Do Men and Women "Lockdown" Differently?

An Examination of Panama's COVID-19 Sex-Segregated Social Distancing Policy

ABSTRACT

State-enforced cCurtailment of mobility - through social distancing and state-enforcednational or sub-national lockdowns -- have has become a fundamental strategy to reduce COVID-19 transmission. Panama instituted a sex-segregated mobility policypolicy to limit human, and in turn disease, circulation, whereby women were allowed outto leave the home for essential services (groceries and pharmacies) on Monday, Wednesday and Friday, and men on Tuesday, Thursday and Saturday. Through a retrospective analysis of global geographic positioning (GPS) data, we present an overview of aggregate mobility patterns in Panama following policy's implementation. The paper looks at relative mobility on female- and male-sex mobility days, examining differences by volume of movement and type of community locations visited. We identify lower visits to all community location categories on female-mobility days. We examine mobility trends on female- and male-sex mobility days, analyzing differences by volume of movement and location visited. We find lower aggregate mobility for all locations on female-mobility days and that sex-segregated lockdown resulted in significantly different aggregate mobility between males and females. However, we found find no statistically significant difference in "workplace" aggregate mobility. We discuss the implications of these findings forgiven: (1) Informal Informal burden of labor and social reproduction, (2) Implications for wWomen's autonomy and domestic safety, and (3) Women's economic empowerment. In addition, the policy and data discussed in the piece raise open ethical questions regarding the use of sex and gender identity in COVID-19 policies.we question gender identity and data privacy by feminist economists studying policies related to women's mobility and physical autonomy.

KEYWORDS

Sex, Gender, COVID-19, Social Mobility, Social Isolation, Workforce

INTRODUCTION

Panama adopted one of the most aggressive responses to COVID-19 in Latin America; scoring highly on Oxford's COVID-19 policy response stringency index (~~Anon.~~ Oxford, 2020). This has centered on a lockdown that allows for mobility based on an individual's sex, as listed on their national identification card *"cedula"*.[1] Accordingly, on Mondays, Wednesdays and Fridays, women can leave their homes while on Tuesdays, Thursdays and Saturdays only men can. The policy was justified to reduce the volume of individuals on the street at any one time and thus reduce risk of disease transmission. This was a novel approach to implementing a social distancing policy, ~~and~~ one ~~which~~that has not been ~~seen~~employed in previous~~ly in~~ disease outbreaks.

Beyond describing social distancing policies that have emerged in response to COVID-19, there is an increasing urgency to better understand ~~understand their impact~~how different populations experience these policies~~, particularly differential effects across a population~~. Early (albeit incomplete) sex-disaggregated data has shown differences in vulnerability to COVID-19 (Zhi 2020): more men than women are dying, potentially due to sex-based immunological (Chen et al. 2020) or ~~other differences~~social factors, such as patterns and prevalence of smoking, obesity and other factors unrelated to biological sex (Liu et al. 2017). ~~However, the sex-disaggregated data available on outcomes are incomplete and correlated to national testing strategies which vary, making early assessments imprecise (Wenham, Smith, and Morgan 2020).~~ In addition, early research from the United States suggests that men may be less likely to take appropriate public health precautions, such as engaging in safe social distancing practices or hand-washing (Altarum 2020). However, ~~the sex-disaggregated data available~~ corresponding data on outcomes are incomplete and ~~correlated to~~reliant on national testing strategies which vary in their accessibility, making early assessments of sex-disaggregated death from COVID-19 imprecise (Wenham, Smith, and Morgan 2020).

~~In addition to mortality, there~~There are additional primary and secondary gendered impacts of epidemic disease and associated response. Previous research has demonstrated women are more likely to be exposed to infectious disease due to formal care giving (70 percent of the global healthcare workforce are women) and informal care within

[1] *The sex marker on the Panamanian ID card is based on an individual's biological sex, a moniker assigned at birth based on the sex organs with which a Panamanian is born. The concept of sex is commonly understood as binary (male or female) and the policy was instituted as such. However, approximately two percent of the global population may be intersex or have a combination of sex organs. In addition, gender refers to the social attributes associated with being male or female. These attributes, and attendant expectations, may or may not align with an individual's sex and can vary between contexts. Throughout this piece, we use the terms "men" and "women" as they are used within the national policy. Due to the spectrum of both sex and gender, this categorization is limited.*

families, which has been mirrored in early testing statistics for COVID-19 (Harman 2016; WHO 2019). Women have disproportionately experienced downstream effects of prior outbreaks and policies enacted to mitigate risk (Wenham forthcoming). This includes increased domestic work for disease control interventions (quarantine, vector control), (Wenham, Nunes, et al. 2020) additional labor of childcare and home schooling (UNDP 2016), interruption of routine maternal health provision during epidemics (Sochas 2017) and increased economic insecurity owing to higher precarious employment contracts (Bandiera et al. 2019). Despite ~~this~~ the existing literature interlinking ~~gender~~ women's wellbeing and outbreaks, we lack a comprehensive understanding of ~~the gendered~~ how ~~impacts~~ the ~~of the~~ widespread curtailment of human mobility ~~undertaken~~ in response to COVID-19 is experienced by men and women.

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The sex-segregated policy enacted in Panama and new data on mobility across the country provide a unique opportunity to examine early differences in aggregate mobility by sex during COVID-19 and what this may reveal about norms of social reproduction, paid and unpaid labor and how ~~male and female~~people do, or do not, ~~interact~~ move ~~differently~~ during a lockdown. We therefore answer the following questions: First, is there a significant difference in aggregate mobility between male- versus female-mobility days? Second, how does the change in aggregate mobility compare by location category? Finally, what ~~are~~ implications ~~of these~~might these differences have on social reproduction, division of labor or women's autonomy?

