

How Radio Affects Violent Conflict: New Evidence from Rwanda

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Abstract

Researchers have long debated how radio broadcasts affected the dynamics of the 1994 genocide in Rwanda, with some arguing that the radio was highly consequential, and others suggesting such effects have been overstated. This article contributes to these debates—as well as to debates regarding the role of old and new media in collective action—by examining whether and how Radio Télévision Libre des Mille Collines (Radio RTLM) coverage was associated with two core aspects of the violence: (1) subnational onset of genocidal violence and (2) participation in genocidal violence across subnational spaces. Drawing on new data on Radio RTLM coverage, we find that areas with coverage were more likely to experience immediate onset of violence. However, our analysis of participation in the genocide—which uses more accurate measures of participation and of radio coverage than prior studies—finds no significant association between Radio RTLM coverage and subnational levels of participation. After illustrating that these results are robust to numerous model specifications, we theorize that information broadcast over the radio's airways contributed to the creation of a critical mass that initiated genocide in localized spaces. We conclude by considering the importance of understanding the role of media in the subnational onset of violence.

Keywords

media, conflict, genocide, Rwanda, collective action

The 1994 genocide that targeted Tutsi in Rwanda resulted in widespread death, displacement, and destruction in just a few months. Numerous factors contributed to the onset and scale of the violence, but a radio station called *Radio Télévision Libre des Mille Collines*,¹ or Radio RTLM, features prominently in most accounts of the genocide. RTLM broadcasts regularly called members of the Tutsi ethnic group “cockroaches” and encouraged violence against them—one of the many reasons why the International Criminal Tribunal for Rwanda (ICTR) found two of the station’s most significant backers guilty of genocide.

The role of Radio RTLM has become part of popular discourse worldwide. Radio RTLM broadcasts can be heard in the 2004 movie *Hotel Rwanda*, with a radio journalist proclaiming, “Rwanda is a Hutu land. We are the majority. They [Tutsi] are a minority of

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traitors and invaders. We will squash their infestation.” Each year around the anniversary of the genocide, news outlets publish pieces regarding the role of Radio RTLM in the violence. For instance, a 2019 *Atlantic* article about the station declared that “Rwanda Shows How Hateful Speech Leads to Genocide” (Ndahiro 2019), and a 2020 *Al Jazeera* piece referenced RTLM as providing “music to kill to” (Swart 2020). Students of journalism, international law, and genocide studies typically learn about the radio station, and policy-related discussions often center on what might have transpired had the radio been jammed (Straus 2007). In fact, Rwanda’s main genocide memorial teaches visitors that the genocide would not have occurred if the United Nations had stopped Radio RTLM’s broadcasts (Nyseth Nzitatira 2019).

Despite its salience in both popular media accounts and research literatures, the actual impact of Radio RTLM on the 1994 genocide in Rwanda remains questionable. Scholars generally agree that Radio RTLM contributed to growing polarization in Rwanda before the genocide, yet disagreement persists on the role the station played once violence began.² Some scholars see the radio as a core mechanism driving widespread public participation in the genocide. Chrétien and colleagues (1995), for instance, suggest the genocide was accomplished through two major tools—the machete and the radio. Consistent with this claim, Yanagizawa-Drott (2014:1947) argues that “approximately 51,000 perpetrators, or approximately 10 percent of the overall violence, can be attributed to the station [RTLM].” Newer research, however, argues that these figures are too high (Danning 2018) and that Radio RTLM’s impact on participation is overstated (Li 2004; Luft 2023; McDoom 2021; Mironko 2007; Straus 2007). Correspondingly, “efforts to document the role of the radio in the Rwandan genocide are far from over” (Richards, Baele, and Coan 2019:525).

We address this debate head-on in this article, focusing on the case of Rwanda and whether and how media affects mass violence within subnational spaces. Beyond theoretical elaboration regarding media effects, as well

as potential mechanisms undergirding radio broadcasts and genocidal participation, we analytically draw on two novel and important sources of data—records from post-genocide *gacaca* courts and new estimates of RTLM coverage across Rwanda. Our findings suggest that, although Radio RTLM did *not* significantly affect overall levels of participation in the genocide, Radio RTLM mattered in another way: it shaped the timing of subnational violence onset across the country. Our results indicate that geographic areas with Radio RTLM coverage experienced genocidal onset earlier than those without coverage. We believe that such a finding, which has to do with spatial processes and timing rather than general and national participation effects, reflects an important insight and focus for future scholarship surrounding collective violence, media diffusion, and mobilization and movements.

Lessons gleaned from this case are important for broader understandings of the role of traditional (or old) forms of media—that is, forms typically disseminated through one-way communication (e.g., television or radio broadcasts)—in mobilization worldwide (Crabtree, Darmofal, and Kern 2015; Karell et al. 2023). Specifically, we convincingly show that traditional media can affect the subnational onset of mass violence via what we theorize as an information mechanism that aids in the creation of a critical mass willing to participate in violence. Models of subnational onset of conflict—which tend not to account for the media (e.g., Rustad et al. 2011)—should arguably consider the role of media in inciting violence. We conclude by discussing the relevance of our results in these regards, and for literatures on collective violence. We also underscore the possible role of media as an atrocity prevention tool, especially within developing countries (Armand, Atwell, and Gomes 2020).

THE 1994 GENOCIDE IN RWANDA

A concise overview of the path to genocide in Rwanda begins with colonialism. Rwanda became a German colony in 1884,

and Belgium took over as the colonial authority following World War I and the Treaty of Versailles. During the early 1930s, Belgian officials mandated that Rwandans carry identification cards that classified each Rwandan as Hutu, Tutsi, or Twa. These groups were largely class-based prior to colonialism, with Hutu (84 percent) working the land, Tutsi (15 percent) owning cattle, and Twa (1 percent) working as potters (Jackson and Payne 2003; Jefremovas 1997; Newbury 1988; Vansina 2005). However, Belgian colonialists enacted policies that benefited Tutsi, who dominated the monarchy and the country's positions of power (Lemarchand 1970; Mamdani 2001).

During the early 1950s, Hutu began to express discontent at years of marginalization despite their numerical majority. Hutu intellectuals penned the "Bahutu Manifesto," which called for the liberation of Hutu from the colonizers and from Tutsi elites (Mamdani 2001). The colonial administration shifted support toward Hutu as well, and this Hutu Revolution culminated in Rwandan independence and in the institution of a Hutu-led government in 1962. Violence and discrimination against Tutsi were common during and after the revolution, forcing tens of thousands of Tutsi to flee Rwanda (Des Forges 1999; Hintjens 1999).

A 1973 coup brought Hutu president Juvénal Habyarimana to power, and he instituted a one-party state tied to his political party—the National Republican Movement for Democracy and Development (MRND). The Habyarimana regime continued to discriminate against Tutsi, and sporadic violence persisted. During this time, Tutsi refugees began forming an armed liberation movement known as the Rwandan Patriotic Front (RPF) in Uganda. In October 1990, their army (called the Rwanda Patriotic Army, or RPA) attacked Rwanda. This initial attack was short-lived, but it initiated a three-year civil war between Rwanda's Hutu-led government and the mostly-Tutsi army (Straus 2019).

Shortly after the war began, prominent Hutu elites began disseminating propaganda. A journalist named Hassan Ngeze created a

magazine called *Kangura* (Wake Others Up) to publish harsh critiques of the RPF and presumed Tutsi supporters (Mamdani 2001). Most infamously, the magazine's Hutu 10 Commandments announced that, "The Hutu should stop having mercy on the Tutsi," and "Every Hutu should know that every Tutsi is dishonest in business. His only aim is the supremacy of his ethnic group" (*Kangura* 1990). The government's radio station—known as Radio Rwanda—also broadcast discriminatory messages and even promoted the killing of Tutsi (Des Forges 2007:42).³

As the government and the RPF were finalizing unpopular peace talks in July 1993, supporters of MRND and of a new, more extreme party called the Coalition for the Defense of the Republic (CDR) joined forces to launch Radio RTLM. This coalition rejected the peace agreement and took to RTLM to denigrate the agreement, the RPF, and all Tutsi (McDoom 2021). President Habayarimana and other high-ranking government officials and military officers backed this new station, which was spearheaded by a historian named Ferdinand Nahimana (Higiro 1996; Ikiriza 2009).

Notably, the founder and editor of *Kangura* was on RTLM's steering committee and even appeared on the air several times (ICTR-99-52-T; Kimani 2007). Some of *Kangura*'s funders also bankrolled RTLM (ICTR-99-52-T). There was thus close correspondence in the content of *Kangura* and Radio RTLM. RTLM was distinct, however, in that it was meant to appeal to the ordinary Rwandan through conversational commentary. As Des Forges (2007:45) explained:

RTLM repeatedly and forcefully underlined many of the themes developed for years by the extremist written press, including the inherent differences between Hutu and Tutsi, the foreign origin of Tutsi and, hence, their lack of rights to claim to be Rwandan, the disproportionate share of wealth and power held by Tutsi and the horrors of past Tutsi rule. It continually stressed the need to be alert to Tutsi plots and possible

attacks and demanded that Hutu prepare to “defend” themselves against the Tutsi threat (RTLM transcripts: 25 October; 12, 20, 24 November 1993; 29 March; 1, 3 June 1994).

On April 6, 1994, as tensions were high and a power-sharing deal loomed (Guichaoua 2015; Longman 2009; McDoom 2021; Verwimp 2013), the president of Rwanda was assassinated. This event marked the national beginning of the genocide, and a new interim government began encouraging Hutu to kill Tutsi. Although the genocide was orchestrated by a small group of elites, it was largely implemented by hundreds of thousands of civilians who joined killing groups within and around their communities (Mironko 2004; Straus 2004). The RPF also reinitiated the civil war within Rwanda, fueling additional fear and violence (Straus 2019). Between April and July of 1994, as many as one million people were killed, and millions more were displaced.⁴ Rape and other forms of sexualized violence were extremely common (Bijleveld, Morssinkhof, and Smeulers 2009; Mullins 2009), and property destruction and looting were rampant.

RADIO RTLM AND THE GENOCIDE

Researchers have analyzed the macro-level causes of this violence, such as colonialism, clientelism, racialized ethnic identities, economic insecurities, authoritarianism, the civil war, and threats to those in power (Des Forges 1999; Fujii 2010; Guichaoua 2015; McDoom 2021; Straus 2006; Verwimp 2013). In addition to these macro-level causes, research on the genocide regularly cites the role of ideology, or a “distinctive system of normative, semantic, and/or reputably factual ideas, typically shared by members of groups or societies, which underpins their understandings of their political world and shapes their political behavior” (Leader Maynard 2014:824). Specifically, ideologies that dehumanize, attribute guilt, construct threats, valorize violence, or present violence

as inevitable are key risk factors of atrocities (Hagan and Rymond-Richmond 2008; Leader Maynard and Benesch 2016; Valentino 2013), including genocide (Harff 2003; Nyseth Brehm 2017).

