

**Results of  
the Observational Surveys of Mask Use and  
Protective Measures of Indoor Public Areas  
in Jefferson County, KY  
during November 5–11, 2020**

**Draft Date: November 17, 2020**

UNIVERSITY OF  
**LOUISVILLE**<sup>®</sup>  
SCHOOL OF PUBLIC HEALTH  
& INFORMATION SCIENCES



DEPARTMENT OF  
**PUBLIC HEALTH  
AND WELLNESS**

## **Key Takeaways**

- The level of protective measures at the Jefferson County indoor public areas/stores is low, and even less so in small public areas.
- It is common to see unmasked staff and visitors in indoor public areas, and even more common to see incorrectly masked staff and visitors in public areas. Observing at least one person incorrectly wearing a mask ranged from 21% to 55% across the County's districts.
- Unmasked staff and visitors in Jefferson County indoor public areas are more commonly 19–44-year-old men.
- There are significant sex and age-related disparities in mask-wearing across the County's districts.

## Summary of Results

### *Protective Measures in Indoor Public Areas (PAs):*

- Overall, 29% of all the Jefferson County public areas (PAs) provided hand sanitizer for their visitors' use, and only 2% of them provide masks for visitors.
  - 90% of the large PAs provided hand sanitizer to their visitors compared to only 13% for the small capacity PAs.
  - Irrespective of the size or the capacity, very few of the PAs provided masks to visitors.
- Of the large PAs, 50% had a separate entrance and exit and 26% sanitized shopping carts.
  - Separation of entrance and exit is more common at the PAs located at the North Center district of the County (28%).
- Visitors' mask-wearing was largely not being checked at the entrances of public areas, with only 36% of large-size PAs checking masks, 10% of medium-sized PAs checking masks, and 4% of small-sizes PAs were checking masks at the entrance
  - Checking visitors' mask is more common at the PAs located in the South East district of the County (25%).

### *Mask Wearing of Staff and Visitors in Indoor Public Areas (PAs):*

- 30% of small PAs had at least one unmasked staff. In medium-size PAs, it was 23%. In large PAs, it was 11%.
  - Unmasked staff was observed in about a third of sampled PAs at the West Center, Central, and North West districts, in about a quarter of sampled PAs at the South & South West, South East, and East & North East districts, and in about a tenth of PAs at the North Center district.
- 35% of small PAs had at least one unmasked visitor. In medium-size PAs, it was 23%. In large PAs, it was 14%.
  - Unmasked visitors were observed in 43%–46% of sampled PAs at the South & South West and Central districts, in at least a quarter of sampled PAs at the North West, West Center, South East, and East & North East districts, and in about one-sixth of sampled PAs at the North Center district.

- 36% of small PAs had at least one incorrectly masked staff. In medium-size PAs, it was 52%. In large PAs, it was 29%.
  - Incorrectly masked staff was observed in about half of PAs at the West Center and North West districts. In other districts, incorrectly masked staff were observed in 29% to 39% of the surveyed PAs.
- 25% of small PAs had at least one incorrectly masked visitor. In medium-size PAs, it was 40%. In large PAs, it was 61%.
  - Incorrectly masked visitors were observed in 55% of sampled PAs at the North Center district, in 21% to 40% of sampled PAs at other districts.
- 82% of unmasked staff and 75% of unmasked visitors were male.
- More than half of the incorrectly masked visitors of the surveyed PAs were male.
- Those unmasked or masked incorrectly also tended to be between 19 and 44 years old in all districts, regardless of if the observed was a staff or visitor.

## Introduction

The University of Louisville-Louisville Metro Department of Public Health and Wellness research team (the Team) has projected the trends in COVID-19 hospitalizations and deaths in Jefferson County, Kentucky (JCKY), in several [reports](#) from May 2020. The Team developed an SEIR (suspected-exposed-infected-recovered) epidemic model and provided projections under different scenarios of non-pharmaceutical interventions (NPIs) that were intended to affect the transmission of the coronavirus.

The impact of NPIs on the transmission of the virus was traced in the pattern of community mobility and the rate of mask-wearing among Jefferson County residents. Information on the rate of mask-wearing was collected from a New York Times national [survey](#) of mask-wearing, conducted on July 2–14, 2020. Facial mask use is an effective preventive action to curb the spread of COVID-19 ([Abkarian et al., 2020](#); [Bahl et al., 2020](#); [Chu et al., 2020](#); [Fischer et al., 2020](#); [Verma et al., 2020](#)), but there is limited information about Jefferson County residents' mask-wearing behavior after New York Times published the result of its surveys. Therefore, the Team designed and conducted an observational study of mask use and protective measures in indoor public areas of Jefferson County, Kentucky, in November 2020.

The phrase “observational study” in this report refers to a non-interventional observation of residents' facial mask-wearing practice (type, prevalence, and proper use) in indoor public areas. The limitations of other types of surveys have led the Team to turn to an observational study as opposed to a study using self-report, which may differ from actual behavior. One-on-one interviews involve the risk of contracting the virus by both interviewers and interviewees. Phone interviews face a low response rate problem, as most people may not be willing to answer unsolicited calls and those who answer the calls may not be representative of the population. Hence, most social distancing surveys are conducted online, which suffer from both low response rate and potentially large selection bias because of disparities in access to and use of the internet.

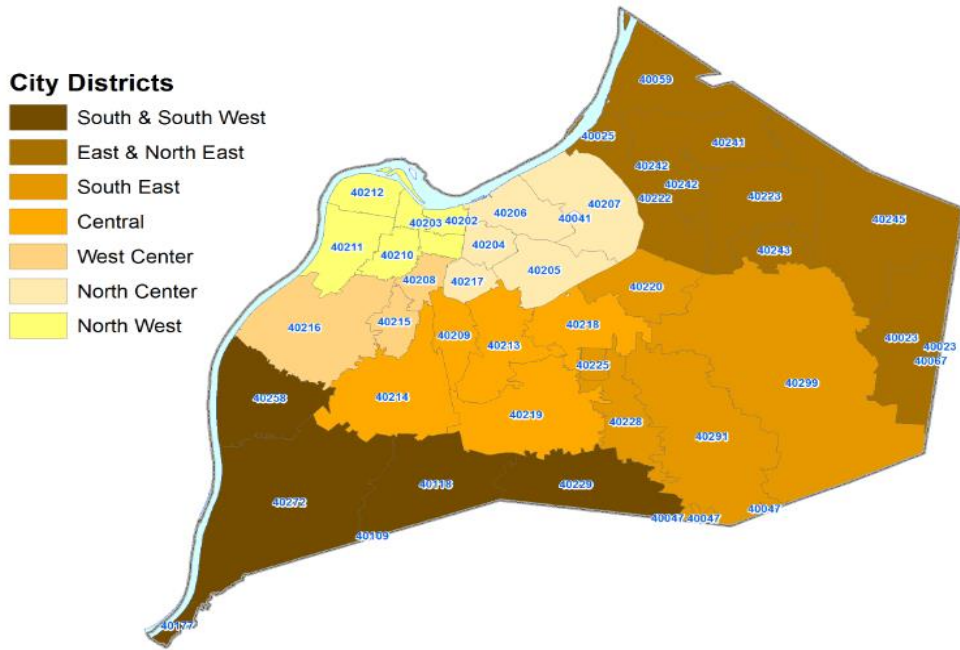
## Methods

In this observational study of Jefferson County, Kentucky, zip codes are the surveying clusters, and the targets were indoor public areas (PAs). The number of selected PAs in each zip code was proportional to the population and the total number of PAs in the zip code. The type of PAs was classified into four groups, and random selections were made from each group. The four groups were: (1) grocery stores; (2) convenience, departmental, and discount stores and pharmacies; (3) wine and liquor stores; (4) other stores—e.g., auto parts, firewood, furniture, gifts, grills, hardware and lumber, lawnmowers, mattresses, office equipment, pet supplies, and variety. Indoor PAs that required personal attendance (e.g., restaurants, bars, barbershops, nail salons) were excluded to preserve the study's mere observational and non-interventional aspect. The technical details are provided in the Technical Supplement.

Surveyors observed the public areas' protective measures and mask-wearing behaviors of its occupants and categorized the public areas into small, medium, and large depending upon the size and capacity. A large PA is a store like a typical Walmart or Kroger, a medium-size PA resembles a typical Walgreens or Dollar Store, and a small PA can be a micro pop-up store, a small single-line store, or a specialty shop. There were six questions in the survey related to the practice of protective measures in the PAs: the availability of separate entrance and exit, checking if visitors were wearing a mask at the entrance of the PA, providing masks to the visitors, providing wipes to the visitors, providing hand sanitizer for visitors' use, and sanitization of the shopping carts.

Jefferson County's thirty-three zip codes with a population of at least 1,000 were grouped into seven city districts: South & Southwest (40118, 40229, 40272, and 40258), East & Northeast (40023, 40025, 40222, 40223, 40241, 40242, 40243, and 40245), South East (40220, 40228, 40291, and 40299), Central (40213, 40214, 40218, and 40219), West Center (40208, 40215, and 40216), North Center (40204, 40205, 40206, 40207, and 40217), and North West (40202, 40203, 40210, 40211, and 40212) (Figure 1). These seven districts were determined according to zip codes' geographical proximity, population demographics, and household median income. The most affluent city district is East & North East with a population-weighted median household income of \$91,141 in 2018. The South East and the North Center districts rank second and third with \$69,642 and \$66,402, respectively. Median household income in other districts are: \$55,153 (South & South West), \$43,911 (Central), \$37,469 (West Center), and \$22,848 (North West).

**Figure 1:** City Districts in Jefferson County



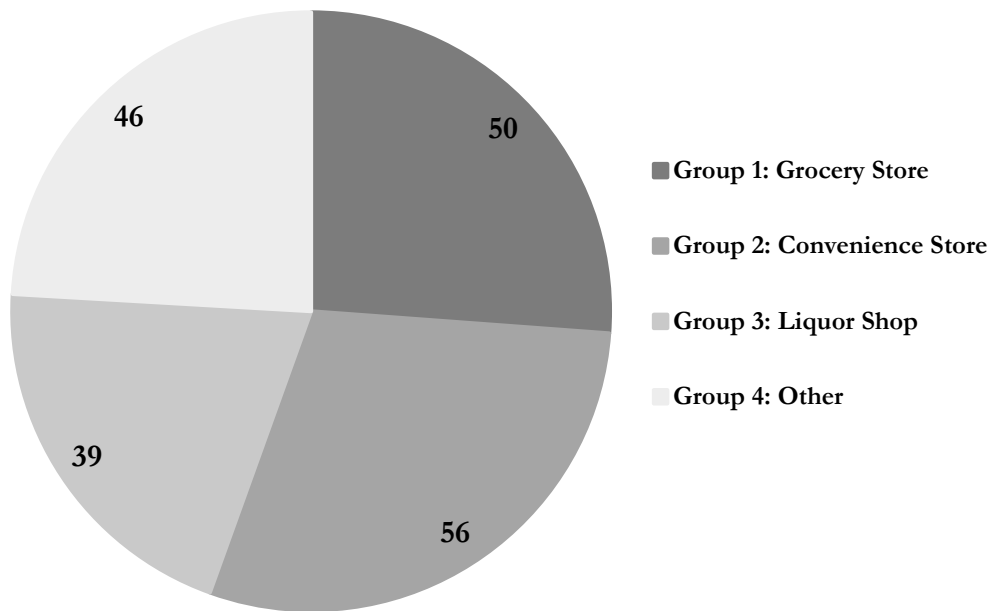
This study is designed to be conducted in multiple waves. The first wave was conducted between November 5-11, 2020. It is funded by the Louisville Metro Department of Public Health & Wellness (LMPHW) through the Coronavirus Aid, Relief, and Economic Security Act (the CARES Act).

