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Examining the effects of COVID-19 on pharmacy dispensing of naloxone and syringes sales across Massachusetts and New Hampshire

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Title: Examining the effects of COVID-19 on pharmacy dispensing of naloxone and syringes sales across Massachusetts and New Hampshire**Authors:** Derek Bolivar, BS¹, Daniel Hartung, PharmD, MPH², Joseph Silcox, MA¹, Jeffrey Bratberg, PharmD, FAPhA³, Jesse Boggis, MPH⁴, Megan Rabin, BS⁵ and Traci C. Green, PhD, MSc¹¹Heller School for Social Policy & Management at Brandeis University, Waltham, MA, USA²Oregon State University College of Pharmacy, Corvallis, OR, USA³University of Rhode Island College of Pharmacy, Kingston, RI, USA⁴The Dartmouth Institute for Health Policy and Clinical Practice, Dartmouth College, Hanover, NH, USA⁵University of Pittsburgh School of Public Health, Pittsburgh, PA, USA**Disclosure Statement:** The authors report there are no competing interests to declare.**External Funding:** This work was supported by the National Institute of Health (NIH)/National Institute on Drug Abuse (NIDA) under grant R01 DA045745.

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Abstract

Background: COVID-19 lockdowns disrupted access to harm reduction supplies and services known to be effective in overdose prevention and contributed to a worsening of the opioid crisis. However, because pharmacies can provide naloxone and sell over-the-counter (OTC) sterile syringes, their continued operation throughout the pandemic potentially reinforced a public health role as a distribution hub for safer use supplies.

Objectives: The objective of this analysis was to examine patterns of naloxone and OTC syringe sale volume at 463 community pharmacies in two states with high overdose rates during the COVID-19 pandemic.

Methods: We analyzed weekly pharmacy-level dispensing data from January 5, 2020, to December 31, 2020, from one corporate community pharmacy chain in Massachusetts (n=415 pharmacies) and New Hampshire (n=48 pharmacies). Descriptive statistics and visualizations over the analytic period were generated as initial explorations of the outcome. Zero-inflated Poisson and negative binomial models were used to analyze distribution data along with county-level COVID-19 case rates and store-level COVID-19 testing location status during the same time. Interactions tested the effect of COVID-19 case rates on naloxone and OTC syringe sales.

Results: Pharmacies that reported selling non-prescription syringes and dispensing naloxone during the study period averaged 210.13 OTC syringes sold and 0.53 naloxone prescriptions per week. Pharmacies in communities that experienced greater COVID-19 case burden also exhibited higher naloxone dispensing and OTC syringe sales during this period. The odds of selling OTC syringes increased over time but naloxone dispensing remained constant over the pandemic year. Pharmacies hosting COVID-19 testing tended to have lower OTC syringe sales and naloxone provision than non-testing sites.

Conclusions: During the COVID-19 pandemic, pharmacies provided harm reduction services and dispensed lifesaving medications by quickly adapting to fulfill community needs without disrupting co-located services for COVID-19 response.

Key Words: COVID-19, Opioid Crisis, Pharmacy, Harm Reduction, Naloxone, Over the Counter (OTC) Syringes

Key Points:

Background

- Pharmacies could effectively address co-occurring public health crises without restricting services for patients impacted by either crisis by continually distributing naloxone and selling OTC syringes in tandem with COVID testing.

Findings

- 98% of the study pharmacies distributed naloxone or sold OTC syringes during 2020.
- Pharmacies were able to continue to distribute naloxone and sell OTC syringes while providing COVID testing, supporting rising community case rates, and adapting to COVID public health restrictions.
- Pharmacies that hosted onsite COVID-19 testing also exhibited lower naloxone dispensing and fewer OTC syringe sales.