Accounts of the causes of the 1994 genocide in Rwanda typically reference Radio RTLM as a vehicle that spread dangerous ideologies between July 1993 and the outset of the genocide (e.g., Mamdani 2001; McDoom 2021). Research on these ideologies has largely involved content analyses of RTLM broadcasts, illustrating that RTLM broadcasts between July 1993 and the onset of the genocide regularly denigrated the RPF and the peace accord process (Kimani 2007). Broadcasts during this period also blamed Tutsi for Hutu marginalization—a theme that surfaced in songs played over RTLM’s airwaves as well (McCoy 2013).⁵

Content from broadcasts between April 6th and the end of the genocide in late July illustrate that RTLM messaging became more incendiary during the genocide.⁶ Most notably, the station blamed the RPF for the president’s assassination (Des Forges 1999; Li 2004).⁷ Much of the station’s content created the perception of pervasive Tutsi support for the RPF and told Hutu listeners that their country was under siege (Leader Maynard 2022; Straus 2007). For instance, on April 8, a broadcast warned, “We know that the *Inkotanyi* [RPF] are now dispersing, in fact, they are spreading out amongst the inhabitants” (Des Forges 1999). Numerous broadcasts from the subsequent days urged Hutu to remain vigilant. According to Kimani (2007:123):

The messages were very clear: the RPA was advancing to take over the country, Tutsis were helping them . . . with the intention of subjugating the Hutu. To achieve their end, the RPA and their Tutsi supporters were willing to do anything including exterminating all Hutu. RTLM told its listeners that the only way to avoid what was coming was for everyone to look out for the “enemy in their midst” and work with the authorities to

ensure the extermination of the RPA and all its accomplices.

Some broadcasts even stated that the violence constituted a war of extermination against Hutu (Chrétien et al. 1995).

The interim government reinforced these messages of impending threat by praising and otherwise supporting Radio RTLM (Thompson 2007). After the genocide began, for instance, the Prime Minister called into a broadcast and told listeners that RTLM was “one of the key weapons in the war” (Kimani 2007:113). The involvement of the Prime Minister and other government officials likely buttressed the content heard over RTLM’s airways. Indeed, individuals regularly rely on epistemic authorities, such as political leaders or news media, to form and reaffirm beliefs. This was certainly the case in Rwanda, where half of the adult population was illiterate and where people were often dependent on state officials for information (IPUMS 1991; Leader Maynard 2022).

Broadcasts explicitly encouraged violence against Tutsi, citing information about Tutsi targets, such as their names or license plate numbers, or buildings where many Tutsi had sought refuge (Des Forges 1999). Political leaders repeatedly came on the air and demanded action (Kellow and Steeves 1998), and RTLM journalists routinized violence by calling for Rwandans to “work”—a euphemism for joining killing groups and a gendered call for men to participate in the violence.⁸ While Rwandans did not just blindly follow orders broadcast on RTLM (Leader Maynard 2022; Li 2004), such encouragement may have affected the violence by neutralizing participation (Alvarez 1997; Anderson 2017) or creating other justificatory narratives (Leader Maynard 2022).

In addition to producing and augmenting perceptions of threat, RTLM’s broadcasts may have increased the salience of the boundary between Hutu and Tutsi (McDoom 2021). Numerous broadcasts slandered and dehumanized Tutsi by referring to them as “cockroaches” (*inyenzi*). Some reports even

suggested that Tutsi were cutting the fetuses out of pregnant Hutu women or that the RPF and their accomplices were dissecting Hutu and eating their bodies (Chrétien et al. 1995; Kellow and Steeves 1998). Propaganda sexualized Tutsi women while also depicting them as menaces who could steal Hutu women’s husbands and jobs (Chrétien et al. 1995; Hogg 2010). Proverbs about Tutsi women, which rape survivors recalled hearing during their victimization, were commonly quoted (Nowrojee 2007). In convicting the station’s backers, the International Criminal Tribunal for Rwanda’s judges said that, “RTLM broadcasts engaged in ethnic stereotyping in a manner that promoted contempt and hatred for the Tutsi population” (ICTR-99-52-T:165).

Whereas earlier research on the genocide often references this stereotyping in line with the “hypodermic needle” effect of media (i.e., media injects ideas into people, resulting in action; for a review, see Straus 2007), more recent work has theorized that such models oversimplify the relationship between media and collective violence. For instance, Luft (2023:343) poignantly argues that the “assumption that civilians hear dehumanizing discourse, believe it, and become motivated to kill friends, family, and neighbors, is itself dehumanizing.” Numerous researchers have also suggested that the stereotypes broadcast over RTLM’s airways were not always believed. Fujii (2004), for example, shows that ideologies disseminated via Radio RTLM created a normative framework that mobilized participation, even when deep belief in the ideological content was absent (see also Bellamy 2020; Bhavnani 2006; Luft 2015).

Overall, Radio RTLM broadcasts often painted the RPF and Tutsi as threats, directly encouraged violence, and contained dehumanizing and polarizing content.⁹ This content became more inflammatory after the genocide began and as the violence progressed. In fact, McDoom’s (2021) analysis of references to Tutsi extermination and Hutu disloyalty in RTLM transcripts illustrates that much of the genocidal violence had occurred before RTLM reporters were at their most

extreme (see also Straus 2007), likely because the destabilization of existing political norms and institutions facilitated further radicalization (Leader-Maynard 2022).¹⁰

Knowledge of Radio RTLM broadcast timing and content is important, but it must be coupled with knowledge of listenership, as the content is irrelevant if most Rwandans were not listening to the radio. Although it is well established that many civilians regularly gathered at homes, bars, and roadblocks to hear radio programming (Li 2004), we do not have data on how many people heard Radio RTLM broadcasts. That said, several researchers who interviewed people who committed violence have assessed how many of their respondents listened to the radio. Straus (2006, 2007) surveyed 210 people who participated in the genocide, finding that only 40 percent listened to Radio RTLM. Luft (2023) analyzed eight interviews conducted by Hatzfeld (2005), finding that only one respondent referenced the inflammatory content of Radio RTLM as affecting their participation. Some studies have identified higher listenership rates: McDoom's (2021) survey of several hundred people found that 60 percent of respondents listened to Radio RTLM, and two-thirds of Anderson's (2017) 80 respondents reported listening to the station. Importantly, these listenership studies were conducted in different locations across Rwanda. Given that Radio RTLM did not broadcast uniformly across the country, the lack of consistency in estimates may stem from variance in RTLM coverage.

Whereas the RTLM content we have thus far reviewed may have affected the national-level onset of the genocide, our analysis focuses on Radio RTLM's possible effects on how the violence unfolded in subnational spaces after the president's assassination. We advance knowledge regarding RTLM and the unfolding violence by drawing on theoretical speculation regarding potential mechanisms, recognition of subnational variations in the Rwandan case, and unique data and modeling. Although we are unable to assess who specifically was listening to the radio, our

analyses along with cutting-edge methods allow us to approximate where Radio RTLM was broadcasting within Rwanda during the genocide. This affords us the ability to capture Radio RTLM coverage and two measurable aspects of the violence: (1) the timing of subnational onset of genocidal violence across the country, and (2) levels of participation in the genocide within Rwandan communities.

We emphasize and contribute to the conceptualization of traditional forms of media in particular and their potential effects. This includes, for instance, research on television broadcasts, newspaper articles, radio broadcasts, and other one-way communication tools. Newer forms of social media provide platforms for two-way engagement, collaboration, and communication (see Zhuravskaya, Petrova, and Enikolopov 2020), but our vein of scholarship provides insight and useful theoretical discussion regarding potential mechanisms of influence—mechanisms that may have pertinence for our understanding of radio and its effects, perhaps especially at a subnational level.

Subnational Onset of Violence

Traditional media have the potential to facilitate mobilization generally, and violent and nonviolent collective action in particular, by disseminating information (Margetts et al. 2015; Roscigno and Danaher 2001; Strang and Soule 1998).¹¹ For instance, newspapers and television broadcasts enabled protesters in the American South to learn about protest events in the 1960s (Andrews and Biggs 2006), and media coverage of the 1964 to 1971 U.S. race riots circulated information among actors, facilitating the occurrence and diffusion of riots (Myers 2000).

Social media, although not the focus of this article, can also affect the onset of collective action through a similar information mechanism. For instance, protesters became aware of events in Egypt's Tahrir Square through social media (Tufekci and Wilson 2012). More recently, Americans involved

in the January 6, 2021, attack on the U.S. Capitol gained information about the insurrection from Facebook groups (Silverman et al. 2022). To be clear, Facebook groups allow for two-way communication and have low barriers to entry, making them different than traditional media. Nonetheless, the information dissemination mechanism remains key to understanding the link between media and collective action.

The way information is framed can also incite action and, in some instances, violence. For example, in Indonesia's Northern Maluku Province, inflammatory speech from politicians affected the subnational onset of violence. There, people close to local politicians enacted violence after hearing politicians' inflammatory speeches, followed by more moderate individuals who committed violence for a variety of reasons (Wilson 2011; see also Kaufman 2006).

Although most subnational models of conflict onset do not include measures of media content or other indicators of the dissemination of information and ideologies (e.g., Buhaug et al. 2011; Rustad et al. 2011), there is good reason to believe Radio RTLM may have affected the subnational onset of violence within Rwanda due to the information it disseminated. Specifically, the genocide began (at a national level) after the president's plane was shot down. Many Rwandans learned about this assassination through Radio RTLM, which blamed the assassination on the Tutsi-led RPF and demonized all Tutsi as associated enemies. For instance, a Rwandan quoted in an *Al Jazeera* article explained, "We heard about Habyarimana's death on the 6am news on RTLM. The radio immediately said the 'cockroaches' shot down the plane. People felt desperate" (Swart 2020). The broadcasts spread information that likely caused fear and that altered power dynamics between Hutu and Tutsi in an ongoing civil war.

Social movement theory suggests that a critical mass of participants is necessary for the onset of collective action in certain spaces (Granovetter 1978; Marwell and Oliver 1993; Oliver and Marwell 1988). Put another way,

there is a tipping point between very limited participation and a mass violence movement that would qualify as genocide starting in a certain area. In this case, exposure to the broadcasts accusing the RPF of assassinating the president may have affected the number of Rwandans who were initially willing to perpetrate genocide, thus resulting in a critical mass that initiated the onset of genocide within communities (for an excellent overview of threshold models, see Macy and Evtushenko 2020). To be clear, we do not suggest the broadcasts were the only factor driving decision-making, but that the information about the assassination—as well as ideologies provided for interpretation—may have been enough to affect some peoples' initial decisions to participate.

Yet, little work has assessed whether and how RTLM broadcasts meaningfully affected the subnational timing of violence, let alone the other reasons behind why violence began almost immediately in some parts of Rwanda and weeks later in others. In 2007, Straus conducted an exploratory analysis of whether Radio RTLM was associated with the subnational onset of genocidal violence in two-thirds of Rwanda's 145 communes.¹² As there were no data on Radio RTLM coverage, Straus constructed a series of hypothetical models of broadcast range, including national coverage, urban coverage, coverage as described in ICTR testimony, and coverage in the capital city of Kigali and flatter regions. He found no significant bivariate associations between these proxies and subnational onset. Since then, there has been only one multivariate analysis of the subnational onset of genocide within Rwandan communes (McDoom 2014). Broadly, this analysis found that violence started earlier where extremist control was strong, where social cohesion was weak, and where there had been prior violence, but it did not assess the possible impact of Radio RTLM.

