From Muscle Drain to Brain Gain: The Long-term Effects of Gurkha Recruitment in Nepal[*]

François Libois[†], Ritu Muralidharan[‡], Juni Singh[§] and Oliver Vanden Eynde[¶]

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Abstract

Gurkha soldiers in Nepal have been recruited by the Indian and later the British armies for over 200 years. The transformational role that these soldiers played in the development of their home communities is often described informally, but is challenging to quantify. Using the plausibly exogenous locations of British recruitment depots in the 19th century, we use a continuous difference-in-difference design to show that exposure to historical Gurkha recruitment is associated with improved outcomes for education and indicators of female empowerment today that are specific to the "recruitable" Gurkha castes. Specifically, historical Gurkha recruitment is associated with higher literacy, a greater probability of attending school, higher educational levels, marrying later, increased women-run non-farm businesses, and a greater share of women currently using contraceptives. There is a differential in these positive effects between the "recruitable" Gurkha castes and other castes. While Gurkha castes tend to hold more assets in historical recruitment grounds, the positive impacts on education remain when we explicitly account for wealth differences. This finding is consistent with the idea that military recruitment changed the culture and preferences of recruited communities, as historians have long argued.

JEL Classification: F22, I25, N35, O15

Keywords: long-term development, international migration; military recruitment; colonialism; educational investment; female empowerment; Nepal

1 Introduction

For over 200 years, Nepalis have left their country of origin in large numbers to work abroad. Today, as much as 1% of Nepal's population serve as migrant workers in places such as the Persian Gulf (GIZ and ILO, 2015), while historically fearsome Gurkha warriors have long been recruited to serve in foreign militaries. After their victory in the Gurkha War (1814-1816), also known as the Anglo-Nepalese War,

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the British recognized the prowess of the Gurkhas, quickly recruiting them to fight for the British Indian Army. These soldiers were recruited from small villages in the region now part of Nepal, and within a short period of time became the area's most prominent export. Gurkha warriors, fighting for the British, were instrumental in both World Wars. After Indian independence in 1947, Gurkha fighters continued to fight for the Indian, British, and Singaporean militaries, serving in the Falkland Island conflicts and in various UN peacekeeping missions.

For generations, Gurkha warriors have left home to fight abroad. Despite spending much of their working careers away from home, these warriors have maintained connections with their communities of origin, not only by sending remittances, but also by bringing home their experiences that have been shaped by years of foreign military service. Many historians believe that this history of migration and military experience have fundamentally changed Gurkha communities, particularly in terms of educational achievement (Kergoat, 2008). This paper attempts to quantitatively determine the degree to which the experience of consistently historically recruiting members of Gurkha ethnicities into foreign armies has affected educational and specific female empowerment[1] outcomes in the Gurkha soldiers' community of origin.

Our empirical strategy exploits plausibly exogenous, historical constraints on Gurkha recruitment. During the 19th century, the British established a limited number of Gurkha recruitment depots, most of which were based in British India. We use the distance to these historical recruitment depots as a proxy for the long-term intensity of Gurkha recruitment at the level of present-day villages or Village Development Committees (VDCs)[2]. We validate this metric by looking at Gurkha casualty data from the World Wars, confirming that relatively more Gurkha soldiers from villages closer to recruitment depots died than those from villages further away.

Our main specification builds on this finding, and introduces a difference-in-difference estimator that captures the differential impact of distance to historical recruitment depots between recruited groups, i.e. the Gurkha castes, and non-recruited groups. Our analysis uses individual-level data from two sources. First, data on educational outcomes, including literacy and schooling levels, and age at first marriage from the 2011 Census. Second, data on specific sex and marriage-related 'female empowerment' outcomes, such as contraceptives use, from three waves (1995/96, 2003/04, and 2010/11) of the Living Standards Survey.

We find that living in a VDC at a lower distance to a historical recruitment depot is associated with better educational outcomes for Gurkhas compared to non-Gurkhas. A 100 km decrease in the distance to a recruitment depot increases the literacy difference between Gurkhas and non-Gurkhas by 3.8 percentage points. Given the country's literacy rate of around 67%, this effect is sizable. Such a 100 km decrease also increases the difference in age at first marriage between Gurkha women and non-Gurkha women by 0.3 years. Hence, our results suggest positive long-term effects of Gurkha recruitment, in line with the historical evidence.

