 to 0.13)	0.01 (-0.08 to 0.09)	0.06 (-0.02 to 0.15)	-0.14** (-0.24 to -0.05)
Constant	-7.10** (-9.40 to -4.79)	-2.57* (-4.55 to -0.59)	-9.54** (-11.25 to -7.84)	-9.32** (-11.35 to -7.29)

NOTE: Robust CI in parentheses. ** p<0.01, * p<0.05. †† indicates significance at the 0.01 level and † at the 0.05 level from Romano and Wolf (2005) joint tests. Effects of log transformed county-level storefront dispensary counts from prior year estimated on log transformed yearly age-adjusted mortality rates for each type of opioid among individuals 21 years and older. Regression models specify random effects at the county level, with controls for county-level demographic and economic characteristics, yearly indicator variables, whether recreational sales were legally sanctioned, and several opioid-related laws in the state the county was located within. Models are estimated with robust standard errors on 3,142 counties across the U.S.

Table 4: Associations between Prior Year's County-level Medical and Recreational Dispensary Counts and Yearly Opioid-Related Deaths, All Counties in U.S.

VARIABLES	(1) All opioid types	(2) Prescription opioids	(3) Heroin	(4) Synthetic non-methadone
Medical dispensary count (ln)	-0.18**†† (-0.24 to -0.11)	-0.09**† (-0.14 to -0.03)	-0.09**†† (-0.15 to -0.04)	-0.15**†† (-0.22 to -0.08)
Recreational dispensary count (ln)	-0.05 (-0.12 to 0.01)	-0.01 (-0.06 to 0.05)	0.04 (-0.02 to 0.10)	-0.16**†† (-0.24 to -0.09)
Unemployment rate	0.04** (0.03 to 0.05)	0.02** (0.01 to 0.03)	0.03** (0.02 to 0.03)	0.02** (0.01 to 0.03)
Average per capita income (ln)	0.38** (0.15 to 0.60)	0.02 (-0.17 to 0.21)	0.74** (0.57 to 0.91)	0.67** (0.46 to 0.87)
GDP (ln)	-0.13** (-0.17 to -0.09)	-0.06** (-0.09 to -0.03)	-0.06** (-0.10 to -0.03)	-0.10** (-0.14 to -0.06)
Proportion white	1.27** (1.04 to 1.50)	1.03** (0.83 to 1.22)	0.37** (0.20 to 0.54)	0.82** (0.63 to 1.02)
Total population 21 and older (ln)	0.05 (-0.11 to 0.21)	-0.17* (-0.30 to -0.03)	0.28** (0.17 to 0.40)	0.09 (-0.04 to 0.23)
Proportion college educated	-0.21 (-0.72 to 0.30)	0.27 (-0.15 to 0.68)	-0.35 (-0.75 to 0.06)	-0.27 (-0.73 to 0.19)
Proportion male	0.37 (-0.91 to 1.64)	0.25 (-0.80 to 1.30)	-0.67 (-1.56 to 0.22)	-0.32 (-1.40 to 0.76)
Population with disability (ln)	0.55** (0.40 to 0.70)	0.56** (0.43 to 0.69)	0.08 (-0.04 to 0.19)	0.38** (0.24 to 0.51)
Naloxone access law	0.17** (0.09 to 0.25)	0.18** (0.11 to 0.25)	0.15** (0.09 to 0.21)	-0.08* (-0.14 to -0.02)
Pharmacist patient id. law	0.04 (-0.02 to 0.11)	0.08** (0.03 to 0.14)	-0.01 (-0.07 to 0.04)	-0.05 (-0.11 to 0.02)
Pain management clinic oversight	-0.03 (-0.09 to 0.04)	0.01 (-0.04 to 0.06)	-0.05 (-0.10 to 0.01)	0.06 (-0.00 to 0.13)
Recreational legal	0.03 (-0.06 to 0.12)	-0.00 (-0.08 to 0.08)	0.06 (-0.02 to 0.14)	-0.15** (-0.24 to -0.05)
Constant	-7.09** (-9.40 to -4.79)	-2.58* (-4.56 to -0.59)	-9.57** (-11.28 to -7.86)	-9.27** (-11.30 to -7.24)

