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Community implications for gun violence prevention during co-occurring pandemics; a qualitative and computational analysis study

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ABSTRACT

This study provides insight into New York City residents' perceptions about violence after the outbreak of Coronavirus disease (COVID-19) based on information from communities in New York City Housing Authority (NYCHA) buildings. In this novel analysis, we used focus group and social media data to confirm or reject findings from qualitative interviews. We first used data from 69 in-depth, semi-structured interviews with low-income residents and community stakeholders to further explore how violence impacts New York City's low-income residents of color, as well as the role of city government in providing tangible support for violence prevention during co-occurring health (COVID-19) and social (anti-Black racism) pandemics. Residents described how COVID-19 and the Black Lives Matter movement impacted safety in their communities while offering direct recommendations to improve safety. Residents also shared recommendations that indirectly improve community safety by addressing long term systemic issues. As the recruitment of interviewees was concluding, researchers facilitated two focus groups with 38 interviewees to discuss similar topics. In order to assess the degree to which the themes discovered in our qualitative interviews were shared by the broader community, we developed an integrative community data science study which leveraged natural language processing and computer vision techniques to study text and images on public social media data of 12 million tweets generated by residents. We joined computational methods with qualitative analysis through a social work lens and design justice principles to most accurately and holistically analyze the community perceptions of gun violence issues and potential prevention strategies. Findings indicate valuable community-based insights that elucidate how the co-occurring pandemics impact residents' experiences of gun violence and provide important implications for gun violence prevention in a digital era.

1. Introduction

Gun and community violence remain critical public health problems in the United States, which has a rate of firearm deaths more than ten times higher than the rate in other high income countries (Grinshteyn and Hemenway, 2019). Over the last two years, cities across the country have experienced a surge in injury and death related to guns (Brownlee, 2022). The problem of gun violence is particularly acute in cities like

New York (Krishnakumar et al., 2021). In 2021, New York City recorded 1562 incidents of gun violence with 1877 victims, a 101% increase in gun violence and 103% increase in victims of gun violence from 2019 (McCarthy, 2022). Statistical analyses show that the social problem of gun violence and crime is related to the co-occurring pandemics of COVID-19 and anti-Black racism, as well as the ensuing stay-at-home restrictions (Kim, 2022a; Koppel et al., 2022) and Black Lives Matter (BLM) protests (Zhang et al., 2020). Moreover, instances of gun violence

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are not distributed equally among neighborhoods in New York. During these dual pandemics, increases in gun violence were higher for neighborhoods with predominantly low-income, Black or Hispanic residents, as well as those who have less options for mobility (Kim, 2022b). Furthermore, gun violence in New York increased more in the four boroughs with higher non-white populations than in Staten Island (Kim, 2022b).

Residents' engagement with social media platforms further complicates the experience of gun violence in marginalized communities. Platforms like Facebook, Instagram, Twitter and Tik Tok can amplify conflict, trauma and grief as well as intentions to commit physical harm or even fatal injury (Lane, 2018; Pyrooz and Moule Jr., 2019). Furthermore, populations most severely impacted by gun violence engage with social media at higher rates. 52% and 49% of Hispanic and Black users, respectively, use Instagram daily, compared to 35% of white users and the majority of American users still report checking in at least once daily (Pew Research Center, 2021), suggesting sustained use of social media during the co-occurring pandemics.

Users' behaviors on social media generate complex and nuanced insights on daily life that can be leveraged as data that may help local institutions and government agencies develop new intervention methods to address a variety of issues that impact their residents' well-being, including gun violence. Large amounts of social media data can inform public health interventions as well as gauge public sentiment in response to the delirance (Merchant et al., 2021).

To address gun violence in the age of social media and co-occurring social crises, research must include transdisciplinary methods (e.g. social work, computer science, design) (Patton, 2020). Otherwise, interventions risk harming the community and worsening the ongoing gun violence crisis. Government institutions frequently use data from social media for outreach, in criminal investigations, and to assess public opinion (Congressional Research Service, 2022). But, to date, there has still been relatively little effort to work with residents as community experts to understand their needs and ideas as expressed in their social media data.

In prior research, we developed a natural language processing (NLP) and computer vision (CV) data science system that integrates qualitative insights from Twitter data with machine learning to automatically identify tweets related to expressions of loss and aggression. We guided the design and implementation of our technological system by social work thinking (Patton, 2020) that ensures ongoing, community-based engagement with social media. Studies have previously shown the importance of context when interpreting tweets, especially those around community violence. For example, knowledge about previous events (e.g. coping with the loss of a friend) and an understanding of group processes (i.e. gang identity) provides important insights into issues related to violence (Stuart et al., 2020; Boyd and Crawford, 2012; Abreu and Acker, 2013; Leverso and Hsiao, 2020).

Analyzing the conversations between users longitudinally may also indicate important shifts in language that uncover new issues related to public safety (Xue et al., 2019). Properly considering context in the natural language and multimodal systems is quite challenging due to cultural and colloquial references used in the tweets. Understanding context requires examination of ongoing conversations between users, not just individual posts. It also requires deeper multimodal integration. One example of this integration is developing methods for inferring the linking of visual symbols to contextual events and how images are referenced by text (Morselli and Décarry-Hétu, 2013; Ristea et al., 2020).

We paired qualitative insights with social media analysis to address the challenges of contextualizing social media posts, particularly for minority and marginalized communities. We aim to advance prevention scholarship by leveraging deep qualitative insights and social media posts from majority low-income, Black and Latinx New York City residents living in New York Housing Authority (NYCHA), the largest public housing authority in the United States, which was created to provide decent, affordable housing. This work includes a mixed methods,

transdisciplinary study that combines in-depth interviews of 69 residents, two community advisory board focus groups, and a large corpus of social media data. When combined, this data will help us to understand how violence affects New York City's most marginalized communities in the midst of co-occurring pandemics, and identify strategies for working with local and national governments to create safer communities.

2. Methods

Data from this study came from our Neighborhood Navigator project, a transdisciplinary research study that leverages qualitative interviews and focus groups and social media analysis to study sentiment related to well-being and safety among low income New York City residents.

In this novel analysis, we used focus group and social media data to confirm or reject findings from qualitative interviews. We first used data from 69 in-depth, semi-structured interviews with low-income residents and community stakeholders to develop a Neighborhood Navigator tool. This tool assesses residents' perspectives of their underserved NYC neighborhoods regarding (1) life in their neighborhoods, (1) impacts of COVID-19, (3) impacts of Black Lives Matter activism, and (4) social media use. After analyzing the qualitative interviews, researchers were able to identify two themes: *Social and Health Impact on Perceptions of Community violence and Safety*, which describes how COVID-19 or Black Lives Matter activism has impacted community safety; and *Community Recommendations to Reduce Violence*, which includes residents' current recommendations to reduce violence and increase safety in their community.