Background

The drug overdose epidemic in the U.S. substantially worsened during COVID-19 as synthetic opioids including fentanyl, and fentanyl analogs continued to drive overdose rates which increased 15% from 2020 resulting in more than 107,000 reported overdose deaths between December 2020 to December 2021.^{1,2} The challenges of the opioid epidemic were further exacerbated by COVID-19-related state lockdowns, business restrictions, travel restrictions, diminished funding, and staff shortages which significantly restricted community health organizations' ability to provide harm reduction services including the distribution of the opioid antagonist naloxone, and over-the-counter syringe (OTC) programs to people who use drugs (PWUD).^{3,17} Studies have suggested a correlation between these co-occurring public health crises to a significant increase in opioid overdoses emphasizing the need to treat these issues simultaneously.^{3,4} Community pharmacies were uniquely positioned to respond to both the COVID-19 public health emergency (i.e., offer pharmacy-based testing, supply personal protective equipment, and administer COVID vaccines) and the opioid crisis.^{5,6}

Objective

Our objective was to characterize trends in community pharmacy-based provision of naloxone and OTC syringes during the COVID-19 pandemic in two states with a high overdose burden.

Methods

Study data derived from a community pharmacy chain participating in the Respond to Prevent (R2P) clinical trial and non-study pharmacy locations in Massachusetts (n=415) and New Hampshire (n=48) from January 5, 2020, to December 31, 2020. R2P was a pharmacy-based intervention centered around promoting naloxone access and OTC syringes sales at community pharmacies.⁷ Naloxone dispensed via pharmacist prescription or standing order and OTC syringes sales data provided by the study pharmacy chain were coupled with state health department reported county-level COVID-19 case rates to evaluate how the evolving pandemic affected access to these harm reduction supplies.^{8,9} Because many pharmacies also provided COVID-19 testing services, we also examined how pharmacy testing availability impacted the provision of naloxone and OTC syringes.

77 Descriptive statistics and visualizations over the analytic period were generated as initial explorations of the
78 outcome. In addition, zero inflated models were utilized to predict naloxone and OTC syringe distribution. Our
79 dependent variables were weekly measures of pharmacy-level naloxone prescriptions and OTC syringe sales as
80 count variables. Due to excessive counts of zeros in the dependent variables at the week level, zero inflated
81 models were utilized. In addition, a dispersion test indicated a zero inflated Poisson (ZIP) model for naloxone,
82 and a zero inflated negative binomial (ZINB) model for syringes best fit the data. Independent variables were
83 time in weeks (continuous), weekly county-level COVID-19 case rates per 100,000 people, state in which
84 pharmacy was located (Massachusetts was the reference group), and a dummy variable to indicate if the
85 pharmacy offered COVID-19 testing, which began as early as May 10th for some sites and as late as December
86 20th for others during the 2020 timeframe. A log function was utilized for time in week intervals, and weekly
87 COVID-19 case rates were included as time-varying fixed effects in the model. We included interactions in the
88 models to test for differences by time for all covariates.

89 **Results**

90 From January to December 2020, 453 (97.8%) of the pharmacies both dispensed naloxone or sold OTC syringes
91 in a given week (Table 1). On average, those pharmacies dispensed 0.51 naloxone prescriptions and sold 203
92 OTC syringes per week. 407 (90%) of the pharmacies were in Massachusetts, 46 (10%) of the pharmacies were
93 in New Hampshire (Table 1). Descriptive statistics highlighted the average weekly naloxone dispensing and
94 syringe sales remaining consistent throughout the study period yet pharmacies that offered COVID-19 testing
95 experienced a 14% increase in average weekly naloxone dispensing from the pre-testing period (January-April)
96 to the testing period (May-December) (Table 1, Figure 1).

97 *(Table 1)*

98 Results from the multivariable ZIP and ZINB models indicated that, if pharmacies were engaged in doing so
99 already, naloxone dispensing, and nonprescription syringe sales were higher for pharmacies in communities
100 with high rates of COVID-19 cases (Table 2). COVID-19 case burden was not associated with whether a

