Robbyn Lewis
Legislative District 46
Baltimore City

Health and Government Operations Committee

The Maryland House of Delegates
6 Bladen Street, Room 304
Annapolis, Maryland 21401
410-841-3772 · 301-858-3772
800-492-7122 *Ext.* 3772
Fax 410-841-3341 · 301-858-3341
Robbyn.Lewis@house.state.md.us

THE MARYLAND HOUSE OF DELEGATES
ANNAPOLIS, MARYLAND 21401

Testimony in Support of HB107

Prohibition on Vending Machine Sales of Drugs and Medicines – Repeal

Dear Chair Pendergrass and Members of the Health and Government Operations Committee:

While the COVID-19 pandemic has revealed many cracks in the foundation of our healthcare system, it has also paved the way to repairing them. One way to repair the system is to make it easier for people to access their basic health needs, like over-the-counter (OTC) – nonprescription - medications.

An easy way to do this is to put OTC meds in vending machines. These free-standing, contactless kiosks have the potential to put products like hand-sanitizer, analgesics, and cough syrup closer to the people who need it.

Unfortunately, Maryland is one of just four states that prohibits the sale of OTC products by means of vending machines. HB 107 proposes to change that by repealing the state prohibition.

Vending machines are a simple, effective, and low-cost way to dispense medications. They can be placed in areas – like racially segregated urban neighborhoods – which are least likely to have pharmacy outlets. In a study published in 2017 in the American Journal of Health-System Pharmacy, researchers found that "areas with a high concentration of minority residents had lower pharmacy density than areas with a high percentage of white residents." It also bears recognizing that people living in rural areas can also suffer from lack of pharmacy access as well.

In Maryland, there are exceptions allowed if the Secretary of Health promulgates regulations. But this has only happened once many years ago for over-the-counter pain medications. What about the all the other over-the-counter medications that people need? Antacids, allergy medications, and motion sickness medication?

As we work to adapt to this pandemic, it makes sense to reduce obstacles to health care access. The simple repeal on the current prohibition to OCT sales in vending machines is a simple, common sense way to do so, while also bringing Maryland's law in alignment with the majority of other states. I request a favorable report.

Robbyn Lewis
Legislative District 46
Baltimore City

Health and Government Operations Committee

The Maryland House of Delegates
6 Bladen Street, Room 304
Annapolis, Maryland 21401
410-841-3772 · 301-858-3772
800-492-7122 *Ext.* 3772
Fax 410-841-3341 · 301-858-3341
Robbyn.Lewis@house.state.md.us

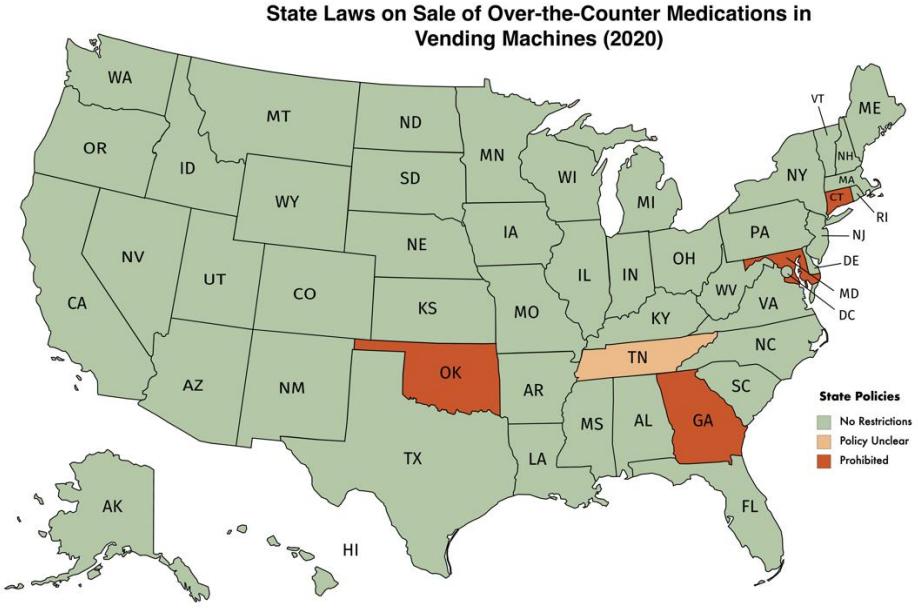
THE MARYLAND HOUSE OF DELEGATES
Annapolis, Maryland 21401

Prohibition on Vending Machine Sales of Drugs and Medicines – Repeal
HB0107 – FAQ's

Background Information on Sale of Over-the-Counter (OTC) Medication in Vending Machines

What are OTC medications?
OTC medications are medications approved by the federal Food and Drug Administration as safe, effective, and appropriate to be sold without a prescription in a variety of non-pharmacy settings. OTC medications can be commonly found in grocery stores, convenience stores, gas stations, and vending machines when allowed. OTC medications include pain medication, such as aspirin, cold/flu relief, and allergy medication.

Do states allow the sale of OTC medication in vending machines?
A 50-state review (including Washington DC) conducted by Public Policy Partners, in partnership with the National Health Law Program, in 2020 has shown that 46 states (displayed in the map below) have no existing restrictions on OTC medication sales in vending machines. The remaining 5 include Tennessee (whose law is unclear) and Connecticut, Georgia, Oklahoma (Plan B only), and Maryland, who prohibit these sales.



Source: Public Policy Partners and National Health Law Program, 2021

What are the benefits from providing OTC medications in vending machines?

1. **Providing access to OTC medications through vending machines could increase round-the-clock access to medications to help manage acute illness in communities where pharmacy access is low.** It has been estimated that the average Marylander lives within 5 miles of a pharmacy[i] but only 5% of chain pharmacies in Maryland are open 24 hours a day (which is less than half of the national average) and they are not distributed evenly throughout the state (with no access in Western Maryland or the Eastern Shore). [ii] Pharmacy density also decreases in areas with higher percentages of minority and low-income residents.[iii, iv, v] These populations rely more heavily on pharmacies and OTC medications to navigate acute illness, but when pharmacy access is low these communities are left with fewer options. [vi].

2. **Access to OTC medications in vending machines could reduce unnecessary clinical contact and help increase physical distancing in response to COVID-19.** Now more than ever there are increased risks and challenges to accessing medical care, and automated access to OTC medications in community settings could allow consumers to access these medications without the increased risk of exposure from entering a facility with known high traffic of potentially ill persons.[vii,viii] It has also been shown that there has been unprecedented demand for OTC medications in response to the pandemic, further demonstrating the need for this access now and in the future. [ix x]

3. **Access to OTC medications in vending machines could help reduce healthcare spending on acute illnesses, as OTC medications reduce clinical contact and save on prescription medication spending.** The use of OTC medications by way of self-care is typically one's first line of defense against acute illness.[xi, xii] OTC access reduces unnecessary clinical visits, saving $94.8 billion a year nationwide, and because OTC medications are less expensive than prescription medications, an additional $51.6 billion is saved for consumers, nationally. Without access to OTC medications 25% of Medicaid patients and 10% of uninsured patients would seek emergency care instead, increasing state Medicaid spending. [xiii]

Where could OTC vending machines be located?

These machines have been used successfully in other states to provide OTC pain medication, cold/flu relief, allergy medication, and more in community settings such as college campuses, airports, city transit locations, office parks, and on medical campuses.[xiv,xv] However, there is also potential for uses beyond those pursued in other states. In neighborhoods with low access to pharmacies and other health resources, strategically placing vending machines could help mobilize existing assets such as community centers and churches as hubs for health education. There is also a possibility to tailor the provisions inside of these machines for the specific communities that will be using them (safe-sex or first-aid kits, nicotine replacement therapy, etc.), or in response to future public health events (by stocking rapid testing kits, personal protective equipment, etc.) These potential uses could position Maryland to pave the way for the use of OTC vending machines as public health tools, rather than simple retail machines.

[i] Adunlin, G., Murphy, P. Z., & Manis, M. (2020). COVID-19: How Can Rural Community Pharmacies Respond to the Outbreak?. The Journal of rural health : official journal of the American Rural Health Association and the National Rural Health Care Association, 10.1111/jrh.12439. Advance online publication. https://doi.org/10.1111/jrh.12439

[ii] Qato, D. M., Zenk, S., Wilder, J., Harrington, R., Gaskin, D., & Alexander, G. C. (2017). The availability of pharmacies in the United States: 2007–2015. PloS one, 12(8), e0183172.

[iii] Marie A. Chisholm-Burns, Pharm.D., M.P.H., M.B.A., FCCP, FASHP, Christina A. Spivey, Ph.D, Justin Gatwood, Ph.D., M.P.H, Adam Wiss, B.S, Kenneth Hohmeier, Pharm.D, Steven R. Erickson, Pharm.D, Evaluation of racial and socioeconomic disparities in medication pricing and pharmacy access and services, American Journal of Health-System Pharmacy, Volume 74, Issue 10, 15 May 2017, Pages 653–668, https://doi.org/10.2146/ajhp150872

[iv] Bernstein, S. L., Cabral, L., Maantay, J., Peprah, D., Lounsbury, D., Maroko, A., ... & Shelley, D. (2009). Disparities in access to over-the-counter nicotine replacement products in New York City pharmacies. American journal of public health, 99(9), 1699-1704.

[v] Qato, D. M., Daviglus, M. L., Wilder, J., Lee, T., Qato, D., & Lambert, B. (2014). 'Pharmacy deserts' are prevalent in Chicago's predominantly minority communities, raising medication access concerns. Health Affairs, 33(11), 1958-1965.

[vi] Millet GA, Jones AT, Benkeser D, et al. Assessing Differential Impacts of COVID-19 on Black Communities. Ann Epidemiol. 2020;47:37-44. DOI: https://doi.org/10.1016/j.annepidem.2020.05.003external icon

[vii] Cadogan, C. A., & Hughes, C. M. (2020). On the frontline against COVID-19: Community pharmacists' contribution during a public health crisis. *Research in Social and Administrative Pharmacy*.

