**Supplemental Appendix for:**

**Increases in pharmacy and community distributed naloxone and the role in the opioid overdose epidemic in Massachusetts, Rhode Island, and New York City**

**Supplemental Table 1: Reverse regression of naloxone distribution (kits per 100,000 persons) as a function of mortality (fatal opioid-related overdose per 100,000 persons)**

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| --- | --- | --- |
|  | Coefficient  | 95% CI |
| Same quarter fatal overdose rate | 5.609 | (0.691-10.528) |
| Prior quarter total naloxone distribution | 0.551 | (0.451-0.651) |
| Linear time trend | 7.064 | (0.987-13.140) |
| *ACS time-varying ZIP-level characteristics*  |  |  |
| Proportion female | -307.9779 | (-968.798-352.842) |
| Proportion young adult <25 | -286.0404 | (-907.451-335.370) |
| Proportion non-white | -40.2374 | (-155.046-74.571) |
| Proportion Hispanic  | -378.2043 | (-866.350-109.942) |
| Proportion with public insurance | 77.4132 | (-42.079-196.906) |
| Proportion uninsured | -290.9972 | (-678.880-96.885) |
| Proportion of households < $25,000/year | -0.000321 | (-0.001-0.000) |

**Supplemental Table 2: Incorporating a lag structure for assessing the association between naloxone distribution and opioid overdose mortality.**

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| --- | --- | --- | --- |
|  | Combined lag only model | Stratified lag only model | Combined lag and change model |
|   | Coefficient  | 95% CI | Coefficient  | 95% CI | Coefficient  | 95% CI |
| Prior quarter mortality | -0.0007 | (-0.1363, 0.1350) | -0.0029 | (-0.1391, 0.1333) | -0.0031 | (-0.1390, 0.1327) |
| Same quarter total naloxone distribution  | 0.0042 | (0.0007, 0.0078) | - | - | 0.0050 | (0.0011, 0.0090) |
| Lag 1 total distribution | 0.0013 | (-0.0027, 0.0053) | - | - | 0.0005 | (-0.0038, 0.0049) |
| Lag 2 total distribution | 0.0002 | (-0.0036, 0.0039) | - | - | 0.0002 | (-0.0036, 0.0040) |
| Same quarter pharmacy naloxone distribution  | - | - | 0.0021 | (-0.0067, 0.0109) | - | - |
| Lag 1 pharmacy distribution | - | - | 0.0028 | (-0.0067, 0.0124) | - | - |
| Lag 2 pharmacy distribution | - | - | 0.0050 | (-0.0048, 0.0147) | - | - |
| Same quarter community naloxone distribution  | - | - | 0.0047 | (0.0007, 0.0087) | - | - |
| Lag 1 community distribution | - | - | 0.0009 | (-0.0038, 0.0057) | - | - |
| Lag 2 community distribution | - | - | -0.0008 | (-0.0050, 0.0035) | - | - |
| Change in distribution from prior quarter | - | - | - | - | -0.0039 | (-0.0125, 0.0047) |
| Linear time trend | -0.1258 | (-0.2900, 0.0385) | -0.1341 | (-0.2988, 0.0305) | -0.1273 | (-0.2916, 0.0371) |
| *ACS time-varying ZIP-level characteristics per 10 percentage point increase in proportion* |
| Proportion female | 23.1651 | (4.8844, 41.4458) | 19.4152 | (0.4224, 38.408) | 22.7394 | (4.4255, 41.0532) |
| Proportion adult 25-64 | 10.0631 | (-5.4773, 25.603) | 11.4485 | (-5.3658, 28.262) | 9.0933 | (-6.6001, 24.7867) |
| Proportion non-white | -2.3067 | (-5.5091, 0.8956) | -2.6396 | (-5.9053, 0.6261) | -2.4948 | (-5.7252, 0.7357) |
| Proportion Hispanic  | 19.9009 | (6.5571, 33.2447) | 19.6060 | (5.9684, 33.243) | 20.3571 | (6.9690, 33.7452) |
| Proportion with public insurance | -1.8551 | (-5.2163, 1.5061) | -1.4006 | (-4.8115, 2.0103) | -1.7721 | (-5.1399, 1.5958) |
| Proportion uninsured | -0.7857 | (-11.891, 10.319) | 0.4467 | (-11.187, 12.080) | -1.0234 | (-12.146, 10.100) |
| Proportion of households < $25,000/year | 0.0000 | (0.0000, 0.0000) | 0.0000 | (0.0000, 0.0000) | 0.0000 | (0.0000, 0.0000) |

**Supplemental Table 3: Combined naloxone regression of mortality (fatal opioid-related overdose per 100,000 persons) as a function of combined pharmacy and community naloxone distribution.**

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|  | Coefficient  | 95% CI |
| Same quarter naloxone distribution  | 0.005 | (0.002-0.008) |
| Change in naloxone distribution from prior quarter | -0.001 | (-0.004-0.002) |
| Prior quarter mortality | -0.026 | (-0.156-0.105) |
| Linear time trend | -0.177 | (-0.337-0.018) |
| *ACS time-varying ZIP-level characteristics*  |  |  |
| Proportion female | 20.536 | (3.469-37.603) |
| Proportion young adult <25 | -6.662 | (-22.864-9.540) |
| Proportion non-white | -2.348 | (-5.338-0.641) |
| Proportion Hispanic  | 19.071 | (6.265-31.876) |
| Proportion with public insurance | -0.843 | (-3.978-2.291) |
| Proportion uninsured | -6.370 | (-16.575-3.835) |
| Proportion of households < $25,000/year | 0.000 | (0.000-0.000) |

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**Supplemental Figure 1: Graphing the quarter-over-quarter change of naloxone distribution (kits per 100,000 persons) and opioid-related overdoses per 100,000 persons**