THEORETICAL FRAMEWORK

~~Intersection of~~Sex, ~~gender~~ Gender and I~~i~~nfectious D~~d~~isease

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The intersection of gender and infectious disease has been documented. At baseline, understanding the social determinants of health show that ~~gender~~being a woman, along with a myriad of other intersecting factors influence~~s~~ one's health and health outcomes (Marmot 2005). While sex and gender are often conflated, research shows that ~~Women~~ women face a double burden of infectious disease (Lee and Frayn 2008)~~, being those most exposed~~at risk of ~~contracting infection through their increase exposure as formal care workers, and burdened with the additional formal and informal care work through formal and informal care work with patients or downstream effects of response policy.~~ ~~.~~This risk of infection, however, ~~is~~ appears to be driven by social factors that are compound by gender norms, as opposed to biological sex. For example, women are often at heightened risk of contracting

infection through increased exposure as formal workers in care-giving roles, and burdened with additional informal work. ~~meaning that women further undertake the majority of "work" involved in response efforts.~~ This can range from being responsible for contraception to limiting sexual transmission of (some) disease ~~,~~(Brown 2015), to being laden with vector control efforts such an insuring there is no standing water in houses or civic spaces (Wenham, Nunes, et al. 2020), or managing the additional childcare and domestic responsibilities when schools shut, and quarantines are implemented (Wenham, Smith, et al. 2020).

Prior to COVID-19 this intersection between gender and infectious disease had rarely been considered by policymakers, albeit documented in academic literature (Wenham, forthcoming; Davies and Bennett 2016; Harman 2016). In addition, neither ~~Gender or~~ sex nor gender ~~had~~ have ~~not~~ been meaningfully mainstreamed into policy to respond to infectious disease (Smith 2019). Thus, this ~~gender-based~~sex-segregated mobility policy in Panama is unusual in~~reflected the first policy of its kind to consider~~ incorporating sex within ~~/ gender to be~~ a ~~mechanism of~~ disease control policy. However, the division of sexes for this policy was not based on an attempt to mitigate the differential effect the outbreak might have for men or women. ~~Whilst it is important to remember this division between sexes for this policy was not based on the inherent differential effects of the outbreak or to redress the burden of response efforts.~~ Instead, sex-stratification was a simple mechanism to rapidly reduce the ~~number~~ volume of people circulating by theoretically halving the quantity each day. Regardless, due to its implementation,~~However, it~~ the policy offers an opportunity to ~~explore~~ better understand ~~to what extent gendered behavioral difference affect~~ mobility by sex during an outbreaks, and question what ~~indirect effect~~implications these~~s such policy has~~ differences might have on broader issues of ~~women's~~ equality.

Social Reproduction

In line with this, while our primary focus is aggregate mobility, we consider the implications of lockdown policies on social reproduction. Across political spectrums, gendered norms and activities are often dictated by everyday political economy (Sjoberg 2016). Social reproduction includes those household activities central to production and reproduction of life and capital economic contribution (Bakker and Gill 2003). Social reproduction includes, but is not limited to: childrearing, caring responsibilities, small-scale agricultural labor, household work and maintenance.

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This is not to suggest that all women have identical roles across houses, communities and the globe, but social reproduction recognizes global patterns of informal, often invisible or de-valorized work, which is usually carried out by women, regardless of the role it plays in capital development.

Feminist economists have demonstrated how this invisible 'feminized' labor within the private, home is a fundamental lynchpin facilitating others, notably men, in their contribution to the public, paid, workforce, and therefore capitalist global economy. In this way, feminized labor is vital to the capitalist functioning system. Smith argues that the conceptual division between the female private space and the public male space maintains the dominance of men in the practice of globalizing, gendered capitalism, and thus societal and global power (Smith 1990). Conversely the global capitalist system can have downstream effects on this feminized social space; economic crises create significant impact on (social) reproduction, as demonstrated by disease outbreaks (Elson 1994; Roberts 2013). Understanding the intersection of mobility and social reproduction can shed a light on women's agency within political and economic systems.

Physical Autonomy and Mobility

In recent models, mobility (or physical autonomy) has consistently been identified as a primary dimension of women's autonomy (Jejeebhoy and Sathar 2004, Osamor and Grady 2016, Samari and Pebley 2018). 'Control over one's life,' or ~~women's~~ autonomy is viewed as a set of inter-linked domains. ~~In recent models, mobility (or physical autonomy) has consistently been identified as a primary dimension of women's autonomy (Jejeebhoy and Sathar 2004,~~ ~~Osamor and Grady 2016,~~ ~~Samari and Pebley 2018).~~ Physical autonomy, as one of those domains, can be defined as an individual's ability to freely interact with the outside world, or the extent to which an individual is free of constraints on their physical mobility (Jejeebhoy and Sathar 2004). In addition to its intrinsic value, physical autonomy is also instrumentally essential. Mobility is fundamental to livelihood~~s~~, ~~everyday life, communities~~community, and the individual~~s~~. Accordingly, a wealth of research has demonstrated how women's mobility, or lack thereof, has gendered implications and indeed molds gendered assumptions. For example, ~~Tracing Understanding women's~~ equality of movement~~s~~ in the public sphere can be a demonstration of~~e a move towards~~ women's economic opportunity and social empowerment, ~~and~~ often accompanied by higher wages and a

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challenging ~~of~~ traditional gender power structures (Hapke and Ayyankeril 2004; Mandel 2004). Conversely, limitations ~~of~~ in mobility may reproduce notions of a public/private divide, with gender norms placing women in the home (private) in comparison to men's participation in (public) civic life (Hanson 2010; Sager 2016). ~~However,~~ ~~D~~during ~~quarantine restriction~~lockdowns, such as those implemented in response ~~due~~ to COVID-19, ~~all~~overall mobility is ~~limited~~curtailed across a population~~,~~ – placing heightened importance on disparities in the limited societal mobility that persists. ~~and thus disaggregation might be less important than over-all curtailment of movement.~~

However, mobility is ~~hard~~ challenging to ~~measure accurately~~assess. It is common for indices that measure physical autonomy to sum the number of places to which a person can go unescorted. For example, p~~P~~revious studies have used indices to assess women's autonomy in India and Pakistan ranging from 0 (if a woman must be escorted everywhere) to five (if she can move unescorted to five select location categories) (Jejeebhoy and Sathar 2004). Data to populate said indices has ~~historically~~ been collected from women themselves in the form of household survey tools, posing questions regarding ability to engage ~~meaningfully in data production or collection~~in a range of activities. Overall mobility measure by a third party and, in turn, comparisons of mobility by sex are rarely included. Thus, aggregate and relative mobility are often missing in ~~data sets; is challenging to measure consistently or meaningfully across populations or, in turn, ascribe value~~assessments of autonomy. ~~This~~ The unique scenario of a COVID-19 ~~and a~~ sex-segregated mobility policy, paired with recently accessible GPS data, allows us to look at disparities in aggregate mobility by sex; a critical yet previously under-explored aspect of women's autonomy. ~~offers an opportunity to understand gendered mobility.~~