Given the limitations of Straus's pioneering yet incomplete analysis and the lack of other studies assessing the effects of Radio RTLM on the subnational onset of violence,

we analyze the relationship between Radio RTLM and the timing of genocidal violence. As the radio station broadcast information regarding the President's assassination, areas that heard this information first—and heard the assassination was being blamed on the RPF—may have seen earlier violence. This crucial information—including how it was framed, as well as the other ideological content broadcast over RTLM's airways—may have been enough to form a critical mass. As such, we expect that areas with Radio RTLM coverage experienced comparatively earlier onset of genocidal violence.

Participation in Violence

In addition to analyzing the onset of the violence, we also assess variation in the levels of civilian participation in the genocide across Rwandan communities. Some Rwandans engaged in violence almost immediately following the president's assassination—in turn affecting the onset of the violence within their communities—but other Rwandans did not participate immediately or never perpetrated genocide. Levels of subnational participation varied across Rwanda, with some regions seeing much more participation (and hence more violence) than others.¹³

Broadly, research linking exposure to media and participation in collective action—including but not limited to violence—has yielded mixed results. On the one hand, scholars have tied traditional media exposure to participation in protests (Onuch, Mateo, and Waller 2021), voting behavior (Hopkins and Ladd 2013; Sørensen 2019), and prejudicial or populist views (Durante, Pinotti, and Tesei 2019; Nassar 2020), among other political outcomes (DellaVigna et al. 2014; Gagliarducci et al. 2020; Paluck and Green 2009).¹⁴ Onuch, Mateo, and Waller (2021) found that frequent consumption of Russian-owned television was a better predictor of protest involvement than consumption of “new” media sources, like social media. Adena and colleagues (2015) documented that radio exposure in pre-war Germany was

associated with variation in antisemitic acts. Notably, however, they found that the effect of antisemitic propaganda was greatest in areas where antisemitism was historically high. Their results suggest that exposure to external messages may influence actions by affecting ideas already held by individuals (see also Berkowitz 1984).

Several researchers have also directly linked media consumption with participation in violence, although most of this work—apart from research on Rwanda that we summarize shortly—focuses on social media.¹⁵ For instance, Bursztyn and colleagues (2019) found that increases in the penetration of social media were associated with hate crimes in Russia between 2007 and 2015. However, the association between media and hate crimes was found in cities that already had a high baseline level of nationalist sentiment prior to the introduction of social media content. More recently, Müller and Schwarz (2023) exploited variation in early adopters of Twitter to show that anti-Muslim hate crimes were significantly associated with Donald Trump's anti-Islamic tweets once he became president, although not before. Müller and Schwarz focused on social media, but their study importantly illustrates the role of epistemic authorities in propagating content that can affect violence (see also Bail et al. 2018).

Research has thus tied exposure to media to collective action and violence, although often only under certain settings. Other work, however, has found that traditional media does not significantly shape collective action and violence, no matter the circumstances. For instance, Crabtree, Kern, and Pfaff (2018) examined the relationship between exposure to Western media broadcasts and the 1953 protests in East Germany. They found no statistically significant relationship between access to Western broadcasts and subsequent protest engagement at the subnational level, suggesting instead that variation in protests was due to social network structures within communities. More recently, Boulianne and colleagues (2020) argued that traditional media like television yields limited potential

for sparking protests, especially compared to social media, which they argue can facilitate recruitment through friendship networks.

Interestingly, these debates mirror research regarding the role of Radio RTLM in participation in the genocide in Rwanda. Some researchers have suggested that Radio RTLM wielded a large effect on participation. Most notably, Yanagizawa-Drott (2014) used trial data from Rwanda's post-genocide *gacaca* courts and an innovative radio propagation model—explained in more detail in the Methods section—to estimate RTLM's geographic coverage, arguing that approximately 51,000 participants can be attributed to Radio RTLM. Yanagizawa-Drott's (2014) finding has been widely cited, and it accords with prior work that suggests the radio broadcasts affected participation (e.g., Chrétien et al. 1995).

Nevertheless, Wilson (2015:302) suggested that Yanagizawa-Drott's finding is an outlier with respect to newer research grounded in the Rwandan case, noting that interview-based case studies of people who perpetrated genocide typically suggest that face-to-face mobilization via social networks and peer pressure were the main drivers of participation once the genocide began (see also Fujii 2010; Luft 2023; Mironko 2007; Straus 2007). Furthermore, Danning (2018) argues that the statistically significant relationships between RTLM coverage and participation in Yanagizawa-Drott's models do not translate into meaningful predictive value.¹⁶

The tensions in the literature regarding the effect of the radio on participation is enough to warrant reanalysis, but there are also several methodological reasons to do so. As we detail shortly, the radio propagation models Yanagizawa-Drott (2014) used are missing radio coverage data for roughly one-third of the country—a sizable amount of missing data that could certainly have affected his findings. Additionally, the participation measure in Yanagizawa-Drott's (2014) analysis is flawed. Specifically, the data available from Rwanda's post-genocide courts at the time of Yanagizawa-Drott's pathbreaking analysis did not enable him to analyze participation,

as he states, but rather the number of trials, which is actually more than double the number of individuals who went through the court system. That is, individuals had multiple trials in the *gacaca* court system—something his analysis did not consider, and which we address in more detail in the next section. We thus reassess the relationship between Radio RTLM coverage and subnational levels of participation.

DATA AND METHODS

To explore the relationship between Radio RTLM coverage and the dynamics of violence, we examine the onset of genocidal violence in Rwanda's 145 communes and the level of participation in the violence within 1,447 sectors. As we address in more detail below, we work with communes and sectors due to data availability, as they are currently the most fine-grained units of analysis for each dependent variable. We begin by addressing how we measure Radio RTLM exposure, the key independent variable in both sets of analysis. Next, we explain the operationalization of the two dependent variables and how we model each of them.

Radio RTLM Coverage

Representative data on which Rwandans listened to Radio RTLM, and under what contexts, would provide an ideal measure of exposure, but such information is not available. Alternative individual-level measures like radio ownership do exist, but these data paint an incomplete picture of exposure, as Rwandans often listened to the radio collectively at bars, fields, or each other's homes (Li 2004; Straus 2007). Moreover, while 34 percent of households owned radios according to the 1991 census (IPUMS 1991), radios were likely often broken or missing batteries (Danning 2018).

Researchers have thus constructed proxies for RTLM coverage, although these estimates are imperfect in important ways. Straus did not have data to reconstruct Radio RTLM's

coverage—which can be done with information about the radio transmitters and the topography—so he created four hypothetical thought experiments. These included national coverage, urban coverage, areas mentioned in court testimony, and coverage in the capital city and flatter/lower-elevation spaces. Straus (2007:617) acknowledged that “no hypothetical model clearly supports the conventional wisdom, and some models flatly contradict it.” Yanagizawa-Drott’s (2014) radio propagation model provided improved estimates of RTLM coverage, as he was able to use core information like transmitter locations and characteristics, as well as topography. Nevertheless, in his models, one-third of the country—mostly in the northern part of Rwanda—are missing data on RTLM coverage because the “predicted signal was incorrect” (Yanagizawa-Drott 2014: footnote 14).¹⁷

We thus constructed a new measure of Radio RTLM coverage. Whereas Yanagizawa-Drott’s (2014) analysis included 1,065 of the possible 1,576 sectors, ours includes 1,447.¹⁸ Like Yanagizawa-Drott, we relied on variation in transmitter locations, characteristics, and topography to estimate radio strength across space using an Irregular Terrain Model, or ITM (Crabtree and Kern 2018; Olken 2009). Although we are not certain as to the cause of incorrect and therefore missing signal predictions in Yanagizawa-Drott’s measure, we believe our measure does not suffer from a similar issue because we also include terrain information for neighboring countries.¹⁹

With respect to transmitter locations, Radio RTLM broadcast from two towers: one in Kigali city and another in former Gisenyi Prefecture in northern Rwanda. As we are unaware of documented information on the precise coordinates for either transmitter, we triangulated the most likely locations using several sources.²⁰ For the Kigali tower, many ICTR documents and scholarly publications reference that RTLM broadcast from their headquarters in Kigali. A source in the research directorate at Rwanda’s National Commission for the Fight Against Genocide²¹ told us that RTLM’s headquarters were located near the current Bank of Kigali, and

we were able to independently confirm this information by speaking with a prominent radio journalist from 1994. We further narrowed potential locations by comparing photographs of the former RTLM headquarters on Harvard’s Rwanda mapping project (Through A Glass Darkly 2010; see also Swart 2020) with current buildings in the blocks surrounding the Bank of Kigali, ultimately identifying RTLM’s exact location in Kigali (see Figure A.1 in the online supplement).

According to Yanagizawa-Drott (2014) and verified in ICTR documents (ICTR-2005-84-I), the second tower was located on Mount Muhe, one of the country’s highest mountains located north of Gisenyi town. Yanagizawa-Drott (2014: footnote 11) indicates that he did not obtain the GPS location of this tower, and we were similarly unable to find documentation of the precise location on the mountain in any public sources. However, we traveled to Mount Muhe, located cement slabs from what was likely the base of the tower, and used a cell phone to pinpoint the GPS coordinates. Although we cannot be certain that the slabs were the remnants of the tower base, ICTR documents point toward the walkability of the location given a cement pouring ceremony that was well attended (ICTR-98-44-T). Additionally, a new radio tower is located near the cement slabs, suggesting the desirability of the location for broadcast purposes.

We identified the characteristics for each transmitter, including power and tower height, from copies of the original purchase order receipts located in ICTR documents (for full transmitter information see Table A.1 in the online supplement, and Figure A.2 for copies of the purchase orders). We then input the tower location and transmitter characteristics into CloudRF, a software that provides global topography data and executes the ITM algorithm.²² The results produced a high-resolution raster of Radio RTLM coverage, measured in dBuv/m, or signal strength. Figure 1a shows the raw signal estimates, ranging from no coverage to around 120 dBuv/m. Again, data from individuals who were in Rwanda in 1994 confirm that some areas did not have Radio RTLM coverage (Mironko 2007).