As the recruitment of interviewees was concluding, researchers facilitated two focus groups with 38 interviewees to discuss several topics including: (1) community (2) safety, (3) markers of community wellness, (4) trust of local government, and (5) the role and impact of technology, social media, and artificial intelligence within their communities. Qualitative analysis of the focus group was coded deductively as researchers looked for insights from residents that support or conflict with the insight from the semi-structured interviews conducted prior.

Lastly, in an effort to validate qualitative findings, data science researchers affiliated with the larger research team analyzed >12 million tweets pertaining to NYCHA and studied their trends over time for various wellness indicators that bolstered or countered the themes expressed by residents. According to Pew Research, the average Twitter user is a younger adult, who is typically a democrat, educated and middle class. We acknowledge that other social media platforms (e.g. Instagram, YouTube, Facebook) may yield a more diverse user base for our study (Wojcik and Hughes, 2021). However, Twitter provided a strong base for identifying hashtags associated with our topic of study which will enable us to identify parallel conversations on other platforms. By utilizing Twitter data we were able to engage in this triangulation of data from three different mediums (interviews, focus groups, social media) to understand how NYCHA community members express feelings of safety and violence.

2.1. Participants

2.1.1. Qualitative interviews and focus group sample

All 69 interviewees and 38 focus groups participants represented 10 different NYC communities. A map of various communities can be found in Fig. 1 below: In order to participate in this research, study residents had to be at least 18-years-old, speak English and live or work in one of the 15 NYCHA communities agreed upon by Columbia University, the New York City Mayor's Office of Criminal Justice (MOCJ) and John Jay Research and Evaluation Center (JJREC) at the John Jay College of Criminal Justice. Residents were recruited through snowball and purposive sampling recruiting techniques. Purposive sampling strategies consisted of researchers being introduced to local community based organizations through MOCJ.

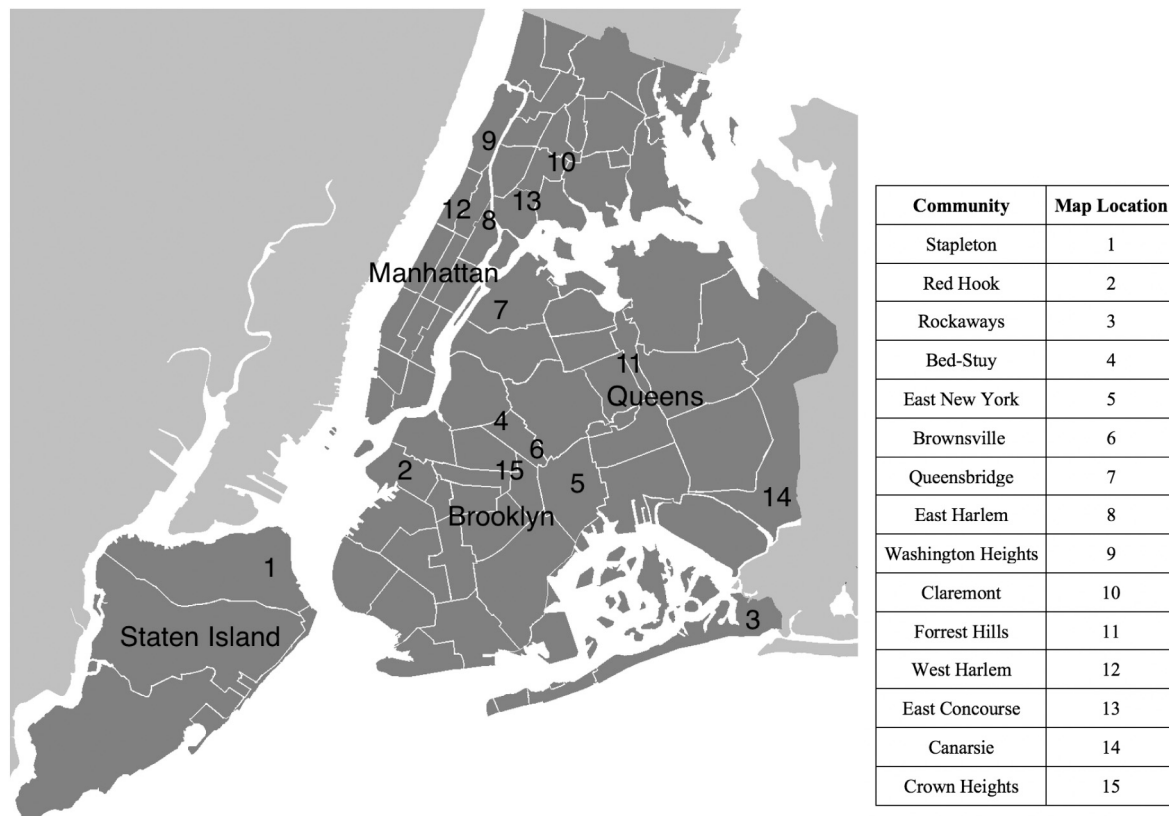


Fig. 1. NYC Neighborhood Recruitment

In the initial meetings with these organizations, researchers were able to describe the study and learn more about the services that these organizations provide. Through continuous meetings and attending six community events, researchers were able to recruit local residents and program participants for this study. Moreover, this research study also used a snowball sampling strategy where participants shared the contact information of other residents in their network with researchers who might be interested in participating in this research. The average age of the interviewees was 39-years-old. 73% of the interviewees identified as Black and 14% identified as Latinx. The average number of years participants lived in their communities was 20, with the range of years living in the community being one to 63. 60% of the interviewees identified as female, 35% identified as male and 5% identified as non-binary. The average age of focus group participants was 36-years-old. 70% of focus group participants identified as Black and 15% identified as Latinx; 55% identified as female, 40% identified as male; and the average number of years that focus group participants lived in their communities was 36 years.

2.2. Procedures

From January of 2021 to December of 2022, researchers collaborated with various community-based organizations whose services range from violence intervention, to youth employment. In order to hear from a broad range of New Yorkers living in low income communities, researchers recruited from 15 different New York City Housing Authority (NYCHA) developments and surrounding areas. After making contact with interested participants, researchers provided an overview of the study, provided a physical consent form and scheduled a time to conduct the virtual interview over Zoom due to COVID-19 health protocols. In addition, from 2016 to 2021, computer scientists developed and utilized an algorithm to scrape and analyze tweets directed towards NYCHA (@NYCHA).