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POLICY CONTEXT

On March 30, 2020 the Panamanian Ministry of Public Security launched ""Executive Decree 507" detailing the country's sex-segregated mobility policy to reduce civic circulation, stating: "*From Wednesday 1st April, public mobility will be conditional on sex as stated on national identification documents {cedula}*," (Panamá 2020). The logic that motivated this policy was based on epidemiological modelling: that it was a relatively simple way to reduce public circulation by half on any given day, and thus enforce social distancing in alternative forms to reduce potential for disease transmission. Mobility was further limited by the ultimate ~~number~~ digit of the *cedula* dictating

the two hours on your permitted male- / female- mobility day on which you could enter supermarkets and pharmacies, which were the only services ~~which~~that remained formally open ~~for~~to the public ~~to visit~~ during lockdown. Every Panamanian citizen over the age of 18, naturalized citizen and permanent resident has access to this *cedula*, and is obliged to carry it in public. Whilst in theory available to all, there are some ~~particularly vulnerable groups~~people who may not have been registered at birth, such as amongst indigenous or migrant communities~~, and therefore without cedula~~, although the exact number this applies to is thought to be less than 2%, the lowest in the region (Midiario 2020). Thus it was considered the most equitable way to easily control public mobility rapidly. Juan Pinto, Minister for Public Security stated "This [policy] is for nothing more than to save your life." However, as a state-enforced policy, t~~T~~he police were tasked with verifying that those in public were compliant with the sex and cedula regulations and were permitted to send ~~those~~anyone breaking the rules home~~,~~ and~~/~~or, if necessary, arrest them for refusing to comply with emergency regulation. ~~Juan Pinto, Minister for Public Security stated "This [policy] is for nothing more than to save your life".~~" Notably, because the policy was based on sex as listed on the *cedula*, ~~which is a biological identifier given at birth in accordance with sex organs. t~~This binary distinction as the basis of a policy to restrict movement raised significant concerns amongst transgender or otherwise non-binary communities.

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Table 1. Timeline of Panama's Policies and National Movement Restrictions in Response to COVID-19(OSAC 2020)

March 12	Schools and workplaces closed
March 22	The Panamanian government suspends all international commercial flights for 30 days.
March 25	Panama enacts nationwide movement restrictions, (quarantine). The movement restrictions will include regular windows of time for people to conduct essential activities, such as grocery shopping, getting gas and medicines, or dealing with a medical emergency, based on the last digit of their cedula number or passport if an individual does not have a *cedula*.
March 26	Panama announces nationwide suspension of commercial passenger and domestic charter flights, in addition to the March 22 ban on international commercial passenger flights. There are exceptions for cargo, humanitarian, medical supplies, medical evacuation, and vaccines.
March 30	The government releases "Executive Decree 507" announcing expanded movement restrictions based on gender. Individuals are permitted to circulate during the same hours determined by *cedula* as set forth in previous decrees. Sales of alcohol were prohibited to limit criminal behavior and/or violence
April 1st	The government enacts gender restrictions, with the following daily designations: - Women: Monday, Wednesday, and Friday - Men: Tuesday, Thursdays, and Saturday - Exceptions apply for holders of permission letters (*salvoconductos*)
April 21	The Municipal Council of the City of Panama passes a new decree stating that anyone leaving their residence must be wearing a mask that covers their nose and mouth. Panamanian National Police and Municipal Police will enforce the decree which extends throughout the metropolitan area of Panama City.
April 23	The Government of Panama announces that both Saturday, April 25, and Sunday, April 26, may be full quarantine whereby no one can leave their homes.
May 13	Select re-opening / mobility permissions extended for workforce, such as: mechanics, plumbers, electricians, air condition repairs, pool repairs, fisherman etc.
May 27	End of the lockdown announced, including relaxation of limitations based on *cedula*.

June 1 National quarantine relaxed, based on a 6 stage process detailed in the policy "Return to Normality"

Panama's ~~trailblazing~~unique sex-segregated policy was replicated by the government of Peru ~~across~~throughout the country and also within the city of Bogota, Colombia recognizing the ~~easy applicability~~ease of such a policy and the impact it could have on ~~significant reduction of~~reducing people circulating in public. However, within eight~~8~~ days on April 10, 2020 Peru's government cancelled this "*pico y genero*" (peak [hours] and gender) policy; President Marin Vizcarra announced that this policy had been insufficient, and it had failed in its objectives. This was later qualified "In our patriarchal world, there are roles assigned to women which must be challenged, but now [amid pandemic] is not the time to fight them," (Cerosetenta 2020). Such an ~~assumption~~ assertion suggests that there were observed differences between activities on male and female days which were thought to ~~considered to be~~ plac~~ing~~e an additional burden on women. Meanwhile, ~~,~~ in Bogota, the mayor launched a similar ~~gender based~~ policy on April 13, 2020 dividing women and men's days not by weekdays, but by odd and even dates in the month, which was also rescinded with similar reasoning.

METHODS

In this paper we take a novel approach to assess~~ing~~ differences in curtailed mobility by sex~~by looking at changes in aggregate social mobility over time~~. To do so, we conducted a retrospective analysis of Global Positioning System (GPS) data from Panama between February 15 and May 29, 2020 (the last weekday that the policy was in effect). We obtained aggregated anonymized data from Google's COVID-19 Community Mobility Reports, a dataset made up of Google users with mobile devices across Panama. Users opted in to sharing their Location History, a feature which is turned off by default (Aktay et al. 2020). The anonymized dataset resulting from these devices is aggregated daily. It is the same data that has been used to create publicly-available Google COVID-19 Community Mobility Reports, the aggregation and anonymization process has been previously described (Aktay et al. 2020).

