

# Artisanal mining, conflict, and sexual violence in Eastern DRC

## Abstract:

The natural resource abundance of the Democratic Republic of the Congo (DRC) has been put forward in policy debates as the prime example of ‘conflict minerals’ driving conflict-related sexual violence. This narrative has dominated how the conflict in the eastern part of the country has been portrayed in the media and by high-level policy-makers. Despite increased attention to research on mining and gender in Eastern DRC, systematic analyses of the links between mineral mining, conflict, and sexual violence are scarce. This paper contributes to shedding light on these links by exploring empirical patterns of how ASM and sexual violence are related in Eastern combining new subnational data on the geographical location of mines with detailed location data on armed conflict events, and data from the 2013/2014 Demographic and Health survey of women aged 15-49. In the analyses, we consider sexual violence committed by intimate partners as well as by other than intimate partner. The results indicate that women living in close proximity to mining activities are indeed more likely to experience sexual violence. We find that women living in the Kivus and Maniema are have a particularly higher risk of experiencing sexual violence by other than intimate partner when they live proximate to a mine controlled by an armed actors (government forces, rebels, or militias).

Keywords: armed conflict, Democratic Republic of the Congo; intimate partner sexual violence mineral mining, sexual violence.

# 1. Introduction

In advocacy narratives, the DRC's war-torn east is portrayed as the 'rape capital of the world' where violence is driven by 'conflict minerals' serving to fuel the activities of various armed actors (e.g. Kelly et al. 2014a; Lindsey and Toft 2014; Prendergast 2009; Meger 2010). Most observers have portrayed the armed actors as focused on capturing 'the benefits from the vast Congolese mineral resources rather than at the achievement of long-term political aims' (Vlassenroot and Romkema 2002: 1), and sexual violence against women and girls has been portrayed as the main consequence (Auteserre 2012). For example, in 2001, Suliman Baldo at Human Rights Watch stated that 'there is a direct link between human rights abuses and the exploitation of resources in areas in the DRC [the Democratic Republic of the Congo] occupied by Rwanda and Uganda'.<sup>1</sup> A more recent report of the UN Secretary-General entitled *Sexual Violence in Conflict* also point out that in some countries there is a correlation between spikes in incidents of sexual violence and military activity linked to the illegal extraction of natural resources, and Eastern DRC is presented as the prime example of rape being used by armed actors to punish civilians for preventing poaching and mineral trafficking (UN 2013).

This article produces a more systematic empirical analysis of whether women living in close proximity to artisanal and small-scale mining (ASM) sites in Eastern DRC are indeed more at risk of sexual violence, and tries to quantify the increased risk posed by the mining context and armed conflict. With this, we contribute a more systematic assessment of a relationship that has been suggested in policy and advocacy circles, and adds to the rapidly growing research field on mining and gender (Bashwira et al. 2014; Cuvelier 2014; Dunn and Matthew 2015; Geenen and Radley 2014; Jenkins 2014), which recently has started to spur more systematic research (e.g. Kelly et al., 2014a). In this article, we look both at sexual violence committed by intimate partners, which sorts under the label of 'domestic violence', and sexual violence by others. Within the latter category is sexual violence perpetrated by armed actors, what is usually referred to in the academic literature as 'conflict-related sexual violence' (Wood 2015; Cohen and Nordås 2014).

We focus in this article on artisanal and small scale mining (ASM)<sup>2</sup> which is carried out using simple hand tools such as hammers and picks. The World Bank has estimates that the ASM supports

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<sup>1</sup> See <http://www.globalissues.org/article/442/guns-money-and-cell-phones>.

<sup>2</sup> Similar elevated risks for women may also exist for large-scale industrial mining (LSM), but the literature attributes the risks for women to ASM. However, ASM and LSM can operate in the same areas making a separation of the effects difficult.

about 16 percent of the DRC's population (World Bank 2008: 7).<sup>3</sup> Now the pendulum has swung more towards large-scale industrial mining, after being at a near standstill in the years when full-fledged war was raging in Eastern DRC (up to 2003), but ASM is still one of the most important livelihood strategies in the DRC (Kilosho et al. 2015; Bashwira et al. 2013). It provides opportunities for informal employment for women in various roles (Bashwira et al. 2013; Kilosho et al. 2015), but also presents possible risks for women (Kelly et al. 2014a, 2014b).

Although practitioners and policy-makers in particular have argued that there is a relationship between ASM and sexual violence in DRC (e.g. UNEP 2013), the mechanisms linking the two are relatively underdeveloped, and few if any systematic analyses have been focused on testing this particular relationship (cf. Jenkins 2014; Kelly et al. 2014a). Also, we still know little about how and why armed conflict and conflict-related sexual violence<sup>4</sup> perpetuates different forms of violence in post-conflict settings. The current article therefore asks: *Whether and to what extent does the presence of artisanal and small scale mining (ASM) increase the prevalence of reported sexual violence against women, perpetrated by intimate partners and others?*

Based on the existing academic literature on sexual violence and natural resources, as well as anecdotal evidence from policy makers and practitioners, we identify two main ways the ASM has been linked to an elevated risk of sexual violence for individual women. First, sexual violence has been argued to be used strategically by armed actors to terrorize and drive out the settled population in order to control mines and gain access to valuable resources, which makes women living in mineral-rich regions particularly vulnerable to sexual violence by armed actors. Second, due to what has been portrayed as a 'hyper-masculine' and inherently violent mining culture, women in or near mining sites may be exposed to various forms of sexual abuse, or enter into transactional sex of various kinds.<sup>5</sup> At particular risk might be women are working outside the home in ASM related activities or near mining sites, as they are more exposed to situation where they might be victimized, and as they can be

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<sup>3</sup> It is also a livelihood which is estimated to pay comparably better than alternative livelihoods (Geenen 2014; Kilosho et al. 2015).