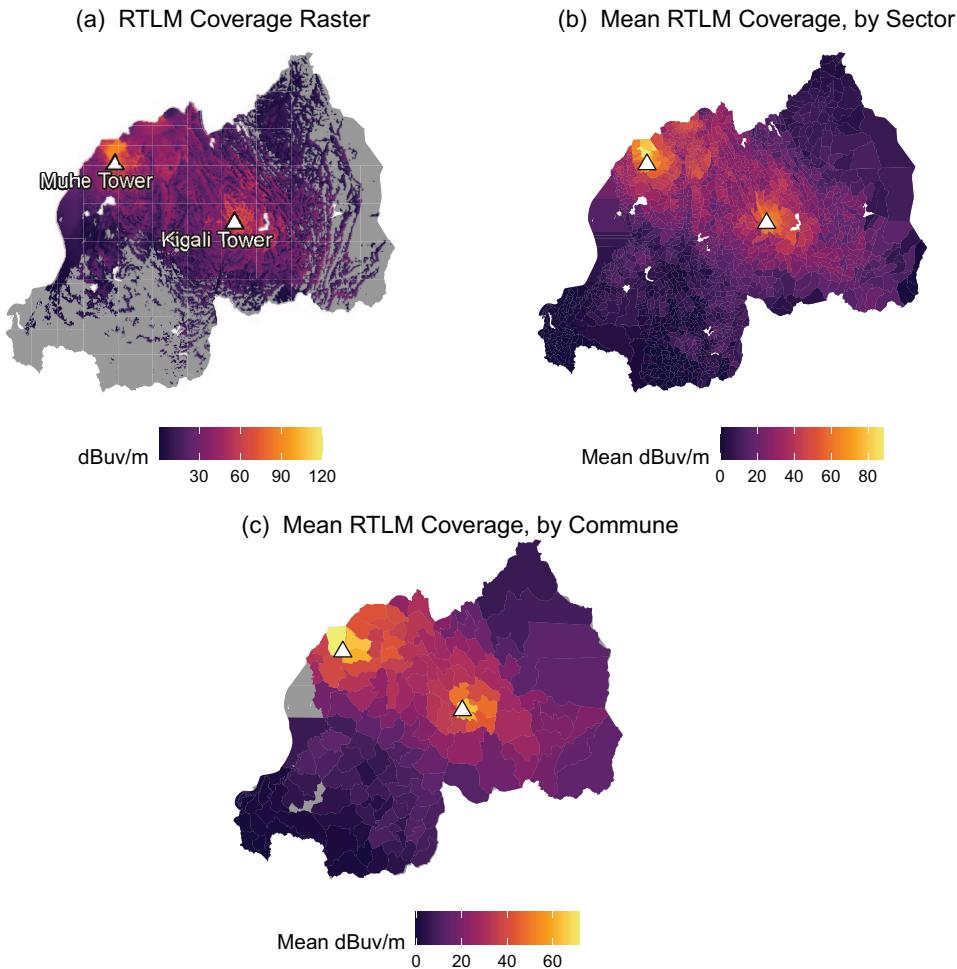


Figure 1. Estimated RTLM Coverage across Rwanda

Next, we extracted the mean signal strength per sector (Figure 1b) and commune (Figure 1c), corresponding to our respective units of analysis. This approach differs from that in Yanagizawa-Drott (2014), which aggregates by calculating the share of “usable” Radio RTLM coverage for each unit. We followed Crabtree and Kern’s (2018:352) recommendation to avoid this approach, however, as it requires technical information on the quality of receivers in use during the study period, as well as information regarding how those receivers were used in practice. Without this information, we cannot defend a cutoff for “useable” signal strength and therefore rely on the more flexible alternative. We

assess Yanagizawa-Drott’s (2014) measure in robustness checks in our online supplement (see Figures A.5 and A.6 and Tables A.6, A.17, A.18, and A.19).

Onset Analysis

The most fine-grained data on the subnational onset of genocidal violence are at the commune level. These 145 regions were the basic levels of development during the early 1990s (Verwimp 2013). Communes were governed by *bourgmeisters*—mayors who wielded much local power and who often directed the violence when the genocide began (Des Forges 1999:236–37; Wagner 1998). Beginning in

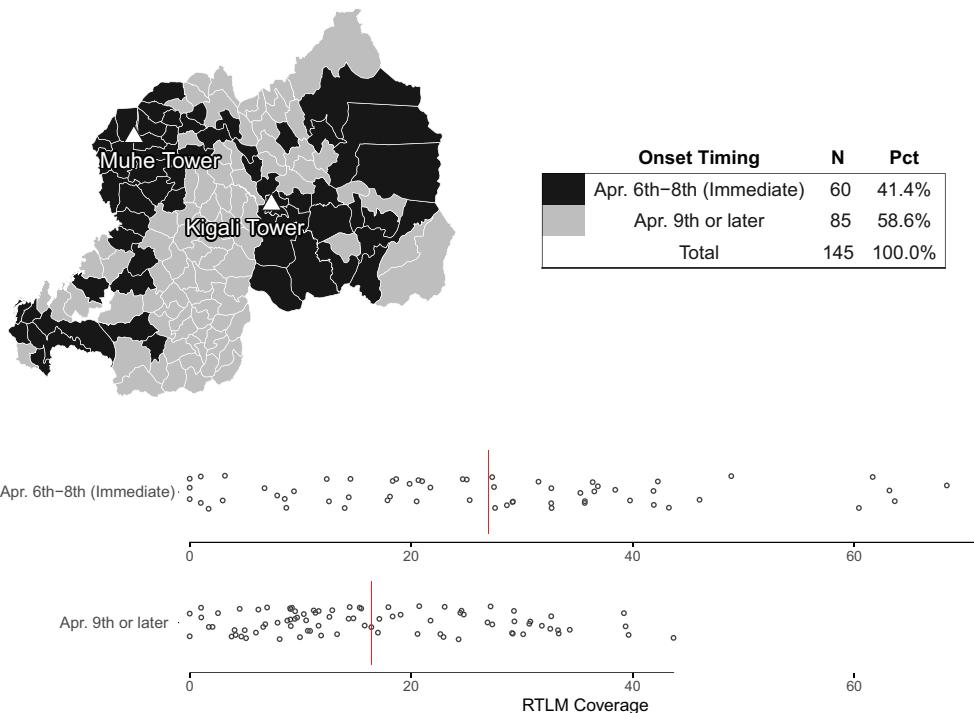


Figure 2. Genocidal Onset Timing and Radio RTLM Coverage

Note: Each point depicts one commune-level observation. Points are jittered along the y-axis for visibility. Vertical lines denote the mean RTLM coverage within each onset group. The x-axis line shows the range of RTLM values in each onset group.

1990, residents needed government permission to move in and out of their communes (Verwimp 2013), suggesting the commune level is an appropriate and stable unit of analysis. In fact, identifying the onset of violence within smaller units has not been possible due to the swiftness of the violence and the lack of historical records (Straus 2006).

Two researchers worked independently to compile data on the onset of violence within communes. First, Straus (2006, 2007) drew on six different sources to create estimates of the onset of violence—defined as public and generalized attacks against Tutsi—in 124 communes. Straus then identified seven three-day periods of onset, although he ultimately collapsed these periods into early (April 6 to 8), mid (April 9 to 14), and late (April 15 plus), casting doubt on the ability to precisely identify the onset date in numerous

communes apart from those that experienced early onset (Straus 2006:249–55). Utilizing the same definition but adding a fourth category of late or no onset²³ starting on April 21, McDoom (2014) ascertained the onset dates for the remaining 21 communes through fieldwork and *gacaca* court records. We use McDoom's (2014) onset data for our analysis.

Given the lack of reliability regarding precise dates and our interest in early onset, we created an indicator for immediate onset, which takes the value of 1 if genocidal violence began April 6 to 8 and the value of 0 otherwise. Over 40 percent of communes experienced immediate onset. Figure 2 displays the onset of violence and Radio RTLM coverage. As seen in the figure, RTLM coverage was higher in communes with immediate onset at nearly 30 dBuv/m, over 10 dBuv/m greater than communes that experienced later onset.²⁴

The key identifying assumption is that Radio RTLM coverage is uncorrelated with factors that cause both coverage and onset timing. There are two main threats to this assumption, and both are related to the primary sources of variation in signal strength—topography and transmitter placement. First, it is well known that patterns of violence vary along with the terrain (Fearon and Laitin 2003). We therefore control for the impact of topography, including the mean distance to four locations: the nearest international border, Kigali, the nearest major road, and the nearest town. We also include elevation and aspect (i.e., the mean cardinal direction of the slope for each commune). Second, because transmitter placement may be endogenous to the actions of the conflicting actors, we control for the presence of the Rwandan Army (FAR) and the RPF, as well as whether the commune was controlled by MRND (i.e., Habyarimana's political party). Finally, we adjust for demographic factors, including the percentage of Tutsi, literacy rates, population and population density, radio ownership, and percentage of Catholics. Broadly, previous literature has suggested that these factors may have affected the onset of violence (McDoom 2014; Nyseth Brehm 2014). Table A.3 in the online supplement provides a full description of all covariates for the onset analysis.

Analyses of Participation

To measure participation in the genocide, we use post-genocide *gacaca* court records (Chakravarty 2016; Doughty 2016; Ingelaere 2016). *Gacaca* court trials for crimes against people were undertaken at courts organized by Rwandan sectors, which were one geographic level smaller than communes. As such, the sector is the most fine-grained unit of analysis available for studying participation in genocidal violence.

Prior studies measuring participation at the sector-level, including Yanagizawa-Drott's (2014)²⁵ have relied on *gacaca* court records the Rwandan government made available online several years before the courts closed

(Friedman 2011; Heldring 2021; La Mattina 2017; Rogall 2021). We utilize a new dataset of *gacaca* court records that improves upon these data; in the online supplement, we address the pitfalls of using *gacaca* court data to approximate participation.

The *gacaca* courts used three categories to try people suspected of committing genocide.²⁶ Category 1 included planning or organizing violence, acting in positions of power, inciting genocide, and committing rape or sexual torture. Category 2 involved murder or being an accomplice, torturing, and other criminal acts against people. Category 3 included property offenses (Organic Law N 13/2008).²⁷ In total, there were 1.96 million trials across these three categories. However, people had separate trials for crimes in different categories or even different types of crimes. Additionally, defendants were tried in the sector where they were accused of committing a crime, meaning individuals who were accused of committing crimes in multiple sectors were tried in each location. The data the Rwandan government posted online—which were used by Yanagizawa-Drott (2014) and in many prior studies—are actually a database of trials and do not permit matching to identify individuals across trials. In fact, Yanagizawa-Drott cited 433,000 *people* prosecuted under Category 2 and used this number as a proxy for participation. Yet, this figure is much closer to the number of *trials* than the number of individuals who stood trial for Category 2, and it is more than double the number of individuals found guilty of Category 2 crimes.