pharmacy engaged in these harm reduction activities over the study period. Models also indicated that pharmacies offering COVID-19 testing services were less likely to dispense naloxone and sell OTC syringes (i.e., logit models) and dispensed fewer naloxone kits and sold fewer syringes on average during 2020 (i.e., log models, Table 2). However, pharmacies that were selected to offer COVID-19 testing distributed less naloxone prior to offering COVID-19 testing (Figure 1). The state in which the pharmacy was located was associated with whether and how many syringes were sold at a pharmacy and how much naloxone was distributed during the study period. Specifically, New Hampshire exhibited lower odds of syringe sales and lower log counts of naloxone dispensing and syringe sales compared to Massachusetts sites. The two states did not differ in the odds of a pharmacy distributing any naloxone during this time (Table 2). Time was not significant in either of the ZIP model components for naloxone dispensing (i.e., no change over time). Time was positively associated with the log odds of selling syringes at all but negatively associated with the log counts of syringes sold (ZINB model, Table 2), though the effect (beta) of time was small. None of the interactions between covariates and time were significant in either model (see Appendix), thus only main effects were retained in the model.

(Table 2, Figure 1, Figure 2)

Discussion

Findings from our study indicate that community pharmacies continued to dispense the lifesaving overdose antidote naloxone and to sell OTC syringes throughout the first year of the pandemic, and even in communities with high COVID-19 case rates. During the study period our corporate partner and pharmacies participating in the R2P intervention did not note naloxone or syringes shortages. Our findings highlighted a significant spike in OTC syringes sales in pharmacies during March of 2020 which may have coincided with harm reduction services being closed or offering limited services during the initial COVID-19 state restrictions.¹⁷ Following the spike in initial stages of state restrictions, pharmacies were more likely to sell OTC syringes as the pandemic wore on, and naloxone continued to be provided at pre-pandemic rates. During COVID-19, there were immense personal and professional pressures placed on healthcare providers, including pharmacies. A study looking at sources of pharmacist burnout identified elevated prescription requests, utilization of drive-through windows,

126 the onset of COVID-19 testing, and COVID-19 and influenza vaccination drives as major contributors.¹⁰In

127 addition, COVID-19 changed pharmacy workflows significantly which led to a gross imbalance between the
128 supply and demand of drugs increasing the vulnerability of patients and their pharmaceutical needs¹¹.

129 Considering the enormous challenge of providing pharmacy care in the community and the hazardous work of
130 essential workers during this time, the fact that harm reduction supplies continued to be provided and even
131 exhibited some element of growth is profound. Pharmacy adaptations during COVID-19 may have resulted in
132 the removal or relocation of harm reduction signage and educational materials impacting customer awareness of
133 the availability of these supplies at the pharmacies.

134 We also found that pharmacies offering COVID-19 testing had lower naloxone distribution and OTC syringe
135 sales. There are several factors which may have contributed to these differences. The Centers for Disease
136 Control and Prevention (CDC) in 2020 recommended a series of modifications to pharmacy processes,
137 including encouraging staff with symptoms of COVID-19 to stay home, handwashing after any direct contact
138 with patients, frequent cleaning and disinfecting of workspaces, patient, and staff protocol changes to ensure
139 social distancing, COVID-19 symptom screening, and vaccine program administrations.¹² It is conceivable that
140 testing sites were preferentially selected in pharmacies that provided fewer ancillary public health services.
141 However, from this study alone it is not possible to determine the underlying mechanisms of how pharmacies
142 were selected to offer COVID-19 testing.

143 While aggregate findings of all pharmacies in the study reflect fluctuations in average weekly naloxone
144 dispensing and OTC syringe sales rates, pharmacies were able to continually provide access to both harm
145 reduction supplies during the study period regardless of whether COVID-19 retesting services were offered or
146 not. Pharmacy's ability to provide services that address co-occurring health crises are in part facilitated by
147 standing orders and legislation in both Massachusetts and New Hampshire which exist to improve provision of
148 naloxone to reduce overdoses. Massachusetts's most recent 2021 amendment to the initial 2018 standing order
149 allows any licensed pharmacist to offer naloxone to those at risk of an opioid overdose, while also mandating
150 naloxone stocking.^{13,14} Because we did not detect a reduction in naloxone dispensing during this unprecedented