<sup>4</sup> Domestic violence can in some settings be related to or affected by, ongoing or previous war/political conflict (e.g. Østby 2014).

<sup>5</sup> Studying this link does not mean we deny women's own agency in selecting into these settings as a strategic decision to gain a livelihood, nor that we do not acknowledge that women play many roles in mining sites.

perceived to challenge gender norms and norms of masculinity associated with breadwinning (Clark et al. 2010).

Overall, the areas with ASM activity in Eastern DRC seem to be largely overlapping with the areas that are reported to have a high prevalence of sexual violence (UNEP 2013), particularly in South Kivu, North Kivu, and Maniema. Combining new geographical data on the placement of artisanal and small scale mines (International Peace Information Service<sup>6</sup> and own coding) with georeferenced survey data from the 2013/14 Demographic and Health Survey (DHS)<sup>7</sup>, we analyze the impact of mining on individual experiences with sexual violence in Eastern DRC.<sup>8</sup> The results indicate that women living in close proximity to ASM activities are indeed more likely to experience sexual violence by both intimate partners and others. The risk of sexual violence by other than partner is particularly high for women in South Kivu, North Kivu, and Maniema living close to ASM controlled by armed actors.

The paper proceeds as follows: Section 2 provides a literature review of the literature on natural resources, conflict, and sexual violence. Section 3 provides a theoretical framework of the possible relationships between ASM, conflict and sexual violence and derives testable hypotheses from this theoretical framework. Section 4 presents the data and research design. In Section 5 we present our empirical results, and Section 6 concludes.

## **2. Natural resources, conflict, and sexual violence in Eastern DRC: A review of the literature**

Even after battles end, a significant number of armed actors continue to commit acts of sexual violence against civilian populations (Nordås and Cohen 2012), something which has also been observed in Eastern DRC. Indeed, although the DRC has been defined as being a post-conflict country, there are still significant levels of violence overall, leading some to refer to it as ‘post-conflict’ in inverted commas (e.g. Larmer, Laudati and Clark 2013). Some studies have also found that conflict-related sexual violence, that is, sexual violence committed by armed actors, impacts violence between

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<sup>6</sup> <http://www.ipisresearch.be/mapping.php>

<sup>7</sup> <http://dhsprogram.com/>

<sup>8</sup> We also run analyses using the 2007 DHS survey and report these in Online Appendix. The results produces are similar but slightly weaker.

intimate partners (e.g. Bartels et al. 2010; Østby 2014; Leiby et al. 2015). In Eastern DRC, sexual violence is not only committed by conflict actors, but seems to also display signs of civilian adoption of rape (Bartels et al. 2010). One study estimates based on nationally representative surveys that 32% of women in the DRC overall have experienced sexual intimate-partner violence (Kidman et al. 2015). However, whether there has been an increase over time that can be attributed to the armed conflict is not clear.

The general risk of sexual violence towards women can be exacerbated by post-conflict settings. These settings can present extraordinary opportunities to commit violence with impunity, as legal systems are often not functioning and social control mechanisms have become weaker (Wood 2008). In several countries and contexts, communities often experience a ‘shock’ to gender relations when conflict ends. In conflict situations, women often become the main economic supporter for the family. When conflict ends, men return to their families and expect the traditional lives to resume, while women have gotten used to working. The result can be clashing gender role expectations which might increase tensions in intimate relationships. According to a feminist perspective, this may in turn lead to increasing frustration and violence against people with less power, such as women and children, as men use violence to reassert their social position of power in the family (Clark et al. 2010). In the post-conflict situation people may also be desensitized to violence, and previous combatants are struggling with transitioning to civilian life.

Conflict-related sexual violence has been widespread in the DRC, both during conflict and in the post-conflict years (Cohen and Nordås 2014). The violence has been argued to prevent a normal life, and causes extreme trauma, stigma and fragmentation of families, particularly in the eastern provinces (Bartels et al. 2010; Mukwege and Nangini 2009). More than just an unavoidable side-effect of war and a result of individual proclivities, preferences, and opportunities; recent academic and policy research often describe sexual violence as *weapon of war* (see e.g. Skjelsbæk 2010; and Baaz and Stern 2013 for a discussion). Sexual violence as a weapon of war is assumed to be carried out for armed actors’ strategic interests and to be an especially efficient and relatively costless tactic.<sup>9</sup> Perpetrating groups are assumed to use sexual violence strategically for a variety of reason to accomplish objectives such as clearing contested territory, humiliating opponents, or severing ties during secession (Wood 2008), or as a bargaining chip (Auteserre 2012).

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<sup>9</sup> The weapon of war interpretation has also received criticism, and some highlight the costs of rape (Cohen 2013).

In general, armed actors that rely heavily on natural resources to fund their war activities have been argued to be particularly likely to attract sadistic and opportunistic individuals who will commit significant abuses against civilian populations (Weinstein 2007).<sup>10</sup> Specifically, Weinstein (2007, 329) found that armed organizations where members have easy access to abundant, lootable natural resources, are less likely to constrain their use of violence against civilians. Although this argument does not specifically focus on sexual violence, it could also be relevant for understanding this particular form of violence. Natural resources, although perhaps not the *cause* of the violence in the DRC (Auteserre 2012), have been an important source of financing of armed actors. This suggests that the problem of opportunistic sexual violence by ‘greedy’ soldiers or by armed actors seeking to control the ‘honey-pot’ of natural resources (de Soysa 2002) should be a pronounced problem in Eastern DRC.<sup>11</sup> At the same time, the low pay received by soldiers has been raised as an explanation for rapes in Eastern DRC as part of a substitution argument. Wood (2009: 135), for instance, reports a statement by a military official who argued rape in the Eastern DRC was prevalence because combatants were ‘too poor to pay prostitutes’, which also echoes findings reported by Baaz and Stern (2009) based on extensive interviews with government troops.