2.2.1. Qualitative interviews procedure

We conducted 69 in-depth interviews using a semi-structured interview guide with four sections exploring resident's perspectives regarding: (1) life in their neighborhoods (2) the impacts of COVID-19 (3) the impacts of Black Lives Matter and (4) use of social media. The interview guide included questions like: (1) *How has your experience in NYCHA changed since you first moved in?* (2) *What emotions has COVID-19 brought up with your family? Your neighborhood? Your neighbors?* and (3) *Can you tell us about your thoughts regarding Black Lives Matter?* All participants were asked the same questions on the semi structured interview guide and were asked probing questions when necessary. At the time of the recorded interviews, we obtained verbal consent and collected demographic data, including age, race, gender and number of years living in the community. MSW and PhD social work students conducted and recorded these virtual semi-structured interviews on Zoom. The interviews lasted between 45 and 60 min and we compensated participants with a \$50 gift card for sharing their experience.

2.2.2. Focus group procedure

We conducted four focus groups with 38 residents who previously participated in qualitative interviews. All interviewees were made aware of the opportunity to participate in our focus group. If they expressed interest in participating in this aspect of the study, they were contacted when researchers were determining a date that would work best for potential focus group participants.

The research team, consisting of MSW and PhD social work students and a user research expert, facilitated the focus groups and each group session lasted 90 min. There were several topics of these focus groups, including: (1) community, (2) safety, (3) markers of community wellness, (4) trust of local government, and (5) the role and impact of technology, social media, and artificial intelligence within the community. We used questions such as (1) *What are some signs that your neighborhood is doing well?* (2) *How might the city government build greater trust*

in your neighborhood? (3) What role does technology and social media play in your community? We also used zoom to conduct the focus groups and compensated participants with a \$350 gift card. The research team or an outside transcription service transcribed verbatim the audio-recorded qualitative data.

2.3. Social media data harvesting

Our group inspected a variety of social media platforms for suitable data. Specifically, we inspected Facebook, Instagram, Twitter, and TikTok. Facebook was a promising source of data because it had existing groups (i.e. pages where users who share interests virtually gather and communicate based on certain topics within the larger Facebook platform) for a number of different housing sites. We thus did an initial data harvest from Facebook. However, post content was almost entirely about physical needs and conditions at the various sites (e.g. maintenance issues affecting various buildings, sanitation conditions, etc.). This, coupled with relatively sparse data, led us to look at other alternatives. While we found a few Instagram and TikTok posts relevant to this research, we ultimately concluded that there were too few relevant posts for meaningful analysis. Twitter was most appealing to us because users appeared to post about a wide variety of topics, the posts featured images, text, and sometimes video, the data was publicly posted, and data could be readily obtained by scraping tools.

After choosing to focus on Twitter posts, our group employed a snowball sampling approach to harvest relevant data. First, we identified around 10 thousand unique users who had sent a tweet tagging the @NYCHA or @CrimJusticeNYC (the Twitter handles for NYCHA and MOCJ, respectively) within a four-year period. After we obtained this list of users who had engaged with these official government social media handles, we harvested all publicly available tweets (as well as associated images) from those users within the past 10 years. Each tweet contains rich metadata, such as the time and date the tweet was posted, as well as metrics for engagement with other users, such as the number of retweets, hashtags, etc. We obtained around 12 million text-only tweets and around 500,000 multimodal tweets (tweets containing both images and text), in total. For comparison, the data we harvested from Facebook and Instagram pages associated with particular NYCHA housing sites was much smaller and consisted of only a few thousand posts. Because the Facebook and Instagram data was too sparse to draw significant conclusions, all of our analysis is conducted on our large-scale Twitter dataset.

2.4. Data analysis

2.4.1. Stage 1: Qualitative interview analysis

Our data analysis process consisted of three steps. First, we applied thematic analysis to identify central themes and categories within the 69 qualitative interviews. Seven members of the research team engaged in open coding using the qualitative analysis software Dedoose. Researchers initially read multiple interviews to become familiar with the content, achieve analyst triangulation and develop an initial codebook. Next, each of the seven researchers used the initial codebook to code five qualitative interview transcripts and explore different patterns within the data, share process notes identifying initial areas of analysis agreement and disagreement, refine the codebook, and establish a final code scheme. The researcher team continued to analyze the remaining interviews, compared codes and began grouping central codes and sorting data into initial themes. As the analysis continued categories were added to provide insights and featured primary patterns that were found within these initial themes. Additionally, during this process the research team added, amended and removed categories based on new emerging content. Through consensus, the research team discussed, refined, and finalized the list of central themes with these qualitative interviews.

2.4.2. Stage 2: Focus group analysis

In stage two of the data analysis process, social work researchers utilized a deductive approach when coding the two focus groups that were composed of 38 participants. In this deductive analysis researchers were guided and coded the focus group data based on the themes found in the qualitative interviews: (1) *Social and Health Impact on Perceptions of Community violence and Safety* and (2) *Community Recommendations to Reduce Violence*. In doing so researchers used focus group data to bolster or weaken the data found in the qualitative interviews pertaining to safety and violence. Throughout this process the research team shared process notes, discussed varying interpretations and came to a consensus of how focus group data differed or enhanced the perceptions around safety and violence expressed in the interviews.

2.4.3. Stage 3: Social media analysis

To understand how NYCHA residents across NYC perceived COVID-19, BLM, violence, and overall well-being, we used multiple strategies to label our Twitter data corpus by topic. At first, our first strategy relied only on the tweet's text. We explored many novel Natural Language Processing (NLP) techniques to cluster social media content within the various wellness indicators and themes, in a hierarchical fashion. We first generated rich numeric representations of the tweets and the topics (by taking a few example tweets per topic), and then assigning these tweets to topics having the highest similarity scores. After automatically labeling each tweet with its topic using the text, we automatically discovered discussions pertaining to these themes, and identified their concerns. We also produced frequency histograms of tweet counts for each theme, per month, by aggregating the number of tweets posted in that month and about that theme. We hypothesized and verified that amount of discussion is generally a good proxy for public concern – as discussion about a public issue (especially on twitter) tends to skew towards complaints or issues being raised. Most trends observed in the data were what we expected to see, corroborated by contemporaneous news articles and incidents; others revealed more unexpected patterns.