We look at the relative change in the number of visits to community locations; specifically, relative change in the average number of visits to Google's five non-residential location categories: 1) grocery and pharmacies, 2) retail stores, recreational sites, and eateries, 3) transit stops, 4) parks and 5) workplaces. We include all five categories because, while certain locations (such as public parks or non-essential retail) may have officially been closed by the government, our goal was to observe actual changes in mobility as opposed to intended changes in mobility. For

each location category studied, ~~each~~ a location history user can contribute at most once to each category (Aktay et al. 2020). To look at these ~~five~~ variables, we use Google's standard algorithm to assess how visits and length of stay at different locations change~~d~~ compared to a pre-COVID baseline. In this model, changes for each day are compared to a non-sex segregated baseline value for that day of the week. The baseline is the median value, for the corresponding day of the week, during the 5-week period from January 3rd to February 6th 2020 (Aktay et al. 2020). For example, if a value is -70 on a Monday, it is 70 percent lower than a "baseline" value based on prior non sex-segregated mobility on Mondays during the five-week pre-period (Aktay et al. 2020). ~~Importantly, for our analysis, during the Panamanian lockdown, many locations falling within categories two and four (as defined by Google, Appendix Table 1) were formally closed, with location three (transit stops) largely available for those with a *salvoconducto* or going to grocery and pharmacy stores. The only workplaces which were open (location five) were those providing essential services.~~

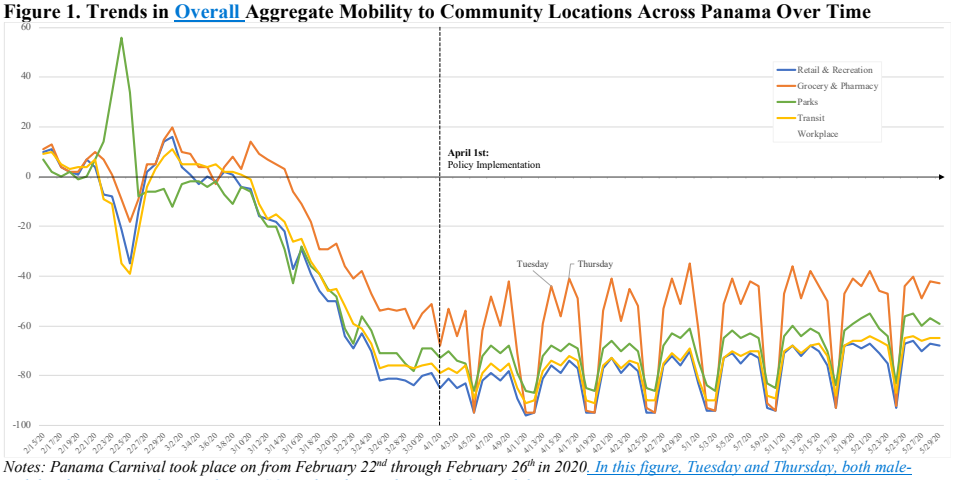
Conceptually, we are comparing male~~-~~ (Tuesday, Thursday)~~-~~ and female- (Monday, Wednesday and Friday) ~~mobility~~ days to mobility trends prior to COVID-19, when people of all genders could move freely. Because the curtailment of overall mobility is an effort to slow the spread of the COVID-19 pandemic and ~~may~~ is ~~be~~ a positive result of the policy, our primary outcome of interest is ~~the differential~~the difference in ~~effect of curtailment on~~mobility between male- v. female- mobility days, during our study period, when overall mobility was curtailed. For this reason, we perform simple two-sided t-tests on the equality of means (Table 2) to assess if there was a ~~meaningful~~ statistically significant difference in the change in mobility between the two types of days as compared to the non ~~-gender~~ sex-segregated baseline.

RESULTS

We find there was a ~~significant~~ large drop in mobility that began ~~from~~ at the start of the outbreak on approximately March 10, which leveled off and was sustained after the lockdown was implemented on April 1, 2020. During the lockdown period, there was ~~with~~ notable day-to-day variation following a distinct weekly pattern (Figure 1). ~~weekly variation in mobility. Analysis of~~In examining ~~different~~ changes in aggregate mobility by ~~days and~~ location ~~categories~~category, we find that ~~,~~ th~~ose~~e location category with the ~~least~~ lowest average change from the pre-COVID baseline ~~are~~ was grocery and pharmacy location~~s~~~~ies~~. This category ~~remains~~ remained ~~that~~ the category with

the least change from baseline ~~over~~ throughout the lockdown period, potentially keeping with the strict enforcement of ~~all~~ retail and other service industry closures~~ies being closed~~.

Figure 1. Trends in Overall Aggregate Mobility to Community Locations Across Panama Over Time



Notes: Panama Carnival took place on from February 22nd through February 26th in 2020. In this figure, Tuesday and Thursday, both male-mobility days, appear closer to the pre-COVID baseline; indicating higher mobility.

However, our data demonstrate that there was less of a change in aggregate mobility from the baseline for the mobility category "grocery and pharmacies" on "male" days when compared to female days (Table 2). In fact, for all mobility categories, there was a statistically significant difference in mobility between male- and female-mobility days during the initial lockdown, through March 13 (Table 2). ~~aggregate~~ Aggregate male-day mobility was closer to the baseline than female-day mobility in all instances. A value closer to zero indicates more mobility / visits to community locations. For example, looking at the grocery and pharmacy results, a -41.5 decrease means that aggregate mobility was 41.5% lower than the pre-COVID baseline, whereas on female mobility days this value was lower (-54.6) indicating greater distance from the pre-COVID baseline and less relative mobility. In addition, while visits to all categories remained low ~~when~~ compared to the baseline, they increased over time during ~~time~~ the lockdown period with slopes ranging from 0.29 (transit) to 0.38 (grocery and pharmacy), Appendix Figure 1. Extending our timeframe beyond May 13~~to the end of the policy~~, we ~~identify~~ find that the difference in means for the mobility category ~~aggregate mobility to~~ transit stations is no longer significant between male- and female-mobility days.