This study is approved by the University of Louisville Institutional Review Board (IRB #20.0966; Reference Number: 716561).

## Results

A total of 191 PAs were surveyed during the period from November 5 to November 11, 2020. Of the 191 total PAs surveyed, 50 were grocery stores (26%), 56 were convenience stores (29%), 39 were liquor stores (20%), and 46 were other PAs (24%) (Figure 2). A majority of the PAs surveyed were small (60%) in capacity, 25% were medium capacity, and 15% were large (Figures 3).

**Figure 2:** Number of Observed Indoor Public Areas by Type





**Figure 3:** Number of Observed Indoor Public Areas by Capacity

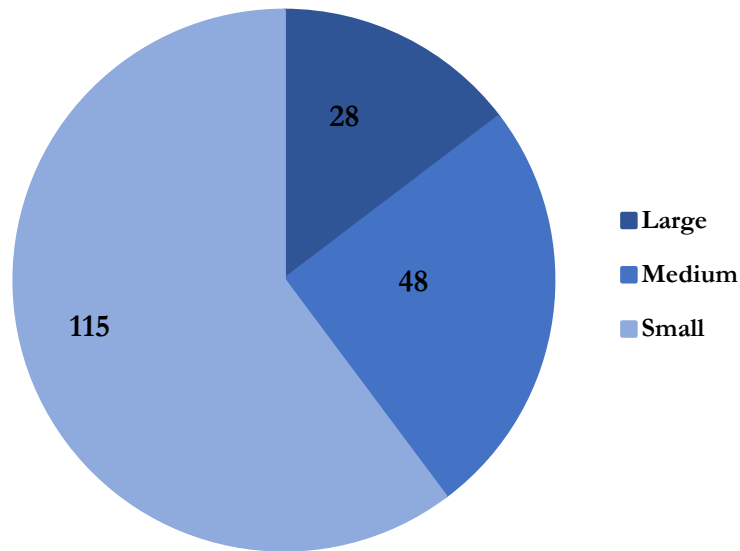
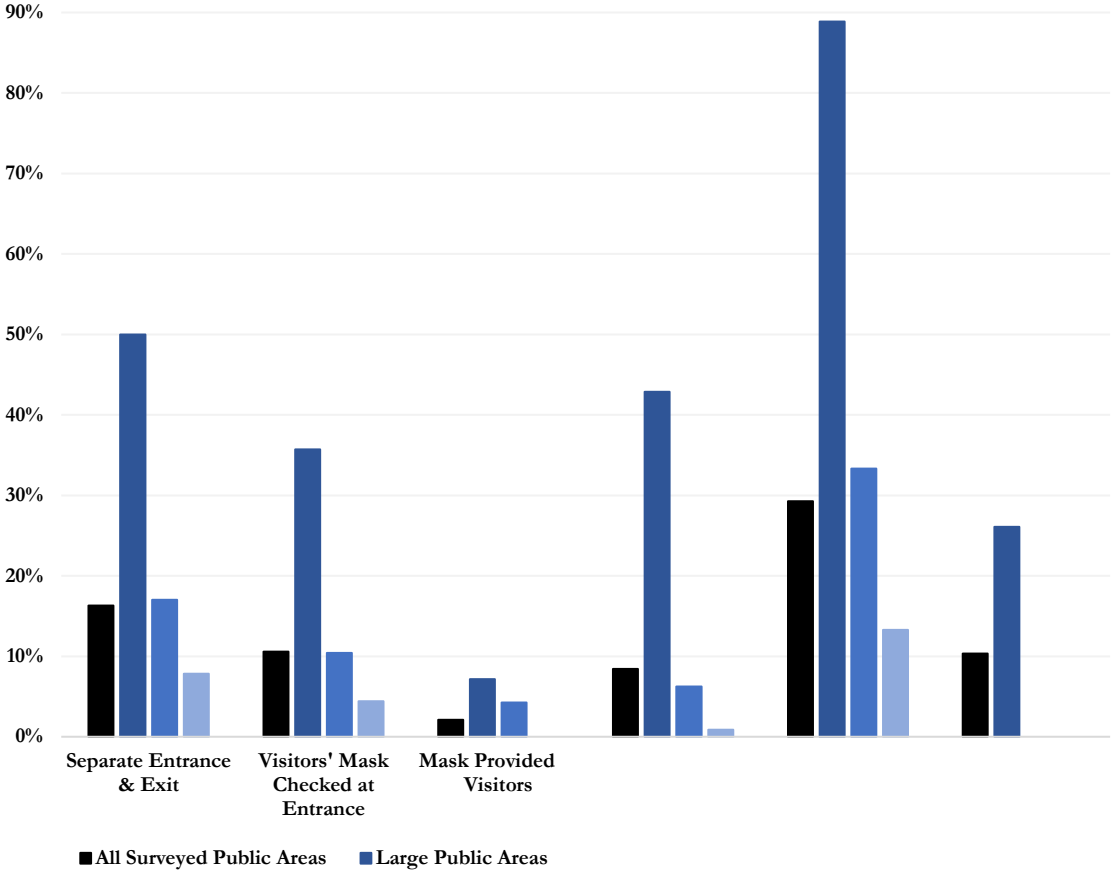


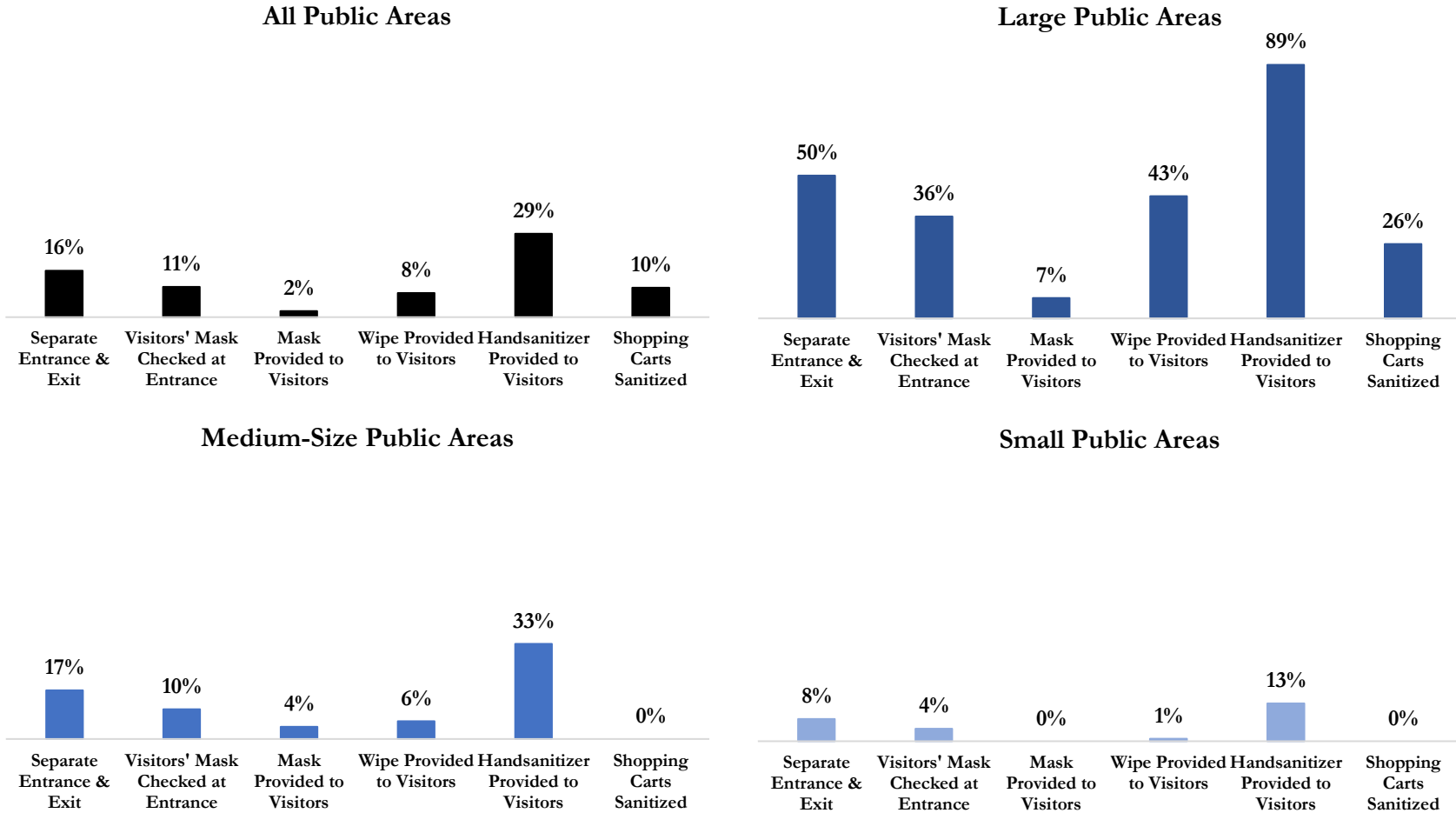
Figure 4 presents the results of investigating the protective measures put in place by PAs overall and by PA size. Overall, 29% of all the PAs provided hand sanitizer for their visitors' use, which varied substantially by PA size. The findings suggest that 89% of the large PAs provided hand sanitizer to their visitors compared to only 13% for the small capacity PAs. Only 2% of the PAs provided masks to the visitors (Figures 4 and 5).

When shopping carts available, only 26% of the large PAs sanitized them. The rate was zero in medium-size and small PAs. 50% of large PAs had a separate entrance and exit, while the separation of entrances and exits was much lower in medium-size PAs (17%) and small-size PAs (8%). Visitors' mask-wearing was largely not being checked at the entrances of public areas, with only 36% of large-size PAs checking masks, 10% of medium-sized PAs checking masks, and 4% of small-sizes PAs were checking masks at the entrance (Figures 4 and 5).