[viii] Adunlin, G., Murphy, P. Z., & Manis, M. (2020). COVID-19: How Can Rural Community Pharmacies Respond to the Outbreak?. *The Journal of rural health : official journal of the American Rural Health Association and the National Rural Health Care Association*, 10.1111/jrh.12439. Advance online publication. https://doi.org/10.1111/jrh.12439

[ix] https://www.pharmaceutical-journal.com/news-and-analysis/news/unprecedented-demand-for-otc-painkillers-as-covid-19-outbreak-spreads/20207830.article

[x] Alexander GC, Qato DM. Ensuring Access to Medications in the US During the COVID-19 Pandemic. *JAMA.* 2020;324(1):31–32. doi:10.1001/jama.2020.6016

[xi] Consumer Healthcare Products Association. (2019). OTC Use Statistics. Retrieved from https://www.chpa.org/about-consumer-healthcare/research-data/otc-use-statistics

[xii] Reis, J. (2001). Consumers' self-care algorithms for the common cold: implications for health education interventions. *Journal of American College Health*, *50*(1), 27-32.

[xiii] Consumer Healthcare Products Association. (2019). OTC Use Statistics. Retrieved from https://www.chpa.org/about-consumer-healthcare/research-data/otc-use-statistics

[xiv] CVS Pharmacy. (2017, September 07). CVS Pharmacy Thinks Outside the Box with Introduction of Health and Wellness Vending Machines. Retrieved from https://cvshealth.com/news-and-insights/press-releases/cvs-pharmacy-thinks-outside-the-box-with-introduction-of-health

[xv] Elizabeth Pace, A. N. (2019, February 20). Jacksonville hospital first, only hospital in Northeast Florida to provide pharmacy kiosk system. Retrieved from https://www.actionnewsjax.com/news/local/jacksonville-hospital-first-only-hospital-in-northeast-florida-to-provide-pharmacy-kiosk-system/922866215/

Evaluation of racial and socioeconomic disparities in medication pricing and pharmacy access and services

Marie A. Chisholm-Burns, Pharm.D., M.P.H., M.B.A., FCCP, FASHP, University of Tennessee College of Pharmacy, Memphis, Knoxville, and Nashville, TN.

Christina A. Spivey, Ph.D., University of Tennessee College of Pharmacy, Memphis, TN.

Justin Gatwood, Ph.D., M.P.H., University of Tennessee College of Pharmacy, Nashville, TN.

Adam Wiss, B.S., University of Tennessee College of Pharmacy, Nashville, TN.

Kenneth Hohmeier, Pharm.D., University of Tennessee College of Pharmacy, Nashville, TN.

Steven R. Erickson, Pharm.D., University of Michigan College of Pharmacy, Ann Arbor, MI.

Purpose. Results of a study to determine if disparities in drug pricing, pharmacy services, and community pharmacy access exist in a Tennessee county with a predominantly minority population are reported.

Methods. A cross-sectional survey of community pharmacies in Shelby County, a jurisdiction with a total population more than 60% composed of racial and ethnic minority groups, was conducted. Data collection included "out-of-pocket" (i.e., cash purchase) prices for generic levothyroxine, methylphenidate, and hydrocodone–acetaminophen; pharmacy hours of operation; availability of selected pharmacy services; and ZIP code–level data on demographics and crime risk. Analysis of variance, chi-square testing, correlational analysis, and data mapping were performed.

Results. Survey data were obtained from 90 pharmacies in 25 of the county's 33 residential ZIP code areas. Areas with fewer pharmacies per 10,000 residents tended to have a higher percentage of minority residents ($p = 0.031$). Methylphenidate pricing was typically lower in areas with lower employment rates ($p = 0.027$). Availability of home medication delivery service correlated with income level ($p = 0.015$), employment rate ($p = 0.022$), and crime risk ($p = 0.014$).

Conclusion. A survey of community pharmacies in Shelby County, Tennessee, found that areas with a high percentage of minority residents had lower pharmacy density than areas with a high percentage of white residents. Pharmacies located in communities with low average income levels, low employment rates, and high scores for personal crime risk were less likely to offer home medication delivery services.

Keywords: community pharmacy, healthcare access, medication costs, pharmacy services, racial disparities, socioeconomic disparities

Am J Health-Syst Pharm. 2017; 74:653-68

In the United States, there are over 1 billion visits to physicians per year, and nearly 75% of these visits result in receipt of a medication prescription.[1] While the use of medications to decrease morbidity and mortality and improve quality of life continues to increase, healthcare and medication access disparities exist and involve various chronic disease states and areas of healthcare, including asthma, cardiovascular disease, diabetes mellitus, human immunodeficiency virus infection, mental health, oncology, and pain control.[2,3] Healthcare disparities may be based on a number of factors, such as race, ethnicity, sex, geographic location, and health literacy.[4]

Socioeconomic factors such as insurance status also play a key role in health disparities and medication access. For example, individuals without prescription drug coverage are more likely to forgo needed medication therapy and cite cost as a motivating factor.[5] In 2012, uninsured patients 18–64 years of age were 4 times more likely than their insured counterparts

Address correspondence to Dr. Chisholm-Burns (mchisho3@uthsc.edu).

DOI 10.2146/ajhp150872

to not receive medications due to financial reasons[2]; this may result in medication nonadherence and negative health outcomes.[5] Outcomes associated with cost-related nonadherence include poorer health and increased hospitalizations.[6]

The proximity of an individual's residence to a community pharmacy and the possible lack of services and drug supplies offered by neighborhood community pharmacies are important factors in medication access. A study of the availability of pharmacies in a Midwestern city (Chicago, Illinois) indicated that "segregated minority neighborhoods" (defined as those in which less than 50% of the population was non-Hispanic white) had fewer community pharmacies.[7] During the period 2000–12, these "pharmacy deserts," located in predominantly black or Hispanic, socioeconomically disadvantaged, and medically underserved areas, experienced less growth in numbers of pharmacies than predominantly white neighborhoods even after adjustments for population density and growth.[7] These data are consistent with findings in other studies examining disparities in medication access. For example, not only are black patients, Hispanic patients, and patients of low socioeconomic status less likely to be prescribed opioids in emergency departments than are white patients with equivalent pain, but those living in predominantly nonwhite areas are less likely to have adequate access to opioid analgesics due to insufficient stocking of supplies by pharmacies in these neighborhoods.[8-11] In another example, Amstislavski and colleagues[12] noted socioeconomic disparities in medication access in a study of New York City pharmacies. Specifically, they found that pharmacies in communities with higher poverty levels were more likely than those in areas with lower poverty levels to be out of stock of common prescription medications used to treat health conditions such as high cholesterol, diabetes, hypertension, and depression.

KEY POINTS

- In Shelby County, Tennessee, areas with predominantly minority populations generally have fewer community pharmacies per 10,000 residents than areas with majority white populations, suggesting disparities in pharmacy access.
- Data from a survey of 90 Shelby County community pharmacies indicated a trend of lower prices for generic methylphenidate in areas of high unemployment; pricing of generic levothyroxine or hydrocodone–acetaminophen did not appear to be affected by socioeconomic variables.
- Surveyed pharmacies in low-income areas and areas of high unemployment and personal crime risk were unlikely to offer home medication delivery.

While ostensibly an artificial and surrogate boundary, the border of the ZIP code area in which an individual resides may influence access to community pharmacies and, in turn, medications and services, thereby creating potential disparities. One study in Wayne County, Michigan, which has a population that is 54.4% white and 40.1% African-American, with the remaining 5.5% consisting of various nonblack minority groups, evaluated out-of-pocket costs for medications and the availability of various pharmacy services in relation to resident characteristics within 63 ZIP code areas.[13] The researchers concluded that individuals belonging to racial and ethnic minorities and those of lower socioeconomic status may be at a disadvantage in terms of access to medications and pharmacy services. For instance, in ZIP code areas characterized by lower average annual household incomes, costs for generic medications such as levothyroxine were significantly higher (mean ± S.D. costs for levothyroxine were 11.0 ± 2.10 in the lowest income quartile, 10.79 ± 2.10 in the second-lowest quartile, 9.25 ± 1.87 in the second-highest quartile, and 8.89 ± 2.53 in the highest quartile; $p = 0.02$), fewer pharmacies offered discount generic drug programs and immunizations, and pharmacy hours of operation were fewer on average.[13] On the other hand, residents of ZIP code areas with a larger white population had greater access to pharmacy services, including discount generic drug programs and immunizations.

Few studies in the literature on pharmacy access factors have focused on geographic locations with resident populations predominantly composed of racial or ethnic minority groups and the possible impact that increased demographic representation might have on pharmacy access. The study described here, conducted in Shelby County, Tennessee (which includes the city of Memphis), sought to address this issue. Although economically and racially diverse, with minority groups constituting more than 60% of the population, Shelby County faces ongoing issues regarding racial disparities in some aspects of healthcare and healthcare outcomes. For example, there is a higher rate of diabetes-related leg amputations in black residents versus nonblack residents, and cancer-related mortality is higher among minority residents versus white residents.[14] However, potential disparities in community pharmacy access, medication pricing, and access to pharmacy services have not been examined. Determination of disparities is critical to development of a better understanding of the barriers to equitable medication and pharmacy access; such understanding is needed in order to design and implement interventions to reduce identified disparities in Shelby County. Therefore, the purpose of the survey-based study was to determine if there are racial and

socioeconomic disparities in community pharmacy access, drug pricing, and services in Shelby County.

Methods

Background. Shelby County was selected as the study site due to its mid-South location and investigator familiarity with the county. Moreover, because previous studies largely focused on regions with a majority white population, Shelby County was selected due to its racial and economic diversity. It has a population more than 60% composed of minority groups, with a median annual household income of $46,250 and an unemployment rate of 6.7% (as of May 2015).[15,16] The study was approved by the institutional review board of the University of Tennessee Health Science Center.