How natural resources in general affect sexual violence specifically, has not been studied systematically, but the broader conflict literature has long associated various natural resources with negative outcomes in terms of violence by armed actors (de Soysa 2002; de Soysa and Neumayer 2007; Fearon 2004; Humphreys 2005; Lujala 2010; Lujala and Rustad 2012; Rustad et al. 2008). In particular, Lujala (2009, 2010) has found that gemstones are associated with an increased risk of conflict. However, although no systematic statistical studies looking specifically into the link between artisanal mining of minerals and conflict, although there is ample evidence from case studies that such a link exists (Boege and Franks 2012).

The natural resource-violence link has been portrayed as particularly relevant in the DRC case (e.g. Prendergast 2009; Meger 2010). The country has vast natural resources, and both a large and increasing industrial large scale mining production, as well as a large informal ASM sector mining gold,

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<sup>10</sup> However, Wood (2009: 134) remarks how several highly abusive groups do not rely so much on these types of incentives.

<sup>11</sup> However, this could also seemingly contradict the argument that individuals in resource-fueled conflicts are attracted to participate for material benefits, which arguably should then reduce their need to rape, and rather to increase prostitution levels.

tin, cassiterite, coltan and gemstones (Kilosho, Stoop & Verpoorten 2015). This is mainly concentrated in the eastern part of the country. Also, the copper belt in the Katanga region puts DRC on the top-ten list of copper producers in the world<sup>12</sup>, and the large copper mines in Katanga have been a source of revenues for the DRC army to finance their warfare according to Nest (2011: 77).

Little care has been taken in managing these resources in a sustainable manner and kleptocratic regimes have exploited the resources for personal riches (Stearns 2011). Many of the mines have been controlled by armed actors (rebel groups, militias and the army) that use the resources to finance their activities in the area. According to the International Peace Information Service mining survey in Eastern DRC (see description in the data section) about 50% of the mines in the area are controlled by armed actors (state military, rebel groups, or militias), including actors from Rwanda and Uganda. For example, while neither country has any diamond deposit they both became diamond exporters during the period of the Second Congo war (1998-2003) (Nest 2011; Olsson and Fors 2004).

Several recent studies have also been focusing on the nexus between mining and violence against women (e.g. Kelly et al. 2014a,b; Cuvelier 2014). Even without factoring in the activities of armed groups around mining sites, ASM towns could be locations where women are particularly vulnerable (e.g. Kelly et al. 2014a; Jenkins 2014). Women actively seek out employment in artisanal and small-scale mining (Bashwira et al. 2014). However, masculine cultures have been argued to encourage and cause more violence against women, particularly sexual violence (e.g. Meger 2010; Baaz & Stern 2009), and such cultures have been found to often form in ASM towns (Cuvelier 2014)). In the next section we outline theories and testable hypotheses about the relationship between ASM and sexual violence in Eastern DRC, based on existing studies.

### **3. ASM, conflict, and sexual violence: Theories and hypotheses**

How does artisanal and small-scale mining relate to sexual violence? Proposing a link between ‘conflict minerals’ from ASM and sexual violence is so predominant in policy and advocacy literatures (e.g. Prendergast 2009; UN 2013), as well as in parts of the academic literature describing the Eastern DRC context (e.g. Meger 2010; Mukwege and Nangini 2009; DeVoe, 2011; Hayes and Perks 2012), that our first overarching hypothesis simply reflects this proposition:

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<sup>12</sup> See <http://www.bgs.ac.uk/mineralsuk/statistics/wms.cfc?method=searchWMS>.

**H1:** Women living in close proximity to mines are more likely to experience sexual violence.

However, based on existing works and policy documents, more specific mechanisms for the literature could be behind a possible ASM-sexual violence relationship, should there be one: *financing of armed actors* and *the hyper-masculine mining culture*. The first focuses on the problem of natural resources as a possible ‘honey-pot’ for armed groups and the associated problems with mineral mining financing armed group activities. The second focuses on problems associated with mining sites in general, as sites where ‘hyper-masculine cultures’ develop and cause insecurity for women. We discuss each in turn.

### ***3.1 Mining and conflict actors: The curse of the ‘honey pot’?***

Sexual violence as a tactic for forced population displacement has been argued to be used by armed actors, in part for controlling or getting access to resource rich areas. Meger (2011), for example, argues that, in Eastern DRC, rape is used strategically by armed actors to drive out the settled population in order to gain access to land and valuable resources. She further argues that armed actors actively maintain the chaos necessary to loot vast resources, and that the very survival of the armed actors operating in Eastern DRC is dependent upon the control over the region’s resources (Meger 2011). Population displacement can also contribute to general state of lawlessness as normal social control mechanisms are weakened, and communities that are characterized by a lack of social control tend to see higher levels of sexual violence (Hinton et al. 2003).