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Table 2. Differences in Aggregate Mobility on Sex-segregated Mobility Days by Location Category

	Male-Mobility Weekdays		Female-Mobility Weekdays		
	Mean	95% CI	Mean	95% CI	p-value
Change in Aggregate Mobility Through May 13th					
Retail and Recreation	-73.4	-75.7 – -71.1	-77.8	-80.2 – -75.4	0.011
Grocery and Pharmacy	-41.5	-43.9 – -39.0	-54.6	-58.0 – -51.2	0.000
Transit Stations	-71.9	-73.6 – -70.3	-75.5	-77.6 – -73.5	0.012
Parks	-64.8	-66.9 – -62.8	-68.9	-71 – -66.8	0.008
Workplace	-70.2	-72.6 – -67.8	-71.4	-74.5 – -68.3	0.549
Change in Aggregate Mobility Through the End of the Policy					
Retail and Recreation	-71.4	-73.6 – -69.2	-75.3	-77.6 – -72.9	0.025
Grocery and Pharmacy	-40.9	-42.7 – -39.2	-51.9	-54.9 – -48.9	0.000
Transit Stations	-69.9	-71.9 – -67.8	-72.8	-75.1 – -70.5	0.073
Parks	-62.5	-64.9 – -60.1	-66.3	-68.6 – -63.9	0.032
Workplace	-67.1	-70.1 – -64.0	-67.8	-71.1 – -64.6	0.734

Notes: all p-values are two tailed; resulting from a two-sample t-test assessing the difference in means between male v. female-weekdays. Data represent aggregated values across the country of Panama. We provide results both before and after May 13 due to select re-opening that occurred after May 13 (as outlined in Table 1).

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In addition, ~~there was~~we find no statistically significant difference in "workplace" aggregate mobility between male and female days. Given that most of the labor market was suspended, or asked to work at home, workplace mobility ~~in theory refers to~~may largely encompass those considered essential workers involved in the COVID-19 response and/or vital infrastructure services across genders, whose mobility was not sex-segregated. I~~i~~ndividuals, who were formally~~s~~ traveling to their workplaces, were provided with exemption letters or *salvoconductos* to facilitate transit.

DISCUSSION

We find that ~~Panama's sex-segregated lockdown resulted in~~ there was significantly different ~~changes in~~ aggregate mobility on male- v. female-mobility days during Panama's sex-segregated lockdown. These findings s~~, s~~uggest~~ing~~ that men and women had distinct ~~women may~~ experiences of the ~~respond to~~ social distancing policy~~differently~~. Differences were observed i~~o~~n both the volume and type of locations visited; with lower aggregate mobility to all community location categories on female-mobility days. ~~This~~ These differences ~~was~~ were particularly pronounced ~~with~~ in ~~mobility~~ visits to grocery and pharmacy locations~~ies~~. ~~This was~~These findings are ~~surprising as it is~~ at odds with media accounts from Peru highlighting longer queues outside supermarkets on "female" days, and broader assumptions of the gendered distribution of ~~domestic~~ out-of-home labor (Cerosetenta 2020). For example, w~~W~~e

assumed that women would be performing the majority of the grocery shopping on their permitted mobility days. ~~These findings motivate discussion of the impact of sex-segregated policy on women's curtailed mobility.~~ It appears women may not be performing all anticipated ~~the~~ informal labor ~~anticipated~~, or specifically that they simply ~~are~~ undert~~aking~~ook fewer tasks outside the home then men. Indeed, ~~given men's mobility was closer to baseline suggesting they may be visiting grocery shops and pharmacies more frequently on their permitted days. This implies~~our findings suggest that men may be performing public domestic activities within families and/or communities at higher rates than women. These findings motivate discussion on inequality in mobility during social distancing, outlined below, particularly given what we know from prior research on the gendered impacts of pandemics. Further investigation is also required to understand the extent to which this differs from normal mobility patterns, why men are undertaking these activities and, conversely, if and why women are not.

1. *Social ~~reproduction~~ Reproduction*

During COVID-19, social reproduction ha~~s~~ been evident. Prior research has found that w~~W~~omen are performing the majority of ~~the~~ care in hospitals and care homes (Autonomy 2020). Moreover, and in line with our findings on lower community mobility, time use surveys and polling has demonstrated that women ~~are~~ may be ~~performing~~ carrying the majority of the domestic burden; caring for ~~the~~ children who are not in school, undertaking additional housework associated with ~~the~~ increased time in the home, and ~~are~~ also report being more anxious than men about the lockdown and associated disruptions (Cambridge 2020). Compounding this, early data suggest that during COVID-19 women are more likely to have been furloughed or made redundant in their professional roles as they are more likely to be ~~on~~ part-time, on flexible or zero hours contracts, or employed in the informal sector (Phimister et al. 2020; WBG 2020).

Although our data does not demonstrate social reproduction directly, our work ~~Our work~~ suggests ~~that~~ women may be experiencing differenti~~al rates of curtailed~~levels of mobility during lockdowns than men in ways ~~that appear to reaffirm~~that may reaffirm the presence of~~which may indicate continued norms of~~ social reproduction in some ways (such as childcare) and not in others (such as supermarket shopping). Our data, paired with prior research, ~~posing questions about mobility,~~raise questions regarding autonomy and women's ~~agency~~ ability to undertake tasks outside the home. While we do not know the extent to which these differences are consistent with pre-COVID trends, ~~Given~~