Survey design. A cross-sectional survey of community pharmacies located in Shelby County (inclusive of the city of Memphis) was conducted. The aim of the study was to evaluate measures of community pharmacy access and drug pricing in relation to resident characteristics. Of the 78 ZIP code areas in Shelby County, 33 include a residential population on which U.S. census data are available; these areas were the focus of the study. Information gathered in the 2010 national census and in the U.S. Census Bureau's American Community Survey[17] were used to collect the following ZIP code–level data (these were the independent variables for study): population total, median age, percentage of white residents, percentage of female residents, median household income, percentage of residents with incomes below the federal poverty line, percentage of residents who graduated from high school, percentage of residents who graduated from college (i.e., with a bachelor's degree), percentage of residents who were employed, and percentage of residents who were uninsured. Data available from the federal Health Resources and Services Administration (HRSA)[18,19] were used to identify primary care shortage areas, mental health services shortage areas, and medically underserved areas within Shelby County. The HRSA data were used to create the following study variables, which were analyzed to characterize pharmacy access by ZIP code area, percentage of pharmacies in mental health services shortage areas, percentage of pharmacies in primary care shortage areas, and percentage of pharmacies in medically underserved areas. Areas designated as having a primary care shortage are those with a physician-to-population ratio of more than 1:3,500; mental health service shortage areas are those for which there are at least 30,000 residents for every psychiatrist.[18] Designation of medically underserved areas is based on a calculation involving the ratio of primary care physicians to residents, the infant mortality rate, the percentage of residents below the poverty line, and the percentage of residents who are 65 years of age or older.[19] ZIP code–level crime risk scores[20] were also considered as independent variables. For each area, 3 scores were evaluated: a total crime risk score (national average = 100, with higher scores indicating greater risk) representing the combined risks of rape, murder, assault, robbery, burglary, larceny, and vehicle theft; a personal crime risk score representing the combined risks of rape, murder, assault, and robbery; and a property crime risk score representing the combined risks of burglary, larceny, and vehicle theft.

During February and March 2015, a telephone survey targeting pharmacies located in the identified residential ZIP codes in Shelby County was conducted. Up to 3 attempts to contact each pharmacy were made. To be eligible for study participation, a pharmacy had to be verified as a retail community pharmacy (defined as an independent, supermarket, chain, or mass merchandiser pharmacy[21]). Of the 157 pharmacies initially identified, 53 were excluded from survey participation because they were not community pharmacies or could not be verified as community pharmacies; the remaining 104 were verified as retail community pharmacies eligible for study inclusion based on oral confirmation by the pharmacy manager or a designee. Publicly available data on the 104 verified community pharmacies were used to determine pharmacy density, defined as the number of community pharmacies per 10,000 residents per ZIP code.[7]

A standardized survey questionnaire was administered to the pharmacist manager, the pharmacist-in-charge, or a designee at each participating pharmacy; questionnaire administration took about 5 minutes. The questionnaire included open-ended questions to ascertain drug pricing and hours of operation and yes/no questions to determine if a pharmacy offered the services of interest. The following data were collected and entered into the study database (the accuracy of data entry was verified by 2 investigators): "out-of-pocket" (i.e., cash purchase) prices of 30-tablet supplies of generic levothyroxine sodium 50 µg, generic methylphenidate hydrochloride extended-release (ER) 20 mg, and generic hydrocodone bitartrate 5 mg–acetaminophen 325 mg); pharmacy hours of operation from Monday through Friday and on Saturdays and Sundays (hours of operation were considered pharmacy access variables for study purposes); and availability of services offered by many pharmacies (a generic drug program, home medication delivery, influenza immunizations, other immunizations, and medication therapy management [MTM]). Levothyroxine, methylphenidate, and hydrocodone–acetaminophen were selected for examination of disparities in pricing because they are frequently prescribed, are included in the list of the top 200 prescription drugs dispensed in the United States, and are used in the treatment and management of common disease states.[22] As a drug often prescribed to children and adolescents, methylphenidate ER was of particular interest because possible disparities in its pricing have not been

previously assessed in the literature. Since methylphenidate is commonly used in the pediatric population to treat attention-deficit/hyperactivity disorder, its use pertains to an understudied area of potential health disparities: pediatric mental health.

Data analysis. Data analysis was conducted using IBM SPSS Statistics 22.0 (IBM Corporation, Armonk, NY). Demographic data, crime scores, and pharmacy density data were aggregated and expressed as mean ± S.D. values. Pearson's correlations (*r* values) were calculated for the ZIP code–delineated variables. Due to non-normal distribution, data on the percentages of pharmacies in mental health services shortage areas, primary care shortage areas, and medically underserved areas were summarized as medians and modes with interquartile ranges (IQRs).

The analysis approach was based on the plan used by Erickson and Workman,[13] in which pharmacy data (medication out-of-pocket prices, pharmacy services, and pharmacy hours of operation) were aggregated at the ZIP code level. Analysis of variance (ANOVA) was performed to assess associations between ZIP code area characteristics (with data segmented into quartiles) and pharmacy variables. Likewise in our study, data from survey participants were aggregated at the ZIP code level: (1) out-of-pocket prices of the 3 drugs of interest (hydrocodone–acetaminophen, levothyroxine, and methylphenidate) and hours of operation were summarized as means, and (2) data on the availability of each pharmacy service of interest were summarized as percentages based on the number of pharmacies offering the service within each ZIP code area. The aggregated data were then used to calculate mean ± S.D. values for the dependent variables (out-of-pocket drug prices, pharmacy hours of operation, and percentages of pharmacies offering selected services).

ANOVA was conducted to determine associations between ZIP code–delineated population characteristics (with the exception of mental health shortage area, primary care shortage area, and medically underserved area) and pharmacy access variables (out-of-pocket drug prices, pharmacy hours of operation, and pharmacy services offered). ANOVA was also used to determine associations between pharmacy density and pharmacy access and pricing variables. Post hoc comparisons were performed after ANOVA using the Bonferroni correction. For ANOVA, data on local population characteristics and pharmacy density were converted to quartile groupings. Chi-square analysis was performed to examine associations of pharmacy density with resident characteristics and crime risk. Due to nonnormal distribution of the independent variables, Spearman correlations were conducted to assess the relationship of the pharmacy variables to the percentages of pharmacies in mental health shortage areas, primary care shortage areas, and medically underserved areas. The a priori significance level was 0.05.

Select demographic and pharmacy characteristics were mapped using ArcGIS Online, version 10.2.2 (Esri, Redlands, CA); all ZIP code areas completely within the boundaries of Shelby County for which the data of interest could be obtained were included. The base map layer was derived from the ArcGIS Web Map collection (Esri), and a Mercator Auxiliary Sphere projection was used. Data collected in the survey and demographic information from public sources were then combined with geographic data to populate the mapped ZIP code areas.

Results

Of 104 eligible community pharmacies, 90 (86.5%) participated in the survey. The 14 pharmacies that declined to participate did so because company policy precluded participation. The participating pharmacies were located in 25 of the county's 33 ZIP code areas. Quartile-based groupings of ZIP code–level data on Shelby County resident characteristics, crime risk, and pharmacy density are presented in Table 1; data on those characteristics and pharmacy-reported data, aggregated as mean ± S.D. values at the ZIP code level, are presented in Table 2. The median percentage of pharmacies in mental health shortage areas per ZIP code was 100% (mode, 100%; IQR, 100%), the median percentage of pharmacies in primary care shortage areas was 80% (mode, 100%; IQR, 100%), and the median percentage of pharmacies in medically underserved areas was 0% (mode, 0%; IQR, 66.5%).

Pharmacy-reported data on out-of-pocket prices for the study drugs, stratified by ZIP code area variable and grouped by quartile, are displayed in Table 3. Select variables were significantly associated with pricing of methylphenidate and levothyroxine (but not hydrocodone–acetaminophen). Specifically, the post hoc analysis found a significant difference in methylphenidate pricing based on employment rate (F = 3.821, df = 19, p = 0.027); prices were lower in ZIP code areas with the lowest employment rates (quartile 1 mean, $74.19), as compared with areas with higher employment rates (quartile 3 mean, $165.71; p = 0.03). Pricing of levothyroxine differed significantly according to pharmacy density (F = 3.826, df = 20, p = 0.026); pricing was higher in ZIP code areas with the fewest pharmacies per 10,000 residents (quartile 1 mean, $16.37) relative to areas with higher pharmacy density (quartile 2 mean, $10.27; p = 0.023). Pricing of methylphenidate and levothyroxine did not differ significantly in relation to any other evaluated ZIP code area variable.

Similarly, few significant associations were noted with regard to the availability of pharmacy services (Table 4 presents a quartile distribution of ZIP code–stratified data on the percentages of pharmacies offering the 5 services of interest). Among those services, only the availability of home medication delivery was found to be significantly associated

with one or more of the ZIP code area variables. A statistically significant difference was found based on income ($F = 4.383$, $df = 21$, $p = 0.015$; Figure 1). The post hoc analysis indicated significant differences in the percentages of pharmacies offering home delivery between ZIP code areas with the lowest income levels (quartile 1 mean, 0%) and higher-income areas (quartile 2 mean, 45.9% [$p = 0.048$]; quartile 3 mean, 44.9% [$p = 0.044$]). Differences in home medication delivery on the basis of employment rate were also found ($F = 3.97$, $df = 21$, $p = 0.022$; Figure 1); ZIP code areas with the lowest rates of employment had a lower percentage of pharmacies offering the service (quartile 1 mean, 0%) than pharmacies in areas with higher employment rates (quartile 2 mean, 55.0%; $p = 0.15$). The availability of home medication delivery was also associated with personal crime risk score ($F = 4.442$, $df = 21$, $p = 0.014$; Figure 1), with delivery service offered by a higher percentage of pharmacies in lower-risk ZIP code areas (quartile 2 mean, 48.1%) versus the highest-risk areas (quartile 4 mean, 0%; $p = 0.034$).