**Figure 4:** Percentage of Indoor Public Areas by Practice of Protective Measures and Capacity

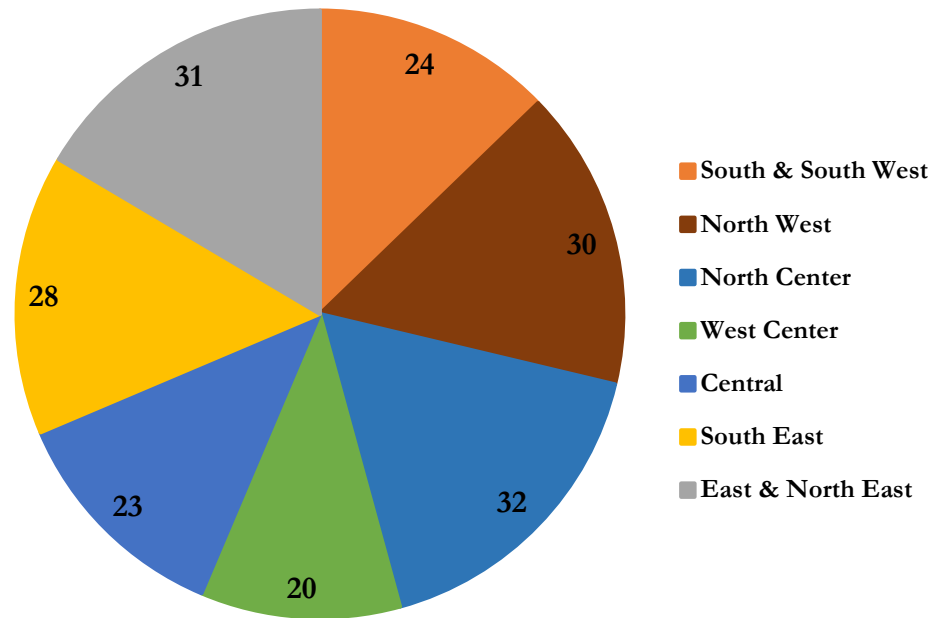


**Figure 5:** Percentage of Indoor Public Areas by Practice of Protective Measures and Capacity



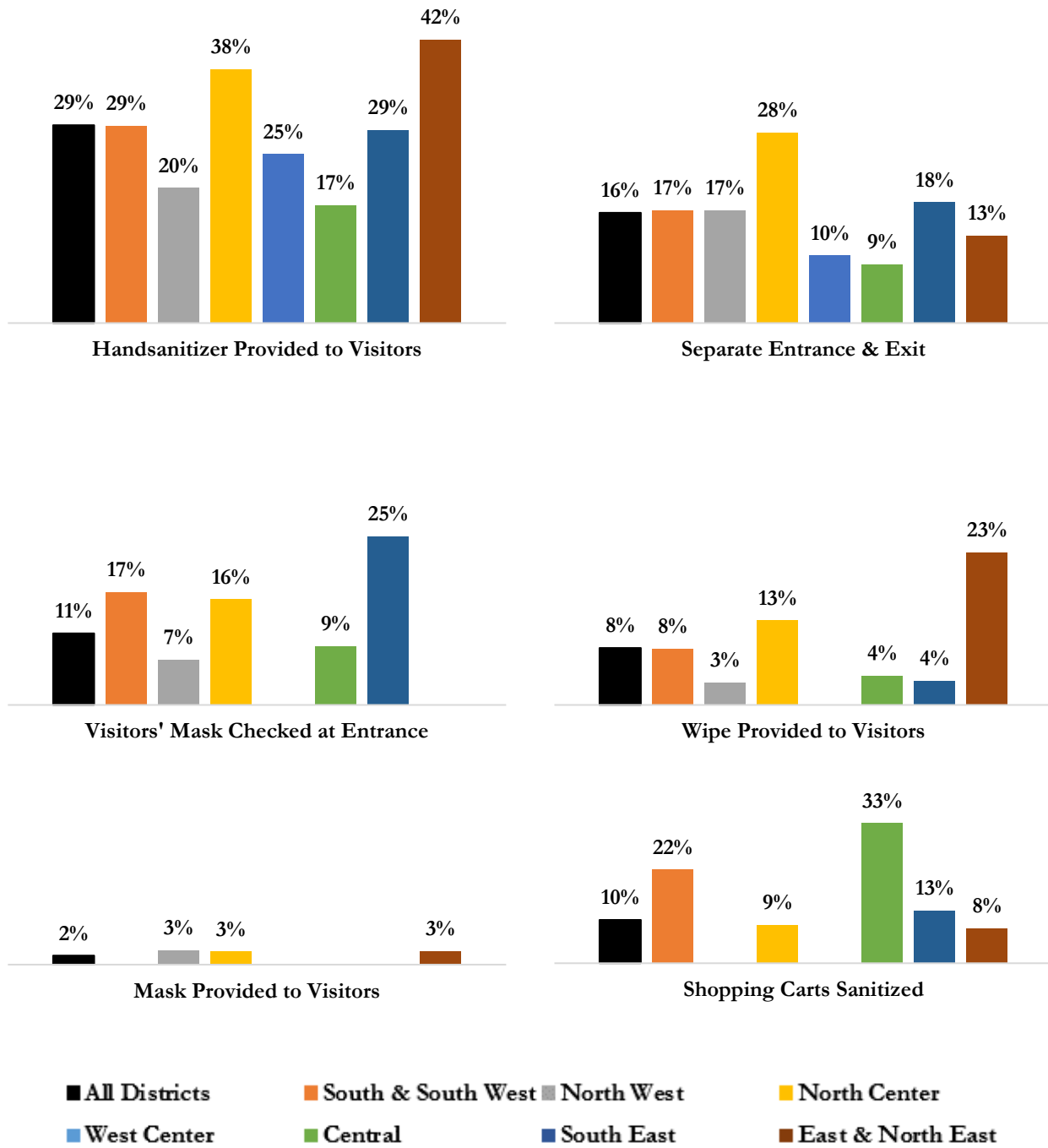
As discussed earlier, the observed PAs in Jefferson County were divided into seven districts. The number of PAs observed in each of these districts ranged from 20 to 32 (Figure 6).

**Figure 6:** Number of Observed Indoor Public Areas by Districts

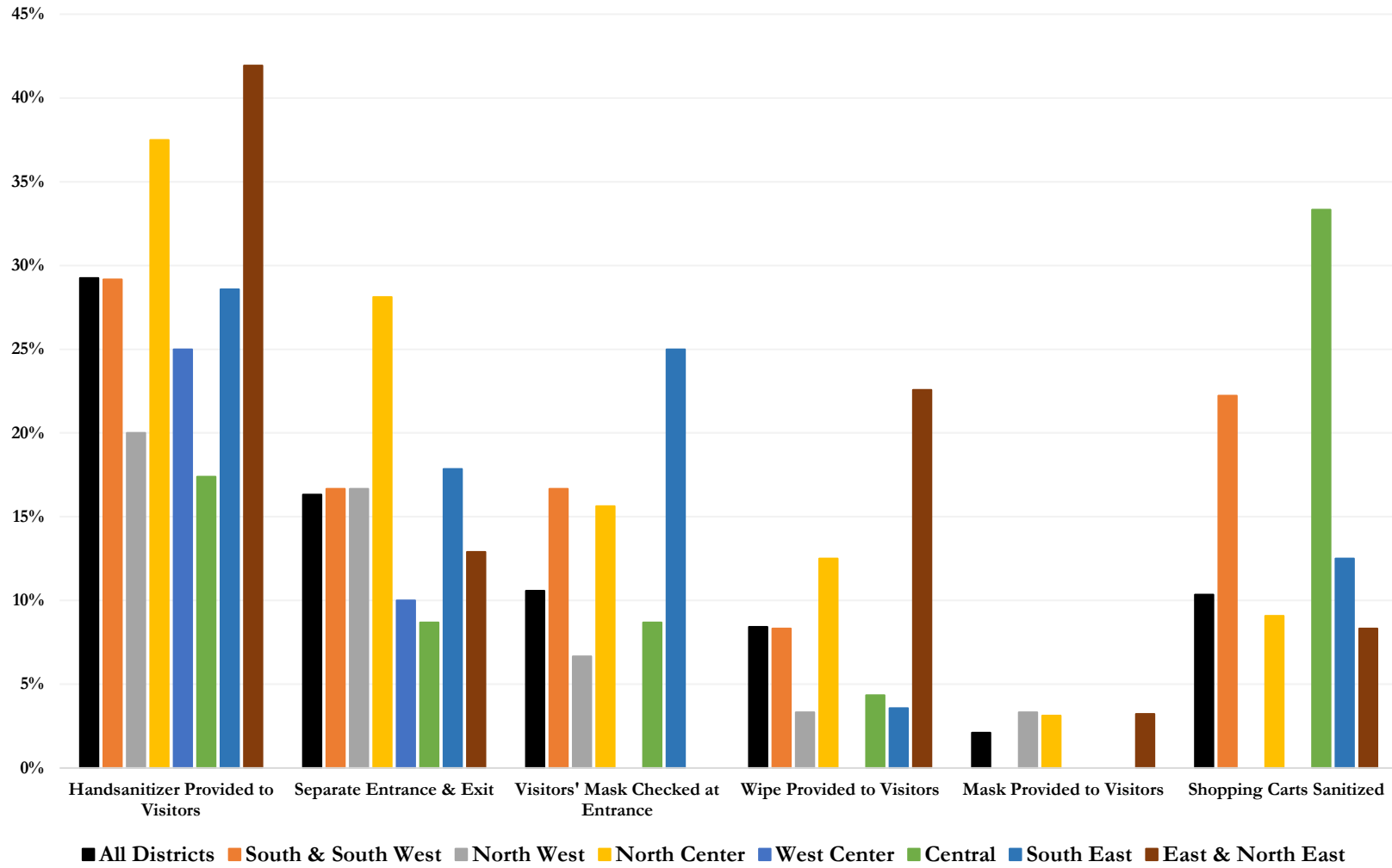


The provision of protective measures at the sampled PAs in Jefferson County was assessed by city district. The findings suggest that protective measures were better in PAs located in the East & North East district, North Center district, and South East district compared with the other districts (Figure 7). With regards to hand sanitizer being provided to visitors, it was the least bad in the East & North East areas with 42% of PAs providing hand sanitizer to visitors and was the worst in the Central district with 17% of PAs providing hand sanitizer to visitors. For better visualization of district-level differences in PA protective measures, components of Figures 7 are combined in Figure 8.

