Technical appendix

How USPS network changes threaten prescription drug access for vulnerable populations

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<u>Econometric Details for Mail Order Analysis</u>

The relationship between mail-order utilization and local pharmacy access is estimated using tract-level ordinary least squares (OLS) regression of the form:

$$MailOrderShare_i = \beta_0 + \beta_1 PharmaDist_i + \Gamma X_i + \varepsilon_i$$

for census-tract i in 2019. The outcome variable of interest, $MailOrderShare_i$, measures the percentage of prescriptions in a given tract that were filled by mail order in 2019. The key variable in this equation, $PharmaDist_i$, reflects the straight-line distance (in miles) from the centroid of each block to the nearest retail pharmacy, aggregated to the tract level using population weights. $\hat{\beta}_1$ captures how variation in the distance (in miles) to the nearest pharmacy correlates with the mail-order share, holding fixed observable characteristics X_i. All regressions are weighted by tract-level total prescription volume to account for heteroskedasticity arising from variation in tract size and prescribing intensity. Standard errors are also corrected to be robust to the most common form of heteroskedasticity.

Appendix Table 1

	All Asthma (1)	All Asthma (2)	Medicare Asthma (3)	Medicare Asthma (4)	All Diabetes (5)	All Diabetes (6)	Medicare Diabetes (7)	Medicare Diabetes (8)
Distance to Pharmacy (miles)	-0.027***	0.002	0.097***	0.118***	0.025	0.033**	0.184***	0.193***
	(0.007)	(0.009)	(0.022)	(0.024)	(0.016)	(0.016)	(0.036)	(0.037)
Rural		-0.412***		-0.469***		-0.283***		-0.447***
		(0.037)		(0.067)		(0.055)		(0.098)
Median HH Income ($1000s)		0.002***		-0.011***		-0.000		-0.017***
		(0.001)		(0.001)		(0.001)		(0.001)
Poverty Rate		0.003		-0.011*		-0.015***		-0.035***
		(0.004)		(0.006)		(0.006)		(0.008)
Unemployment Rate		-0.022**		-0.040***		-0.023*		-0.056***
		(0.009)		(0.014)		(0.012)		(0.018)
Uninsurance Rate		-0.054***		-0.057***		-0.086***		-0.092***
		(0.002)		(0.003)		(0.003)		(0.004)
Share Age 65+		0.041***		0.052***		0.057***		0.075***
		(0.002)		(0.003)		(0.003)		(0.005)
Digital Divide Index		-0.028***		-0.050***		-0.035***		-0.076***
		(0.003)		(0.004)		(0.004)		(0.006)
Constant	4.615***	4.821***	6.631***	8.401***	6.882***	7.662***	9.570***	12.666***
	(0.019)	(0.151)	(0.036)	(0.218)	(0.030)	(0.208)	(0.054)	(0.304)
Observations	82,160	81,161	82,080	81,085	82.175	81,174	82,175	81,174
R-squared	0.000	0.090	0.002	0.043	0.000	0.104	0.004	0.062

Robust standard errors in parentheses. Models weighted by prescription volume.
="* p<0.10   ** p<0.05   *** p<0.01"

Data Sources and Integration

This analysis integrates prescription transaction data, pharmacy and postal infrastructure records, and geographic reference datasets to measure where mail-order prescription use overlaps with limited pharmacy access and exposure to postal network restructuring. Table A2 summarizes each dataset and its analytic role.

Table A2. Data Sources Used in Analysis

Dataset	Years Used	Geographic Unit	Key Variables	Use in Analysis
IQVIA Longitudinal Prescription Transactions (LRx)	2019	Provider ZIP (aggregated to census tract / county)	Prescription fills, days supplied, delivery channel (mail vs retail), payer type	Core dataset for descriptive statistics and regression analysis of mail-order utilization (Tables 1–2, Figures 2–3).
National Plan and Provider Enumeration System (NPPES)	2024	Address-level (geocoded)	Retail pharmacy coordinates and identifiers	Used to compute straight-line distance from census-block centroids to the nearest pharmacy; basis for tract-level pharmacy-access measures (Figure 3).
U.S. Postal Service Post Office Locations (2019) + RTO/DFA Status (PRC, N2024-1)	2019 and 2025	ZIP code / address	Post office location, RTO-affected status	Datasets merged to form a unified postal network file. 2019 data supplement missing 2025 addresses; remaining records assigned ZIP-centroid coordinates. Used to identify tracts exposed to postal restructuring (Tables 3–4, Figure 5).
CDC NCHS Urban–Rural Classification	2013 (released 2020)	County	Six-level urbanicity scheme	Used to stratify Medicare mail-order rates by metropolitan status (Table 2).
Digital Divide Index (Purdue University)	2019	Census tract	Broadband access and digital connectivity indices	Control variable in tract-level OLS regressions of mail-order use (Figure 3).
HUD–USPS ZIP–Tract Crosswalk	2020	ZIP ↔ Census tract	Population-weighted relationships	Used to aggregate prescription data (ZIP-level) with pharmacy-access and postal-infrastructure metrics (tract-level).
Pharmacy Desert Classifications	2023	Census tract	Low-income + low-access indicator	Used contextually to illustrate areas of extreme retail access constraint (Section 4). Not merged with IQVIA data.
ACS 5 Year	2023	Tract	Demographic characteristics	Control variables in tract-level OLS regressions of mail-order use

Integration and Geo-Coding Notes:

- **Analytic Unit:** Census tract, with all data aggregated or merged using the HUD ZIP–tract crosswalk.
- **Geocoding**: All facility addresses for pharmacies and post offices were geocoded using the OpenCage Geocoding API.
- **Pharmacy Distances:** Computed using 2024 NPPES pharmacy coordinates and census-block centroids.
- **Postal Network Data:** 2025 post office dataset forms the base data; here, post offices are only identified by zipcode. 2019 facilities database containing addresses was merged to supplement address information. Unmatched 2025 records were assigned coordinates based on ZIP-centroids.
- **RTO Exposure:** For each census block, the straight-line distance to the nearest post office was calculated; block populations were classified as RTO-affected if their nearest post office was identified by the PRC as RTO-affected. Population-weighted shares of affected blocks were then aggregated to the county or tract level (Figure 1).
- **Derived Burden Measure:**
    - Mail-order share = Mail-order fills / total prescriptions per tract;
    - High Mail-Order Use = Top quartile mail-order share (within urbanicity class)
    - Limited pharmacy access = Either (1) top quartile distance to nearest pharmacy (within urbanicity class) or (2) bottom quartile pharmacy density per 10,000 residents (within urbanicity class)
    - High RTO exposure = affected population greater than or equal to 50%
    - Triple burden = Tracts meeting all three conditions: limited pharmacy access + high mail-order use + High RTO exposure.