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given overall lowered mobility across society, we posit that tasks outside the home ~~during lockdown~~ may be ascribed new value during lockdown which in turn may impact~~s~~ household bargaining (Agarwal 1997). For example, going to the grocery store may be one of the only opportunities to leave the home and engage with non-household members. ~~. It may also be that men are "sent" to the shops or choose to seek respite from the private domain.~~ While ~~it~~ grocery shopping may have previously been valued as a purely domestic task, it now provides novel social benefit ~~reflected in household negotiations~~. Although we have no conclusive data ~~for~~on social reproduction, we suggest that unequal ~~looking at this~~ mobility ~~data This might~~patterns appear to reaffir~~m~~m~~s~~ the invisibility of women; suggesting some level of confinement to ~~even within their own~~ domestic spaces either caused, or revealed, by the policy. Alternatively, the in-home domestic burden borne by women may be high enough that ~~they~~ women are actively ~~are unable to or may not have the agency~~ choosing not to engage in external tasks. ~~Men~~ While men are "going to the store" more, ~~but~~ this could be less ~~a pro-active~~the result of differential bargaining ~~choice~~ power ~~on their part~~ than a reflection of women's burden in the home~~, e.g. undertaking childcare~~. A final consideration might be ~~gendered~~ that perception~~s~~ of risk vary, and ~~whether~~ going ~~out in public~~to community locations and potentially ~~being exposed~~exposing oneself to infection is evaluated differently by men and women. ~~Our data do not reveal the motivating factor behind men's differential mobility comparable to women, but they raise questions about women's autonomy and mobility, reproduce notions of the public/private divide, and suggest that women may self-isolate to a greater degree than men (whether an active choice or not). This is an important finding for infectious disease control interventions. Yet we do not suggest that such a policy should be replicated, as we are yet to understand the downstream effects of sex-segregated isolation, and how such policies may disenfranchise women and jeopardize their physical and economic security.~~

2. ~~*Implications for women's*~~ *Women's* ~~*autonomy*~~ *Autonomy and* ~~*safety*~~ *Safety* ~~*in the home*~~

~~These findings~~Unequal mobility raise~~s~~ further ~~consideration for~~ concern regarding women's ~~mobility~~ autonomy ~~in~~ across Panama. In the short term, as previously discussed, ~~the lack of~~lower mobility ~~might~~ may ~~optimistically~~ mean that women are abiding by the country's strict quarantine measures, that they are simply "better at social distancing" and thus are less likely to be exposed to COVID-19. However, ~~This may be the case~~u~~, but u~~nequal ~~rates of curtailed~~ mobility raise~~s~~ ~~questions~~ concern regarding ~~women's physical autonomy~~the extent to which these differences are by

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choice and, if not, the extent to which they represent compromised physical autonomy ~~in the near term~~. This has immediate practical implications ~~e.g.~~during a pandemic. An example is access to basic goods, such as ~~concerns over foregone access to~~ food and ~~, access to~~ healthcare~~, etc~~. Food shortages ~~, whether caused by supply or demand side, are~~ have been widespread ~~increasingly apparent in~~during COVID-19 (Guardian 2020; The World Bank 2020). Similarly, ~~limitations of~~access to routine health services may be curtailed ~~providers to only offer~~ through the limited provision of "essential services" beyond COVID-19 related care~~.~~, an issue ~~as well as~~compounded by demand~~-~~side concerns~~,~~ such as ~~over~~ fear of infection ~~risk~~within clinical settings ~~of individuals in healthcare settings are increasingly evident in the outbreak~~. ~~Moreover,~~ G~~g~~lobally there have been widespread ~~trends~~ reports of reduced admissions to emergency rooms during the pandemic, ~~with medics suggesting this~~in part a reflection of~~s~~ individual's concerns ~~about~~regarding disease transmission in hospitals (Thornton 2020). Indeed, we saw health-system distrust manifest similarly during Ebola; serving as a barrier to timely case presentation (Woskie and Fallah 2019). ~~I~~f women do have ~~the added burden of~~ limited ~~mobility~~physical autonomy, this may ~~also~~ further impact health-seeking behavior ~~along gendered lines~~at a time when the need for access is heightened, but access itself limited. ~~Previous research demonstrated that, excluding obstetric care, women are less likely to visit hospitals, noting out-of-pocket expenditure, travel expenses and discrimination for travelling alone as reasons for low attendance (Anon 2020). Moreover, globally there have been trends of reduced admissions to emergency rooms during the pandemic, with medics suggesting this reflects individual's concern about disease transmission in hospitals (Thornton 2020).~~ We ~~are~~ have yet to secure sex-disaggregated data on~~for~~ health seeking behavior during COVID-19 for non-pandemic ~~related~~ health ~~concerns~~ conditions ~~to~~ which would allow us to better understand how different perceptions and/or domestic demands may alter this interaction with the health system.

Lack of mobility also poses concerns with increased time in the home and narrowed social networks, which have historically compounded issues of intimate partner violence (IPV) and safety in the home (Lanier and Maume 2009; (Goldenberg et al. 2014; Pronyk et al. 2006). COVID-19 has amplified existing rates of IPV globally, with estimates of increases to calls to domestic violence hotlines increasing 60 percent in Europe (Mahase 2020) and alarmingly up to 79 percent in Colombia during March and April 2020 (Zapata-Garesché and Cardoso 2020). Notably, as part of the COVID response, the Panamanian government also prohibited the sale of alcohol during the quarantine period in an effort to reduce violence. Official statistics in Panama suggest a significant decrease in rates of such violence

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(Panama 2020), but further specialists have suggested that it is exactly this lack of mobility to report these crimes explain the low numbers (Mumtaz and Salway 2005). As IPV is under-reported, or data recorded through proxy measures after the fact, we must consider these data as they appear and include them in further analysis of the impact of sex-segregated policies for self-isolation.

3. *Economic ~~empowerment~~ Empowerment*

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In the longer term,~~,~~ ~~curtailed female~~inequalities in mobility if- compounded by COVID-19 and corresponding lockdown policies, m~~ight~~ay raise~~s~~ broader challenges for women's economic empowerment. In the wake of the Ebola outbreak in West-Africa, for example, women were out of work for longer than men in the post-crisis period (Bandiera et al. 2019). Whilst our data shows no significant difference ~~for~~in workplace mobility between male- and female-mobility days, it is hard to interpret this data. It is unclear ~~, and whether more~~if more men or women continued to work during quarantine, as there is no data ~~for~~disaggregating those who were offered "salvoconductos" (exemption passes) to continue to work by sex or gender ~~is not available~~. ~~However, we know that the main group of essential workers who were able to apply for these passes were healthcare workers, 70% of whom globally are women.~~ We also do not know how much informal out-of-home labor may have occurred during the lockdown period outside of the salvoconducto system and the extent to which this contributed to mobility captured in the category "workplace."