**Figure 7: Percentage of Indoor Public Areas by Practice of Protective Measures and District**

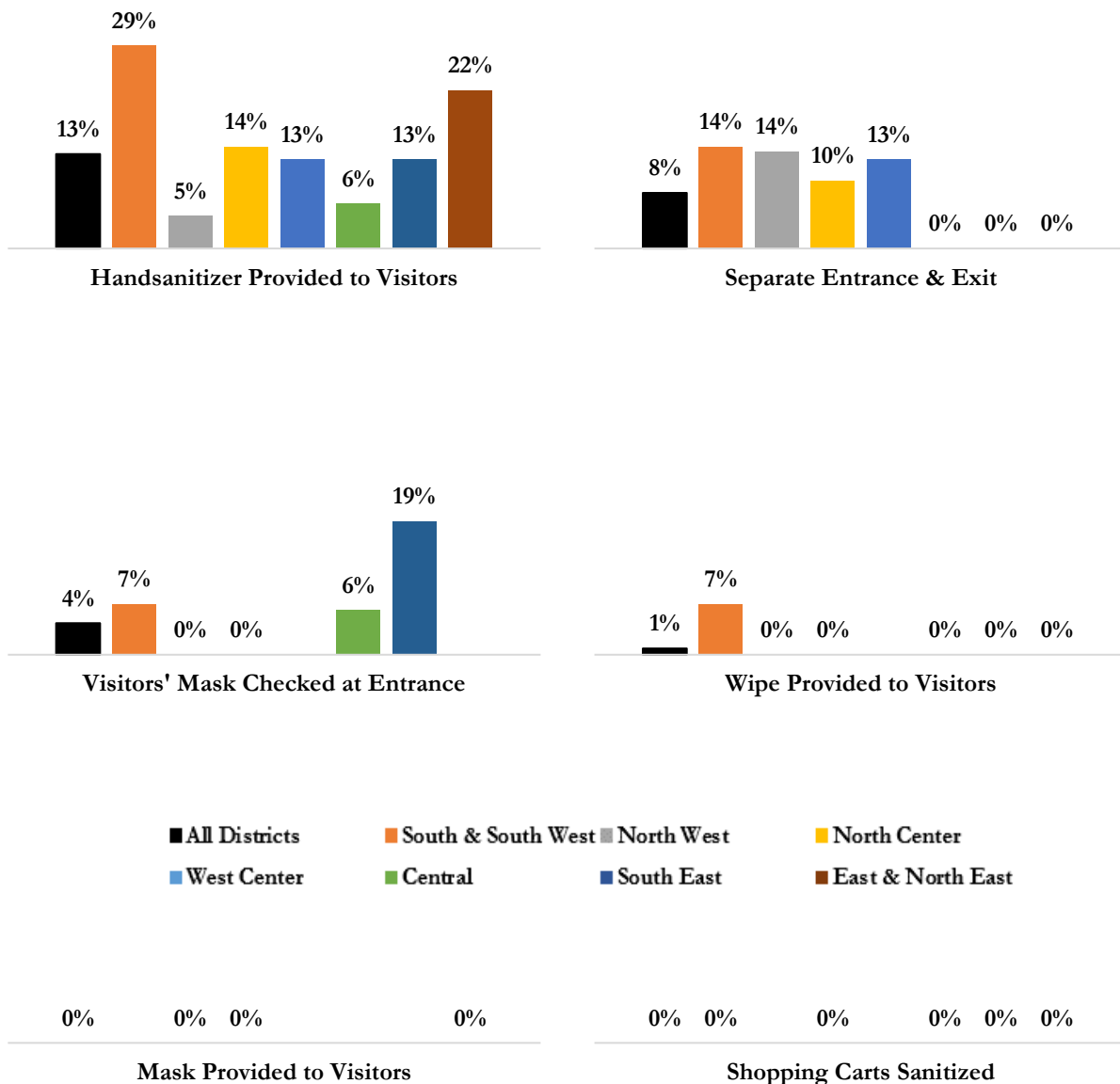


**Figure 8:** Percentage of Indoor Public Areas by Practice of Protective Measures and District

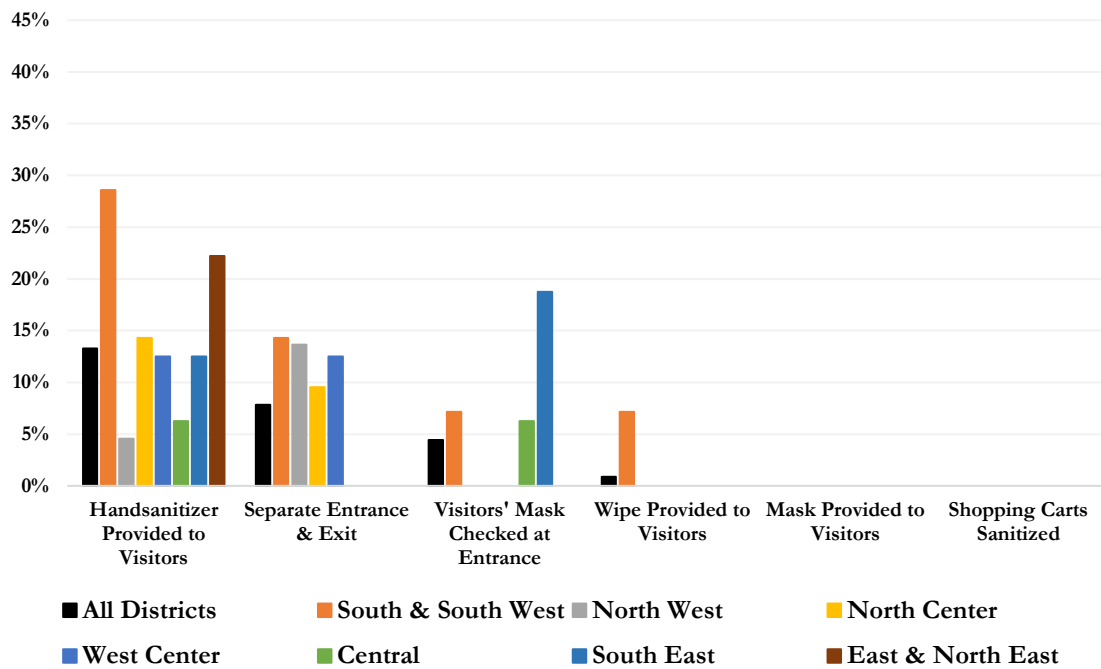


The provision of protective measures was minimal in small PAs, which constituted 60% of all observed PAs. 13% of the sampled small PAs provided hand sanitizer for visitors' use, but the rate significantly varied across districts: 29% in the South & South West district, 22% in the East & North East district, 5%–6% in the North West and Central districts, 13%–14% in the other districts (Figure 9). No mask was provided, and shopping carts (if available) were not sanitized in any of the observed small PAs. For better visualization of district-level differences in PAs' protective measures, components of Figures 9 are combined in Figure 10.

**Figure 9:** Percentage of Small Indoor Public Areas by Practice of Protective Measures and District



**Figure 10:** Percentage of Small Indoor Public Areas by Practice of Protective Measures and District

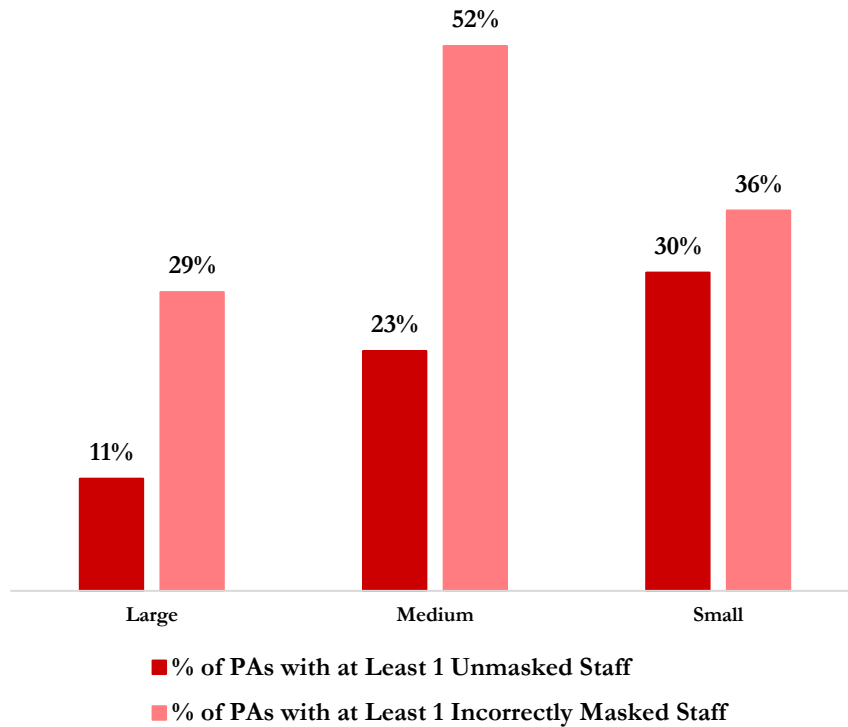


The staff and visitors’ mask behavior in the sampled PAs was categorized according to PA capacity and district. The share of small PAs where at least one unmasked staff or visitor was observed was greater than that in medium-size and large PAs. The share of medium-size PAs where at least one incorrectly masked staff was observed was greater than others, but the share of large PAs where at least one incorrectly masked visitor was observed was greater than others. (Figures 11 and 12).

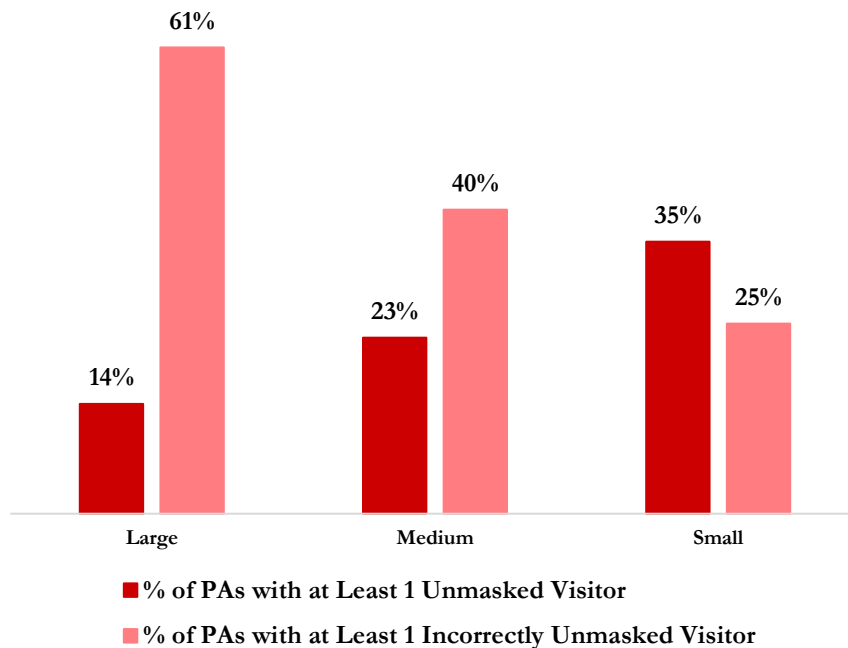
Unmasked staff was observed in about a third of the sampled PAs at the West Center, Central, and North West districts. Also, unmasked staff was observed in about a quarter of sampled PAs at the South & South West, South East, and East & North East districts. The chance of observing an unmasked staff was significantly smaller in PAs at the North Center district than in other districts (Figure 13). Incorrectly masked staff was observed in about half of PAs at the West Center and North West districts. In other districts, incorrectly masked staff were observed in 29% to 39% of the surveyed PAs (Figure 13). Unmasked visitors were observed in 43%–46% of sampled PAs at the South & South West and Central districts. Also, in at least a quarter of sampled PAs at the North West, West Center, South East, and East & North East districts. The likelihood of observation of unmasked visitors was significantly smaller in the sampled PAs at the North Center district, while observation of incorrectly masked visitors was significantly more likely at this district’s PAs (Figure 14).



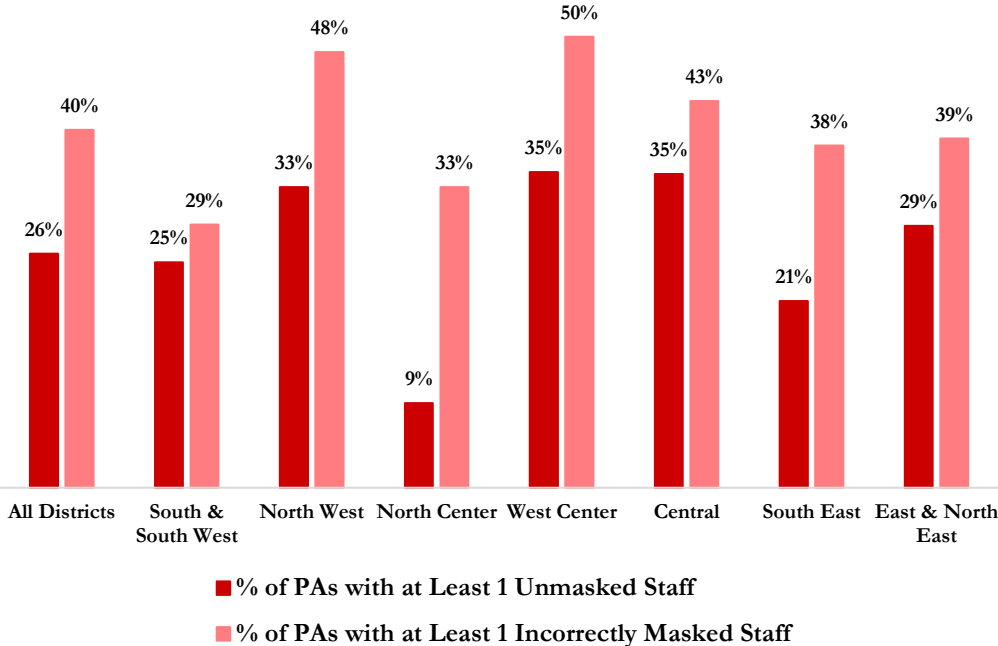
**Figure 11: Staffs' Mask Use in Jefferson County Indoor Public Areas by Capacity, Nov. 5–11, 2020**