Pharmacy access was examined in relation to hours of operation per week and pharmacy density (Table 4 presents pharmacy-reported data on mean hours of operation stratified by ZIP code variable quartiles). Significant differences based on ZIP code area were found in Monday–Friday hours of operation ($F = 6.684$, $df = 21$, $p = 0.002$), Saturday hours of operation ($F = 5.52$, $df = 21$, $p = 0.006$), and Sunday hours of operation ($F = 7.792$, $df = 21$, $p = 0.001$). Regarding Monday–Friday hours of operation, pharmacies in the least-populated areas typically reported fewer hours per week (quartile 1 mean, 50 hours) than those in the most-populated ZIP codes (quartile 3 mean, 68.1 hours [$p = 0.008$]; quartile 4 mean, 70.4 hours [$p = 0.004$]). Likewise for Saturday hours of operation, pharmacies in the least-populated ZIP code areas tended to report fewer hours of operation (quartile 1 mean, 4.9 hours) than pharmacies in the most-

Table 1. Quartile Distribution of ZIP Code–Level Data on Resident Characteristics, Local Crime Risk, and Pharmacy Density[17]

Variable	Value
Population total	
Quartile 1	<21,559
Quartile 2	21,559 to <26,905
Quartile 3	26,905 to <41,604
Quartile 4	≥41,604
Median age (yr)	
Quartile 1	<31.75
Quartile 2	31.75 to <34.00
Quartile 3	34.00 to <38.28
Quartile 4	≥38.28
Median household income ($)	
Quartile 1	<27,411
Quartile 2	27,411 to <40,466
Quartile 3	40,466 to <62,882
Quartile 4	≥62,882
% Female residents	
Quartile 1	<51.0
Quartile 2	51.0 to <52.9
Quartile 3	52.9 to <54.1
Quartile 4	≥54.1
% White residents	
Quartile 1	<7.8
Quartile 2	7.8 to <16.8
Quartile 3	16.8 to <59.3
Quartile 4	≥59.3
% Residents with income below federal poverty line	
Quartile 1	<8.45
Quartile 2	8.45 to <27.10
Quartile 3	27.10 to <35.75
Quartile 4	≥35.75
% Graduated high school	
Quartile 1	<74.7
Quartile 2	74.7 to <85.2
Quartile 3	85.2 to <92.00
Quartile 4	≥92.00
% Graduated college	
Quartile 1	<10.00
Quartile 2	10.00 to <18.50
Quartile 3	18.50 to <42.85
Quartile 4	≥42.85

Continued on next page

Continued from previous page

Table 1. Quartile Distribution of ZIP Code–Level Data on Resident Characteristics, Local Crime Risk, and Pharmacy Density[17]

Variable	Value
% Employed	
Quartile 1	<46.4
Quartile 2	46.4 to <56.7
Quartile 3	56.7 to <65.3
Quartile 4	≥65.3
% Uninsured	
Quartile 1	<11.0
Quartile 2	11.0 to <16.9
Quartile 3	16.9 to <22.9
Quartile 4	≥22.9
Local personal crime risk score	
Quartile 1	<248.5
Quartile 2	248.5 to <410.0
Quartile 3	410.0 to <497.5
Quartile 4	≥497.5
Local property crime risk score	
Quartile 1	<181.5
Quartile 2	181.5 to <321.0
Quartile 3	321.0 to <397.0
Quartile 4	≥397.0
Local total crime risk score[a]	
Quartile 1	<182.0
Quartile 2	182.0 to <354.0
Quartile 3	354.0 to <400.5
Quartile 4	≥400.5
Pharmacy density	
Quartile 1	<0.72
Quartile 2	0.72 to <1.21
Quartile 3	1.21 to <1.88
Quartile 4	≥1.88

[a]U.S. average = 100.

populated areas (quartile 3 mean, 10.1 hours [p = 0.016]; quartile 4 mean, 10.6 hours [p = 0.010]). In the post hoc analysis of Sunday hours of operation, pharmacies in the least-populated ZIP code areas averaged fewer hours of operation (quartile 1 mean, 1.9 hours) than pharmacies in more populated areas (quartile 2 mean, 7.5 hours [p = 0.015]; quartile 3 mean, 8.0 hours [p = 0.005]; quartile 4 mean, 9.1 hours [p = 0.002]).

In the chi-square analysis of pharmacy density, only 1 variable (percentage of white residents) was statistically significant (χ^2 = 18.353, p = 0.031), indicating that ZIP code areas with more pharmacies per 10,000 residents had a higher percentage of white residents (and thus a lower percentage of minority residents). To better illustrate this finding, Figure 1 maps data on pharmacy density and minority population percentage per ZIP code area.

No significant associations were found when data on the percentages of pharmacies in mental health service shortage areas, primary care shortage areas, and medically underserved areas were analyzed in relation to the dependent variables (medication out-of-pocket prices, pharmacy services offered, and pharmacy access factors [hours of operation and pharmacy density]). Significant correlations (p < 0.01) of independent variables (those pertaining to race, income, employment, poverty, insurance, education, and crime risk) were found, with predominantly white ZIP code areas more likely than predominantly minority areas to have higher proportions of insured residents, better socioeconomic indicators, higher levels of education, and lower crime risk scores.

Discussion

Previous studies have indicated that neighborhood of residence may affect pharmacy access, particularly among minority and low-income populations.[7,12,13] However, for the most part, these studies focused on regions in which whites constituted the largest racial group. Our study sought to examine pharmacy access issues in an area where minority groups constitute a majority of the population.

The study findings regarding pharmacy density and race suggest that the risk of poor pharmacy access is increased in predominantly minority ZIP code areas; this is problematic given that major chronic disease states such as hypertension and diabetes are more prevalent among minority populations, particularly African Americans, as compared with whites.[23] As medication therapy is the typical treatment modality for most chronic conditions, limited community pharmacy access and, in turn,

limited medication access jeopardize treatment efforts and may result in poorer health outcomes in minority groups. Strategies proposed by Qato et al.[7] to increase the number of community pharmacies (and thus pharmacy access) include expansion of public policies such as economic incentives to prompt pharmacy openings in these communities. Another option may be to create partnerships with health clinics in predominantly minority neighborhoods wherein pharmacies operate on clinic premises. Mobile pharmacies (analogous to mobile blood donation centers) may also be a strategy by which greater access can be provided.

In contrast to racial disparities in pharmacy access (measured in our study through evaluation of pharmacy density), economic forces such as consumer demand and costs of operation seem the more likely factors driving pharmacy access, as measured by pharmacy hours of operation. We found that pharmacies in the least-populated ZIP code areas were, on average, open fewer hours per week than pharmacies in more heavily populated areas. Perhaps due to their smaller consumer base and subsequently reduced consumer demand, pharmacies in less populated ZIP code areas may limit their hours per week to decrease operational costs.

Economic factors at both the individual level (e.g., employment status) and the pharmacy level (e.g., number of competing pharmacies per ZIP code) were also noted to affect out-of-pocket drug prices. Generic methylphenidate was generally priced lower in areas of greater unemployment. This finding contrasts with results of prior studies indicating socioeconomic disparities in the pricing of a range of commonly used generic drugs.[12,13] Our finding provided evidence of favorable pricing of methylphenidate for individuals of low socioeconomic status in Shelby County, suggesting that the medication was more affordable for these residents. Pharmacy-reported pricing of methylphenidate did not appear to be influenced by any other evaluated ZIP code area variable or by pharmacy density, nor were any pricing differences found with regard to hydrocodone–acetaminophen.

Table 2. Data on Shelby County Demographics and Pharmacy Access Factors Aggregated by ZIP Code Area

Variable	Mean ± S.D.
Demographics in 33 Evaluated Residential ZIP Code Areas	
Population total	29,139.9 ± 12,300.7
Median age (yr)	34.9 ± 5.03
% Female residents	51.8 ± 3.46
% White residents	34.7 ± 30.2
Median household income ($)	45,540.12 ± 22,014.33
% Residents with income below federal poverty limit	24.2 ± 16.1
% Graduated high school	83.8 ± 10.2
% Graduated college	27.0 ± 18.9
% Residents employed	55.5 ± 10.8
% Residents uninsured	16.9 ± 7.0
Local crime risk scores[20]	
Personal crime risk	375.5 ± 149.1
Property crime risk	292.8 ± 124.3
Total crime risk (U.S. average = 100)	305.9 ± 122.6
Data on Pharmacy Access Factors, as Reported by 90 Surveyed Pharmacies[a]	
Pharmacy density (no. community pharmacies per 10,000 residents)[b]	1.49 ± 1.04
Price for 30-day supply of commonly used medications ($)[c]	
Levothyroxine	13.85 ± 3.79
Methylphenidate extended-release	120.89 ± 54.05
Hydrocodone–acetaminophen	27.93 ± 3.08
Services offered (%)	
Generic drug program	85.4 ± 28.2
Home medication delivery	27.1 ± 32.4
Influenza immunization	94.1 ± 20.3
Other immunizations	92.6 ± 21.0
Medication therapy management	92.4 ± 20.6
Weekly hours of operation	
Monday–Friday	63.5 ± 11.4
Saturday	8.8 ± 3.4
Sunday	6.7 ± 3.8

[a] n = 89 for data on hydrocodone–acetaminophen and levothyroxine pricing; n = 88 for data on methylphenidate pricing.
[b] As calculated by investigators.
[c] Prices are out-of-pocket (i.e., cash purchase) prices.