To address the fact that many people had multiple trials, we obtained data on the final *gacaca* trials, including the names of people who went through the court system, their alleged crime, their parents' names, their birth years, where they were tried, and whether they were found guilty.²⁸ As described in the online supplement, we then engaged in probabilistic and deterministic matching to arrive at a dataset of individuals accused and found guilty of each category of crime in each sector. Accusations have been linked to

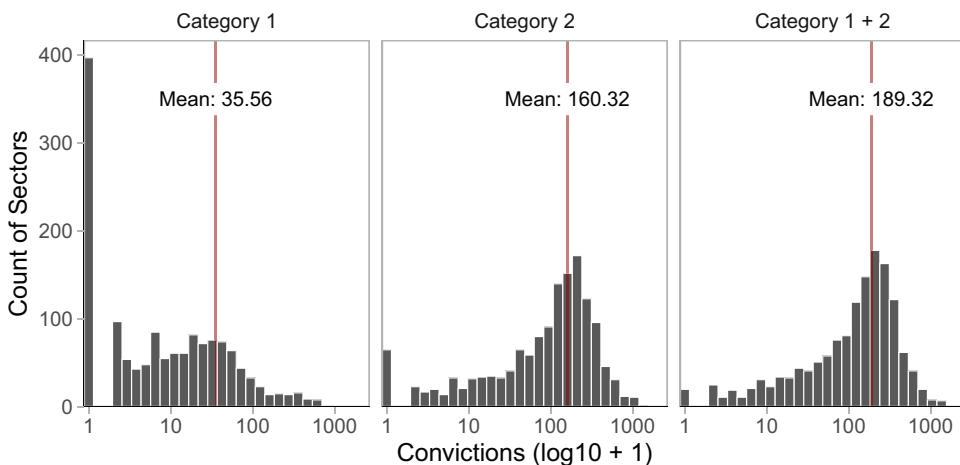


Figure 3. Distribution of Genocide Participation (Convictions) across *Gacaca* Categories

political and other motives (e.g., neighborly disagreements, see Ingelaere 2016), so we use the number of individuals found guilty in each sector as our measure of participation. We present key analyses with the number of trials—in line with Yanagizawa-Drott’s (2014) analysis—in Table A.20 in the online supplement.

We created three dependent variables of participation in violence aggregated to the sector level, including the count of Category 1 participants, the count of Category 2 participants, and the sum of Category 1 and Category 2 participants. Figure 3 shows the distribution of these variables, each $\log(x + 1)^{29}$ transformed to address skewness while retaining sectors with zero convictions (see Table A.2 and Figure A.3 in the online supplement). The average sector tallied nearly 36 individuals convicted of Category 1 crimes and over 160 individuals convicted of Category 2 crimes, resulting in approximately 190 individuals per sector in total.

Like in the onset analysis, identification assumes that Radio RTLM coverage is unrelated to factors causing both signal strength and genocidal participation. To address concerns about this assumption, we closely follow the modeling approach in Yanagizawa-Drott (2014), which relies on two key strategies. First, we introduce commune-level fixed effects such that we exploit only variation in

RTLM coverage across sectors within the same commune. This approach ensures that we rely on the more local and plausibly exogenous determinants of signal strength, such as “whether a hilltop randomly happens to be in the line of sight between the transmitter and the village” (Yanagizawa-Drott 2014:1968). Second, we adjust for variables that might predict both RTLM coverage and participation at the sector level, including population, population density, longitude, latitude, mean elevation and its square, the standard deviation of elevation and its square, and the mean distance from the nearest transmitter to a sector and its square (Yanagizawa-Drott 2014). In the most comprehensive specifications, we also control for average distance to the nearest town, a major road, and an international border, as well as aspect (again, the average cardinal direction of the slope for each sector). For additional information regarding these covariates, see Table A.7 in the online supplement.

RESULTS

Radio Station Coverage and the Onset of Violence

Table 1 presents logistic regression results modeling the relationship between Radio RTLM coverage and immediate onset. We

Table 1. Average Marginal Effects of Radio RTLM on the Immediate Onset of Genocide

	Bivariate	Propagation	Propagation and Demography	Propagation, Conflict, and Politics	All Covariates
RTLM	.011* (.004)	.020** (.004)	.017** (.006)	.017** (.004)	.014** (.005)
Aspect		.000 (.001)	.001 (.001)	.000 (.001)	.001 (.001)
Border Distance		.007 (.050)	.006 (.005)	.003 (.006)	.003 (.005)
Kigali Distance		.010* (.004)	.010* (.004)	.008 (.004)	.007 (.004)
Elevation		-.088 (.243)	-.108 (.175)	.123 (.235)	.090 (.190)
log(Population)		.397 (.218)	.313 (.226)	.403 (.218)	.305 (.225)
log(Pop. Density)		-.072 (.147)	-.055 (.159)	-.093 (.126)	-.074 (.163)
Roads Distance		.007 (.011)	.009 (.010)	.003 (.010)	.005 (.009)
Towns Distance		-.001 (.005)	-.002 (.004)	-.003 (.004)	-.004 (.004)
Pct Catholic			-.237 (.365)		-.241 (.365)
Literacy Rate			-1.293 (1.270)		-1.189 (1.200)
Radio Ownership			1.617* (.717)		1.516 (.834)
Pct Tutsi			-.191 (.823)		-.049 (.693)
FAR				.218** (.083)	.220* (.095)
MRND				.175 (.170)	.142 (.169)
RPF				-.167 (.201)	-.163 (.359)
Num. Obs.	145	145	145	143	143
Log. Lik.	-89.650	-71.544	-68.318	-66.425	-63.458

Note: Standard errors clustered by prefecture are in parentheses.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$ (two-tailed tests).

cluster by prefecture, which was one administrative level higher than the commune in 1994.³⁰ Additionally, we rely on average marginal effects (AMEs) rather than logit coefficients to ease interpretation.³¹

In Model 1, we see a positive and statistically significant bivariate relationship between RTLM coverage and immediate onset of genocidal violence across communities. Specifically, a 1 dBuv/m increase in average RTLM strength increases the probability of

immediate onset by about 1 percentage point. In Model 2, where we introduce a series of geographic covariates, the AME of RTLM coverage doubles in size to 0.02 and is highly statistically significant. Controlling for demographic variables in Model 3 does not result in any substantial changes. In Model 4, which adjusts for factors related to military and political presence, the AME for RTLM coverage remains positive and statistically significant. Finally, in the most comprehensive

specification (Model 5), which includes all covariates, RTLM coverage is associated with around a 1 percentage-point increase in the probability of immediate onset, an estimate that is again highly statistically significant.

To further aid the interpretation of these results, Figure 4 plots the predicted probability of immediate onset across the range of RTLM coverage for each model. In the most comprehensive specification, shown in Panel (e), under 8 percent (95% CI: 2 to 26 percent) of communes with no RTLM coverage are predicted to experience immediate onset. Shifting to the median level of RTLM coverage (around 18 dBuv/m), 33 percent (95% CI: 24 to 45 percent) of communes are predicted to experience immediate onset, a difference of about 25 percentage points. At around RTLM coverage of 45 dBuv/m, nearly 90 percent (95% CI: 58 to 97 percent) of communes are predicted to experience immediate onset. Taken together, these results indicate that RTLM is associated with onset timing in a substantively meaningful way.

Alternative Specifications

Signal strength may not have a linear effect on signal quality in practice, so Crabtree and Kern (2018) recommend exploring alternative functional forms. We follow their recommendations (see Figure A.4 in the online supplement), and for the first alternative, we apply a $\log(x + 1)$ transformation, which assumes that small increases in signal strength at low coverage levels have a larger effect on signal quality than do similar changes at higher levels of quality. We present these estimates to assess sensitivity to alternative specifications, but this assumption is problematic given that small improvements in signal quality at low signal levels are unlikely to produce listenable coverage until a certain point (Crabtree and Kern 2018: footnote 5).

A second alternative, an inverse logistic transformation, is more theoretically plausible. This transformation produces a sigmoid shape, with small changes in signal strength at both low and high levels of coverage producing little variation. After transforming

signal strength via the inverse logistic function, there is a sizable uptick in signal strength at around 17 dBuv/m; after about 30 dBuv/m, the marginal rate of improved signal strength levels off. Put another way, this transformation implies that small shifts in signal strength only matter for the listener between 17 and 30 dBuv/m. Below this range, signal strength is too low for marginal improvements to translate into listenable coverage; above this range, signal strength is already relatively strong. Marginal improvements are thus less meaningful because the listener's sound quality is already very good.

Figure 5 presents results from these alternative functional forms across the series of models. Full tables can be found in the online supplement (Tables A.4 and A.5). As in the models with linear signal strength, the marginal effects of Radio RTLM coverage on the probability of immediate onset are positive. However, the $\log(x + 1)$ transformation estimates are much more imprecisely estimated, although we reiterate that this functional form is theoretically implausible. By contrast, the estimates when using the inverse logit transformation are statistically significant across all models, including the most comprehensive specification. Taken together with the previously presented results, this strongly suggests that Radio RTLM played a role in the timing of genocidal onset across Rwandan communes.

Radio Coverage and Participation at the More Local Level

We now turn to the relationship between Radio RTLM coverage and participation in genocidal violence at the sector level. As with the onset analysis, we first present the results with linear RTLM signal strength and then explore alternative functional forms for RTLM coverage. All models are estimated via OLS with commune fixed effects and clustered robust standard errors at the district level following Yanagizawa-Drott (2014) and in line with recommendations to cluster at the coarsest level available (Cameron and Miller 2015). We use a $\log(x + 1)$ transformation

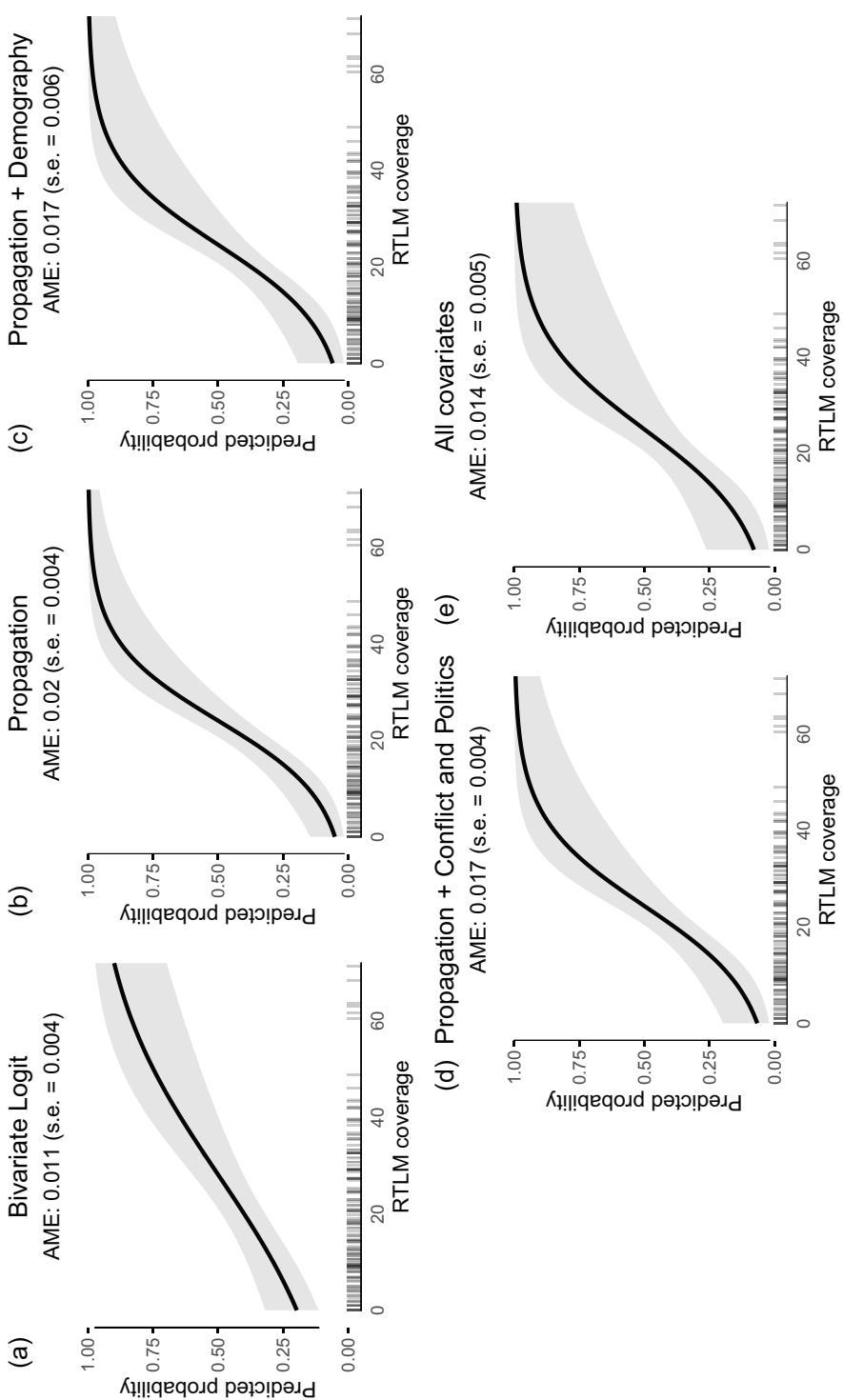


Figure 4. Predicted Probabilities of Immediate Onset across RTLM Coverage
 Note: 95 percent confidence intervals shown around predicted probability that immediate onset = 1. Average marginal effects (AMEs) and standard errors clustered by prefecture labeled for each model.