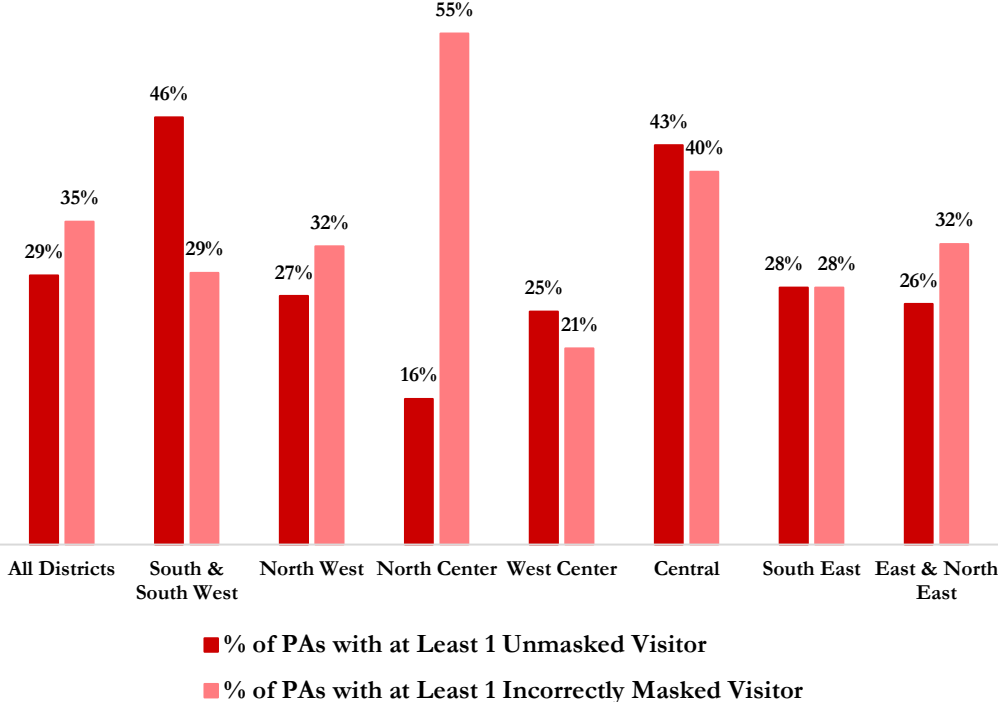
**Figure 12: Visitors' Mask Use in Jefferson County Indoor Public Areas by Capacity, Nov. 5–11, 2020**



**Figure 13:** Staff's Mask Use in Jefferson County Indoor Public Areas by District, Nov. 5–11, 2020

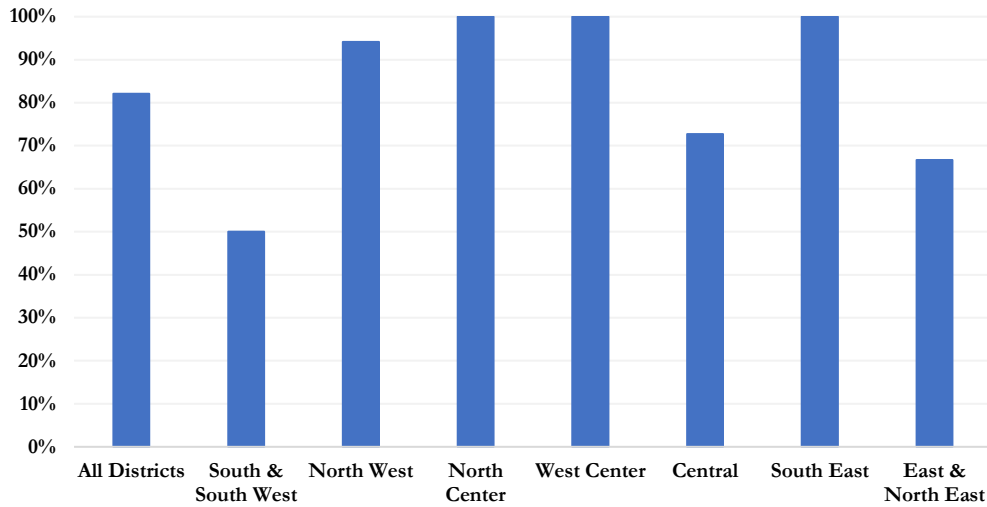


**Figure 14:** Visitors' Mask Use in Jefferson County Indoor Public Areas by District, Nov. 5–11, 2020



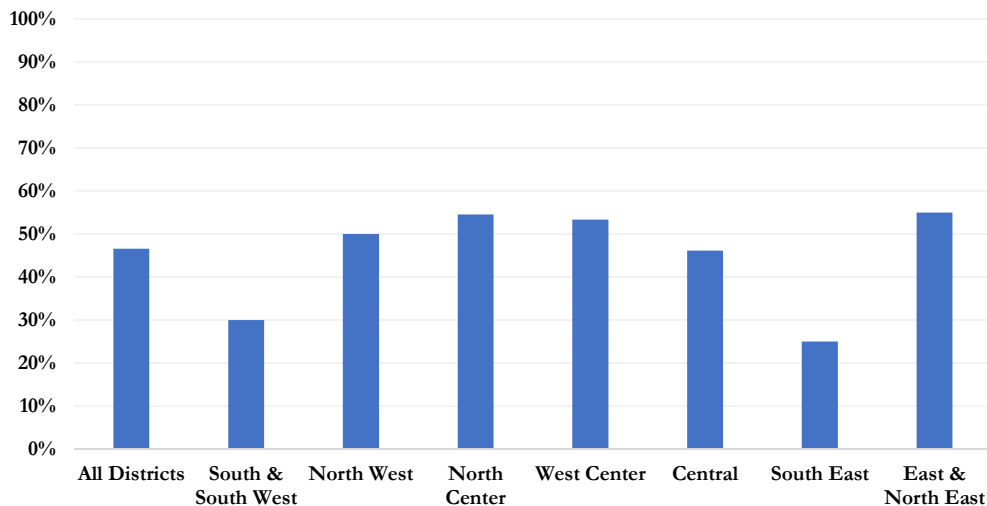
Eighty percent of unmasked staff were male among all Louisville districts. Observers noted an even split among male and female unmasked staff in the South & South West district. Other districts predominately had PAs with unmasked male staff. Notably, in the North Central, West Central, and South East districts, all unmasked staff were males (Figure 15).

**Figure 15:** Percentage of Males among Unmasked Staff by District



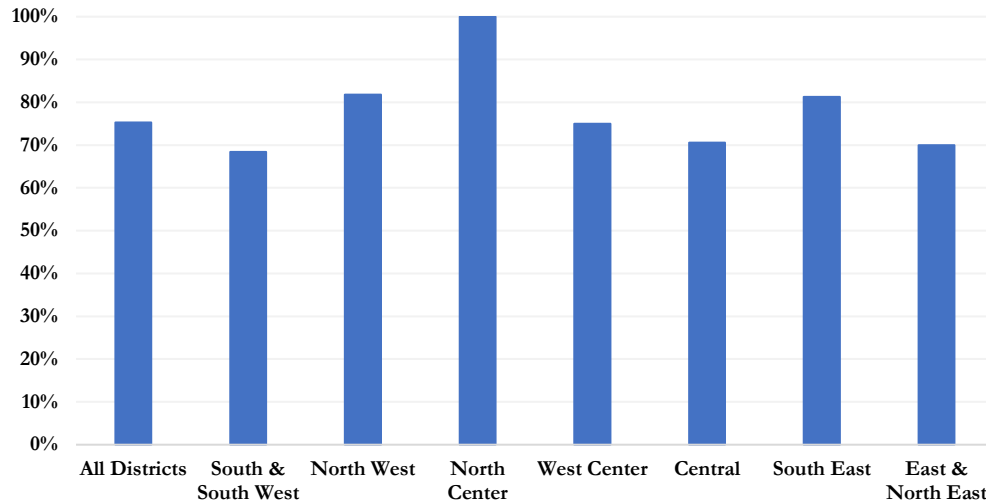
Among the staff incorrectly wearing masks, males made up 47% across districts. The districts with the highest proportions of males wearing their masks incorrectly were the North Central and the East & North Eastern district (55%) (Figure 16).

**Figure 16:** Percentage of Males among Incorrectly Masked Staff by District



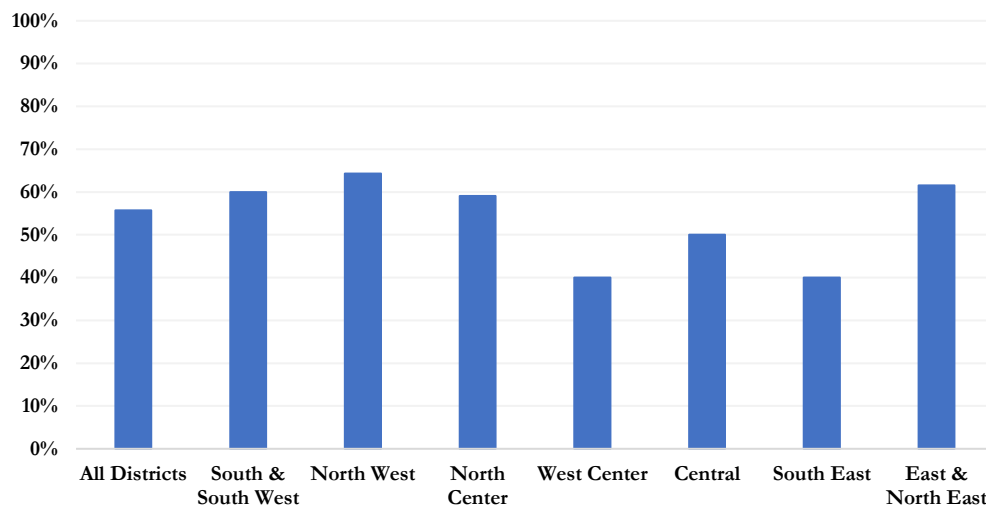
The highest proportion of unmasked visitors in the sampled PAs were male (75%). All unmasked visitors in the North Central district were male, and over 80% of the unmasked visitors in the South Eastern and North Western districts were male (Figure 17).

**Figure 17:** Percentage of Males among Unmasked Visitors by District



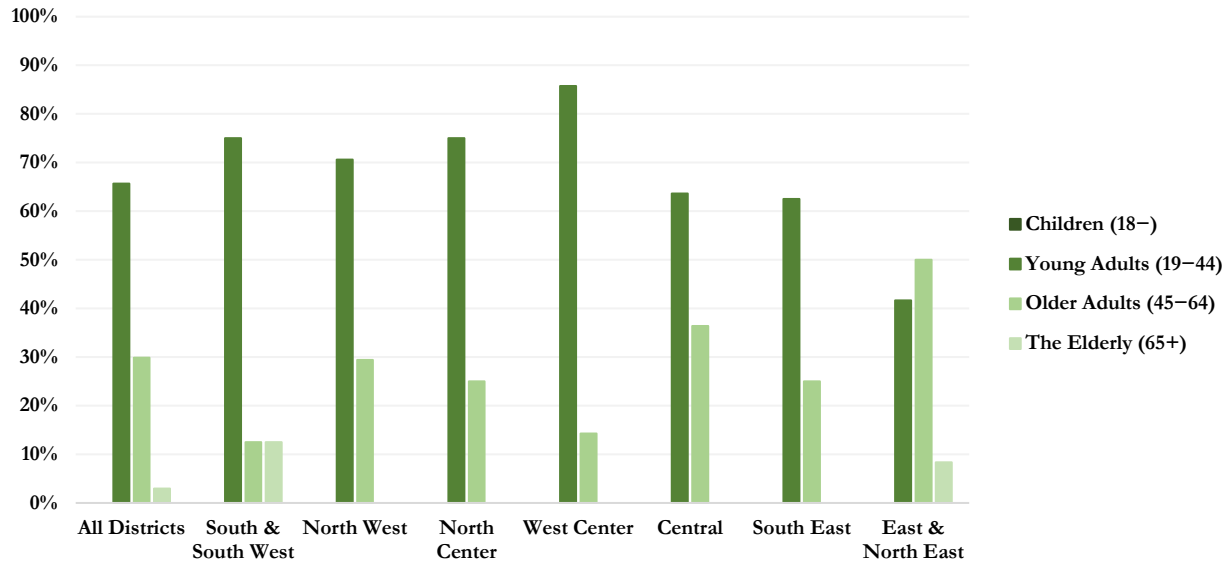
Among the visitors incorrectly wearing masks, males made up 56% across districts. The districts with the highest proportions of males wearing their masks incorrectly were the North West and the East & North Eastern districts (Figure 18).