The third medication of interest in the study was generic levothyroxine. As previously mentioned, a study conducted by Erickson and Workman[13] in Wayne County, Michigan, found

Table 3. Quartile Distribution of Pharmacy-Reported Drug Pricing Data Stratified by ZIP Code Area Variable

Variable	Mean ± S.D. Price ($) for 30-Day Supply[a]		
	Hydrocodone–Acetaminophen	Levothyroxine	Methylphenidate
Population total			
Quartile 1	25.99 ± 5.88	17.63 ± 4.77	151.76 ± 109.10
Quartile 2	28.42 ± 2.05	11.86 ± 3.18	128.60 ± 37.35
Quartile 3	28.24 ± 1.03	13.05 ± 2.36	95.92 ± 24.88
Quartile 4	28.72 ± 2.34	13.61 ± 3.35	121.74 ± 43.20
Median age			
Quartile 1	27.94 ± 1.35	13.68 ± 5.36	125.64 ± 21.59
Quartile 2	29.47 ± 1.52	13.94 ± 1.50	92.37 ± 28.24
Quartile 3	28.11 ± 3.31	13.84 ± 3.09	118.40 ± 53.88
Quartile 4	26.22 ± 4.70	13.93 ± 5.07	147.96 ± 83.04
Median household income			
Quartile 1	28.86 ± 0.72	13.93 ± 5.49	87.90 ± 29.05
Quartile 2	28.34 ± 2.03	13.89 ± 2.13	108.63 ± 33.15
Quartile 3	28.28 ± 1.42	12.94 ± 2.12	107.21 ± 27.18
Quartile 4	26.36 ± 5.69	14.80 ± 5.47	171.11 ± 77.60
% Female residents			
Quartile 1	29.40 ± 1.96	14.40 ± 1.13	92.98 ± 31.10
Quartile 2	26.69 ± 5.74	14.68 ± 5.54	165.99 ± 83.06
Quartile 3	27.69 ± 1.24	12.54 ± 2.78	118.62 ± 29.66
Quartile 4	28.24 ± 1.23	14.08 ± 4.65	97.87 ± 21.45
% White residents			
Quartile 1	28.73 ± 0.80	13.72 ± 5.02	90.71 ± 27.02
Quartile 2	27.29 ± 1.23	12.55 ± 2.84	123.50 ± 22.40
Quartile 3	29.64 ± 2.34	14.82 ± 2.21	106.35 ± 40.17
Quartile 4	25.68 ± 4.87	13.93 ± 5.07	160.83 ± 82.48
% Residents with income below federal poverty limit			
Quartile 1	26.90 ± 5.47	14.81 ± 5.47	158.23 ± 80.20
Quartile 2	27.49 ± 2.57	13.15 ± 2.24	123.07 ± 43.19
Quartile 3	28.55 ± 1.76	13.56 ± 2.11	105.87 ± 31.42
Quartile 4	28.86 ± 0.72	13.93 ± 5.49	87.90 ± 29.05
% Graduated high school			
Quartile 1	29.77 ± 1.45	15.42 ± 5.55	94.46 ± 27.36
Quartile 2	28.06 ± 1.09	12.92 ± 2.51	101.82 ± 35.72
Quartile 3	27.37 ± 2.44	12.89 ± 2.05	115.96 ± 40.05
Quartile 4	27.23 ± 5.48	15.00 ± 5.39	162.11 ± 78.08
% Graduated college			
Quartile 1	28.85 ± 0.64	14.47 ± 5.08	96.19 ± 31.25
Quartile 2	28.58 ± 2.14	13.21 ± 1.60	105.98 ± 34.62
Quartile 3	27.88 ± 2.99	13.56 ± 3.09	125.70 ± 45.83

Continued on next page

Continued from previous page

Table 3. Quartile Distribution of Pharmacy-Reported Drug Pricing Data Stratified by ZIP Code Area Variable

Variable	Mean ± S.D. Price ($) for 30-Day Supply[a]		
	Hydrocodone–Acetaminophen	Levothyroxine	Methylphenidate
Quartile 4	26.55 ± 5.00	14.10 ± 5.08	148.29 ± 82.63
% Employed			
Quartile 1	29.06 ± 0.52	14.97 ± 4.86	74.19 ± 22.40
Quartile 2	28.41 ± 1.64	12.95 ± 2.73	108.18 ± 33.99
Quartile 3	26.55 ± 4.98	14.17 ± 4.73	165.71 ± 65.71
Quartile 4	28.14 ± 2.59	13.44 ± 3.24	112.44 ± 37.14
% Uninsured			
Quartile 1	28.01 ± 5.65	15.24 ± 5.35	154.14 ± 86.14
Quartile 2	26.79 ± 2.30	15.03 ± 3.95	127.94 ± 38.37
Quartile 3	27.85 ± 1.09	11.51 ± 2.06	106.83 ± 33.83
Quartile 4	29.10 ± 1.39	13.62 ± 2.68	95.82 ± 27.26
Local personal crime risk score			
Quartile 1	28.10 ± 3.39	12.51 ± 4.19	143.48 ± 52.77
Quartile 2	28.96 ± 1.94	13.91 ± 1.48	106.15 ± 27.58
Quartile 3	27.95 ± 1.41	14.16 ± 4.50	116.15 ± 26.64
Quartile 4	26.48 ± 5.31	14.95 ± 4.82	117.15 ± 98.01
Local property crime risk score			
Quartile 1	28.10 ± 3.39	12.51 ± 4.19	143.48 ± 52.77
Quartile 2	28.18 ± 1.99	15.05 ± 4.08	114.16 ± 35.57
Quartile 3	28.73 ± 4.35	14.19 ± 4.67	122.71 ± 77.68
Quartile 4	29.12 ± 1.51	13.54 ± 1.44	97.95 ± 27.98
Local total crime risk score			
Quartile 1	28.10 ± 3.39	12.51 ± 4.19	143.48 ± 52.77
Quartile 2	28.35 ± 1.79	15.15 ± 4.00	100.26 ± 26.23
Quartile 3	28.45 ± 1.73	12.67 ± 2.90	120.54 ± 24.12
Quartile 4	26.52 ± 5.33	15.55 ± 4.11	114.90 ± 98.40
Pharmacy density			
Quartile 1	27.66 ± 5.46	16.37 ± 3.70	119.16 ± 94.31
Quartile 2	28.82 ± 1.36	10.27 ± 2.77	115.62 ± 46.10
Quartile 3	27.84 ± 1.58	14.79 ± 4.43	119.24 ± 25.55
Quartile 4	27.42 ± 2.84	13.97 ± 1.04	129.26 ± 34.47

[a]Prices are out-of-pocket (i.e., cash) prices, as reported by surveyed pharmacies; for hydrocodone–acetaminophen and levothyroxine pricing, n = 89; for methylphenidate pricing, n = 88.

that ZIP codes with lower household income were associated with significantly higher out-of-pocket prices for generic levothyroxine. In contrast, our study found that prices for generic levothyroxine did not differ significantly on the basis of income or any other racial or socioeconomic variable. Higher prices for levothyroxine were noted in ZIP codes with fewer pharmacies per 10,000 residents, suggesting that when pharmacies have less competition (and residents have fewer purchasing options) the prices for select medications may be affected.

The pharmacy services findings of our study also differed from those of Erickson and Workman,[13] who found

Table 4. Quartile Distribution of Survey Data on Pharmacy Access Factors Stratified by ZIP Code Area Variable

Variable	Mean ± S.D. % Pharmacies Offering Service					Mean ± S.D. Weekly Hours of Operation		
	Generic Drug Program	Home Medication Delivery	Influenza Immunization	Other Immunizations	Medication Therapy Management	Mon–Fri	Sat	Sun
Population total								
Quartile 1	63.3 ± 49.7	20.0 ± 40.0	83.3 ± 40.8	83.3 ± 40.8	80.0 ± 40.0	50.0 ± 10.8	4.9 ± 4.2	1.9 ± 3.3
Quartile 2	92.3 ± 8.9	46.1 ± 26.1	92.3 ± 8.9	89.8 ± 12.4	98.0 ± 4.9	64.6 ± 2.5	9.5 ± 0.6	7.5 ± 0.8
Quartile 3	87.6 ± 18.7	14.9 ± 17.9	100 ± 0	96.4 ± 9.4	94.7 ± 9.1	68.1 ± 11.0	10.1 ± 2.8	8.0 ± 3.8
Quartile 4	98 ± 4.9	29.3 ± 40.7	29.3 ± 40.7	100 ± 0	96.7 ± 8.2	70.4 ± 7.1	10.6 ± 2.0	9.1 ± 2.2
Median age								
Quartile 1	88.3 ± 20.4	25.5 ± 34.3	100 ± 0	95.8 ± 10.2	96.7 ± 8.2	66.0 ± 16.1	9.8 ± 4.3	7.2 ± 5.6
Quartile 2	91.8 ± 9.3	45.0 ± 40.8	96.7 ± 8.2	96.7 ± 8.2	93.8 ± 9.6	66.7 ± 9.3	10.3 ± 1.7	7.5 ± 4.0
Quartile 3	82.9 ± 37.3	5.3 ± 9.1	85.7 ± 37.8	85.7 ± 37.8	82.9 ± 37.3	60.4 ± 10.1	7.7 ± 3.4	5.8 ± 4.0
Quartile 4	78.9 ± 39.2	36.1 ± 30.7	95.6 ± 6.9	93.2 ± 11.9	98.0 ± 4.9	61.2 ± 10.9	7.7 ± 3.8	6.4 ± 3.2
Median household income								
Quartile 1	83.3 ± 40.8	0 ± 0	83.3 ± 40.8	83.3 ± 40.8	83.3 ± 40.8	59.6 ± 12.5	6.8 ± 3.9	5.1 ± 3.9
Quartile 2	82.9 ± 18.5	45.9 ± 30.5	94.6 ± 8.7	90.5 ± 11.2	94.7 ± 8.6	70.8 ± 12.2	10.9 ± 3.2	8.9 ± 4.3
Quartile 3	93.9 ± 7.8	44.9 ± 38.5	98.0 ± 5.3	95.9 ± 11.0	94.7 ± 9.1	65.1 ± 8.5	10.0 ± 1.7	7.2 ± 3.6
Quartile 4	80.0 ± 40.0	14.5 ± 19.6	100 ± 0	100 ± 0	96.7 ± 8.2	58.0 ± 10.7	7.5 ± 3.7	5.4 ± 3.1
% Female residents								
Quartile 1	75.9 ± 38.0	39.3 ± 41.1	77.9 ± 39.1	78.0 ± 39.1	81.3 ± 40.1	60.3 ± 11.3	7.9 ± 4.0	5.4 ± 4.2
Quartile 2	80.0 ± 40.0	25.0 ± 33.3	100 ± 0	100 ± 0	93.3 ± 10.3	60.8 ± 12.7	8.0 ± 4.1	6.2 ± 3.8
Quartile 3	92.9 ± 18.9	26.1 ± 31.6	100 ± 0	96.4 ± 9.4	100 ± 0	65.0 ± 9.5	9.5 ± 2.2	7.1 ± 3.1
Quartile 4	91.5 ± 9.5	18.0 ± 27.5	97.7 ± 5.7	95.2 ± 11.8	93.8 ± 9.6	67.5 ± 13.6	9.8 ± 3.8	8.0 ± 4.7
% White residents								
Quartile 1	97.2 ± 6.9	2.8 ± 6.9	100 ± 0	100 ± 0	97.2 ± 6.9	65.0 ± 10.5	8.9 ± 2.7	6.8 ± 3.7
Quartile 2	71.7 ± 40.2	28.3 ± 32.4	83.3 ± 40.8	79.2 ± 40.1	80.0 ± 40.0	64.4 ± 17.1	9.1 ± 5.5	7.0 ± 5.6
Quartile 3	93.4 ± 8.5	46.3 ± 41.3	95.1 ± 8.5	93.0 ± 12.2	97.1 ± 7.6	64.8 ± 7.6	9.6 ± 1.4	7.0 ± 3.3
Quartile 4	77.9 ± 39.1	27.6 ± 25.8	97.9 ± 5.1	98.0 ± 4.9	94.7 ± 8.6	59.3 ± 11.4	7.7 ± 3.8	5.7 ± 3.4