Access to and control over particularly valuable natural resources can be critical for financing a war, and might also in itself constitute a motive for fighting. Baaz and Stern (2009), based on interviews with soldiers in the DRC, found that militia commanders have been determined to maintain their hold on power in order to protect economic interests, which has also slowed down the Demobilization, Disarmament and Reintegration process. The soldiers further explained sexual violence as a result either of a livelihood strategy, or as an expression of suffering and frustration - rationalized as somehow reducible to an indirect result of poverty (Baaz and Stern 2009). Most of the armed actors profit from the extraction of natural resources that can be undertaken with low level technology as well as extortion of the civilian population. Typical ASM natural resources are therefore often used to finance armed group activities. This can have the potential side effect of keeping the community in an unstable and unlawful state, with an influx of weapons and soldiers desensitized to



violence; which could produce more security problems for women than when mines are controlled by mining companies.

Hence, a mechanism linking natural resources to sexual violence is that sexual violence may to a larger extent occur in areas where conflict and lawlessness is being sustained by various armed actors exploiting the resources for economic gain. When armed actors control the ASM, there could be a particularly heightened risk of sexual violence against women in the area. This leads to our second hypothesis:

**H2:** The closer a woman lives to ASM controlled by an armed actor, the more likely she is to experience sexual violence.

### ***3.2 Mining and masculinity: The curse of the mining culture?***

Does ASM in itself increase the risk of sexual violence towards women, and not only due to the presence of armed actors? The mining industry is often portrayed as being inherently violent and the mining zones as particularly hostile environment for women (Jenkins 2014). Specifically, the mining culture has been presented as ‘hyper-masculine’ (e.g. Cuvelier 2014), producing masculinities akin to those that emerge through initiation rituals into gangs, counter-cultures of marginalized youth, and other fringe cultures (e.g. Werthmann 2009).<sup>13</sup> The hyper-masculine sub-cultures or ‘fringe cultures’ in ASM sites have been found to pride themselves on delinquent behavior and rejecting the norms and regulations of society (Cuvelier 2014, 9), including scandalizing existing sexual norms and piety. Such masculine cultures have been argued to encourage and cause more violence against women, particularly sexual violence (e.g. Meger 2010; Baaz and Stern 2009).

In Africa, as much as 50% of the ASM workforce consist of women (Hayes and Perks, 2012), and mining is central in the livelihoods of many girls and women in Eastern DRC (Bashwira et al. 2014; Kelly et al. 2014a,b). Indeed, work in the ASM industry and related tasks (such as transporting and processing) in particular can be one of the more accessible entry points to paid wages for women. This might challenge ideals of masculinity and challenge traditional power structures in the home that have been argued to become particularly pronounced in post-conflict contexts. An additional problem

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<sup>13</sup> This also echoes Cohen’s (2013) finding that groups that recruit by force are more likely to commit gang rape in particular, to create cohesion within the armed group.

of underemployment or unemployment of men might increase these tensions, as Cuvelier (2014, 9) reports that men increasingly find themselves humiliated and scorned by their household members 'because of their inability to perform the role of reliable male breadwinner'. Mining in Eastern DRC can therefore, both directly and indirectly, contribute to compromise women's safety, as in other places (e.g. Benya 2009; Grätz 2009).

The above mentioned findings that there are subcultures of hyper-masculinity associated with mining means that women could, in working in ASM and walking to and from work associated with the mining industry, be more at risk of falling victim to sexual violence from men outside their household. Many women working in the mining sector are also recruited to the sex industry (World Bank 2012), and exchange of sex for money is very prevalent in artisanal mining towns in Eastern DRC (Kelly et al. 2014b: 4). Women who are involved in transactional sex are also more at risk of rape and other forms of sexual violence. Based on the mechanisms discussed above and expectations from policy circles, we can therefore hypothesize that working outside the home in or around artisanal mining sites may increase the risk for women of experiencing both intimate partner sexual violence (IPSV) – as she challenges gender norms -- as well as sexual violence committed by other men – as she is exposed to a potentially dangerous mining culture in her daily occupational life. This leads to the last hypothesis<sup>14</sup>:

**H3:** Women who live close to ASM sites and work outside the home are more likely to experience sexual violence.

## 4. Data and research design

To assess the relationship between the presence of mining and sexual violence in Eastern DRC we use individual-level data on sexual violence for women aged 15-49 from the most recent Demographic and Health Survey (DHS)<sup>15</sup> conducted in 2013-14, and spatially link these with the location of ASM using data from International Peace Information Service.

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<sup>14</sup> Importantly, proposing this as a possible empirical regularity does not imply that we propose a deterministic relationship between ASM and sexual violence, nor that women do not have agency in ASM sites.

<sup>15</sup> According to The DHS Program, their 'Domestic Violence Module and ethical and safety guidelines provide methods to collect valid and reliable data while meeting the highest ethical and safety standards'.

#### ***4.1. Dependent variables: Experiences of sexual violence***

For this study we use two alternative dependent variables extracted from the DHS: Sexual violence by intimate partner (IPSV), whether respondent has ever experienced intimate partner sexual violence) and whether respondent has ever experienced sexual violence by other than partner. These data represent 172 randomly sampled clusters in Eastern DRC, covering a maximum of 2,134 respondents with information on sexualized violence. The geographic distribution is shown in Map 1.

We use dichotomous dependent variables (exposure to various forms of sexual violence) and therefore we use a logistic regression model. The dataset is a cross section, and we therefore do not make any definite claims about causal relationships between ASM and sexual violence based on the analyses, although the analysis produces tests of some observable implications from existing theories.