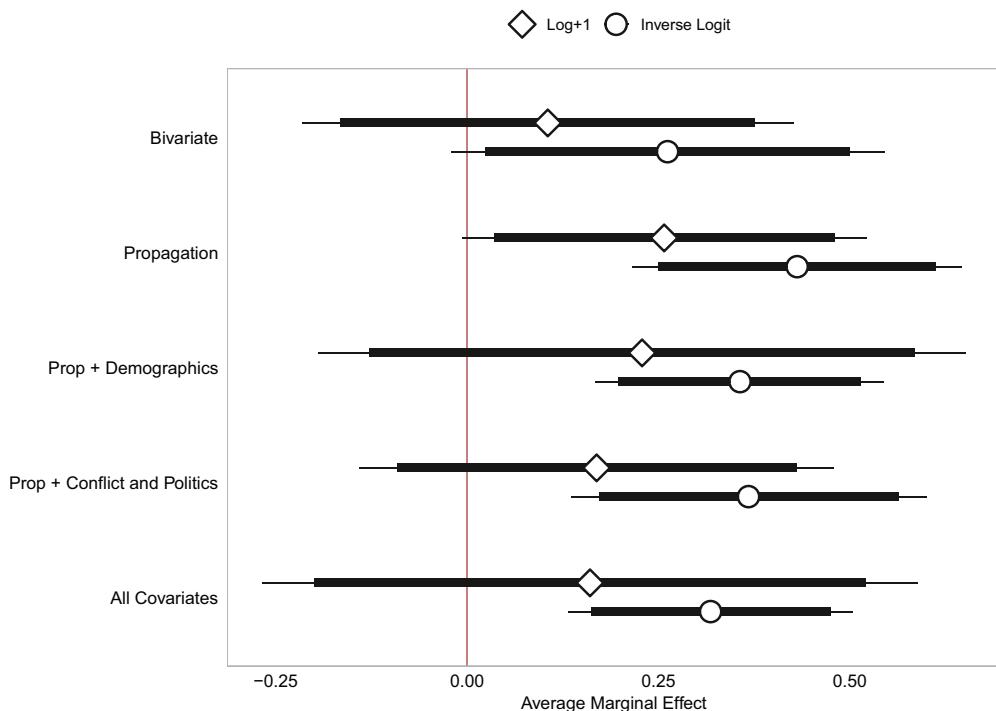


Figure 5. Marginal Effects of Radio RTLM Coverage on the Probability of Immediate Onset with Alternative Signal Strength Functional Forms

Note: Error bars are 90 and 95 percent confidence intervals.

for the participation outcomes to account for skewness in the distributions.

We again built models sequentially, starting with no controls, then propagation controls, and finally all controls, in line with Yanagizawa-Drott's (2014) modeling technique. Given the number of tables involved, we first provide an overview of the results in Figure 6, followed by Table 2, which presents the most complete models. Full tables tied to Figure 6 can be found in the online supplement (Tables A.8, A.9, and A.10).

In Figure 6, we plot estimates surrounded by 90 and 95 percent confidence intervals for all models. Error bars that do not cross the vertical line at zero should be interpreted as statistically significant at the 0.1 and 0.05 levels for the respective bars. In the first panel of Figure 6, we see a positive relationship between Radio RTLM coverage and Category 1 participation in the model including only

RTLM signal strength and commune-level fixed effects. This relationship is statistically significant, but only at the 0.1 level. Once we introduce control variables, this effect becomes indistinguishable from zero. A similar pattern holds for Category 2 participation, although the estimates shrink slightly.

This pattern of a significant bivariate effect (at the 0.1 level) that is no longer significant once controls are added to the model continues when summing Category 1 and 2 participants. These consistently null estimates when adjusting for confounders across all outcomes imply it is unlikely that Radio RTLM increased participation in the genocide in a statistically meaningful way. Table 2 presents the full models with propagation and other control variables for Category 1 participants, Category 2 participants, and the combined measure (full tables with sequentially built models are in the online supplement).

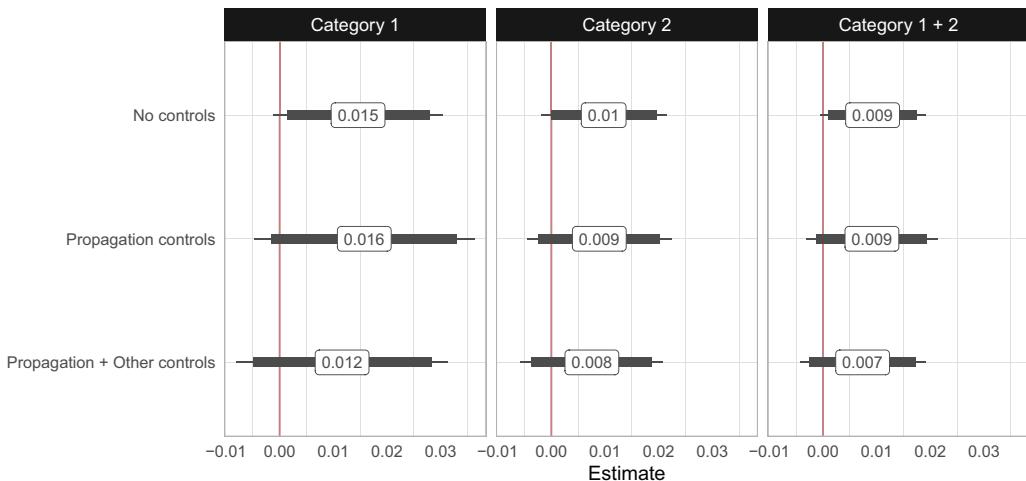


Figure 6. Effects of Radio RTLM Coverage on Genocidal Participation

Note: Error bars are 90 and 95 percent confidence intervals.

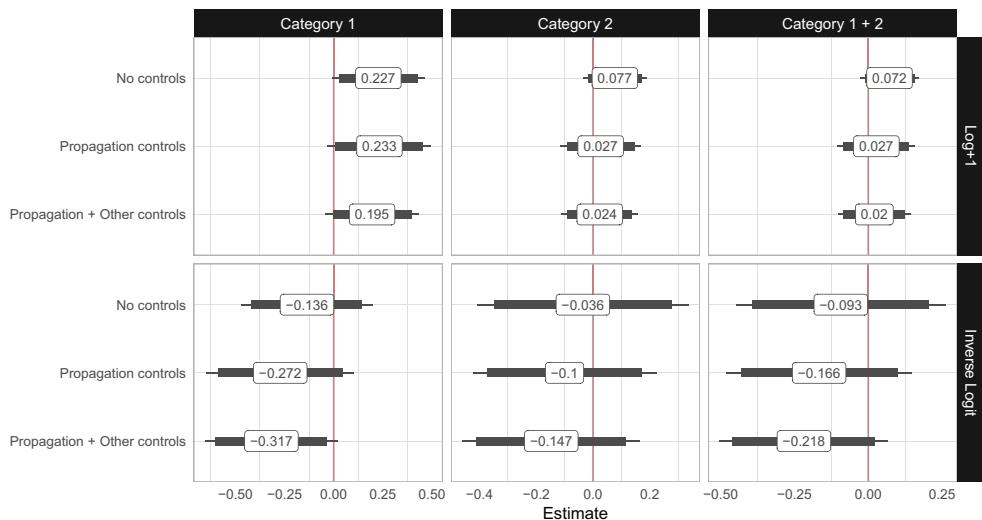


Figure 7. Effects of Radio RTLM on Participation with Alternative Signal Strength Functional Forms

Note: Error bars are 90 and 95 percent confidence intervals.

Alternative Specifications

To assess the degree to which these estimates are sensitive to the functional form of signal strength per Crabtree and Kern's (2018) recommendations, Figure 7 plots estimates with a $\log(x + 1)$ and inverse logistic transformations of Radio RTLM coverage (for full tables, see A.11 to A.16 in the online

supplement). For the $\log(x + 1)$ specification, the results are positive but null across most models with control variables. Category 1 participants with only propagation controls is significant at the 0.1 level, although we again note that this specification is theoretically implausible. With the inverse logistic transformation, all estimates are negative but

Table 2. Fixed-Effects Estimates for RTLM and Participation in Genocide, Including Propagation and Other Controls

	Category 1	Category 2	Category 1 + 2
RTLM	.012 (.010)	.008 (.007)	.007 (.006)
log(Population)	.372** (.096)	.562** (.110)	.533** (.079)
log(Pop. Density)	-.365* (.138)	-.510** (.109)	-.510** (.096)
Latitude	-2.672* (1.180)	-1.305 (1.274)	-2.323* (1.066)
Longitude	1.930 (1.283)	-2.388* (1.037)	-1.658* (.805)
Elevation	-2.605 (2.728)	-1.769 (2.548)	-1.706 (2.421)
Elevation Squared	.588 (.696)	.119 (.645)	.220 (.653)
Elevation Std. Dev.	-4.132 (4.508)	.581 (3.269)	-.958 (3.064)
Elevation Std. Dev. Squared	13.109 (15.803)	1.152 (11.247)	4.474 (9.784)
Towers	.016 (.035)	-.006 (.018)	.004 (.016)
Towers Squared	.000 (.000)	.000 (.000)	.000* (.000)
Towns	-.010 (.020)	.024* (.011)	.016 (.011)
Roads	-.041** (.011)	-.039* (.016)	-.037** (.013)
Border	.010 (.012)	.024* (.010)	.025* (.010)
Aspect	.000 (.001)	-.001 (.001)	.000 (.001)
Num. Obs.	1,447	1,447	1,447
<i>R</i> ²	.666	.679	.748

Note: All models include commune fixed effects. Robust standard errors clustered by district are in parentheses.

p* < 0.05; *p* < 0.01; ****p* < 0.001 (two-tailed tests).

are also indistinguishable from zero. As with the models with linear RTLM coverage, these alternative functional forms suggest there is no meaningful relationship between signal strength and participation in genocidal violence at the sector level.