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However, if our hypotheses on social reproduction in response to the lockdown are accurate, and women are performing additional tasks during the lockdown such as childcare, this will likely continue in the post-crisis period until schools re-open preventing women from returning to their jobs at potentially higher rates than men (SERTV 2020). In addition, although all employment was limited during COVID-19 quarantine in Panama, in Panama's re-opening strategy the first tranche of sectors opening are traditionally male dominated; mechanics, construction, building maintenance and fishing (SERTV 2020). Industries that traditionally employ women (education, hospitality, tourism) will be re-opened later. If labor participation is gendered by the pandemic, this may have widespread impacts on stability and economic development, each of which has been shown to improve with greater female participation in the labor market, as well as secondary effects on women's civic and political participation. While we cannot draw substantive conclusions on women's workforce participation during Panama's lockdown

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from the data presented in this piece, research on the non-health sequalae of prior outbreaks suggest the interaction between overall curtailed mobility and formal employment is often gendered (Bandiera et al. 2019).

~~If women are not as mobile as men during the pandemic, such as demonstrated by our data, this may extend into the post-COVID period and during the re-opening up of the economy. We have seen in Panama's exit strategy that the first tranche of sectors opened are those which are traditionally male-dominated; mechanics, construction, building maintenance and fishing (Anon 2020). Industries which traditionally employ women (education, hospitality, tourism) are delayed in re-opening until later in the "return to normal" government plan, placing further economic insecurity on women. Although all employment was limited during COVID-19 quarantine in Panama, we cannot draw substantive conclusions about women's employment futures compared to men, it is an important reminder of the interaction between mobility and employment, and one which policymakers should consider as they continue with this sex-segregated mobility policy.~~

~~Moreover, if our assumptions about social reproduction within the mobility data are accurate, and women are performing the majority of the childcare, this will likely continue in the post-crisis period until schools re-open (not until stage five of the "return to normal" strategy) preventing women from returning to their jobs (Anon 2020). This can have widespread impacts on stability and economic development, each of which has been shown to improve with greater female participation in the labor market, as well as secondary effects on women's civic and political participation. At time of writing, lockdown was still in place, and a number of sectors remain still closed, thus this remains speculative and we wait to see how economic empowerment of women is affected, and whether the government of Panama takes proactive steps to mitigate against the indirect effects on women posed by additional childcare, and the effects of which sectors of the economy are opened and in what order.~~

4. *Gender-Identity*

Finally, implementing a policy to limit mobility based on sex ~~segregation,~~ presupposes that all individuals identify as male or female and that this ~~identity~~ both aligns with the sex listed on their *cedula* ~~as well as~~and their gender presentation. With this assumption, this policy has failed transgender and non-gender or sex-binary Panamanians from its inception. Early reports from Human Rights Watch suggest that transgender individuals, specifically, have

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suffered discrimination when leaving their homes on days that were in accordance with their gender identity, yet others for being outside of the home on days that were in accordance with the sex listed on the *cedula*: "*Transgender people in Panama are being humiliated and accused of breaking the law under the quarantine policy simply for being themselves*," ~~(Anon 2020)~~(Human Rights Watch, 2020). This form of discrimination may have short term consequences, such as forgoing important goods, as well as longer term impacts on individuals' mental health and wellbeing. We require a deeper exploration of this issue; ensuring policies do not utilize citizens' identities (or erasure of those identities) in ways that compound existing societal inequalities, particularly those borne out through law enforcement.

LIMITATIONS

There are several limitations to this study. First, the data used is reliant on both the ownership of a smart phone and the decision to opt in to sharing data with Google. Because we lack information on individuals' characteristics, we do not know the extent to which the population represented in Google's aggregated data is reflective of the true population of Panama, and how this may lead to selection bias ~~of~~amongst those ~~reporting data~~contributing to the aggregated data ~~to be those most engaged with Google's location platform or use of the app on mobile phones,~~used in this paper. In line with this, ~~we do not have estimation of ownership how~~ smart phone ownership may vary by gender, by age, ~~by~~ socio-economic status ~~or ,~~ rurality or other relevant characteristics. For example, the population represented in this data may be on average younger than the general population. As a result, we only look at relative change in mobility - ~~compare~~ comparing changes in the ~~same group~~overall population to ~~that same group's~~ the pre-trend period. Second~~ly~~, we have no way to disaggregate men and women's differential mobility prior to the policy's implementation. While we compare aggregate mobility to a pre-COVID baseline, we do not know if the baseline reflects higher rates of mobility amongst men. As such, the policy may have either led to, or simply revealed, differences in mobility by sex. Third~~ly~~, our analysis is ~~only~~ limited to data on weekdays. On weekends there ~~was a~~were significant ~~drop in~~limitations to all mobility, ~~as well as~~with Sunday being absolute quarantine for all. The exclusions of Saturdays~~l, thus this~~ may affect the validity of results. Finally, this study only refers to mobility, and offers no insight into the motivations for mobility and/or the activities undertaken whilst in public. For example, why we see increased visits to groceries and pharmacies on male mobility days, we have no data on what men were

buying (if at all) and whether this reflects differences in shopping trends which may reflect further gendered differences.