#### ***4.2. Independent variables***

The data on ASM is collected by the International Peace Information Service (IPIS)<sup>16</sup> using nine different on-the-ground teams consisting of representatives from both the civil society and Congolese mining administration between 2011 and 2014. The data includes geographical data on 1139 artisanal and small scale mines in five districts in Eastern DRC: South Kivu, North Kivu, Maniema, Katanga, and Oriental. Map 2 shows the geographical distribution of these mines. The dataset also includes information about whether the mine is controlled by an armed actor (rebel, militia, or government army).

Our main independent variables measure proximity of ASM from the DHS survey cluster. To test H1, the first variable measures how proximate the women lives to any ASM site (*Distance to ASM*). To test H2, we measure how close the woman lives to the nearest mining site controlled by an armed

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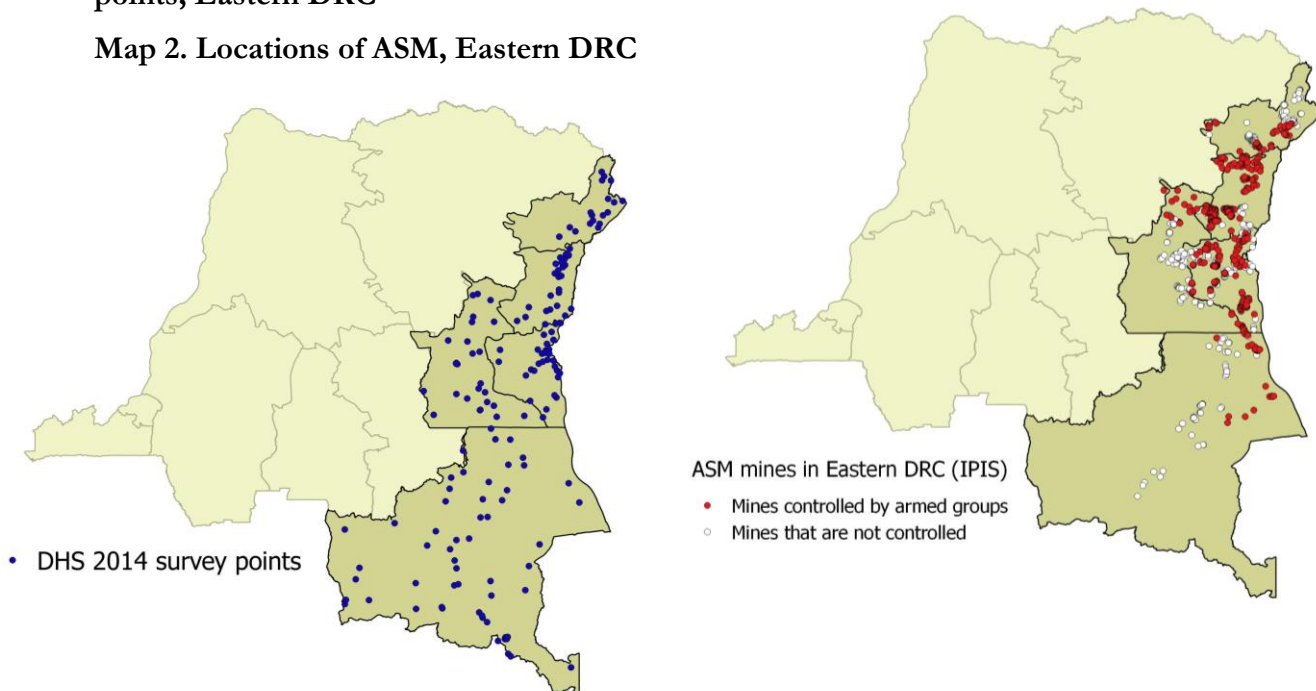
Nonetheless, critics have question the reliability of these data in the DRC, because of lack of detail on, and contextual understanding of, local factors. Also, with sensitive topics like sexual violence, there is always the risk of under-reporting, or even over-reporting sexual violence experiences (see e.g. Douma and Hilhorts 2012; Nordic Africa Institute 2011). Despite these concerns, the DHS survey represents the best available systematic data on experiences of sexual violence in the current case. Importantly, there is also no specific reason to believe there is a systematic patterns over- or underreporting between the relevant geographical locations for the comparison in the current study.

<sup>16</sup> <http://www.ipisresearch.be/mapping.php>.

actor (*Distance to ASM controlled by armed actor*). These measures have both been calculated using GIS tools. We also use a dummy variable from DHS indicating whether the woman reports to work outside the home (1) or not (0) (*Works outside home*). We interact this variable with the distance to mining variable *Distance to mine*, to account for whether the combination of working outside the home and residing near ASM sites increases a woman's risk of sexual violence, as proposed in H3.