While our text-only labeling approach allows us to identify social media data relevant to a particular topic when the user mentions enough about the topic in the text, many posts are multimodal (i.e. contain image(s) and text). In these cases, looking at the text alone may not be sufficient to determine the post's topic, e.g. text says "disappointing" and an image about the availability of COVID-19 vaccines. Thus, we also explored a strategy for labeling posts with a topic using the image. We used a recent method for representing the meaning of visual and textual content in a joint way (Radford et al., 2021) to capture the meaning of multimodal tweets. We then probed this joint space for the topics of interest (e.g. COVID-19 and community safety) and retrieved the 200 tweets for each topic the model was most confident belonged to that topic. This state-of-the-art method works by learning to represent the meaning of an image or a piece of text in a learned numerical representation called an "embedding". For example, a photo of a "gun" could be represented by a list of 300 numbers. If we calculate the embeddings of other photos of firearms, we will find that, in general, the embeddings of photos showing firearms will be closer in distance to one another than to the embeddings of photos of some other object. This method also allows one to calculate an embedding of text. Thus, one can calculate an embedding for the sentence, "A man holding a gun." The critical point is that the embedding of this sentence will be closer in distance to the embeddings of the gun photos than to unrelated content. This allows us to discover images by writing text prompts. Lastly, from our social media dataset, we labeled a sample of 400 tweets tagged with each theme to quantify the degree to which the perspectives advocated on social media agreed with those put forward in the qualitative interviews. We discuss our findings below.

2.5. Ethics

We received ethics approval for this research project from the

Columbia University internal review board. Before conducting the interviews and focus groups, all participants provided informed consent. The study's written and verbal aims were presented to the participants, including the right to refuse to participate or to end the interview and focus group. All the participants' names were de-identified to maintain their anonymity. We also conducted social media analyses to validate our qualitative work. To protect social media users, we anonymized the data by removing identifying information like names, addresses and usernames.

3. Findings

Two central themes emerged from the qualitative analysis:

1. *Social and Health Impact on Perceptions of Violence and Safety*: Residents describing how COVID-19, Black Lives Matter, or Defund the police have impacted their perceptions of community violence.
2. *Community Recommendations to Reduce Violence*: Residents presenting recommendations to reduce violence and increase safety in their communities.

3.1. Themes 1: Social and health pandemics impact on perceptions of violence and safety

Study participants described how COVID-19 and the Black Lives Matter movement impacted how they conceptualize safety in their communities. Although our broad questions focused on perceptions regarding community safety and Black Lives Matter, they generated many comments around community life, social justice, and nuanced views concerning law enforcement (Table 1).

Quinn, a resident who worked in a gun violence prevention program, described that COVID-19 and the increase in gun violence within the community resulted in a sense of ‘hell’ (Interview Quote 1 [Q1]). Participants shared how they preferred to stay home during the first years of COVID-19 because they were afraid of what was happening outside (Q2). For example, Susan, age 38, who lived in NYCHA for 27 years bolstered this claim and detailed how the sense of safety in the community has been compromised due to COVID-19. She experienced that the stay-at-home orders resulted in teenagers staying out later because there were no activities for them to participate in which resulted in an uptick in shootings (Q3). Residents also observed that staying at home had an impact on community safety and stressors. Angela, who participated in a focus group described how she perceived an increase in domestic violence within her community due to the ongoing stress of the pandemic, crime, and people not being able to leave their apartments (Focus Group Quote 1 [FGQ1]).

Next, participants shared how they coped with gun violence in their communities and suggested improving the relationship between their communities and law enforcement is critical for gun violence prevention. Dan, a 20-year-old Black male who has lived in the community for 11 years, described his desire for police to connect with and better support the community (Q4). Leslie, Octavia, and Hazel, three women whose residency in the community ranged from 8 to 36 years, shared similar feelings that the community needs to acknowledge how policing can be stressful and scary. However, they also highlighted how police need to be more educated about racial bias and dealing with individuals who are struggling with mental illness (Q5-Q7). Robin also explained her apprehension to defund the police as their presence prevents crime and violence and allows community members to engage with their neighborhood without fear of victimization (FGQ2).

Finally, participants echoed the need to defund the police as a required solution to improve their communities. Participants shared personal accounts of negative experiences with police throughout their life. Leslie noted how prevalent it was to witness police brutality as a young girl in Philadelphia and that Black people have had these

Table 1

Themes 1: Social and Health Pandemics Impact on Perceptions of Violence and Safety.

Definition: Quotations in which residents how COVID-19, black lives matter, or defunding the police have impacted community safety.

Category 1: COVID-19's impact on violence and safety

Definition: Quotations in which discuss how COVID-19 has directly or indirectly changed the way residents in the community engage with one another. Transformations in community interactions can result in the changing of perceptions regarding violence and safety.

Q1: “I was grateful enough to be one of the people on the frontline facing both pandemics, the rise in gun violence and fatalities. As a supervisor for anti-gun violence prevention programs and also COVID-19 - facing both of those pandemics was hell.” - Quinn, black, 47 -year-old, 47 years living in NYCHA

Q2: “There're a lot of shootings in the area at times. The kids are a little bit rowdy at nighttime, and they are socially outside since COVID. It seems like everybody's outside from midnight to morning.” - Susan, black, 38 -year-old, 27 years in NYCHA

Q3: “It's just since the pandemic and since last year and this year, I really feel scared, and I stay inside more because stuff is happening out there.” - Denise, black, 38 -year-old, 4 years in NYCHA

FGQ1: “I think people are just staying inside because they don't feel safe, and it's all those factors from my neighborhood added up together that makes it feel like you just want to go to the store and cannot. It's a horrible way to live. And it has really affected the way people feel. There's a lot more domestic violence. I know that because I've spoken with the cops. We've had some meetings [with the police] and heard that domestic violence calls have gone up significantly. And I think that's because people are on top of each other. It's the pandemic stress, and it's the crime stress and everything. It's a big ball of bad.” - Angela, white, 54 -year-old, 6 years living in NYCHA

Category 2: Need for more focused policing

Definition: Quotations in which residents discuss their apprehension for defunding the police.