CONCLUSION

Using newly accessible data on human mobility, we found significantly lower visits to community locations on female-days during Panama's sex-segregated social distancing policy. ~~This data can inform meaningful discussions concerning the impact of sex-segregated mobility policies. First, it can offer an indication that women may be adhering to lockdown to a greater extent than men, which may signal reduced risk of disease transmission. As sex-disaggregated data becomes more available, it is critical to explore this beyond Panama. Secondly, the difference in mobility on male and female mobility days provides early evidence that social distancing policies may differentially impact men and women.~~ The disparity in mobility between male and female days~~Women's reduced mobility may be a reflection of "better social distancing," but also causes~~raises concern ~~regarding~~ regarding the extent to which differences in mobility are chosen, or reflect compromised freedom of movement. We posit that differences may be informed by societal factors, such as: diminished intra-household bargaining power, the corresponding distribution of in-home labor (in dual parent household~~),s) and whether women are not mobile because of intrager-household bargaining,~~ or other ~~additional~~ tasks ~~within the home~~ that amplify~~ing~~ social reproduction; all of which may be compounded by COVID-19 and corresponding decreases in mobility across society. The~~is mobility~~ differences in mobility also ~~sheds light on~~bring into question existing private and public divides beyond COVID-19.~~-~~ For example, there is some chance the implementation of the policy simply allowed us to observe existing – but previously unquantified – inequalities in how people engage in public spaces. ~~within social norms of men being more likely to participate in civic activity and women more likely to stay at home.~~ Regardless, ~~Third, more pronounced changes in aggregate mobility from baseline on~~ lower mobility on female-~~mobility~~ days during the pandemic raises concern~~s of~~ regarding access to basic goods, such as food and healthcare ~~for women, and~~ as well as ~~if lockdown differences by sex may increase~~exposure to interpersonal violence. ~~Fourth, mobility differences may pose a concern for women's economic empowerment in the medium to long term if they are less mobile and quick to return to work as lockdown eases.~~ Finally, the policy failed to recognize the diversity of~~e~~ gender ~~identities~~ identity and may reproduce inequalities and injustice ~~for~~ experienced by non-binary individuals. ~~This initial paper goes some way to analyzing each of these areas, but m~~More ~~data~~in-depth research ~~particularly utilizing mixed-methods must be collected and~~

~~collated as it becomes available~~is required to substantiate and better understand~~ing~~ the concerns ~~we~~ raised ~~in practice~~.

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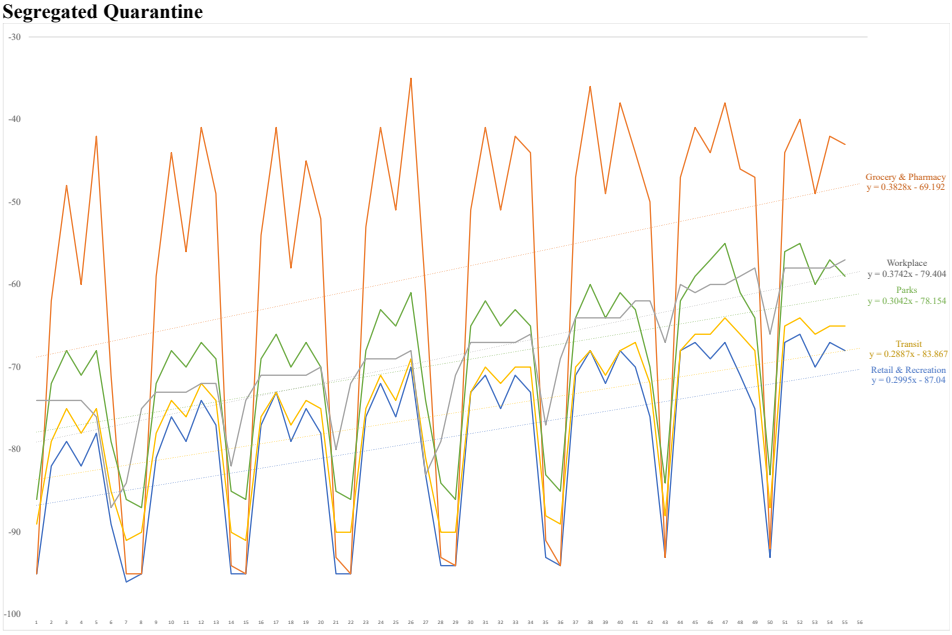
APPENDIX TABLES AND FIGURES

Appendix Table 1. Google Mobility Location Categories

	Example locations include:
Retail and recreation	Restaurants, cafes, shopping centers, museums, libraries and movie theatres
Grocery and pharmacy	Grocery markets, food warehouses, farmers markets, specialty food shops, drug stores and pharmacies
Parks	National parks, public beaches, marinas, dog parks, plazas and public gardens
Transit Stations	Public transport hubs, such as subway, bus and train stations, taxi stands

More information on Google Location Categories can be found at on the COVID-19 Community Mobility Reports webpage: https://www.google.com/covid19/mobility/

Appendix Figure 1. Trends in Aggregate Mobility Over Time by Location Category During the Sex-Segregated Quarantine




REPÚBLICA DE PANAMÁ
GOBIERNO NACIONAL
Plan
Protégete
Panamá
El mecanismo más sencillo para reducir, como mínimo a la mitad la presencia, es asignar algunos días de circulación para las mujeres y algunos días de ciculación para los hombres.
Manteniendo el mismo esquema del último número de la cédula, y los horarios.
Si eres mujer, circularás los días:
· Lunes
· Miércoles
· Viernes
Si eres hombre, circularás los días:
· Martes
· Jueves
· Sábado
Domingo: todos en casa en familia.
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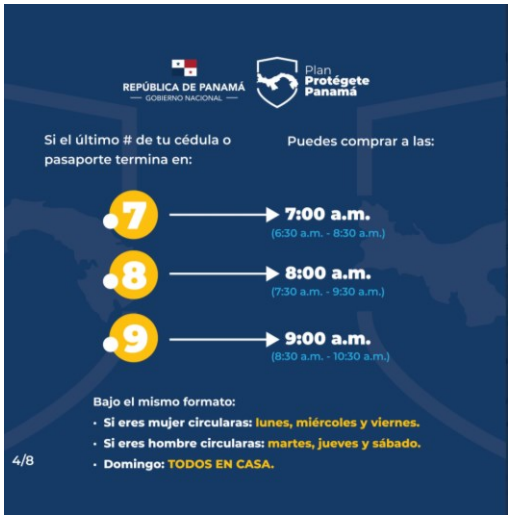
REPÚBLICA DE PANAMÁ
GOBIERNO NACIONAL
Plan
Protégete
Panamá
Si el último # de tu cédula o pasaporte termina en:
Puedes comprar a las:
7
7:00 a.m.
(6:30 a.m. - 8:30 a.m.)
8
8:00 a.m.
(7:30 a.m. - 9:30 a.m.)
9
9:00 a.m.
(8:30 a.m. - 10:30 a.m.)
Bajo el mismo formato:
· Si eres mujer circularas: lunes, miércoles y viernes.
· Si eres hombre circularas: martes, jueves y sábado.
· Domingo: TODOS EN CASA.
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