Continued on next page

Continued from previous page

Table 4. Quartile Distribution of Survey Data on Pharmacy Access Factors Stratified by ZIP Code Area Variable

Variable	Mean ± S.D. % Pharmacies Offering Service					Mean ± S.D. Weekly Hours of Operation		
	Generic Drug Program	Home Medication Delivery	Influenza Immunization	Other Immunizations	Medication Therapy Management	Mon–Fri	Sat	Sun
% Residents with income below federal poverty line								
Quartile 1	81.0 ± 40.0	23.0 ± 30.5	97.7 ± 5.7	95.2 ± 11.8	100 ± 0	59.9 ± 10.5	7.5 ± 3.7	6.1 ± 3.1
Quartile 2	92.6 ± 8.6	38.1 ± 37.0	97.9 ± 5.1	98.0 ± 4.9	94.7 ± 8.6	60.6 ± 7.6	9.2 ± 0.9	5.7 ± 3.3
Quartile 3	84.7 ± 18.0	44.3 ± 32.5	97.1 ± 7.6	93.6 ± 11.1	91.9 ± 10.2	72.3 ± 11.2	11.4 ± 3.0	9.4 ± 4.0
Quartile 4	83.3 ± 40.8	0 ± 0	83.3 ± 40.8	83.3 ± 40.8	83.3 ± 40.8	59.6 ± 12.5	6.8 ± 3.9	5.1 ± 3.9
% Graduated high school								
Quartile 1	76.0 ± 43.4	12.0 ± 26.8	76.0 ± 43.4	76.0 ± 43.4	80.0 ± 44.7	57.5 ± 12.7	6.5 ± 4.4	4.5 ± 4.1
Quartile 2	90.0 ± 19.1	33.3 ± 37.5	100 ± 0	96.4 ± 9.4	94.3 ± 9.8	71.6 ± 11.2	10.8 ± 3.1	9.0 ± 4.0
Quartile 3	91.2 ± 8.7	32.8 ± 35.4	98.2 ± 4.7	98.3 ± 4.5	93.0 ± 9.0	62.1 ± 9.0	9.7 ± 1.4	6.3 ± 3.6
Quartile 4	81.0 ± 40.1	25.7 ± 30.6	97.7 ± 5.7	95.2 ± 11.8	100 ± 0	60.6 ± 10.5	7.5 ± 3.7	6.2 ± 3.1
% Graduated college								
Quartile 1	91.7 ± 20.4	8.3 ± 20.4	100 ± 0	95.8 ± 10.2	100 ± 0	61.3 ± 10.2	7.9 ± 2.2	5.4 ± 3.5
Quartile 2	73.8 ± 37.4	30.0 ± 34.0	80.0 ± 40.0	80.0 ± 40.0	77.2 ± 38.9	70.2 ± 15.6	10.2 ± 5.5	8.9 ± 5.0
Quartile 3	95.4 ± 8.1	18.6 ± 28.4	100 ± 0	100 ± 0	94.3 ± 9.8	64.3 ± 7.4	9.6 ± 1.2	7.3 ± 2.2
Quartile 4	78.9 ± 39.2	52.8 ± 34.2	95.6 ± 6.9	93.2 ± 11.9	98.0 ± 4.9	57.9 ± 10.8	7.5 ± 3.7	5.1 ± 4.0
% Employed								
Quartile 1	83.3 ± 40.8	0 ± 0	83.3 ± 40.8	83.3 ± 40.8	83.3 ± 40.8	60.4 ± 13.1	6.8 ± 3.9	5.2 ± 4.0
Quartile 2	88.8 ± 20.2	55.0 ± 39.8	100 ± 0	95.8 ± 10.2	93.8 ± 9.6	66.7 ± 13.2	10.4 ± 2.8	7.3 ± 5.2
Quartile 3	75.4 ± 34.4	28.0 ± 21.1	97.1 ± 7.6	97.1 ± 7.6	94.3 ± 9.8	61.9 ± 14.0	9.0 ± 4.6	6.6 ± 4.3
Quartile 4	95.6 ± 6.9	25.1 ± 33.0	95.6 ± 6.9	93.2 ± 11.9	98.0 ± 4.9	65.1 ± 4.3	9.2 ± 0.5	7.6 ± 1.0
% Uninsured								
Quartile 1	83.3 ± 40.8	30.5 ± 40.0	100 ± 0	100 ± 0	100 ± 0	58.3 ± 11.1	7.4 ± 3.7	5.0 ± 3.9
Quartile 2	90.3 ± 8.1	30.6 ± 29.0	95.6 ± 6.9	93.2 ± 11.9	94.7 ± 8.6	58.9 ± 8.9	8.4 ± 2.3	5.6 ± 3.3
Quartile 3	83.3 ± 37.3	25.7 ± 38.6	85.7 ± 37.8	85.7 ± 37.8	80.4 ± 36.5	67.9 ± 12.8	9.5 ± 4.6	8.1 ± 4.2
Quartile 4	85.0 ± 19.7	21.7 ± 27.1	96.7 ± 8.2	92.5 ± 11.7	96.7 ± 8.2	68.1 ± 10.9	10.0 ± 2.9	7.8 ± 3.8

Continued on next page

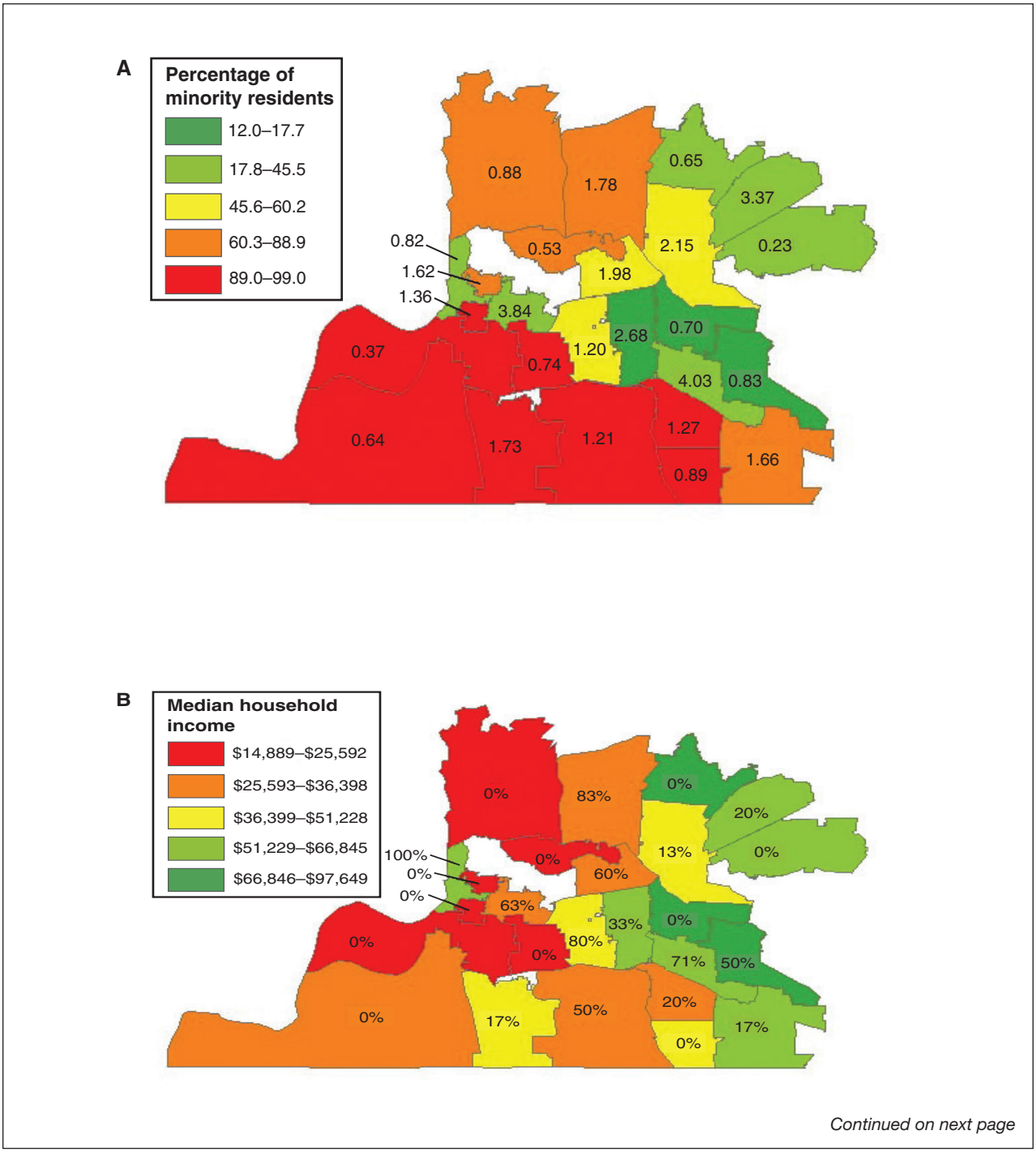
Continued from previous page

Table 4. Quartile Distribution of Survey Data on Pharmacy Access Factors Stratified by ZIP Code Area Variable