**Figure 18:** Percentage of Males among Incorrectly Masked Visitors by District

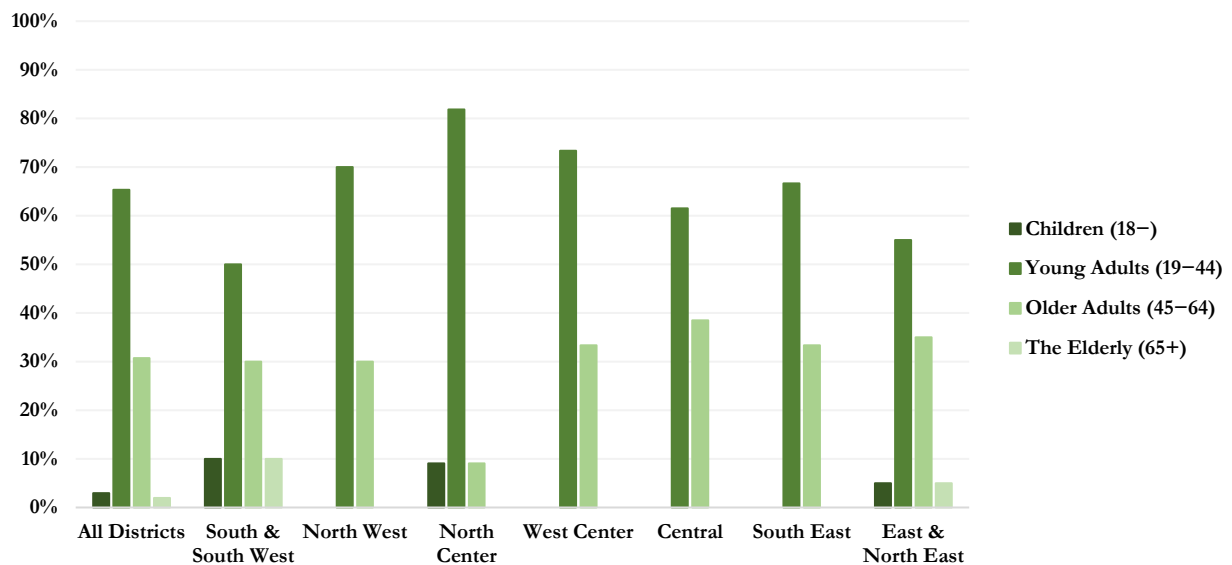


About 66% of unmasked staff among all Jefferson County districts were young adults. This observation was consistent in all Jefferson County districts (Figure 18). Moreover, the percentage of incorrectly masked staff in all the districts was consistently higher among young adults (Figure 20).

**Figure 19: Age Distribution of Unmasked Staff by District**

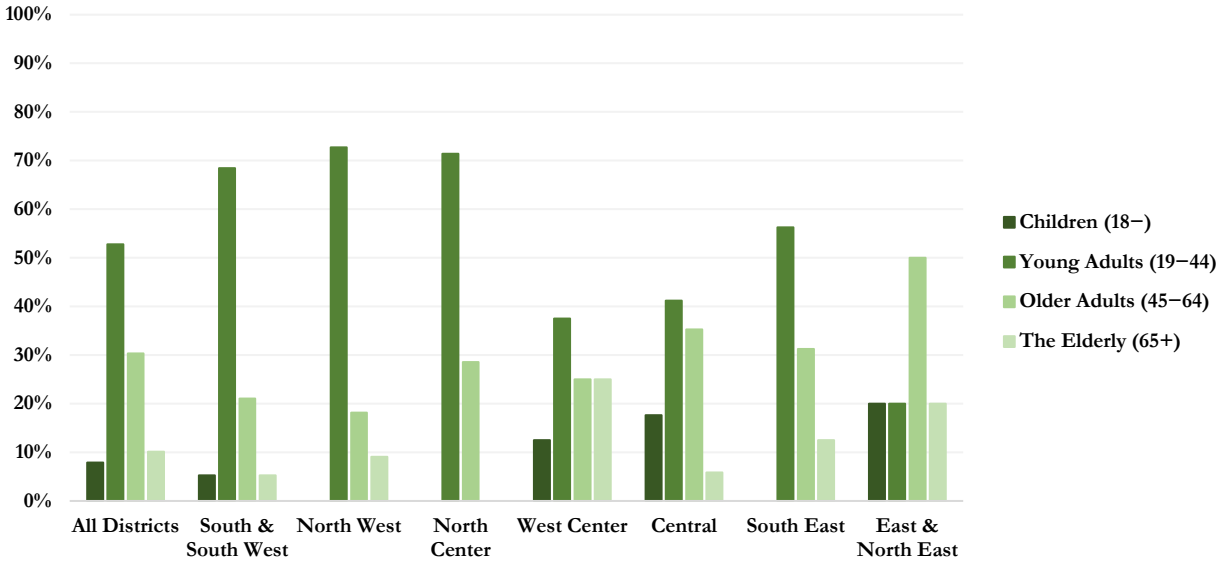


**Figure 20: Age Distribution of Incorrectly Masked Staff by District**

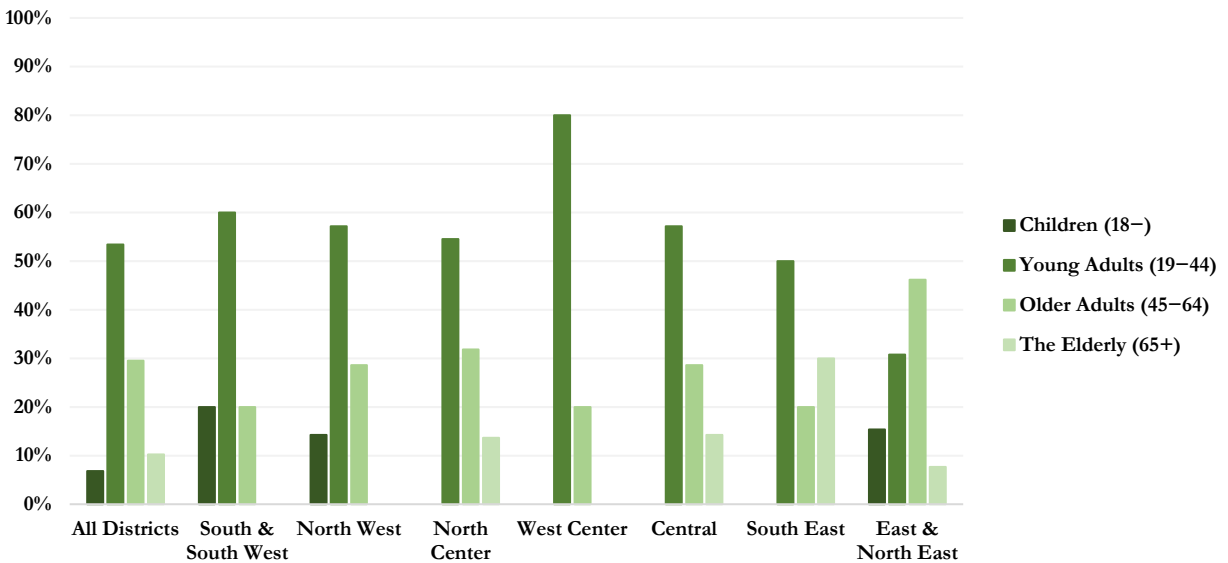


The percentage of unmasked and incorrectly masked visitors in the PAs across all Jefferson County districts was higher for young adults. Almost 50% of unmasked visitors in the East & North East district were older adults (Figures 21 and 22).

**Figure 21:** Age Distribution of Unmasked Visitors by District



**Figure 22:** Age Distribution of Incorrectly Masked Visitors by District



## Summary

The Mask Survey Project conducted observations in 191 public areas across 7 districts and 33 zip codes within Jefferson County, Kentucky. Most of the observed public areas were small; most observations occurred in grocery or convenience stores. Observers visited liquor stores, pet stores, automotive stores, department stores, and others. Public area capacity appeared associated with the extent of protective measures offered to visitors. Regardless of the size, provision of hand sanitizer and separation of entrance and exits were the most common protective measures.

Not wearing a mask, whether visitor or staff, appeared more common within small establishments also in North West, West Center, and Central districts. Further, observers noted that among those unmasked and masked incorrectly, most were male. This appeared consistent across districts and zip codes. In terms of age, those unmasked or masked incorrectly also tended to be between 19 and 44 years old in all districts, regardless of if the observed was a staff or visitor.

In sum, messaging about mask use may need to target the 19-44-year-old male. No matter the location in Jefferson County, these individuals were the most prevalent among those unmasked or masked incorrectly. Additionally, businesses' protective measures may depend on their resources to operate in such a manner. Hand sanitizer is easier to offer visitors, while staffing to regularly sanitize carts or funds to provide an accurate number of wipes, gloves, or masks may present further challenges.

A more detailed summary of the results is provided in the following.

### *Protective Measures in Public Areas (PAs):*

- Overall, 29% of all the Jefferson County public areas (PAs) provided hand sanitizer for their visitors' use, and only 2% of them provide masks for visitors.
  - 90% of the large PAs provided hand sanitizer to their visitors compared to only 13% for the small capacity PAs.
  - Irrespective of the size or the capacity, very few of the PAs provided masks to visitors.
- Of the large PAs, 50% had a separate entrance and exit and 26% sanitized shopping carts.
  - Separation of entrance and exit is more common at the PAs located at the North Center district of the County (28%).

- Visitors' mask-wearing was largely not being checked at the entrances of public areas, with only 36% of large-size PAs checking masks, 10% of medium-sized PAs checking masks, and 4% of small-sizes PAs were checking masks at the entrance
  - Checking visitors' mask is more common at the PAs located in the South East district of the County (25%).

*Mask Wearing of Staff and Visitors in Public Areas (PAs):*

- 30% of small PAs had at least one unmasked staff. In medium-size PAs, it was 23%. In large PAs, it was 11%.
  - Unmasked staff was observed in about a third of sampled PAs at the West Center, Central, and North West districts, in about a quarter of sampled PAs at the South & South West, South East, and East & North East districts, and in about a tenth of PAs at the North Center district.
- 35% of small PAs had at least one unmasked visitor. In medium-size PAs, it was 23%. In large PAs, it was 14%.
  - Unmasked visitors were observed in 43%–46% of sampled PAs at the South & South West and Central districts, in at least a quarter of sampled PAs at the North West, West Center, South East, and East & North East districts, and in about one-sixth of sampled PAs at the North Center district.
- 36% of small PAs had at least one incorrectly masked staff. In medium-size PAs, it was 52%. In large PAs, it was 29%.
  - Incorrectly masked staff was observed in about half of PAs at the West Center and North West districts. In other districts, incorrectly masked staff were observed in 29% to 39% of the surveyed PAs.
- 25% of small PAs had at least one incorrectly masked visitor. In medium-size PAs, it was 40%. In large PAs, it was 61%.
  - Incorrectly masked visitors were observed in 55% of sampled PAs at the North Center district, in 21% to 40% of sampled PAs at other districts.
- 82% of unmasked staff and 75% of unmasked visitors were male.
- More than half of the incorrectly masked visitors of the surveyed PAs were male.
- Those unmasked or masked incorrectly also tended to be between 19 and 44 years old in all districts, regardless of if the observed was a staff or visitor.