**Map 1. Locations of DHS survey cluster points, Eastern DRC**

**Map 2. Locations of ASM, Eastern DRC**

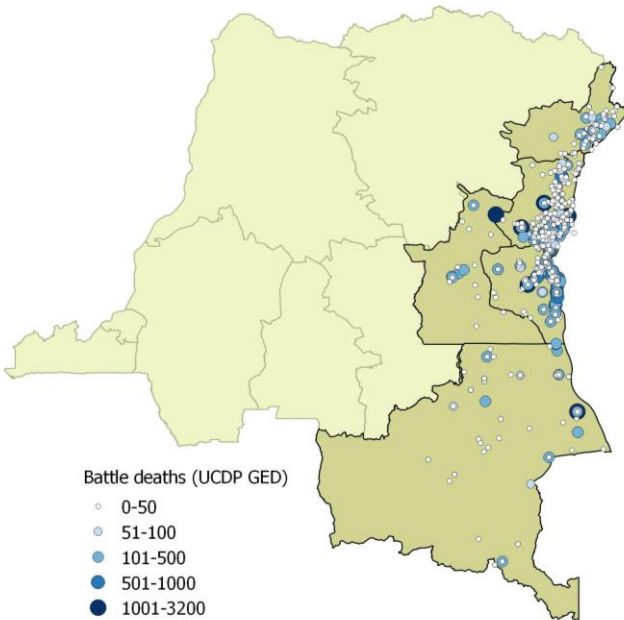


### **4.3. Control variables**

First, the armed conflict may have had an impact the relationship between mining and sexual violence (Østby 2014). We therefore control for conflict intensity using a log-transformed measure of the number of battle deaths within a 10km radius of the respondent, using the UCDP Geo-referenced Events Dataset (GED) for the period 1989-2010 (Sundberg and Melander 2013). The buffer zones that did not experience any battle deaths were coded 0 after the log-transformation, to avoid missing

observations. Map 3 shows locations of conflict events and the level of battle deaths within the conflict buffer zones for Eastern DRC.

**Map 3. Conflict events and battle deaths, Eastern DRC, 1989-2010**



Second, we include the respondent's current age, as younger women have been found to have higher risk of being affected by sexual violence (see e.g. USAID 2008). Third, we control for the respondent's education. Here, previous findings are inconclusive (see e.g. Simister and Makowiec 2008; Kimuna and Djamba 2008), but if anything, we expect education to negative affect risk of sexual violence, particularly by intimate partner . The husband's alcohol abuse is a significant predictor in previous studies (e.g. Gage 2005; Jewkes 2002), as male alcohol abuse may result in conflict over the man's drinking and/or behavioral disinhibition, which in turn may lead to higher levels of partner violence (Saile et al., 2013; Jewkes 2002). The control for partner's alcohol abuse is included in the models with sexual violence by intimate partner as the dependent variable.

We also expect that women from richer households are less exposed to sexual violence, particularly from other than partner, as she might have more means to protect herself. We control for household wealth using the DHS-defined 'wealth index' consisting of 5 income groups based on household assets. Finally, we include controls for urban or rural residence as well as regional dummies.

Descriptive statistics for all variables are provided in the online appendix.

## 5. Results

In this section we present our empirical tests of the relationship between ASM and sexual violence. In Table 1, Model 1 and 2, we test hypothesis 1, that *women living in close proximity to mines are more likely to experience sexual violence*. Distance to a mine is negative and significant in both models, thus a woman is more likely to have experienced both sexual violence by intimate partner and by others the closer she lives to an ASM site, which supports H1. This finding is in line with the theoretical proposition that ASM sites represent places with masculine ideals conducive of sexual violence against women, although the particular mechanism cannot be conclusively tested.

In terms of substantial effect, based on Model 1 and keeping all controls at their median values, a woman who lives closer to a mine (10<sup>th</sup> percentile) has 5 percent points higher risk of experiencing sexual violence by other than intimate partner than a woman who lives further away from a mine (90<sup>th</sup> percentile). To exemplify this further, this means that in a location with 10,000 women, will see 500 additional women being sexual violence victims if it is located in the 10<sup>th</sup> percentile closest to ASM activities compared to locations furthest away from ASM activities (in the 90<sup>th</sup> percentile). The corresponding change in risk for intimate partner sexual violence is 7 percentage points.

**Table 2. ASM, armed actors, and sexual violence, Eastern DRC, 2014**

	Model 1 SV by other than partner	Model 2 SV by intimate partner (IPSV)	Model 3 SV by other than partner	Model 4 SV by intimate partner (IPSV)	Model 5 SV by other than partner	Model 6 SV by intimate partner (IPSV)
					Kivus and Maniema	Kivus and Maniema
Distance to ASM	-0.392**	-0.250**				
	(0.153)	(0.121)				
Distance to ASM controlled by armed actor			-0.104	-0.087	-1.325***	-0.0432
			(0.118)	(0.084)	(0.427)	(0.272)
Works outside home	0.233	0.281	0.240	0.285	0.0127	0.325
	(0.200)	(0.202)	(0.203)	(0.203)	(0.244)	(0.275)
Conflict fatalities (ln) 1989-2010, 10km buffer zone	-0.0388	0.0213	-0.044	0.019	-0.0113	0.0119
	(0.044)	(0.038)	(0.045)	(0.038)	(0.0485)	(0.0473)
Age	-0.03	-0.014*	-0.003	-0.015*	-0.000282	-0.0276**
	(0.009)	(0.008)	(0.009)	(0.008)	(0.0111)	(0.0112)
Education ( <i>Ref: no formal education</i> )						
Primary	0.050	-0.149	0.051	-0.152	0.130	-0.351*
	(0.162)	(0.158)	(0.163)	(0.160)	(0.211)	(0.190)
Secondary or higher	0.0580	0.278	0.055	0.277	0.155	-0.182
	(0.227)	(0.186)	(0.229)	(0.186)	(0.268)	(0.225)