151 period, study findings suggest that naloxone standing orders work in tandem with or without COVID-19 testing
152 services to maintain broad geographic access to naloxone for all populations. Pharmacies are the most
153 accessible health care providers and the first touchpoint of patient engagement within the health care system;
154 naloxone provision benefits from this unique position.¹⁵ In addition, laws in both states permit the
155 nonprescription sale of syringes in community pharmacies.¹² With these policies pharmacists are well-
156 positioned to continue efforts toward naloxone distribution and syringe sale by lessening harm reduction
157 workload on a singular pharmacy staff member, especially at stores that also offer COVID-19 related services.
158 New Hampshire's laws supporting naloxone access and permitting OTC syringe sales in pharmacies are more
159 recent, which may explain the observed state differences. Due to similarities in state insurance profiles results
160 were not impacted by insurance coverage. While naloxone is covered by insurance in both states, syringe access
161 could be enhanced by expanding insurance coverage to OTC syringes.¹⁶

162 These data suggest pharmacies are essential for providing harm reduction even during pandemic times.
163 Considering the enormous constraints on community syringe service programs throughout major United States
164 cities during the pandemic, wherein a recent study documented 43% decreased services and 25% had one or
165 more site closures, pharmacy access to harm reduction supplies can sustain needed access.¹⁷

166 Limitations of this study pertained to data availability which restricted our ability to explore additional
167 pharmacy elements that may have impacted the dispensing of the naloxone and syringes during the study
168 period. A significant study limitation included lack of pharmacy size with respect to the site-specific capacity of
169 pharmacy staff, which may have impacted pharmacy's ability to effectively integrate COVID-19 store
170 adaptations, address staffing shortages, and dispense harm reduction supplies. We controlled for pharmacy
171 capacity by including population rates which reflect the expected coverage of the pharmacy, since we lacked
172 weekly or monthly staffing records. In addition, dispensing data was aggregated at the individual pharmacy
173 level restricting our ability to determine whether the sale of naloxone or syringes was initiated by the customer
174 or pharmacy staff. Analyses to explore naloxone and syringe dispensing rates from years prior to the study

175 period were not included in the present work but such longitudinal research could be a worthwhile endeavor in
176 future studies.

177 **Conclusion**

178 The results from this study highlight the importance of community pharmacies providing harm reduction
179 services to combat the growing impacts of the opioid epidemic during COVID-19. With the continued
180 expansion of pharmacist scope of practice, the public will come to rely on community pharmacies as a primary
181 source of healthcare, including harm reduction services. In addition to continued provision of naloxone and
182 OTC syringes, pharmacists and staff can act as advocates for harm reduction efforts and educational resources
183 for patients and providers.¹⁸ Substance use disorder professionals indicate pharmacists have the capacity to
184 bridge the gap between healthcare providers and their patient population during the ongoing opioid crisis and
185 future public health emergencies. The unique healthcare challenges presented by co-occurring public health
186 crises demonstrate the valuable role that community pharmacies play in providing harm reduction resources.

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Table 1: Average weekly naloxone prescriptions dispensed and over the counter syringe sales during 2020 in all Massachusetts and New Hampshire from one community pharmacy business by COVID-19 testing status

Descriptive	Massachusetts (MA) N (%)			New Hampshire (NH) N (%)			Total N (% of the total N)
	Total Stores	415 (90%)			48 (10%)		
Dispensing Naloxone	407 (89.8%)			46 (10.2%)			453 (97.8%)
Selling Syringes	409 (89.5%)			48 (10.5%)			457 (98.7%)
Testing v. Non-Testing	Testing			Non-Testing			Total
	MA	NH	Total	MA	NH	Total	
N (%)	109 (26%)	26 (54%)	135 (30%)	306 (73%)	22 (46%)	328 (70%)	463
Avg. Weekly Naloxone Prescriptions Dispensed							
Pre-Testing Period (January-April 2020)	0.4012	0.1731	0.3539	0.5691	0.3052	0.5516	0.4938
Testing Period (May-December 2020)	0.4427	0.2374	0.4029	0.5759	0.2531	0.5559	0.5111
Year 2020	0.4285	0.2172	0.3875	0.5745	0.2697	0.5546	0.51
Avg. Weekly OTC Syringe Sales							
Pre-Testing Period (January- April 2020)	218.1	216.2	217.7	223	163.5	219	200.4
Testing Period (May - December 2020)	189.8	204.1	192.5	201.1	158	198.3	204.8
Year 2020	198.6	207.9	203.6	208	159.8	204.8	203