NOTE: Robust CI in parentheses. ** p<0.01, * p<0.05. †† indicates significance at the 0.01 level and † at the 0.05 level from Romano and Wolf (2005) joint tests. Effects of log transformed county-level Medical and Recreational storefront dispensary counts from prior year estimated simultaneously on log transformed yearly age-adjusted mortality rates for each type of opioid among individuals 21 years and older. Regression models specify random effects at the county level, with controls for county-level demographic and economic characteristics, yearly indicator variables, whether recreational sales were legally sanctioned, and several opioid-related laws in the state the county was located within. Models are estimated using robust standard errors on 3,142 counties across the U.S.

Table 5: Associations Between of Current Year's Storefront Dispensary Counts and Yearly Opioid-Related Deaths, County-level

VARIABLES	(1) All opioid types	(2) Prescription opioids	(3) Heroin	(4) Synthetic non-methadone
Dispensary count, all types (ln)	-0.16**†† (-0.22 to -0.11)	-0.06*† (-0.11 to -0.01)	-0.10**†† (-0.16 to -0.04)	-0.20**†† (-0.26 to -0.14)
Unemployment rate	0.02 (-0.01 to 0.04)	0.01 (-0.01 to 0.03)	-0.01 (-0.03 to 0.01)	0.00 (-0.02 to 0.02)
Average per capita income (ln)	0.17 (-0.20 to 0.55)	0.33* (0.03 to 0.63)	0.24 (-0.12 to 0.61)	0.46* (0.09 to 0.83)
GDP (ln)	-0.14* (-0.27 to -0.02)	-0.09* (-0.17 to -0.02)	-0.04 (-0.18 to 0.11)	-0.05 (-0.16 to 0.06)
Proportion white	0.87** (0.44 to 1.29)	0.50** (0.15 to 0.84)	0.01 (-0.40 to 0.42)	0.79** (0.37 to 1.21)
Total population 21 and older (ln)	-0.21 (-0.53 to 0.12)	-0.30* (-0.55 to -0.06)	-0.18 (-0.47 to 0.11)	-0.05 (-0.34 to 0.23)
Proportion college educated	0.93* (0.05 to 1.81)	0.17 (-0.57 to 0.91)	0.63 (-0.14 to 1.39)	0.75 (-0.05 to 1.55)
Proportion male	1.23 (-1.35 to 3.81)	1.62 (-0.61 to 3.85)	-0.97 (-2.88 to 0.95)	-1.46 (-3.68 to 0.77)
Population with disability (ln)	0.79** (0.48 to 1.09)	0.70** (0.46 to 0.94)	0.54** (0.28 to 0.79)	0.45** (0.18 to 0.72)
Naloxone access law	-0.21 (-0.48 to 0.05)	-0.29* (-0.53 to -0.05)	-0.07 (-0.26 to 0.12)	-0.15 (-0.38 to 0.07)
Pharmacist patient id. law	-0.40** (-0.54 to -0.26)	-0.28** (-0.40 to -0.17)	-0.20** (-0.32 to -0.07)	-0.30** (-0.46 to -0.15)
Pain management clinic oversight	-0.26** (-0.41 to -0.11)	0.01 (-0.13 to 0.15)	-0.48** (-0.63 to -0.34)	-0.00 (-0.15 to 0.14)
Recreational legal	-0.34** (-0.45 to -0.23)	-0.25** (-0.35 to -0.15)	-0.17** (-0.28 to -0.07)	-0.50** (-0.62 to -0.37)
Constant	-3.55 (-7.59 to 0.49)	-4.44** (-7.78 to -1.09)	-3.04 (-6.74 to 0.66)	-6.11** (-10.10 to -2.12)

NOTE: Robust CI in parentheses. ** p<0.01, * p<0.05. †† indicates significance at the 0.01 level and † at the 0.05 level from Romano and Wolf (2005) joint tests. Effects of log transformed county-level storefront dispensary counts from current year estimated on log transformed yearly age-adjusted mortality rates for each type of opioid among individuals 21 years and older. Regression models specify random effects at the county level, with controls for county-level demographic and economic characteristics, yearly indicator variables, whether recreational sales were legally sanctioned, and several opioid-related laws in the state the county was located within. Models are estimated using robust standard errors on 812 counties in the 23 states with legal, operating storefront dispensaries by the end of 2017 and D.C.