DISCUSSION AND CONCLUSIONS

This article examined the relationship between Radio RTLM coverage and the subnational

dynamics of genocidal violence in Rwanda. We provided robust evidence that *Radio RTLM coverage was significantly associated with earlier onset of genocidal violence within Rwanda's 145 communes but it was not significantly associated with levels of participation in this violence within 1,447 sectors*. As Straus (2007) argued that Radio RTLM coverage did not account for the subnational onset of genocidal violence and as Yanagizawa-Drott (2014) tied RTLM coverage to 51,000 participants, these results significantly advance

knowledge regarding whether and how Radio RTLM affected the subnational dynamics of the genocide. In doing so, we have provided new data on Radio RTLM, covering 92 percent of Rwanda compared to Yanagizawa-Drott's measure that covered 67 percent of the country. We updated *gacaca* court records to enable assessment of participation rather than trials, correcting erroneous assumptions equating the number of trials with the number of participants (see Heldring 2021; Rogall 2021; Yanagizawa-Drott 2014).³²

In line with theories that link the dissemination of information to collective action (e.g., Roscigno and Danaher 2001; Strang and Soule 1998), it is likely that Radio RTLM's broadcasts regarding President Habyarimana's assassination affected the immediate onset of violence in the communes that had Radio RTLM coverage. The mechanisms tying the radio to the onset of the violence are almost certainly multifaceted and varied, however, and we do not suggest there was simply one major mechanism. Rather, there is good reason to suspect that multiple mechanisms were at play.

First, the assassination of a head of state—who happened to be nicknamed *Ikinani* (indestructible)—significantly altered conflict dynamics (McDoom 2021; Straus 2006). Radio RTLM blamed this catastrophic event on the RPF and encouraged Hutu to act swiftly to save their families from the RPF's Tutsi accomplices (Des Forges 1999; Li 2004). In doing so, the radio station spread important information about the assassination, which is widely recognized as the trigger of the genocide. As such, we suggest that an informational mechanism is an important part of the story. Indeed, in the first author's interviews (for a different project) with 165 Rwandans who committed genocide, roughly one-fourth indicated they heard about the plane crash from the radio (Nyseth Nzitatira and Gasana Gasasira 2024). Many discussed how they felt afraid after hearing the broadcasts, which often claimed the RPF was going to attack villages next.³³ Learning that one's president had been assassinated and the army

allegedly responsible was in the country—especially in light of the context of the Rwandan civil war—may have contributed to some peoples' decisions to initiate violence, be it local leaders or civilians.

Radio RTLM also provided listeners with ways to think about this information. As such, the broadcasts may have directly shaped the perceptions, orientations, and actions of some individuals. Specifically, the radio framed the assassination as a political crisis, invoking security politics that are ideologically tied to genocide as well as propagating justificatory narratives for engagement in violence (Leader Maynard 2022). Yet, more indirectly, the framing of broadcast content can be seen as ideological scaffolding—"scaffolding that supports, motivates, and seeks to justify repressive actions" (Roscigno et al. 2015:24). Such framing may have contributed to an ambiguous context in which many other Rwandans watched the violence unfold, not participating yet also, in some ways, enabling violence by standing idly by.

With regard to the point above, Radio RTLM had been broadcasting incendiary messages in the areas with coverage for months before the president's assassination. The inflammatory content of many of their broadcasts may have increased the salience of the Hutu–Tutsi divide in these areas, as well as perceptions of threat and fear, in line with priming theory. In fact, Figure 8 shows an April 3, 1994, RTLM broadcast suggesting the RPF (*Inkotanyi*) would attack just a few days later (ICTR-99-52-T). During the period of immediate onset (April 6 to 8), Radio RTLM broadcasts likely incited fear by encouraging Hutu to "look carefully, see whether there are no *Inyenzi* [cockroaches] inside" (ICTR-99-52-T). We do not suggest these broadcasts are the only factor that led to immediate subnational onset of violence, but it is highly plausible they played a role.

The association with violence onset suggests that Radio RTLM affected participation, at least initially. In-depth interviews are needed to support a conclusion regarding the specific effects of Radio RTLM over time,

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They want to carry out a little something during the Easter period. In fact, they're saying: "We have the dates hammered out." They have the dates, we know them too.

They should be careful, we have accomplices among the RPF, my dear. We have accomplices among them who provide us with information. They tell us, "On the 3rd, the 4th and the 5th, something will happen in Kigali city." As from today, Easter Sunday, tomorrow, the day after tomorrow, a little something is expected to happen in Kigali city; in fact also on the 7th and the 8th. You will therefore hear gunshots or grenade explosions.

Nonetheless, I hope that the Rwandan armed forces are vigilant. There are *Inzirabwoba* [fearless], yes, they are divided into several units! The *Inkotanyi* who were confronted with them know who they are. They know them better than I do, because they were face to face with them, and they know what they did to them. Or, those who launched the attack on Nyamagumba would be in a better position to tell us how the vultures had a feast.

As concerns the protection of Kigali, yes, indeed, we know, we know, on the 3rd, the 4th and the 5th, a little something was supposed to happen in Kigali. And in fact, they were expected to once again take a rest on the 6th in order to carry out a little something on the 7th and the 8th ... with bullets and grenades. However, they had planned a major grenade attack and were thinking: "After wrecking havoc in the city, we shall launch a large-scale attack, then...." (Noel Hitimana, RTLM, 3 April 1994)

Figure 8. Radio RTLM Broadcast from April 3, 1994

but we postulate that Radio RTLM broadcasts spurred some people to action as the genocide began. Local leaders and ideologically committed individuals were among the first to incite violence (Des Forges 1999; Loyle and Davenport 2020), and some of these individuals likely acted, at least in part, due to the content they heard on the radio. It is thus likely that the radio affected the formation of a critical mass necessary for the onset of collective action in certain spaces (Oliver and Marwell 1988). Costs of participating in the violence may have seemed higher at the outset of violence, although what may have mattered is that there were enough Rwandans who were willing to perpetrate violence to reach a critical mass and initiate the genocide within communities (see also Marwell and Oliver 1993).

Nonetheless, research on the genocide suggests that face-to-face mobilization via social

networks and peer pressure were ultimately the most important drivers of participation as the genocide progressed (Fujii 2010; McDoom 2013; Straus 2006), in line with research on other cases that underscores how social capital can have deleterious consequences (Satyanath, Voigtlander, and Voth 2017). For instance, Fujii (2008) shows that leaders used family ties to target male relatives for recruitment into killing groups, hypothesizing that most people who perpetrated violence were low-level participants who joined due to peer pressure. While Rwandans did gather around the radio, which may have affected social network formation, it is important to underscore that studies regarding face-to-face mobilization do not discuss networks tied to radio consumption. Put another way, people did listen to the radio in groups, but there is little evidence to suggest that Radio RTLM forged

the networks that were then active during the genocide. Instead, research on the Rwandan case suggests that many people were recruited to participate by their friends and neighbors and, specifically, people they were connected to well before 1993 when Radio RTLM began broadcasting (McDoom 2013). Many individuals were recruited by their local leaders or by violence entrepreneurs from neighboring villages (Straus 2006). We do not doubt that some social ties may have been forged through listening to the radio, but we again emphasize that the face-to-face mobilization as documented in literature on Rwanda is tied to other social networks.

Prior work has directly compared accounts to weigh the role of the radio versus face-to-face mobilization. In Luft's (2023) analysis of Hatzfeld's eight transcripts, she finds that the one person who mentioned Radio RTLM placed more weight on the role of direct mobilization from those engaged in killing. Quoting this individual, Luft (2023:335) explains:

Even though “the radios were yammering at us since 1992 to kill all the Tutsis,” he said, this did not transform his suspicion into hatred until the militia, with district leader support, entered his commune and required all men to assemble in the village center at risk of noncompliance (Hatzfeld 2005:72). There, he explained, “The intimidators shouted ‘Just look at these cockroaches—we told you so!’ And we yelled, ‘Right, let’s go hunting!’” (Hatzfeld 2005:219). *The radio, he claimed, “prepared” him to obey, but without this face-to-face mobilization, his life would likely have continued as usual after the president’s assassination* (Hatzfeld 2005:72; emphasis added).

Many researchers have cast doubt on the strength of the relationship between Radio RTLM and the overall levels of participation in the genocide (Danning 2018; McDoom 2021; Straus 2007), and our null results suggest their doubt is well-founded.

Our results and findings are robust, but there are several limitations. As previously

noted, our indicator of Radio RTLM coverage is an imperfect measure of exposure, and we concur with Danning (2018) that in-depth fieldwork regarding local consumption patterns would augment quantitative studies examining country-wide coverage. The first author has interviewed several hundred people who participated in the genocide, and their discussions of whether there was RTLM coverage in their area aligns with our measure of coverage. Nonetheless, much more thorough work is needed to assess whether people who were living in every sector in 1994 report they did or did not receive broadcasts. One may also question whether Rwandans left their sectors to listen to the radio; we cannot ascertain whether this was the case, although we note again that many people listened to the radio near their homes or in fields where they worked (Li 2004; Straus 2007). Some Rwandans did walk long distances to get to the field, but most people would have remained within their sectors, which were roughly equivalent to the size of a census tract in the U.S. state of Maryland.

We also are not able to fully explore whether MRND control affected the role of the radio. Specifically, MRND control is associated with earlier onset of violence in our models, and there may have been a priming effect of the media in places where MRND—the president’s political party—had control. Forty of the 50 original individuals involved in the founding of Radio RTLM were from Northern Rwanda, which was President Habyarimana’s home region (Des Forges 1999). One of the chief financiers of RTLM was Felicien Kabuga, and two of his daughters were married to two of Habyarimana’s sons (Mutahi 2020). Several other core MRND personnel, including the President and Executive Secretary of MRND, were among the station’s founders (Des Forges 1999). This means the epistemic authorities broadcasting over RTLM’s airways may have been more seriously regarded in areas with great MRND presence and control. This possibility suggests there may be an interactive effect between MRND control and RTLM

coverage, although a preliminary assessment revealed no statistically significant interaction. We do, however, caution against over-interpreting this result, as robustly identifying an interactive effect would require a much larger sample than available for this analysis. Future research should qualitatively examine the interaction between Radio RTLM and support for MRND.