Q4: “You [the public] would say there's a lot of crime in black and brown communities. So when you defund the police, who's going to be there to help us? But we're not trying to say get rid of them, we just want them to help us...we just want them to better the community and just help us.” - Dan, black, 20-year-old, 11 years living in NYCHA

FGQ2: “How do I measure safety in the neighborhood? Being able to come outside, being able to sit in front of your building and not having to worry about drive-bys or drug deals. I actually really appreciate having the police on nearly every street corner, because I feel like it's been a really good deterrent to those kinds of activities.” - Robin, Latina, 34-year-old 10 years living in NYCHA

Q5: “It'd be nice to get to a place where law enforcement admits that some communities have been treated differently just because they're communities of color. And at the same time, to have [the community] acknowledging that being in law enforcement is hard and going into an area that is known to have a lot of violence is scary, and the community knowing how to respond is hard for law enforcement. When people feel scared, how do we find that balance? I don't think it's defunding the police. I live around the block from a police station, and I like that.” - Octavia, white, 47-year-old, 8 years living in NYCHA

Q6: “I'm not about defunding the police, but I am about making sure that the police are better educated, in particular they get better education around racial profiling and probably post-traumatic stress disorder. I know a lot of them have that. And I can imagine how scary it can be being a policeman, like walking into certain situations and that some of their reactions are out of their own fear or lack of education about how to handle or de-escalate situations. - Lesley, black, 61-year-old, 18 years living in NYCHA

Q7: “You know, I don't want to say completely shut down the police because we need somebody policing. But at the same time, retraining [and] defunding with a purpose. Don't just have it be a punishment, because then the police are going to react in a negative way. They need to be funded with a purpose. Relocate not defund and try to see how we can try to help everyone understand each other. Try to make sure that our youth is educated enough to understand that this can be fixed. We empower youth so that the future can be better. How we can fix the people that are now. I don't know if you can train an old dog with new tricks.” - hazel, Latina, 41-year-old, 36 years living in NYCHA

Category 3: Support for defund the police or black lives matter

Definition: Quotations where residents express either their support for defund the police or black lives matter or express views about the ineffectiveness or harm of police.

Q8: “I went to parties when I was in high school, they [police] sicked dogs on us. I grew up in Philadelphia, and there were a lot of troubles in Philadelphia with police brutality. This isn't new, for some of these people, young kids, I feel like [they're thinking] ‘oh my god, this has never happened. I'm incensed’. I'm like, dude, I've been treated like this for 40 years. This isn't new. And I'm happy that it came to a tipping point that people wanted to do something about it.” - Lesley, black, 61-year-old, 18 years living in NYCHA

(continued on next page)

Table 1 (continued)

Q9: "They [police] didn't really do much. I'm not gonna pick on anybody. But just not too long ago, within the last two months, the number of black people who got shot just for doing damn near nothing. It just goes to show that not much has changed." - Drew, black, 21-year-old, 6 years living in NYCHA

Q10: "What they're [black lives matter] doing right now is trying to stand up for our people because like they've [the police] been putting us down...we are all one, and we all are equal, so putting one race down and putting the other race up was not right. Now to see how strong we will be and what we will build together will definitely create a better community" - Pricilla, black, 35-year-old, 34 years living in NYCHA

FGQ3: That money can't buy respect and understanding between higher authorities and these communities, because it's just so broken right now. The way we look at police officers and the way police officers look at us, there's literally a divide. As you were growing up and seeing the way that they treated your cousins and brothers, mothers, fathers, everybody in your family, and your community extremely badly. - Trevor, black, 25, 23 years living in NYCHA

experiences with law enforcement for decades (Q8). Drew also expressed feelings that the police do not do much to stop violence in his community and noted how very little has changed regarding police brutality from his point of view, highlighting the recent trend of Black people being shot by the police for no apparent reason. (Q9).

Interview participant Pricilla, who has been living in the community for 34 years, expressed her gratitude for the Black Lives Matter movement pushing equality, social justice, and standing up for people who have been historically marginalized (Q10). Trevor, a young Black man who has spent most of his life in NYCHA, also described the need for police reform by highlighting how the decades-long tension between the police and the community can be felt with simple eye contact. He stated, "the way we look at police officers, the way police officers look at us, there is literally a divide." Additionally, he detailed how hearing about injustices experienced by family members and friends continues to grow the disconnect between law enforcement and the greater community (FGQ3).

We also wanted to assess the level of support for the theme of *Social and Health Impact on Perceptions of Violence and Safety* in our social media data. We used a machine learning model (described above) to retrieve relevant posts for a number of related categories: "COVID-19 and violence", "COVID-19 and gun violence", "defund the police and violence", and "defund the police and gun violence". We retrieved the top-50 posts for each category as scored by our model. Of the 200 posts retrieved for theme 1, we observed that 95% were relevant and disregarded irrelevant retrievals in our analysis. Of the remaining tweets, we found that the vast majority of the tweets agreed with our finding from our qualitative interviews that the co-occurring pandemics of COVID-19 and gun violence were not jointly discussed within the tweets. However, we observed Twitter discussions around COVID-19 and incarceration and the need to reform the criminal justice system. In addition, there were few tweets that addressed challenges regarding mental health exacerbated by COVID-19.

We also saw strong support for the "defund the police" movement in our social media tweet sample. However, we found a small minority of tweets that opposed defunding the police and supported law enforcement. Moreover, users also tweeted to bring attention to community-based gun violence that has impacted their neighborhood and loved ones. In general, we found that our social media data was largely confirmatory of our qualitative findings related to the theme of *Social and Health Impact on Perceptions of Violence and Safety*.

3.2. Theme 2: Community recommendations to reduce violence

A large number of study participants shared their opinions and recommendations towards reducing violence in their communities. They provided researchers with a range of direct and indirect strategies to improve safety within the community. Direct strategies pertain to those that directly reduce violence and increase safety in their communities.

The primary objectives of these strategies are to immediately reduce violence and increase safety. Examples of such direct approach include improving building security and bolstering bystander intervention. Additionally, participants discussed indirect strategies that primarily provide services that address more systemic issues and may not address gun-violence, exclusively, but will have a more long-term impact on violence. An example of this type of systemic strategy is to increase mental health services for youth.

Oscar and Nicole are young residents who have spent much of their lives living in NYCHA detailed how building security and the use of security guards can be direct and immediate solutions to improve safety within their community. They both noted how these efforts can provide "essential security" and restrict building access to those who "aren't supposed to be in your building" (Q10–11). Adam, who has been living in NYCHA for nearly 50 years, expanded on this idea of security by reflecting on his own upbringing and recommended that residents bring back a tenant patrol where each tenant takes turn monitoring the building by setting up a table at the building entrance requiring everyone to sign in to gain access (Q12). Focus group participant Denise echoed similar views emphasizing a need for residents to look out for the safety of one another "before the cops can help us or other government agents that can help us, we have to look out for each other" (FGQ4).