Table 6: Associations Between of Current Year's Medical and Recreational Dispensary Counts and Yearly Opioid-Related Deaths, County-level

VARIABLES	(1) All opioid types	(2) Prescription opioids	(3) Heroin	(4) Synthetic non-methadone
Medical dispensary count (ln)	-0.11**†† (-0.17 to -0.05)	-0.04 (-0.10 to 0.01)	-0.11**†† (-0.17 to -0.05)	-0.08* (-0.15 to -0.01)
Recreational dispensary count (ln)	-0.13**†† (-0.19 to -0.07)	-0.04 (-0.09 to 0.01)	-0.02 (-0.07 to 0.03)	-0.23**†† (-0.30 to -0.16)
Unemployment rate	0.01 (-0.01 to 0.04)	0.01 (-0.01 to 0.03)	-0.01 (-0.03 to 0.01)	0.00 (-0.02 to 0.02)
Average per capita income (ln)	0.19 (-0.18 to 0.56)	0.33* (0.03 to 0.64)	0.24 (-0.12 to 0.60)	0.49** (0.12 to 0.86)
GDP (ln)	-0.15* (-0.27 to -0.02)	-0.10* (-0.17 to -0.02)	-0.03 (-0.17 to 0.11)	-0.06 (-0.17 to 0.05)
Proportion white	0.88** (0.45 to 1.31)	0.50** (0.16 to 0.84)	-0.01 (-0.42 to 0.40)	0.85** (0.43 to 1.26)
Total population 21 and older (ln)	-0.20 (-0.52 to 0.13)	-0.30* (-0.55 to -0.05)	-0.17 (-0.46 to 0.12)	-0.04 (-0.33 to 0.24)
Proportion college educated	0.90* (0.02 to 1.78)	0.16 (-0.58 to 0.90)	0.62 (-0.14 to 1.39)	0.69 (-0.10 to 1.49)
Proportion male	1.20 (-1.39 to 3.78)	1.60 (-0.63 to 3.83)	-1.00 (-2.92 to 0.92)	-1.48 (-3.71 to 0.75)
Population with disability (ln)	0.77** (0.46 to 1.08)	0.69** (0.45 to 0.94)	0.52** (0.27 to 0.78)	0.44** (0.17 to 0.71)
Naloxone access law	-0.21 (-0.48 to 0.05)	-0.29* (-0.53 to -0.05)	-0.07 (-0.27 to 0.12)	-0.15 (-0.37 to 0.07)
Pharmacist patient id. law	-0.40** (-0.54 to -0.26)	-0.28** (-0.40 to -0.17)	-0.18** (-0.30 to -0.05)	-0.33** (-0.49 to -0.17)
Pain management clinic oversight	-0.24** (-0.39 to -0.10)	0.02 (-0.12 to 0.15)	-0.48** (-0.63 to -0.34)	0.03 (-0.12 to 0.18)
Recreational legal	-0.35** (-0.46 to -0.23)	-0.26** (-0.36 to -0.16)	-0.18** (-0.29 to -0.07)	-0.49** (-0.62 to -0.36)
Constant	-3.58 (-7.62 to 0.46)	-4.45** (-7.80 to -1.11)	-3.01 (-6.72 to 0.69)	-6.25** (-10.21 to -2.28)
Observations	3,248	3,248	3,248	3,248
Number of dispensary_fips	812	812	812	812

NOTE: Robust CI in parentheses. ** p<0.01, * p<0.05. †† indicates significance at the 0.01 level and † at the 0.05 level from Romano and Wolf (2005) joint tests. Effects of log transformed county-level medical and recreational storefront dispensary counts from current year estimated simultaneously on log transformed yearly age-adjusted mortality rates for each type of opioid among individuals 21 years and older. Regression models specify random effects at the county level, with controls for county-level demographic and economic characteristics, yearly indicator variables, whether recreational sales were legally sanctioned, and several opioid-related laws in the state the county was located within. Models are estimated using robust standard errors on 812 counties in the 23 states with legal operating storefront dispensaries by the end of 2017 and D.C.