We are additionally limited in that we could not include data on other broadcasts that individuals may have heard. Most radios in Rwanda were not strong enough to receive international broadcasts, but Radio Muhabura and Radio Rwanda could be heard over Rwanda's airwaves during the genocide. As the RPF's radio station, Radio Muhabura had a limited following, compounded by its weak signal strength in Western Rwanda (Li 2004; Temple-Raston 2005). As the government's radio station, Radio Rwanda had a larger audience, but we were not able to obtain data on Radio Rwanda coverage for the entire country. We thus cannot speak to whether or how this station affected the subnational dynamics of the genocide, although Radio Rwanda broadcasts may have been less likely to affect immediate onset. Specifically, many Rwandans began to suspect that Radio Rwanda was withholding key details about the civil war in the months before the genocide. In Li's (2004:16) words, "Radio Rwanda's inability to adjust to the fluid political situation in the early 1990s is best captured by the memory of many Rwandans of Habyarimana's death": while Radio RTLM broadcast updates about the assassination and the unfolding political crisis, Radio Rwanda played classical music. Future work should nonetheless explore the impact of Radio Rwanda and other media on the dynamics of the violence.

We hope future research will be able to interrogate more systematically the mechanisms through which the radio may have affected onset in certain communes via case-based analysis, as the relatively small sample precludes us from doing so quantitatively. Furthermore, research could address other ways the radio may have shaped the violence. For instance, repertoires of violence, such as

the specific strategies used to inflict harm, seem to have been spread via the airways. RTLM broadcasts asserted that Tutsi were cutting fetuses out of pregnant Hutu women, for example, yet that very form of violence was actually perpetrated against pregnant Tutsi women (Sharlach 1999). In line with this, Li (2004) suggested the radio's calls to pillage the belongings of Tutsi may have shaped women's engagement in this form of crime. As such, researchers could examine how Radio RTLM may have affected the forms of violence that unfolded. Research could likewise assess the presence and possible effects of narratives that competed with those spread via Radio RTLM and, specifically, what Leader Maynard (2022) terms *limitationalist narratives* that may have depicted the genocide as costly, ineffective, or immoral. Radio propagation models like we used here would be well suited for this task and could engage with the wealth of sociological knowledge regarding framing. Moreover, these models could be used to study current conflicts. For instance, reports indicate that Hezbollah's radio antenna located in Lebanon has broadcast Hamas messaging in Israel and Palestine—something that could be analyzed quantitatively and paired with subnational information (Bachner 2019).

For now, our findings regarding the onset of genocide in subnational spaces are important and correct the record on one of the deadliest episodes of mass violence of the twentieth century. Moreover, our findings inform knowledge regarding a paradigmatic case that is often centered within discussions regarding the intersection of media, propaganda, and violence. In fact, assumptions of a clear link between radio broadcasts and participation in the genocide are often rooted in oversimplified and sometimes even racist views of Rwandans (see discussion of this in Leader Maynard 2022; Luft 2023; Straus 2007). Highlighting how the radio actually mattered—at least for the outcomes we measured here—helps correct these views and presents a more nuanced and accurate picture of the complicated violence that unfolded across Rwanda in 1994.

More broadly, our results suggest the importance of modeling factors associated with the subnational onset of violence. Many subnational models of conflict onset do not include measures of media content or other indicators of the dissemination of information and ideologies (e.g., Buhaug et al. 2011; Rustad et al. 2011). Yet, our finding that radio broadcasts may lead to earlier onset—perhaps due in part to the spread of information, contextualization of this information, and an effect on the formation of a critical mass—suggests that those seeking to forecast the subnational onset of violence should pay attention to media sources. Indeed, better understanding which spaces are most likely to see earlier onset of violence can aid interventions in genocide. Moreover, the timing of genocidal violence within communities likely affected numerous dynamics, as Tutsi in places with later onset had more time to flee or to seek refuge with neighbors (Des Forges 1999). As such, our results speak to the importance of better understanding the factors tied to subnational conflict dynamics and, specifically, onset, in Rwanda as well as during other episodes of mass violence.

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Notes

1. This name is French for “Free Radio and Television of a Thousand Hills,” although television was never part of the station.

2. We do not suggest that all researchers accord equal weight to the role of Radio RTLM, but rather that scholars generally agree that the radio affected polarization within Rwanda prior to the national onset of genocide.
3. Radio Rwanda was Rwanda’s only radio station at the outset of the war. Between 30 and 60 magazines were in circulation during this time as well (Higiro 2007).
4. Commonly cited death estimates range from a low of 500,000 to over 1,000,000. For more, see Meierhenrich’s (2020) opening article for the *Journal of Genocide Research* forum on death tolls from the genocide and civil war.
5. For instance, a popular song exclaimed, “Turn your eyes back, you Rwandan! Remember the whip, remember the harsh labor. Remember the days you spent working for the [Tutsi] chief without any compensation!”
6. The station ultimately stopped broadcasting when its reporters fled Rwanda on July 31, 1994. Violence continued, especially in Zaire, long after this.
7. There is no definitive evidence regarding the assassins, although there is significant scholarly debate on this topic. Here, we emphasize what lay Rwandans may have thought during the genocide, rather than post-hoc empirical assessments, and hence we do not engage this debate.
8. Men were expected to work to provide for their families. The calls for “work” should be understood within the context of development in Rwanda, as well as some of its community-work programs like *umuganda* (see Li 2004).
9. See Chambers and Siguru Wahutu (2024) for an analysis of how these broadcasts may have affected media framing of the violence by other African countries.
10. McDoom’s (2021:121) analysis focused on RTLM broadcasts and deaths over time in the Kibuye region. See Richards and colleagues (2019:527) for a list of other content analyses of Radio RTLM broadcasts.
11. Media may also help people coordinate action, but this mechanism is largely limited to social media and applies much less to the top-down, one-way communication of RTLM. Low barriers to entry for social media as opposed to traditional media also result in varying mechanisms with respect to collective action (Boulianne et al. 2020; Crabtree, Darmofal, and Kern 2015; Pierskalla and Hollenbach 2013).
12. Straus (2006) also utilized bivariate regression to analyze the onset of violence within Rwanda’s 11 prefectures, finding that violence began earlier in areas with lower unemployment rates, higher population growth, and where there was more MRND support.
13. Variation in participation has been linked to Hutu unemployment and education levels (Friedman 2011), as well as to areas with longer state presence

- (Heldring (2021), areas along borders of Rwanda's rural paysannat resettlement schemes (McNamee 2018), and areas closer to the main road that saw less rainfall (Rogall 2021). Other work has analyzed subnational death tolls (Nyseth Brehm 2017; Verpoorten 2012).
14. Other work has similarly documented that greater exposure to extremist views in social media is related to increases in mobilization at the subnational and individual levels (Mitts 2019; Thompson 2011).
 15. Prior work has tied inflammatory speech to support for policies that harm outgroup members (Gubler and Kalmoe 2015) and to support for political violence (Berinsky 2007).
 16. This reanalysis was based on methods suggested by Ward, Greenhill, and Bakke (2010), which emphasize the need to consider how independent variables improve predictive performance, rather than relying on regression coefficients and statistical significance alone.
 17. We are unable to comprehensibly match these data to the sectors named in our *gacaca* court data based on the information publicly released by Yanagizawa-Drott (2014). First, there is some variation in sector and commune names between Yanagizawa-Drott's (2014) dataset, which relied on accusations in the *gacaca* courts, and the final trial dataset we use. Second, the longitude-latitude variables for sector centroids in the publicly released data are in kilometers defined by an unknown coordinate reference system, meaning we cannot identify where these points fall within a full shapefile of sectors or communes. Finally, Yanagizawa-Drott only provides data at the sector level, rather than the raw raster from the radio propagation model, again prohibiting overlaying these estimates with our shapefiles. Nonetheless, despite these issues, we did match his data to ours, and we include results using his data in supplementary models in our online supplement.
 18. Missing data are due to matching issues; we address missing data in our online supplement.
 19. We surmise that the signal prediction errors in northern Rwanda in Yanagizawa-Drott (2014) may have been mitigated in our models by the inclusion of terrain information from neighboring countries, rather than abruptly stopping at the Rwandan border, which may not have been possible when Yanagizawa-Drott created his measure a decade ago.
 20. Yanagizawa-Drott (2014) identified the tower locations with information from the Rwanda Bureau of Information and Broadcasting (ORINFOR), but we were not able to obtain this information from this organization's successor, the Rwanda Broadcasting Agency.
 21. The government created a new ministry to replace this specific organization in 2021.
 22. We followed Crabtree and Kern's (2018) advice for setting algorithm parameters, including setting 95 percent reliability, average/mixed context, no diffraction, and no clutter mode.
 23. This category includes the eight communes that had significant RPF presence and control as the genocide began, which are coded as "no onset" by Straus (2006) and McDoom (2014). Other sources suggest there was at least some (but far more limited) genocidal violence in these communes (Verpoorten 2012:555). We thus include these eight communes in the analysis (as not early onset), although we note that analyses excluding them yield similar results to those we present in the Results section.
 24. Figure 2 shows that the area west of the Kigali tower did not experience immediate onset. While there may be several reasons for this, we note that the borders align with prefectures, which were one geographic level higher than communes. We cluster standard errors by prefecture in our analysis to account for this, as prefectures were the main higher-level geographic cluster above the commune.
 25. Yanagizawa-Drott terms these units "villages." However, he actually models sectors, and it thus appears that he uses the term "village" generally. We avoid the term "villages" because it was associated with a geographic level of administration that was much smaller than sectors. Specifically, a sector (*umurenge*) was composed of cells (*utugari*), and cells were composed of villages (*imidugudu*).
 26. The ICTR also indicted 90 individuals for organizing or inciting violence. Rwanda's national court system conducted some trials as well, ultimately trying at least 1,179 cases (Hola and Nyseth Brehm 2016). War crimes and crimes against humanity tied to the concurrent civil war were not tried in any court system (Straus 2019).
 27. Yanagizawa-Drott (2014) uses Category 1 as "militia violence" and Category 2 as individual violence. However, almost all violence was committed in groups, so this distinction is not as meaningful as it might seem (Danning 2018; Fujii 2010; Straus 2006).
 28. We obtained these data from the Rwandan government. Although there are certainly concerns with official government data (see the online supplement for more on the validity of these data), McDoom (2021) compared *gacaca* court pilot data—which he obtained directly from local *gacaca* coordinators—with the final government data. He suggested their close correspondence with respect to Category 1 and 2 crimes indicates that "fears of post hoc political manipulation of the data—at least for the more serious crimes against the person—may be unfounded" (McDoom 2021:288). McDoom's analysis suggests it is highly unlikely that the Rwandan government adjusted the *gacaca* court data after they received case files from local *gacaca* coordinators and secretaries. This underscores our firm belief that the data we received from the government were not tampered with.

29. We add a one to avoid dropping zeros in the log transformation.
30. Prefectures were run by leaders who also likely affected timing of violence, which is an important reason to cluster at the prefecture level (see Straus 2006:50).
31. All logistic regressions were estimated using the `glm` function in R. Marginal effects were derived using the `marginaleffects` package, and clustered standard errors were estimated using the `sandwich` package with an HC3 clustering correction.
32. Again, however, Table A.20 in the online supplement illustrates that modeling trials instead of participants also results in a null effect of Radio RTLM coverage.
33. Many others explained they heard the news from their neighbors who shared they had obtained the information from the radio.

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