Variable	Mean ± S.D. % Pharmacies Offering Service					Mean ± S.D. Weekly Hours of Operation		
	Generic Drug Program	Home Medication Delivery	Influenza Immunization	Other Immunizations	Medication Therapy Management	Mon–Fri	Sat	Sun
Local personal crime risk score								
Quartile 1	96.7 ± 8.2	14.5 ± 19.6	100 ± 0	100 ± 0	96.7 ± 8.2	62.2 ± 6.1	9.1 ± 0.4	6.6 ± 1.7
Quartile 2	89.3 ± 9.0	48.1 ± 32.5	94.6 ± 8.7	94.7 ± 8.6	94.7 ± 8.6	66.2 ± 11.7	10.5 ± 2.6	7.5 ± 4.5
Quartile 3	88.4 ± 18.5	43.0 ± 36.9	98.0 ± 5.3	92.3 ± 13.2	94.7 ± 9.1	65.6 ± 13.3	9.6 ± 3.5	7.3 ± 4.8
Quartile 4	66.7 ± 51.6	0 ± 0	83.3 ± 40.8	83.3 ± 40.8	83.3 ± 40.8	59.6 ± 14.4	6.1 ± 4.7	5.2 ± 4.0
Local property crime risk score								
Quartile 1	96.7 ± 8.2	14.5 ± 19.6	100 ± 0	100 ± 0	96.7 ± 8.2	62.2 ± 6.1	9.1 ± 0.4	6.6 ± 1.7
Quartile 2	92.3 ± 8.8	47.8 ± 41.9	97.7 ± 5.7	95.2 ± 11.8	96.7 ± 8.2	65.4 ± 16.6	10.0 ± 4.2	6.9 ± 6.0
Quartile 3	76.8 ± 38.5	16.1 ± 27.7	98.2 ± 4.7	94.7 ± 9.8	98.3 ± 4.5	61.6 ± 11.3	7.7 ± 3.5	5.9 ± 3.5
Quartile 4	77.2 ± 38.9	31.7 ± 32.7	80.0 ± 40.0	80.0 ± 40.0	77.2 ± 38.9	64.9 ± 12.2	8.8 ± 4.5	7.4 ± 4.0
Local total crime risk score								
Quartile 1	96.7 ± 8.2	14.5 ± 19.6	100 ± 0	100 ± 0	96.7 ± 8.2	62.2 ± 6.1	9.1 ± 0.4	6.6 ± 1.7
Quartile 2	90.3 ± 8.1	44.4 ± 39.2	95.6 ± 6.9	93.1 ± 11.9	94.7 ± 8.6	63.2 ± 14.6	9.4 ± 3.7	6.3 ± 5.5
Quartile 3	90.0 ± 19.2	43.7 ± 34.4	97.1 ± 7.6	93.6 ± 11.1	97.1 ± 7.6	66.7 ± 9.6	10.1 ± 2.3	7.8 ± 3.4
Quartile 4	63.8 ± 49.9	2.8 ± 6.9	83.3 ± 40.8	83.3 ± 40.8	80.5 ± 40.0	61.3 ± 15.6	6.6 ± 5.2	5.8 ± 4.7
Pharmacy density								
Quartile 1	83.3 ± 40.8	0 ± 0	100 ± 0	100 ± 0	100 ± 0	64.2 ± 12.0	7.5 ± 3.7	6.7 ± 3.3
Quartile 2	100 ± 0	38.3 ± 44.9	100 ± 0	100 ± 0	96.7 ± 8.2	63.8 ± 8.0	9.6 ± 1.3	6.5 ± 3.5
Quartile 3	73.3 ± 37.0	26.7 ± 29.9	85.7 ± 37.8	82.1 ± 37.4	80.4 ± 36.5	63.1 ± 18.0	8.8 ± 5.6	6.5 ± 6.0
Quartile 4	86.9 ± 7.3	43.3 ± 24.4	92.3 ± 8.9	89.8 ± 12.4	94.7 ± 8.6	62.9 ± 5.6	9.4 ± 0.9	7.0 ± 1.8

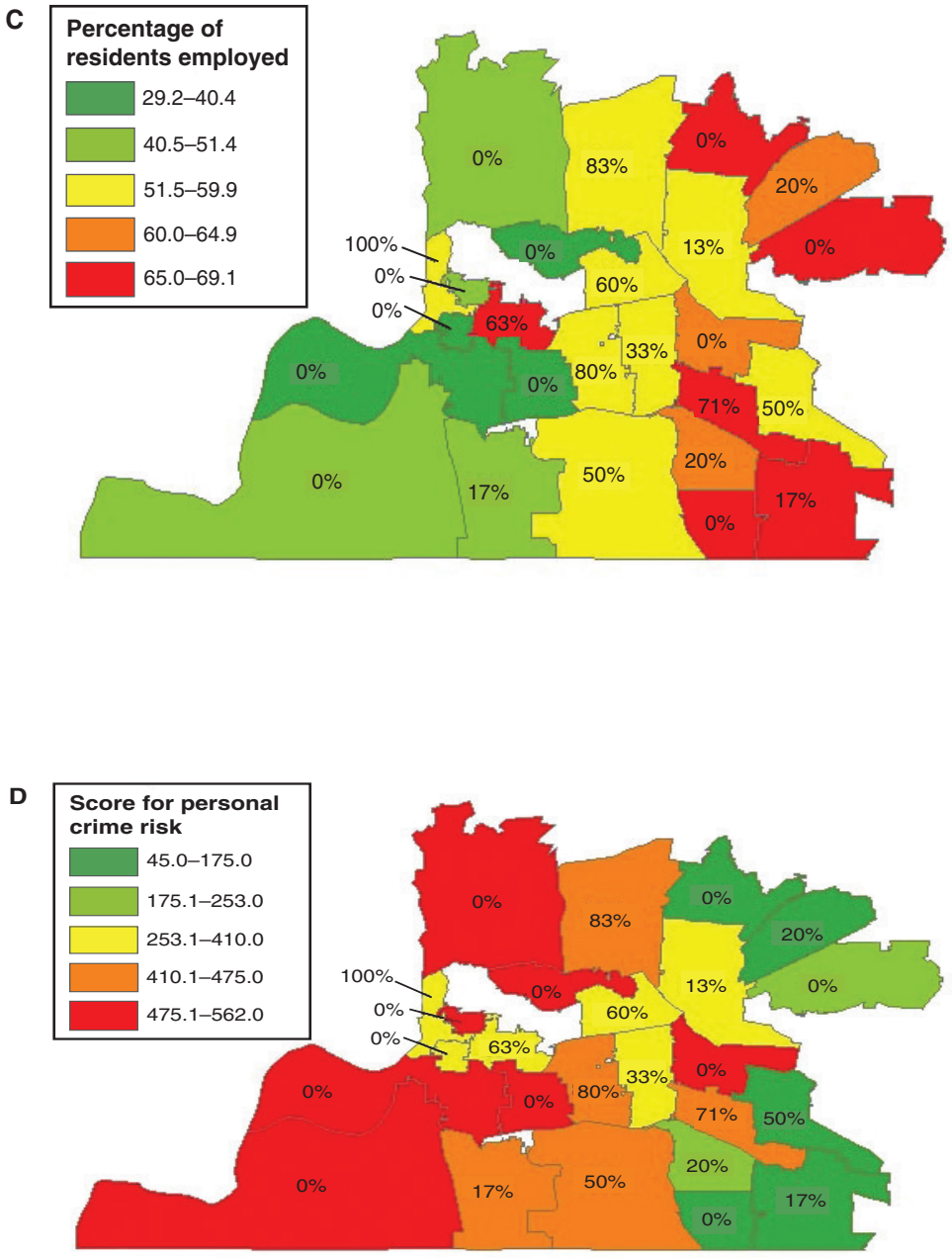
[a]MTM = medication therapy management.

Figure 1. Relationship of racial/ethnic and socioeconomic factors to pharmacy access measures in Shelby County, Tennessee. The mapped data were mainly collected in a survey of 90 community pharmacies in 25 of the county's 33 residential ZIP code areas (areas from which survey data were not obtained are shown in white). Panel A shows the number of community pharmacies per 10,000 residents within each ZIP code area in relation to local minority population representation. Panels B, C, and D show the percentage of surveyed pharmacies in each area that reported offering home medication delivery in relation to household income, employment rate, and personal crime risk score, respectively. The maps were generated using a Web-based application (ArcGIS Online, Esri, Redlands, CA), with the base map layer derived from the ArcGIS Web Map collection (source of original shape file: U.S. Census Bureau).



Continued on next page

Continued from previous page



that pharmacies in lower-income ZIP code areas was associated with decreased availability of generic drug programs as well as influenza and other immunization programs; they also found no significant association between income and home medication delivery. In our analysis of the availability of pharmacy services in relation to multiple ZIP code area variables, no significant socioeconomic or racial differences were found with regard to generic drug programs, MTM services, and influenza and other immunizations. However, pharmacies in ZIP code areas characterized by lower median household incomes and lower employment rates were less likely to offer home medication delivery. Thus, socioeconomic disparities influence access to home medication delivery. Such access may be critical to patients who experience transportation barriers. Additionally, availability of home

medication delivery is more limited in ZIP code areas with higher scores for personal crime risk. We speculate that pharmacies in these areas may not offer the service due to concerns over employee safety.

Although home medication delivery may not be as commonplace as other pharmacy services, it was offered by more than one third of pharmacies participating in our study. This finding provides evidence of consumer demand for the service in Shelby County and suggests the importance of reducing barriers to home medication delivery. Therefore, one suggestion to improve access to home medication delivery is to explore the possibility of pharmacies in low-income and low-employment areas partnering and contracting with community health workers. Community health workers are trained to participate in health education and outreach and are embedded in local neighborhoods. They have relationships and familiarity with the communities they serve that may allow them to navigate these areas with greater ease than pharmacy employees. Contracts with community health workers may also involve a lower cost to pharmacies relative to hiring employees specifically to perform medication deliveries. Although such partnerships face challenges (e.g., adhering to Health Insurance Portability and Accountability Act rules regarding patient health information), they may also help to increase community access to pharmacy home medication delivery services.