Alcohol abuse ( <i>ref: no abuse</i> )						
Partner sometimes or often gets drunk		0.890**		0.903**		1.153**
		(0.388)		(0.388)		(0.466)
Missing on alcohol variable		0.134		0.148		0.0400
		(0.390)		(0.390)		(0.497)
Household wealth ( <i>ref: Poorest</i> )						
Poorer	-0.260	0.001	-0.277	-0.009	-0.215	-0.160
	(0.258)	(0.201)	(0.255)	(0.201)	(0.302)	(0.248)
Middle	-0.173	0.264	-0.184	0.259	-0.178	0.413*
	(0.226)	(0.192)	(0.226)	(0.192)	(0.278)	(0.239)
Richer	0.209	0.0783	0.220	0.093	0.297	0.0388
	(0.260)	(0.228)	(0.256)	(0.230)	(0.299)	(0.285)
Richest	0.347	-0.616**	0.295	-0.671**	0.119	-0.484
	(0.346)	(0.311)	(0.349)	(0.312)	(0.451)	(0.461)
Urban	-0.174	0.376	-0.165	0.388	0.0363	0.366
	(0.264)	(0.250)	(0.264)	(0.251)	(0.295)	(0.325)
Province ( <i>Ref: Province Katanga</i> )						
North Kivu	-0.462	-0.0251	-0.352	0.0173	0.0840	-0.238
	(0.349)	(0.248)	(0.363)	(0.270)	(0.399)	(0.259)
Maniema	0.181	-0.138	0.323	-0.087	reference	reference
	(0.327)	(0.295)	(0.378)	(0.334)		
South Kivu	-0.902*	-1.707***	-0.749	-1.634***	0.476	-0.774**
	(0.468)	(0.398)	(0.472)	(0.410)	(0.397)	(0.322)
Oriental	0.537*	-0.642*	0.688*	-0.582		
	(0.326)	(0.328)	(0.370)	(0.361)		
Constant	-2.036***	-1.352***	-2.179***	-1.419***	-1.891***	-0.838
	(0.370)	(0.492)	(0.409)	(0.520)	(0.538)	(0.665)
N	2,009	1,658	2,009	1,658	1,074	869

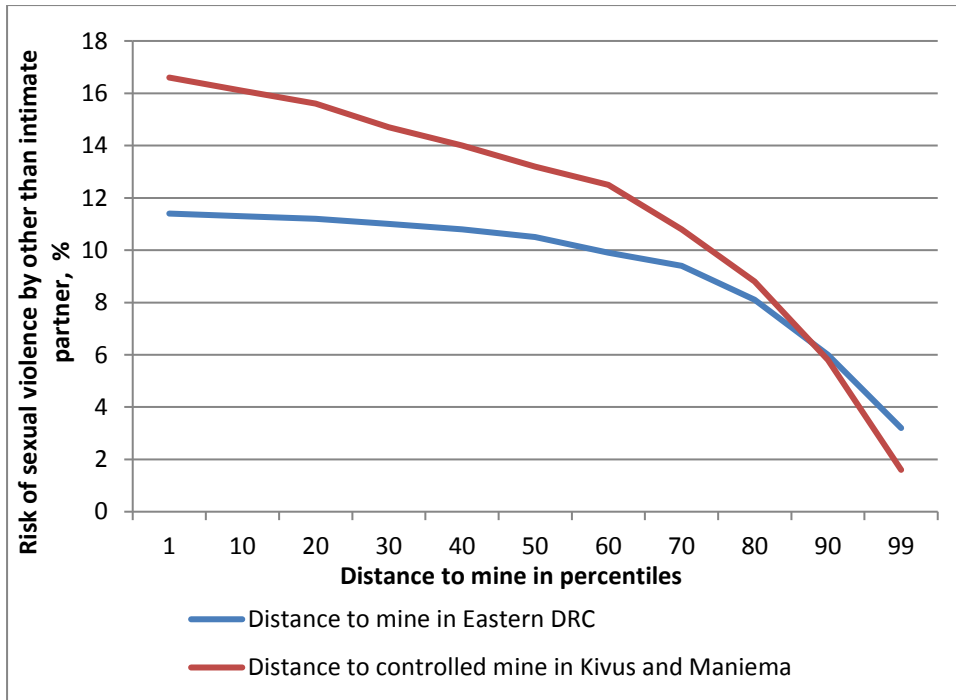
Logit regression coefficients (standard errors in parentheses), \*  $p < 0.1$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$ .

To test hypothesis 2, that *women living close to mines that are controlled by armed groups are more likely to experience sexual violence*, we analyze how risk of sexual violence changes with the distance to the closest mine that is controlled by an armed actor (Models 3 and 4). We see that in both models the coefficient for the variable *Distance to ASM controlled by armed actor* is negative, indicating that the closer the respondent lives to an armed actor controlled mine, the more likely she is to experience sexual violence. However, the effect is not statistically significant. A reason for this insignificant finding could be that as the distance to the nearest armed actor controlled ASM site becomes large, it makes particularly little sense to expect a heightened risk, particularly due to the lack of good roads and infrastructure for travel across distances in Eastern DRC. Hypothesis 2 can therefore be particularly relevant in the near areas with armed conflict. As map 3 shows, the two Kivus and Maniema provinces have had high levels of conflict. Therefore, we also run the analysis on a subsample of only the respondents living in these areas. Here, we find a highly significant relationship between living closer to ASM sites

controlled by armed actors and sexual violence by other than partner. Thus, we can confirm hypothesis 2 for these three provinces, but not for Eastern DRC overall.

Based on the results from North Kivu, South Kivu and Maniema, the effect of living proximate to armed group controlled ASM are also substantively quite large. From those living the furthers away from the mine (90<sup>th</sup> percentile) to those that live the closest (10<sup>th</sup> percentile) the risk increases from 5.7 to 16.2 which is almost three times as high. Figure 1 compares the risk of experiencing sexual violence by other than intimate partner when we look at just distance to the closest mine for all respondents (Model 1) compared to the distance to armed actor controlled mine for the restricted sample of the most conflict affected areas (Model 5). We see that the increased risk by living close to mines is much higher in the latter. In Model 6 the coefficient is negative but not significant, hence there does not seem to be a clear relationship between sexual violence by intimate partner and distance to armed actor- controlled ASM, the effect is for sexual violence by other than partner only.