Kevan also echoed thoughts concerning resident strategies when they shared their experiences on how bystanders refused to intervene when someone was in distress. They noted that bystanders' inaction often caused more harm than the perpetrator. Furthermore, Kevan's direct recommendation to reduce violence and increase safety means knowing that they're understood by the community and that people know how to step in and protect them if they can't. Although participants detailed various direct recommendations to decrease community violence, some choose to avoid engagement with local programs and neighbors. A young resident of NYCHA, Jake, shared that his approach to staying safe in his community was to keep to himself and not interact with other community members, so he would not end up going down the "wrong path" (Q13).

Finally, participants provided systemic recommendations to reduce community violence. Systemic recommendations are services that address broader issues that will have a more long-term impact on violence. Tanya, a 33-year-old Black female resident of NYCHA detailed the need for indirect violence intervention services like mental health for children and teenagers in the community. She highlighted the stress that the youth in her community experience at school, as well as the anxiety of witnessing community violence and recognizes how these dual burdens need to be addressed (Q14). Quintin, a resident of NYCHA for his entire life, expressed that his community needs more affordable housing and programs to get the youth introduced to various careers such as construction and culinary arts. He feels such efforts will help reduce idle time for youth and keep them out of trouble, because he sees how the lack of housing and job opportunities has created a sense of chaos in the community (Q15). Additionally, Trevor, a focus group participant has seen the benefit of job programs in his NYCHA development. Being able to see youth outside playing sports or going to work as he himself is leaving to work at 9 am is a positive and "productive" thing for the community (FGQ6).

Analogous to our analysis for the first theme, we retrieved tweets using our machine learning model for *Community recommendations to reduce violence* for the following categories: "NYCHA security," "youth mental health," "summer jobs," "affordable housing," and "bystander intervention." We retrieved the 50 most relevant tweets for each category, according to our model. Of the 250 tweets retrieved for theme 2, 35% were relevant (correctly retrieved). We observed support for theme 2 in these tweets, through advocacy efforts for more resources regarding youth mental health, affordable housing and summer employment. Additionally, many tweets concerning security in NYCHA were posted by law enforcement, promoting their efforts to reduce crime and engage

with various communities.

Theme 2: Community recommendations to reduce violence:

Definition: Quotations where residents present recommendations to reduce violence and increase safety in their community.

Category 1: Direct recommendations

Definition: Quotations where residents are discussing recommendations that directly reduce violence and increase safety in their community. These recommendations' primary objectives are to immediately reduce violence and increase safety.

Q10: "Such as having a security guard in NYCHA buildings, which I don't see at any NYCHA building at all. If I visit somebody that lives in NYCHA, I never see a security guard or anything like that. Not just watching over for safety, but just being there providing essentially security." - Oscar, Latino, 24-year-old, 12 years living in NYCHA

Q11: As for improvement, I would say, definitely security in the buildings. For most of our buildings, the doors are just broken, so people can come in and out as they please. So that's a big issue for me, just security. There're always people that you don't know that aren't supposed to be in your building, and it can be dangerous. - Nicole, black, 23-year-old, 23 years living in NYCHA

Q12: When I was growing up, they had tenant patrol. My mom used to do that. There used to be somebody downstairs sitting at a table, and for anybody that came in, they got to sign the book and put their names down, but now there's none of that. It's like, come on in. I remember each tenant used to take turns for 24 h to monitor the building. Don't get me wrong. Somebody could still come in here and do something to them, but it's less likely that way" - Adam black, 63-year-old, 47 years living in NYCHA

Q13: My neighborhood ain't the best to be honest. Lots of stuff happens, fights, arguments, gang activities, but I feel like that's all-around Queens in general. ... for anybody that would be over here is just to stay to themselves, don't talk to anybody. If you come here and you just want to go to school or get a job and leave, then fine do exactly that. Don't dilly dally and talk to cool people trying to be down, because you will end up going down a wrong path and you will regret it. - Jake, Latino, 19-year-old, 13 years living in NYCHA

Focus group quote to support this claim:

FGQ4: Safety in our community is to look out for each other as neighbors and as friends because sometimes living in New York stuff happens to us on the street, and other people passing by act like nothing happened. Nobody stops to call the police. So we have to look out for each other, first in the community, before the cops can help us or other government agents can help us, we have to look out for each other, and we have to have each other back. ... so we have to be our own keepers too before the police even can assist us. So that is a part of safety too, and we have to be part of that. Denise, black, 38-year-old, 4 years in NYCHA

FGQ5: So for me, safety is, god forbid, if something ever happens to me, I know I could rely on people around me to understand me and respect me. I can't even tell you how many times I would be on the train or elsewhere, and the people who caused more harm than the perpetrator were the people watching, laughing, and recording, whether they saw an LGBTQ person being attacked or a Jewish person. So for me safety means knowing that I'm understood and that people know how to step in and protect me if I can't. Kevan, mixed, 2.5 years in NYCHA

Category 2: Indirect recommendations

Definition: Quotations where residents are discussing recommendations that indirectly reduce violence and increase safety in their community. These recommendations' primary objectives are to provide services that address more systemic issues that will have a more long term- indirect impact on violence.

Q14: We're seeing more negative things right now because we're seeing people drop like flies right now. There's been so much gun violence. So, before the children go to school, as they're waking up, they can hear the gunshots. And then, that's what is on their mind the whole day at school. The kids see all this [violence] there, a lot of them don't have therapists that they can talk to, and a lot of them can't talk to their friend about this because the friend is going through the same thing. So, there's no help, all of this is weighing on the brain. Then they get to school, they have to worry about passing grades and all of that. We need to be helping them more mentally, emotionally. When they are mentally and emotionally good, they can prosper, and they can blossom." - Tanya, black, 39-year-old, 6 years living in NYCHA

Q15: The biggest concern I have for my neighborhood and I would like to see change is more affordable housing. I'm talking about people owning their own houses. There's no program for that. You want to build [construction], culinary arts? Those are the things I would like to see more. See, all these guys need to be doing something, good work, good jobs, and decent jobs. It'll keep these guys, you know, all of us as a community out of negativity. And this will be a positive and growing neighborhood. But if there's no job and no housing, people can't see themselves growing. It's just chaos bro. - Quintin, black, 30-year-old, 30 years living in NYCHA

FGQ6: I spent the majority of my life living in NYCHA. When I go outside, I can see all of the young boys who are outside playing ball, or all of the young people are going to their summer youth jobs. And while I'm going to work at nine o'clock, I see the 16 to 17-year olds who are going to work at the same time everybody is doing something productive. - Trevor, black, 25-year-old, 23 years living in NYCHA

4. Discussion

This study provides nuanced insights regarding how NYCHA residents perceived violence and safety within the context of the co-occurring pandemics of COVID-19, Black Lives Matter and defund the police. We combined qualitative insights with computational retrieval methods and social media analysis to provide acute and broad interpretations of gun violence issues and potential strategies that may inform practitioners and government officials on varied ways of addressing the current gun violence epidemic. This triangulation isn't necessary for conducting gun violence intervention research but may provide additional rigor to the validation of qualitative data.