There were limitations to the study. Individuals may travel across ZIP code boundaries to procure goods and services on a regular basis.[13] However, prior studies have successfully used ZIP code–related characteristics or similar geographic variables to examine disparities in drug pricing, pharmacy services availability, and community pharmacy access.[7,12,13] Additionally, ZIP code–level data are readily available from the U.S. Census Bureau. Therefore, ZIP code of residence was selected as an appropriate indicator of geographic access to community pharmacies. Another limitation was that the study focused only on one U.S. jurisdiction, Shelby County, in which the largest racial or ethnic group is a minority group (African Americans). Therefore, the results may have limited generalizability, reinforcing the need for individual counties and cities to examine and address the specific pharmacy access disparities that may exist within a particular geographic region.

Conclusion

A survey of community pharmacies in Shelby County, Tennessee, found that areas with a high percentage of minority residents had lower pharmacy density than areas with a high percentage of white residents. Pharmacies located in communities with low average income levels, low employment rates, and high scores for personal crime risk were less likely to offer home medication delivery services.

Disclosures

The research project was supported by funding from the National Association of Chain Drug Stores Foundation. The authors have declared no potential conflicts of interest.

References

1. National Ambulatory Medical Care Survey: 2010 summary tables. www.cdc.gov/nchs/data/ahcd/namcs_summary/2010_namcs_web_tables.pdf (accessed 2015 May 4).
2. National Center for Health Statistics. Health, United States, 2013: with special feature on prescription drugs (2014). www.cdc.gov/nchs/data/hus/hus13.pdf#092 (accessed 2015 May 4).
3. Hall-Lipsy EA, Chisholm-Burns MA. Pharmacotherapeutic disparities: racial, ethnic, and sex variations in medication treatment. *Am J Health-Syst Pharm*. 2010; 67:462-8.
4. Healthy People 2020. Disparities. www.healthypeople.gov/2020/about/foundation-health-measures/Disparities (accessed 2014 Nov 19).
5. Piette JD, Heisler M, Wagner TH. Cost-related medication underuse among chronically ill adults: the treatments people forgo, how often, and who is at risk. *Am J Public Health*. 2004; 94:1782-7.
6. Mojtabai R, Olfson M. Medication costs, adherence, and health outcomes among Medicare beneficiaries. *Health Aff*. 2003; 33:220-9.
7. Qato DM, Daviglus ML, Wilder J et al. 'Pharmacy deserts' are prevalent in Chicago's predominantly minority communities, raising medication access concerns. *Health Aff*. 2014; 33:1958-65.
8. Joynt M, Train MK, Robbins BW et al. The impact of neighborhood socioeconomic status and race on the prescribing of opioids in emergency departments throughout the United States. *J Gen Intern Med*. 2013; 28:1604-10.
9. Pletcher MJ, Kertesz SG, Kohn MA, Gonzales R. Trends in opioid prescribing by race/ethnicity for patients seeking care in US emergency departments. *JAMA*. 2008; 299:70-8.
10. Morrison RS, Wallenstein S, Natale DK et al. "We don't carry that"—failure of pharmacies in predominantly nonwhite neighborhoods to stock opioid analgesics. *N Engl J Med*. 2000; 342:1023-6.
11. Green CR, Ndao-Brumblay SK, West B, Washington T. Differences in prescription opioid analgesic availability: comparing minority and white pharmacies across Michigan. *J Pain*. 2005; 6:689-99.
12. Amstislavski P, Matthews A, Sheffield S et al. Medication deserts: survey of neighborhood disparities in availability of prescription medications. *Int J Health Geogr*. 2012; 11:48.
13. Erickson SR, Workman P. Services provided by community pharmacies in Wayne County, Michigan: a comparison by ZIP code characteristics. *J Am Pharm Assoc*. 2014; 54:618-24.
14. Healthy Memphis Common Table. Report 4. Status report on efforts to advance health equity in clinical care and health outcomes in Memphis and Shelby County, Tennessee (May 2011). http://healthcarequalitymatters.org/assets/2011_HMCT_Equity_Report.pdf (accessed 2015 Aug 4).
15. U.S. Census Bureau. State and county quickfacts. Shelby County, Tennessee (May 29, 2015). http://quickfacts.census.gov/qfd/states/47/47157.html (accessed 2015 Aug 4).
16. Tennessee Department of Labor and Workforce Development. May 2015 county unemployment rates. www.tn.gov/workforce/news/15492 (accessed 2015 Aug 4).
17. U.S. Census Bureau. American Community Survey, 2010 American

Community Survey 1-year estimates. http://factfinder2.census.gov (accessed 2014 Dec 18).
18. Health Resources and Services Administration. HPSA search. http://datawarehouse.hrsa.gov/tools/analyzers/hpsafind.aspx (accessed 2015 Aug 10).
19. Health Resources and Services Administration. Medically underserved areas/populations (August 2015). www.hrsa.gov/shortage/mua/index.html (accessed 2015 Aug 10).
20. Move, Inc. City profiles report. www.moving.com/real-estate/city-profile/ (accessed 2015 Apr 8).
21. Academy of Managed Care Pharmacy. http://amcp.org/WorkArea/DownloadAsset.aspx?id=14653 (accessed 2016 Mar 1).
22. Bartholow M. Top 200 drugs of 2012 (July 17, 2013). www.pharmacytimes.com/publications/issue/2013/July2013/Top-200-Drugs-of-2012 (accessed 2015 Jan 5).
23. National Center for Health Statistics. Health, United States, 2014: with special features on adults aged 55–64 (2015). www.cdc.gov/nchs/data/hus/hus14.pdf (accessed 2015 Aug 4).

CVS Pharmacy Thinks Outside the Box with Introduction of Health and Wellness Vending Machines

Thursday, September 7, 2017

1 2

Automated retail vending machines will be placed at select landmark locations across the Northeast, including Boston's South Station and New York City's LaGuardia Airport

Company continues to innovate and to meet customers where they are with unparalleled access to on-the-go solutions

WOONSOCKET, R.I., Sept. 7, 2017 /PRNewswire/ -- CVS Pharmacy, the retail division of CVS Health (NYSE: CVS), today announced that the company is introducing automated retail vending machines stocked with convenient, on-the-go necessities including over-the-counter health products, "better-for-you" snacks and popular personal care products typically sold at CVS Pharmacy locations nationwide. The new vending machines are designed to help maximize convenience and meet customers where they are with on-the-go wellness solutions outside the traditional retail space.

"We are always looking for new ways to combine convenience and innovation to help better serve our customers," said Judy Sansone, Senior Vice President of Front Store Business & Chief Merchant at CVS Pharmacy. "Our new CVS Pharmacy vending machine program allows us to extend that convenience beyond our brick-and-mortar locations to offer customers on-the-go essentials in the locations where they often need them most, like airports, hotels and other transportation hubs."

Each vending machine will be customized with offerings to fit each location with more than 70 products to choose from, including many from exclusive CVS Pharmacy store brand lines like CVS Health, Beauty 360, Gold Emblem and Gold Emblem Abound. Products available in the vending machines include:

- Over the counter remedies for allergy, pain relief, digestive health, and cough and cold
- Beauty and personal care products like shaving cream, deodorant, makeup remover

- Vitamins and supplements
- Eye care and oral health care products
- Solutions for healthy sleep such as melatonin
- Children's health and on-the-go first aid items such as bandages and antiseptic cream
- Healthy snacks and beverages
- Home and office essentials such as batteries, phone chargers, earbuds, lint rollers and stain removal sticks

The first 25 CVS Pharmacy vending machines will be unveiled throughout New England and New York between now and the end of October in targeted areas including:

- Airports including LaGuardia in New York City
- Public transit stations such as South Station Bus Terminal in Boston
- Office parks
- College campuses

These machines enhance customer convenience with strategic placements in areas well-trafficked by local residents and travelers alike who may need products in a pinch, eliminating the need to make a special trip to a retail location. CVS Pharmacy is also considering an additional 50+ locations throughout the country including college campuses, corporate offices, hotels and other transportation hubs to host vending machines in the future.

"These new vending machines allow us to make our innovative CVS Brand products available to customers outside of our store locations for the very first time," said Cia Tucci, Vice President of Store Brands and Quality Assurance at CVS Health. "The CVS Pharmacy vending

machines will be located in places where we can bring our customers smart solutions and convenient access to the products they trust when they are on-the-go."

To help customers navigate this new shopping experience, the vending machines, will feature a 22" multi-touch screen, high resolution images with expansive product information and a QR code reader to read barcodes and promotional codes. The machines will be ADA compliant, allowing those in wheelchairs to fully access the touchscreen and its functionality, and will accept all major credit and debit cards.

CVS Pharmacy is a trusted health and beauty destination for more than 5 million shoppers every day. The new vending machines, along with recent nationwide store design enhancements and expanding digital programs, represent the company's ongoing efforts to evolve the retail customer experience in stores and beyond. With this pilot program, CVS Health adds to a growing portfolio of innovative services including CVS Curbside Pickup, CVS Pay and digital pharmacy tools available through the CVS Pharmacy app, that together build on the company's enterprise mission to help people on their path to better health.

Contact:

CVSHealthKiosk@CVSHealth.com

About CVS Pharmacy

CVS Pharmacy, the retail division of CVS Health (NYSE: CVS), is America's leading retail pharmacy with over 9,700 locations. It is the first national pharmacy to end the sale of tobacco and the first pharmacy in the nation to receive the Community Pharmacy accreditation from URAC, the leading health care accreditation organization that establishes quality standards for the health care industry. CVS Pharmacy is reinventing pharmacy to help people on their path to better health by providing the most accessible and personalized expertise, both in its stores and online at CVS.com. General information about CVS Pharmacy and CVS Health is available at **www.cvshealth.com.**

SOURCE CVS Pharmacy

https://cvshealth.com/news-and-insights/press-releases/cvs-pharmacy-thinks-outside-the-box-with-introduction-of-health