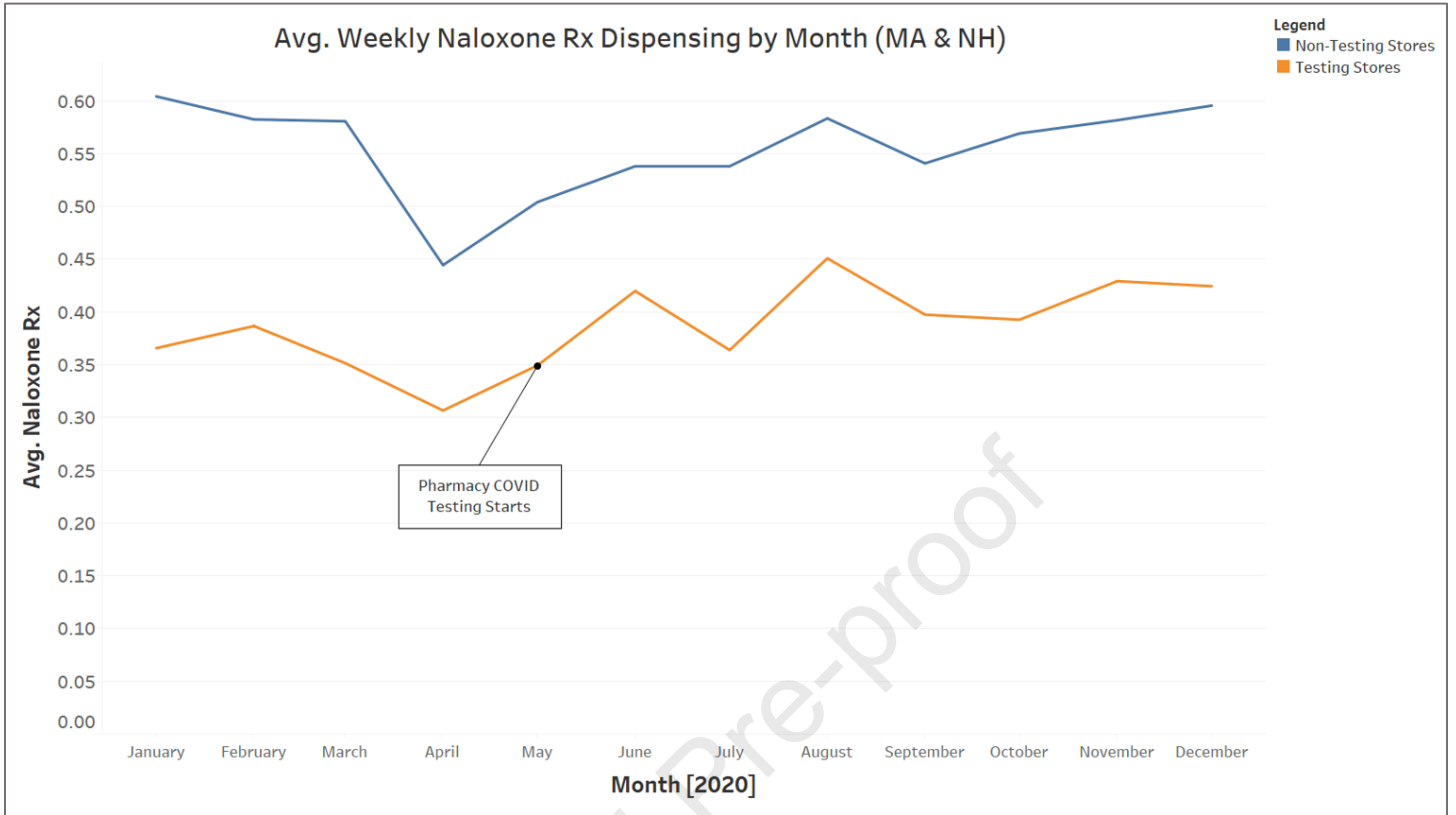
Table 2 Results from multivariable modelling of average weekly naloxone prescriptions dispensed and over the counter syringe sales from all Massachusetts and New Hampshire from one community pharmacy business