While gun violence traditionally spreads through face-to-face interactions, social media presents new challenges as the ease of uploading, writing, and downloading violent content and the potential to go viral, share, retweet and otherwise amplify content speed or intensify the transmission and spread of content related to gun violence (Patton et al., 2018).

Our qualitative findings detailed how COVID-19 resulted in fewer people being outside and engaging in community programs. Participants felt that this increased levels of social disorganization and decreased feelings of safety in the community. These findings underscore prior research noting the increase in violence and crime since the start of the COVID-19 pandemic (Kim, 2022a; Koppel et al., 2022; Martin et al., 2022).

In our social media findings, users did not explicitly express issues related to both COVID-19 and gun violence together. This may be due to the fact that Twitter limits the amount of characters one uses in a tweet, confining users' ability to provide details around the impact of COVID-19 and gun violence. Moreover, the user's perception of COVID-19 and gun violence could be latent. For example, users may be complaining about increased gun violence, but not mention or even realize the problem is being exacerbated by COVID-19.

Residents also highlighted how Black lives Matter and *defund the police* rhetoric inform their sense of safety in the community. Recent research by Kim (2022a) conveys how the Black Lives Matter protests correlated with an increase in non-fatal shootings in New York City, which is congruent with our qualitative findings.

Social media users also indicated that some community members question law enforcement's ability to improve community safety and decrease gun violence. Cobbina-Dungy and Jones-Brown (2021) corroborate our findings and provide further reasoning that defunding the police would yield positive community outcomes. The authors note how law enforcement enforces racial hierarchy through proactive policing and utilizes a "warrior-style" training that establishes an expectation of unquestioned compliance to the institution. Our social media analysis supports our qualitative findings regarding defunding the police and highlights a wide range of support to defund the police by tweets that include images of posters, cartoons, and protests that advocate for this cause.

Finally, residents had clear recommendations for ethical policing for gun violence prevention. Residents suggested law enforcement should be better trained in acknowledging their own racial biases and supporting individuals who may present in mental health crises. Residents advocated for the redistribution of police funds to community-based services. These findings contribute to past literature documenting how residents see police as being unconcerned with the structural challenges within Black communities (Payne et al., 2017). It also corroborates scholarship displaying how residents, community leaders and local organizations often leverage their relationships and community insights to handle disputes involving those who are most likely to be perpetrators and victims of violence (Brunson and Wade, 2019). However, some participants indicated a desire for neighbors to understand the challenges that police encounter while on the job (Nalla et al., 2016; Merkey, 2015).

Through our social media analyses, we also found individuals who

were supportive of police. We suspect that our model was able to detect tweets in this category because passionate topics such as law enforcement are expressed and shared with more volume than less controversial topics. This is especially true given that our model analyzed data regarding police throughout 2020 and 2021 when police reform was a main topic of public discourse (Wirtschafter, 2021).

Some residents suggested having police in the community serves as a deterrent against crime but specified that at the same time non-lethal policing keeps everyone safe. These findings strengthen past research conducted in Ferguson, Missouri, which found that white and Black residents were opposed to decreasing the frequency of police patrols and felt that decreasing patrols would decrease trust in law enforcement (Kochel, 2017). These findings also bolster findings that police intervention targeting specific high-risk places and individuals can effectively reduce crime (MacDonald et al., 2015) and can improve police legitimacy when they are executed with a strong eye towards community partnership (Braga et al., 2019).

Our social media analysis also bolstered the idea of more focused policing which we found numerous associated tweets through our computational retrieval process.

This study provides a wide range of recommendations to reduce violence within their community. These recommendations included direct interventions such as improved building security, resident patrol, and a willingness for residents to intervene when they see someone in distress. Recommendations for bystander intervention build upon past literature highlighting how addressing community-based social norms can reduce violence (Milam et al., 2016; Webster et al., 2012). Additionally, participant recommendations to reduce community violence consisted of indirect intervention targeting institutions for more long-term results. These indirect interventions included affordable housing, mental health services for youth, activism around shootings and employment opportunities for emerging adults. These findings support previous research that highlight long term benefits of youth programs and employment opportunities for reducing crime and boosting individual outcomes (Heckman et al., 2013; Modestino, 2019).

Regarding direct and indirect recommendations to reduce violence, our social media analysis supports qualitative findings around the importance of affordable housing, providing services for youth mental health, and providing opportunities for youth summer employment. In addition, our social media analysis findings provide an opportunity for law enforcement to utilize social media to engage with the community and present effective police practices. Recently, research has shown that law enforcement agencies are investing efforts to communicate with the communities through social media (Cheng, 2021).

5. Implications

Our study has several important implications for gun violence research. First, studies on gun violence may also consider using social media data to understand the communities studied and provide additional perspective to the more traditional qualitative and quantitative methods that are used. In this study we utilized qualitative interviews, focus groups and social media data to expand the concept of gun violence to include context and health related pandemics. Mixed-method data analysis offers a broader context and diversity of experience related to the phenomenon of gun violence. Secondly, our findings illuminate the nuanced experiences of gun violence and recommendations to reduce it. When supported by evidence-based research these insights and recommendations can benefit street intervention organizations and policymakers actively working to reduce community-based gun violence. For example, the qualitative interviews and focus groups illuminated ideas that participants feel that community-based gun violence requires multiple solutions. Some participants felt that more police intervention was needed, while social media posts included more content targeted towards law enforcement alternatives to improve safety within communities. Although current literature corroborates the

feelings by some residents that more police is needed to increase safety (Parker and Hurst, 2021), oftentimes studies of police intervention rarely investigate their individuals or communities level impact (Peyton et al., 2019).

Thirdly, residents detailed the need for programs that center around community wellness such as mental health programs, stable housing, adequate livability conditions, and youth programs to curb community-based gun violence in the long term. Findings from social media posts as well as focus group and individual interviews illuminated how residents felt a need for positive and structured programming for young people living within the NYCHA community. Prior research has demonstrated how services for adolescents and young adults such as youth employment can reduce rates of crime and violence by using positive engagement as a mechanism for community safety (Butts et al., 2010; Modestino, 2019). Lastly, results from this study also detail how NYCHA residents are seeking more immediate interventions to reduce gun violence within their community. Participants described their desired willingness for fellow residents to intervene when they see someone in distress. The process of intervening could be thought of as a behavior shaped by social norms and the relationships people share with their peer networks. Community programs using this approach employ trained violence intervention workers who have strong and trusted relationships within the community and can engage in outreach and direct interruption or mediation of neighborhood conflicts. Research capturing the efficacy of such programs in reducing gun violence have produced promising results (Milam et al., 2016; Webster et al., 2012) but more studies are needed.