## The Research Team

---

Project Manager:

Seyed M. Karimi<sup>a,b</sup>

Scientific Committee:

YuTing Chen<sup>b</sup>, Natalie C. DuPre<sup>a</sup>, Bert B. Little<sup>a</sup>, Seyed M. Karimi<sup>a,b</sup>, W. Paul McKinney<sup>a</sup>, Riten Mitra<sup>a</sup>, Sonali S. Salunkhe<sup>a</sup>, Kelsey B. White<sup>a</sup>

Organization Committee:

Sahal A. Alzahrani<sup>a</sup>, Rebecca Hollenbach<sup>b</sup>, Seyed M. Karimi<sup>a,b</sup>, Sarah Moyer<sup>b</sup>, Sonali S. Salunkhe<sup>a</sup>, Kelsey B. White<sup>a</sup>

Surveyors:

Emily R. Adkins<sup>a</sup>, Sahal A. Alzahrani<sup>a</sup>, Julia A. Barclay<sup>a</sup>, Emmanuel Ezekekwa<sup>a</sup>, Caleb X. He<sup>a</sup>, Dylan M. Hurst<sup>a</sup>, Aravind R. Kothagadi<sup>a</sup>, Martha M. Popescu<sup>a</sup>, Sonali S. Salunkhe<sup>a</sup>, Shaminul H. Shakib<sup>a</sup>, Devin N Swinney<sup>a</sup>, Kelsey B. White<sup>a</sup>

---

<sup>a</sup> University of Louisville

<sup>b</sup> Louisville Metro Department of Public Health and Wellness (LMPHW)

# Technical Supplement

## Abbreviations

---

Team	University of Louisville- Louisville Metro Department of Public Health & Wellness team
JCKY	Jefferson County, Kentucky
NPI	non-pharmaceutical intervention
JCR	Jefferson County resident
JCZC	Jefferson County zip code
PA	Public area
JCPA	Jefferson County public area
UofL	University of Louisville
SPHIS	School of Public Health and Information Sciences
LMPHW	Louisville Metro Department of Public Health & Wellness

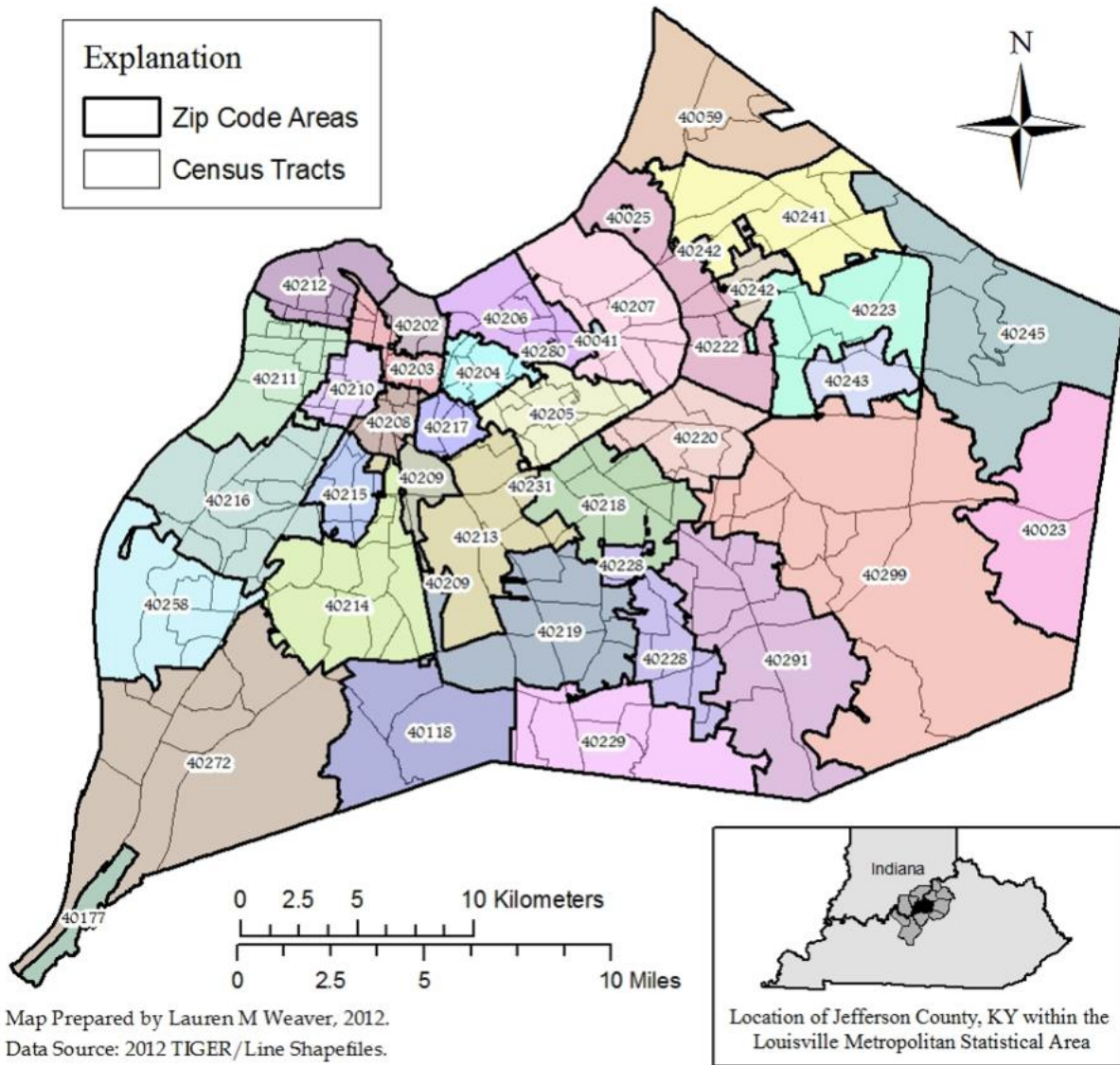
---

## Sampling Plan

The objective of the research study is to examine the Jefferson County residents (JCRs) mask-wearing behavior in 33 Jefferson County zip codes (JCZCs) with at least 1,000 population (Supplementary Figure 1). According to the 2010 Census, three JCZCs' including 40041, 40209, and 40280, comprised of a population of less than 1,000.

Notable demographic differences exist across JCZCs. For instance, at least 50% of residents of five zip codes located at the north and west of the Jefferson County (namely, zip codes 40202, 40203, 40210, 40211, and 40212) are predominantly non-Hispanic blacks. On the other hand, non-Hispanic blacks constitute less than 5% of residents of five zip codes in the northeast and east of the County (namely, zip codes 40023, 40059, 40205, 40207, and 40272). The largest concentration of Hispanics (~7%–12%) is in zip codes 40118, 40215, 40218, and 40219, while Hispanic population concentration is less than 5% in other zip codes (Supplementary Table 1). The oldest zip codes of Jefferson County are 40222 and 40243 located in the east of the county, comprising of ~20% or more senior population, while the population share of seniors is less than 10% in zip codes 40023, 40202, 40208, 40215, and 40245 (Supplementary Table 1).

Supplementary Figure 1: Map of Jefferson County Zip Codes (Source [link](#))



**Supplementary Table 1: Jefferson County Demographics by Zip Code, Census 2010 (Authors' Calculations Using U.S. Census Bureau Data)**

Zip Code	Census 2010 Population	Age Group				Female	White Non-Hispanic	Black Non-Hispanic	Asian Non-Hispanic	Hispanic
		0-18	19-44	45-64	65+					
40023	4,118	48%	27%	31%	34%	9%	94%	2%	1%	2%
40059	16,708	51%	30%	24%	34%	12%	87%	4%	5%	2%
40118	9,724	51%	26%	35%	27%	11%	86%	2%	1%	9%
40202	6,772	36%	11%	54%	28%	6%	38%	54%	3%	3%
40203	19,694	52%	28%	36%	24%	12%	31%	64%	1%	2%
40204	14,236	49%	15%	47%	27%	11%	85%	9%	1%	2%
40205	23,678	53%	19%	35%	31%	16%	93%	3%	1%	2%
40206	18,865	51%	17%	42%	28%	13%	84%	9%	2%	3%
40207	29,745	53%	21%	32%	28%	18%	90%	3%	2%	3%
40208	13,227	48%	20%	53%	21%	6%	61%	29%	2%	4%
40210	14,822	55%	30%	31%	26%	12%	7%	89%	0%	1%
40211	22,612	55%	31%	30%	26%	13%	4%	93%	0%	1%
40212	17,685	52%	29%	31%	28%	11%	36%	60%	0%	1%
40213	16,796	50%	23%	37%	27%	14%	71%	18%	1%	8%
40214	45,291	51%	25%	37%	26%	12%	68%	14%	5%	9%
40215	22,287	52%	29%	36%	26%	9%	57%	32%	2%	7%
40216	40,746	53%	25%	32%	29%	14%	60%	34%	1%	3%
40217	12,507	50%	17%	44%	27%	12%	86%	7%	3%	2%
40218	31,658	52%	26%	37%	25%	12%	47%	39%	2%	8%
40219	38,032	52%	25%	36%	25%	14%	63%	21%	1%	12%
40220	33,109	52%	21%	34%	28%	17%	76%	14%	3%	5%
40222	21,359	53%	19%	34%	26%	20%	82%	7%	4%	4%
40223	22,011	53%	25%	29%	31%	15%	82%	9%	3%	4%
40228	15,743	52%	26%	34%	27%	14%	77%	15%	2%	4%
40229	36,852	50%	28%	38%	24%	10%	87%	6%	1%	4%
40241	28,988	52%	24%	32%	29%	15%	78%	10%	6%	4%
40242	10,930	52%	23%	34%	27%	16%	82%	8%	2%	5%
40243	10,210	54%	22%	28%	28%	22%	87%	5%	2%	4%
40245	30,109	52%	29%	34%	29%	8%	81%	9%	5%	3%
40258	26,465	52%	26%	33%	27%	14%	84%	11%	1%	2%
40272	37,394	51%	26%	33%	27%	14%	91%	4%	1%	3%
40291	35,427	52%	25%	35%	28%	12%	82%	10%	1%	4%
40299	38,371	51%	26%	33%	29%	13%	85%	8%	2%	4%

Each cluster is a JCZC, and targets are public areas (PAs) in the JCZC. The number of selected PAs in JCZC was proportional to its population. If a JCZC constitutes less than 2% of the population of the county, then 4 PAs in that JCZC are selected, 5 PAs are selected if the population share is between 2% and 4%, and 6 PAs are selected if it is more than 4% (Supplementary Table 2).

**Supplementary Table 2:** Jefferson County Zip Code by Percentage of Population, Total Number of Targeted PAs, and Number of Sampled PAs

Zip Code	Percentage of Population	Total Number of Targeted PAs	Number of Sampled PAs (Planned)	Number of Sampled PAs (Sampled)
40023	0.5	0	4	0
40202	0.9	45	4	4
40118	1.3	6	4	4
40243	1.3	16	4	4
40242	1.4	3	4	3
40217	1.6	14	4	4
40208	1.7	24	4	4
40204	1.9	25	4	4
40210	1.9	15	4	4
40228	2.1	16	5	5
40059	2.2	6	5	5
40213	2.2	36	5	5
40212	2.3	23	5	5
40206	2.5	21	5	5
40203	2.6	33	5	5
40222	2.8	30	5	5
40223	2.9	16	5	5
40215	2.9	18	5	5
40211	3.0	20	5	5
40205	3.1	15	5	5
40258	3.5	29	5	5
40241	3.8	27	5	5
40207	3.9	39	5	5
40245	3.9	9	5	5
40218	4.1	33	7	7
40220	4.3	33	7	7
40291	4.6	22	7	7
40229	4.8	18	7	7
40272	4.9	33	7	7
40219	5.0	65	7	7
40299	5.0	39	7	7
40216	5.3	55	7	7
40214	5.9	53	7	7
<b>Total</b>	100	837	174	169

Designated PAs in cluster  $j$  are  $JCPA_{j,1}, JCPA_{j,2}, \dots, JCPA_{j,N_j}$ , where  $N_j \in \{4, 5, 6\}$  is the number of sampled PAs in the  $j$  (Supplementary Figure 2).