**Figure 1. Distance to armed actor-controlled ASM and risk of sexual violence by other than intimate partner**



In order to provide a more direct test of Hypothesis 3, that *women who live close to ASM sites and who are working outside the home are more likely to experience sexual violence*, we interacted the term for women



working outside the home with distance to ASM, presented in Models 7 and 8 in Table 3. We find no significant effect for the interaction term, and therefore not support for H3. Contrary, we see that the distance to mine variable is negative and significant in Model 7. This indicates that the risk of sexual violence particularly by other than the intimate partner increases when you live closer to the mine if you *do not* work outside the home. One reason could be that the measure of working outside the home is too crude to pick up a difference in exposure to dangerous situations in the daily lives of women in Eastern DRC, and not sufficiently able to proxy working in the mining sector. Another way of interpreting these findings is that a woman in Eastern DRC is not necessarily any safer from sexual violence in her home than outside. Many stories of women being attacked by armed actors in their homes is testament to this (Harvard Humanitarian Initiative 2010). With access to better measures of women's income-generating activities and types of work, future studies might be able to conduct more nuanced tests of the exposure risk depending on whether and how a woman is engaged in work outside the home.

**Table 3. Mining, work outside of home and sexual violence exposure, Eastern DRC, 2014**

	Model 7 SV by other than partner	Model 8 SV by intimate partner (IPSV)
Distance to mine	-0.796** (0.379)	-0.265 (0.231)
Works outside home	0.041 (0.237)	0.271 (0.249)
Works outside home * distance to mine	0.476 (0.370)	0.017 (0.228)
Conflict fatalities (ln) 1989-2010, 10km buffer zone	-0.003 (0.009)	-0.014* (0.008)
Age	-0.796** (0.379)	-0.265 (0.231)
Education (Ref: no formal education)		
Primary	0.049 (0.162)	-0.149 (0.158)
Secondary or higher	0.057 (0.227)	0.278 (0.186)
Alcohol abuse (ref: no abuse)		
Partner sometimes or often gets drunk		0.891** (0.390)
Missing on alcohol		0.134 (0.391)
Household wealth (ref: Poorest)		
Poorer	-0.265 (0.256)	0.001 (0.201)
Middle	-0.180 (0.227)	0.264 (0.192)
Richer	0.205 (0.260)	0.078 (0.229)
Richest	0.362 (0.343)	-0.614** (0.313)

Urban	-0.170	0.376
	(0.262)	(0.250)
Province (Ref: Province Katanga)		
North Kivu	-0.451	-0.024
	(0.351)	(0.249)
Maniema	0.188	-0.138
	(0.327)	(0.295)
South Kivu	-0.893*	-1.707***
	(0.469)	(0.398)
Oriental	0.551*	-0.642*
	(0.325)	(0.329)
Constant	-1.869***	-1.344***
	(0.400)	(0.497)
N	2,009	1,658

In terms of the control variables, our conflict measure (*Conflict fatalities*) is not significant. Further, we find that age has a negative and significant relationship with sexual violence by other than partner, i.e. younger women are more at risk, which is as expected. For sexual violence by intimate partners, the effect of age is negative but insignificant. The woman's level of education does not have a significant effect. Also the level of household wealth has little effect on whether the respondent experiences sexual violence by other than partner or not, but the richest have lower risk of experiencing sexual violence by intimate partner (IPSV) compared to the poorest. As expected, alcohol abuse by partner has a large positive impact on whether the respondent has experienced sexual violence by partner or not. Whether the respondent lives in an urban or rural area does not seem to matter. Controlling for the respondent's province of residence we find that women residing in the two Kivu provinces are more exposed to sexual violence by other than partner (Model 2 and 4), which is in line with abundant case evidence from these regions.

## 6. Conclusion

The dominant narrative among policy makers and practitioners suggests that there is a strong link between natural resource extraction and sexual violence in Eastern DRC. In an attempt to systematically test the relationship between ASM and sexual violence, this article presents a quantitative analysis of women in Eastern DRC, and how their exposure to ASM sites is associated with heightened risk of sexual violence. Using GIS, we link data on the location of ASM with georeferenced data from the Demographic and Health Surveys on individual women's reports of sexual violence, by intimate partner and others.

The findings indicate that in Eastern DRC, women living close to ASM are more likely to be sexually victimized by both partners and non-partners. At particular risk of sexual violence by other

than partner are women living close to armed actor-controlled ASM sites in North and South Kivu and Maniema districts. Women who report working outside the home are not more subject to sexual violence than others, and this relationship is also not contingent on distance from mining areas. Second, contrary to our expectation, sexual violence by non-partners is not significantly more prevalent close to mines that are controlled by armed actors. However, in this context, the risk of intimate-partner sexual violence actually increases.

The findings in this article confirm that mining can be associated with insecurity for women, and a heightened risk of both sexual violence by partners and others. This relationship, although not previously tested in a systematic fashion, has been assumed among policy makers and in advocacy circles, and several policy initiatives have been geared towards addressing this. Given this additional statistical evidence, the need for establishing stronger measures and regulations that counteract the heightened risk of sexual and gender-based violence in mining areas is further confirmed. However, policy measures need to continuously be sensitive to the fact that ASM constitutes an important livelihood strategy for local women, and that their access to this income-generating activity must be upheld while establishing measure for prevention of sexual violence.

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