Model Output							
Zero Inflated Poisson Distribution				Zero Inflated Negative Binomial Distribution			
Naloxone				Syringes			
<i>Log</i>	β	SE	<i>p</i>	<i>Log</i>	β	SE	<i>p</i>
State (NH)	-0.672	0.081	$p < 0.001$	State (NH)	-0.096	0.023	$p < 0.001$
Testing (Yes)	-0.549	0.131	$p < 0.001$	Testing (Yes)	-0.104	0.04	0.04
Week	-0.019	0.018	0.30	Week	-0.029	0.009	0.03
New Cases per 100k	0.091	0.016	$p < 0.001$	New Cases per 100k	0.036	0.009	0.0003
				Log(theta)	0.239	0.01	$p < 0.001$
Constant	0.096	0.015	$p < 0.001$	Constant	5.69	0.008	$p < 0.001$
<i>Logit</i>	β	SE	<i>p</i>	<i>Logit</i>	β	SE	<i>p</i>
State (NH)	0.184	0.143	0.194	State (NH)	-0.033	0.036	$p < 0.001$
Testing (Yes)	-2.057	0.913	$p < 0.001$	Testing (Yes)	-0.644	0.102	$p < 0.001$
Week	-0.013	0.032	0.60	Week	0.135	0.019	$p < 0.001$
New Cases per 100k	-0.005	0.031	0.735	New Cases per 100k	-0.027	0.019	0.13
Constant	0.034	0.026	0.18	Constant	-0.824	0.0158	$p < 0.001$