6. Limitations

This research has several noteworthy limitations. First, several changes in COVID-19 vaccine requirements and mandates occurred in NYC during the interview phase. These policy changes may have impacted the participants' views about COVID-19. Second, we recruited residents from 15 NYCHA sites in New York City by attending community events and through the help from local non-profit organizations who put us in contact with community residents. Given this level of outreach and the fact that recruitment happened during the COVID-19 pandemic, our interviewees and focus group participants may have high levels of community engagement which may impact the variety of perspectives that we found in this study. In future research, it is essential to engage residents who might not be as involved in community life to get a wider understanding of life in public housing. Additionally, we invite future researchers to engage residents from other housing developments across different locations locally and nationally to gain deeper insights and perspectives. Third, we only interviewed residents who spoke English. Further research should prioritize the opinion of residents whose primary language is not English to understand the opinions from other ethnic groups. Further, the social media analysis of this study was only done on tweets. Further research interested in expressions shared on social media should review posts from other platforms such as Facebook, Instagram and TikTok. Last, the machine learning models that we used to automatically label the theme posts were trained with data harvested from Twitter without human expertise to ensure proper interpretation and contextualization of tweets. Thus, the model's understanding of the words and visual content constituting our themes may differ from ours. Tuning the model with human-annotated data illustrative of these themes could help mitigate this but requires a large amount of annotated data which may be expensive to obtain (Frey et al., 2018).

7. Conclusion

This study provides a unique opportunity to study the perception and impacts of gun violence and opportunities for prevention during the occurring pandemics of COVID-19 and anti-Black racism, as experienced

by low-income New York City residents. This study is distinct because we use social media sentiment, captured using computational analysis tools, to validate traditional qualitative interviews and focus groups. The design of the study includes insights and input from MOCJ, social work researchers, computer scientists, and local New York City residents. By working alongside the aforementioned communities, we identified key factors for how gun violence affects residents' lived experiences and recommendations for community- and government-level interventions for these intersecting social crises. We expanded on the current prevention scholarship and support ongoing conversations about the importance of community engagement and collaboration when addressing social issues marginalized communities face. Future studies should look into, and potentially replicate, similar analyses of different social issues with emphasis on community collaboration and social media data.

Credit author statement

Desmond U. Patton: Conceptualization, Formal analysis, Funding acquisition, Methodology, Project administration, Writing-review and editing, Writing- Original Draft, Supervision. **Nathan Aguilar:** Project administration, Data curation, Writing- Original draft preparation, Editing, Methodology. **Aviv Y. Landau:** Project administration, Writing- Original Draft Preparation, Validation, Supervision. **Chris Thomas:** Methodology, Investigation, Editing, Writing original draft preparation. **Rachel Kagan:** Methodology, Writing, reviewing & Editing. **Tianai Ren:** Writing- Reviewing and Editing. **Eric Stoneberg:** Writing- Reviewing and Editing. **Timothy Wang:** Methodology, Reviewing and Writing. **Daniel Halmos:** Methodology, Writing- Reviewing and editing. **Anish Saha:** Methodology, Writing- original draft,. **Amith Ananthram:** Methodology, Writing- review&editing. **Kathleen McKeown:** Investigation, Methodology, Project Administration.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

Data availability

The data that has been used is confidential.

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Appendix A. Appendix

Interview Guide:

Small Demographic Guide

1. Name:
2. Gender:
3. Birth Date:
4. Race:
5. Ethnicity:
6. Highest Level of Education:
7. Years as a NYCHA resident
8. Please state the social media platforms you use (e.g. Twitter, Instagram, YouTube etc.)

Qualitative Question Guide

Introduction

1. Do you have any questions for me before we begin?
2. Tell me about yourself
3. Tell me about your family
4. Tell me about your community
5. How do you find out about things, events, news happening in the community?
6. What is your relationship with your neighbors?
7. How do you communicate with the Mayor? Phone call? Email? Social Media?
8. If it's social media, can you show me an example?

Social Media

1. Do you use social media? What social media app do you prefer? Why?
2. Can you give me an example about things you read or look through social media?
3. Do you post about your life in NYC?
4. What things do you post about?
5. Do you follow or communicate with people in your community through social media?
6. Can you give me an example of these interactions?
7. What types of things do you comment on when using social media?
8. Can you give me an example of the things you comment on through social media?
9. Is there community leader/influencer that you and others follow online?

NYCHA

1. How long have you lived in your current residence?
2. Can you tell us about your experience(s) at NYCHA?
3. How has your experience in NYCHA changed since you first moved in?
4. What are some things that you like about living in NYCHA housing?
5. What are some concerns you have from living in NYCHA housing?
6. Do you have any suggestions about improving NYCHA housing?
7. Who do you reach out to get your needs addressed?
8. If you had one to inform NYCHA official about what would it be?
9. Where do you go when you have free time?

COVID-19

1. Can you tell us about your thoughts regarding Covid-19?
2. Can you tell us about your experience with COVID-19?
3. How has it impacted you? Your family? Your neighborhood? Your neighbors?
4. Who do you talk to about COVID-19?
5. What emotions has COVID-19 brought up with your family? Your neighborhood? Your neighbors?
6. How do you feel the city and/or state handled Covid-19 during the initial outbreak in mid-March?
7. How do you feel the city and/or state is currently handling Covid-19?
8. How do you feel your community has handled Covid-19?
9. What suggestions do you have for people dealing with or experiencing COVID-19? Can you give an example?

Black Lives Matter

1. Can you tell us about your thoughts regarding Black Lives Matter?
2. How has Black Lives Matter impacted you? Your family? Your neighborhood? Your neighbors?
3. What emotions has Black Lives Matter brought up with your family? Your neighborhood? Your neighbors?

4. Who do you talk to about Black Lives Matter?
5. How do you feel about the city and state's response to Black Lives Matter?
6. What role do you feel the government has regarding Black Lives Matter (focusing on equity, inclusion, and racial justice)?
7. What role do you feel your community has regarding Black Lives Matter (focusing on equity, inclusion, and racial justice)?
8. Do you have any suggestions about how to continue the Black Lives Matter movement?
9. What does the successful implementation of Black Lives Matter demands look like?

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