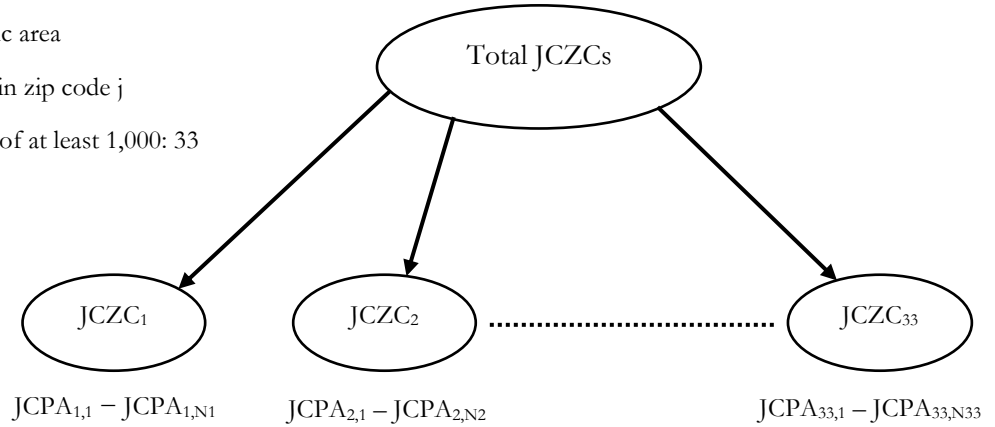
**Supplementary Figure 2: Sampling Plan for Louisville Covid-19 Social Distancing Project**

**JCZC:** Jefferson County zip code

**JCPA:** Jefferson County public area

**$N_j$ :** Number of sampled PAs in zip code  $j$

Total JCZCs with population of at least 1,000: 33



The selected JCPAs were categorized into four groups as follows:

- Group 1      Grocery Stores
- Group 2      Convenience, Departmental, and Discount Stores and Pharmacies
- Group 3      Wine and Liquor Stores
- Group 4      Auto Parts, Firewood, Furniture, Gifts, Grills, Hardware and Lumber, Lawnmowers, Mattresses, Office equipment, Pet supplies, and Variety

All PAs were indoor areas. The list of each type of PAs made the study populations of each cluster. PAs were randomly sampled per cluster. Given the list of PAs, the within-cluster probability of inclusion under random sampling was calculated. Since the PA distributions were not always equal among the clusters, statistical adjustments were made to accommodate the sample’s actual data (Cochran, 1977). Once a PA was selected, the two criteria were applied: (1) store is operational and (2) having a setting that allowed visitors to be in each other’s close proximity. If the PA did not meet the criteria, then another period of the same type was randomly drawn from the list in the corresponding cluster without replacement. A PA was excluded if it provided services only through self-service (e.g., a gas station), appointment (e.g., a bank), or isolated cashier or teller setting. PAs that involved personal assistance from staff (e.g., bars, restaurants, nail salons, barbershops, etc.) were

excluded from this study for the convenience of surveyors and minimization of any potential risk of confrontation.

The list of JCPAs was stratified by JCZC and used to identify those included in the sample. A random sample without replacement was done on the JCPA list by JCZC. The observational survey of the PAs was conducted from November 5, 2020 through November 11, 2020. Once a PA was identified, a surveyor went to its location as a customer at a specific weekday/weekend between 10:am to 5:00 pm and observed personal protection behavior at the PA for a specific period (10–30 minutes depending on the store size. An electronic survey was designed on Microsoft Teams.

While in a PA, the surveyor paused once in a while to fill the survey questionnaire on her/his cellphone. No other method of data collection (e.g., pen and paper or using an electronic tablet) was used to avoid attracting any attention and affecting subjects' behavior. No identifiable information from any visitor of the PA (including name, birth date, address, exact age, data collection date, and HIPAA protected information) and any PA staff (including the PA's, its owner's, and its personnel's name and address) were collected.

During the implementation phase, a few exceptions to the ideal design were encountered (i.e., PA types and number, etc.), which were handled by an adaptive consensus design as done in clinical trials to maximize data collection integrity and work with variations that occur when working with real-world research problems ([Pallmann et al., 2018](#)).

## The Survey Questionnaire

#	Question	Answer
<b>General</b>		
1	Date of survey	e.g. 10/31/20
2	Time of survey	e.g., 12pm / 5pm
3	Zip Code	eg, 40210
4	PA Capacity	<ul style="list-style-type: none"> <li>• Small</li> <li>• Medium</li> <li>• Large</li> </ul>
5	Type of PA	<ul style="list-style-type: none"> <li>• Group 1: Grocery</li> <li>• Group 2: Convenience</li> <li>• Group 3: Liquor</li> <li>• Group 4: Other</li> </ul>
<b>Protective arrangements at the PA</b>		
6.1	ENTRANCE and EXIT were separated?	Yes / No
6.2	Visitors were checked for MASK?	Yes / No
6.3	MASK provided to visitors?	Yes / No
6.4	GLOVES provided to visitors?	Yes / No
6.5	WIPES provided to visitors?	Yes / No
6.6	HAND SANITIZER provided to visitors?	Yes / No
7	Saw an employee sanitizing SHOPPING CARTS?	Yes / No (observe if a person was assigned to this task) / NA
<b>Mask-wearing among the PA's Staff</b>		
<b>No mask</b>		
8	Saw STAFF member(s) WITHOUT mask?	Yes / No
9	Number of STAFF WITHOUT mask?	<ul style="list-style-type: none"> <li>• 1 to 3</li> <li>• 4 or more</li> </ul>
10	SEX of UNMASKED staff	
	Staff 1	Female / Male
	Staff 2	Female / Male



- |    |  |   |
|----|--|---|
|    | Staff 3                                  | Female / Male   |
| 11 | RACE of UNMASKED staff                   |   |
|    | Staff 1                                  | White / Black / Other   |
|    | Staff 2                                  | White / Black / Other   |
|    | Staff 3                                  | White / Black / Other   |
| 12 | AGE of UNMASKED staff                    |   |
|    | Staff 1                                  | 18 or younger / 19-44 / 45-64 / 65 or older   |
|    | Staff 2                                  | 18 or younger / 19-44 / 45-64 / 65 or older   |
|    | Staff 3                                  | 18 or younger / 19-44 / 45-64 / 65 or older   |
| 13 | <u>BMI</u> of UNMASKED staff             |   |
|    | Staff 1                                  | Underweight / Normal / Overweight / Obese   |
|    | Staff 2                                  | Underweight / Normal / Overweight / Obese   |
|    | Staff 3                                  | Underweight / Normal / Overweight / Obese   |
|    |  | Underweight / Normal / Overweight / Obese   |
| 14 | Most common MASK TYPE used by the STAFF? | <ul style="list-style-type: none"> <li>• N95 or N99</li> <li>• Disposable or cloth mask</li> <li>• Neck gaiters</li> <li>• Bandana</li> <li>• Face shield</li> <li>• Other</li> </ul> |

**Incorrect Wearing**

- |    |   |   |
|----|---|---|
| 15 | Saw STAFF member(s) wearing mask INCORRECTLY? | Yes / No  |
| 16 | Number of STAFF wearing mask INCORRECTLY?     | <ul style="list-style-type: none"> <li>• 1 to 3</li> <li>• 4 or more</li> </ul> |
| 17 | SEX of STAFF wearing mask INCORRECTLY         |   |
|    | Staff 1                                       | Female / Male   |
|    | Staff 2                                       | Female / Male   |
|    | Staff 3                                       | Female / Male   |
| 18 | RACE of STAFF wearing mask INCORRECTLY        |   |

	Staff 1	White / Black / Other
	Staff 2	White / Black / Other
	Staff 3	White / Black / Other
19	AGE of STAFF wearing mask INCORRECTLY	
	Staff 1	18 or younger / 19-44 / 45-64 / 65 or older
	Staff 2	18 or younger / 19-44 / 45-64 / 65 or older
	Staff 3	18 or younger / 19-44 / 45-64 / 65 or older
20	<a href="#">BMI</a> of STAFF wearing mask INCORRECTLY	
	Staff 1	Underweight / Normal / Overweight / Obese
	Staff 2	Underweight / Normal / Overweight / Obese
	Staff 3	Underweight / Normal / Overweight / Obese
		Underweight / Normal / Overweight / Obese

---

### Mask-wearing among the PA's Visitors

#### No Mask

21	Saw VISITORS WITHOUT mask?	Yes / No
22	Number of VISITORS WITHOUT mask?	<ul style="list-style-type: none"> <li>• 1 to 3</li> <li>• 4 or more</li> </ul>
23	SEX of UNMASKED visitors	
	Staff 1	Female / Male
	Staff 2	Female / Male
	Staff 3	Female / Male
24	RACE of UNMASKED visitors	
	Staff 1	White / Black / Other
	Staff 2	White / Black / Other
	Staff 3	White / Black / Other
25	AGE of UNMASKED visitors	
	Staff 1	18 or younger / 19-44 / 45-64 / 65 or older
	Staff 2	18 or younger / 19-44 / 45-64 / 65 or older

	Staff 3	18 or younger / 19-44 / 45-64 / 65 or older
26	<u>BMI</u> of UNMASKED visitors	
	Staff 1	Underweight / Normal / Overweight / Obese
	Staff 2	Underweight / Normal / Overweight / Obese
	Staff 3	Underweight / Normal / Overweight / Obese
		Underweight / Normal / Overweight / Obese
27	Most common MASK TYPE used by the VISITORS?	<ul style="list-style-type: none"> <li>• N95 or N99</li> <li>• Disposable or cloth mask</li> <li>• Neck gaiters</li> <li>• Bandana</li> <li>• Face shield</li> <li>• 6. Other</li> </ul>
<b>Incorrect wearing</b>		
28	Saw VISITORS wearing mask INCORRECTLY?	Yes / No
29	Number of VISITORS wearing mask INCORRECTLY?	<ul style="list-style-type: none"> <li>• 1 to 3</li> <li>• 4 or more</li> </ul>
30	SEX of STAFF wearing mask INCORRECTLY	
	Staff 1	Female / Male
	Staff 2	Female / Male
	Staff 3	Female / Male
31	RACE of VISITORS wearing mask INCORRECTLY	
	Staff 1	White / Black / Other
	Staff 2	White / Black / Other
	Staff 3	White / Black / Other
32	AGE of VISITORS wearing mask INCORRECTLY	
	Staff 1	18 or younger / 19-44 / 45-64 / 65 or older
	Staff 2	18 or younger / 19-44 / 45-64 / 65 or older
	Staff 3	18 or younger / 19-44 / 45-64 / 65 or older

33 [BMI](#) of STAFF wearing mask INCORRECTLY

Staff 1

Underweight / Normal / Overweight / Obese

Staff 2

Underweight / Normal / Overweight / Obese

Staff 3

Underweight / Normal / Overweight / Obese

Underweight / Normal / Overweight / Obese

34 Approximate number of VISITORS?

- 0
  - 1-5
  - 6-20
  - 20+
-