SE=standard error

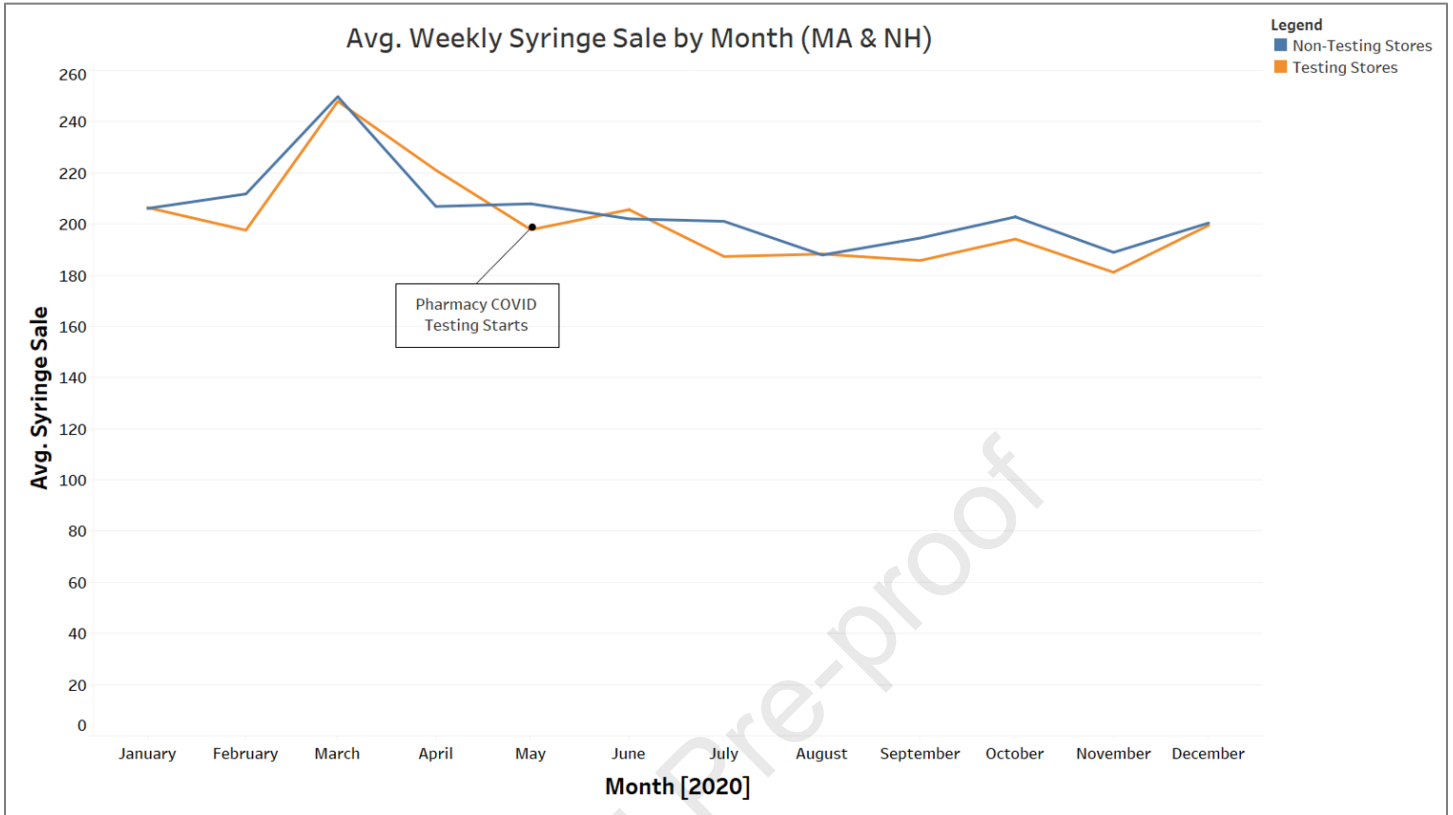
NH=New Hampshire

Figure 1 Average weekly naloxone prescriptions dispensed by month during 2020 in all Massachusetts and New Hampshire from one community pharmacy business by COVID-19 testing status



MA=Massachusetts, NH=New Hampshire, Rx=prescription

Figure 2 Average weekly over the counter syringe sales by month during 2020 in all Massachusetts and New Hampshire from one community pharmacy business by COVID-19 testing status



MA=Massachusetts, NH=New Hampshire

Supplemental Table 1: Results from multivariable modelling of average weekly naloxone prescriptions dispensed and over the counter syringe sales with interactions by store testing status from all Massachusetts and New Hampshire locations from one community pharmacy business

Model Output with Interaction							
Zero Inflated Poisson Distribution				Zero Inflated Negative Binomial Distribution			
Naloxone				Syringes			
<i>Log</i>	β	SE	<i>p</i>	<i>Log</i>	β	SE	<i>p</i>
State (NH)	-0.672	0.081	$p < 0.001$	State (NH)	-0.096	0.023	$p < 0.001$
Testing (Yes)	-0.549	0.131	$p < 0.001$	Testing (Yes)	-0.104	0.04	0.04
Week	-0.019	0.018	0.30	Week	-0.029	0.009	0.03
New Cases per 100k	0.091	0.016	$p < 0.001$	New Cases per 100k	0.036	0.009	0.0003
Testing*Week	-0.044	0.109	0.69	Testing*Week	-0.041	0.037	0.08
				Log(theta)	0.239	0.01	$p < 0.001$
Constant	0.096	0.015	$p < 0.001$	Constant	5.69	0.008	$p < 0.001$
<i>Logit</i>	β	SE	<i>p</i>	<i>Logit</i>	β	SE	<i>p</i>
State (NH)	0.184	0.143	0.194	State (NH)	-0.033	0.036	$p < 0.001$
Testing (Yes)	-2.057	0.913	$p < 0.001$	Testing (Yes)	-0.644	0.102	$p < 0.001$
Week	-0.013	0.032	0.60	Week	0.135	0.019	$p < 0.001$
New Cases per 100k	-0.005	0.031	0.735	New Cases per 100k	-0.027	0.019	0.13
Testing*Week	0.825	0.683	0.23	Testing*Week	0.107	0.091	0.08
Constant	0.034	0.026	0.18	Constant	-0.824	0.0158	$p < 0.001$

SE=standard error; NH=New Hampshire