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[1]This paper limits its exploration of female empowerment outcomes to ones related to sex (e.g. contraception) and marriage (e.g. marital age).

[2]Note that the terms "village" and "VDC" are used interchangeably throughout this paper.

This paper adds to a growing body of literature on the returns to military service[3]. The military is different from other employers in that it recruits disproportionately from disadvantaged sections of society, provides significant on-the-job training, and often requires employees to spend considerable time away from their families. Employees from disadvantaged backgrounds may gain novel experiences and skills they otherwise would not have had access to. This may have the effect of improving their and their families' economic prospects. Angrist (1998) demonstrates that, in the context of the US military, nonwhite recruits experienced a slight increase in their long-term civilian earnings following their military service. To date, it is still unclear how the effect of military service pans out in the developing world. Given that the average human capital in developing countries is lower, it could be that the returns from military service are higher than in the developed world. For example, Vanden Eynde (2016) showed how voluntary military service in the British Indian Army raised literacy rates in areas that experienced heavy recruitment. Despite mild evidence of intergenerational transfers, establishing this effect past India's 1949 Partition is difficult, given the amount of population displacement that occurred. However, in Nepal there has been significant historical continuity in recruitment efforts, making it a good test bed for estimating the long-term effects of military service.

Gurkha soldiers, by serving in foreign militaries, also represent Nepal's first experience with large-scale labour migration[4]. They have been recruited to fight abroad since the early 19th century, and this flow of soldiers has been relatively well documented and uninterrupted by political upheaval. As a result, Gurkha recruitment provides a useful test bed for studying the long-term effects of labour migration in origin countries. In recent years, as the number of global labour migrants has increased, scholars have been investigating the effects of this migration on home communities. In particular, Beine, Docquier, and Rappoport (2008) develop a framework for understanding this effect and demonstrate — in contrast with conventional narratives about brain drain — that emigration from developing countries can either be beneficial or detrimental. Factors like the initial levels of human capital and the emigration rates influence whether the net effect of the emigration is positive or negative. One important aspect of these authors' framework is that in order to benefit from emigration, home communities invest in human capital. Shrestha (2016) demonstrates this aspiration effect in the context of British Army Gurkha recruitment. After introducing higher educational requirements in the 1990s for Nepali men to work in the British Army[5], education attainment appears to have increased in Nepal. Shrestha and Palaniswamy (2017) additionally find that this education policy change raised the education of the men directly exposed to this new policy at the expense of their female siblings. In other words, the *marginal* impact of a small, recent policy change led to educational investments being substituted away from female to male siblings. Our results, in contrast, indicate that a direct aspirational effect cannot solely account for long-term improved education outcomes for two reasons. First, we found educational impacts even for the cohort that were

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[3]See, for example, Lee (2012) for the effect of the American Civil War on social mobility, or Grenet, Hart and Roberts (2012) for the effects of World War II conscription on subsequent earnings.

[4]Current-day migration is not just driven by demand factors. Libois (2015) finds that Nepali households use migration as a coping strategy when faced with violent conflict.

[5]No formal education was required to join the British Gurkha Army prior to 1993, when the selection criteria exclusively consisted of physical examinations. 1993 onwards, recruits were required to have completed at least eight years of education, and the selection process added written tests in mathematics and English. In 1997, the minimum education requirement was increased to 10 years.

not subject to educational requirements in the British Army. Second, we found educational impacts for both men and women. This in turn also suggests that while sibling rivalry may be generated on the margin in the short term, there may *not* be a persistent negative impact on female education. Ultimately, aspiration investments are one of several channels through which migration affects education. Theoharides (2018), for example, finds that the income channel is dominant in migration demand induced secondary enrollment increases in the Philippines. In the Nepali context, Gurkha soldiers may create increased demand for education back in their communities by sending home remittances[6]. Migrant associations, like Nepal's Gurkha Welfare Fund, may intensify this effect[7]. However, as suggested by Bucheli, Bohara, and Fontenla's (2018) results on the effect of remittances on secondary school enrollment in Ecuador, the positive income effects of remittances may be offset by the negative effects of a missing parent due to migration. Our results show that while villages benefitting from schools constructed under the patronage of the Gurkha Welfare Fund are associated with higher education attainment, this school construction is not the main channel impacting long-term education outcomes in Nepal[8].

Shaped by years abroad and extensive military service, Gurkha soldiers may simply be more likely to educate their children. Historians in both Nepal (Kergoat, 2008), and India (Mazumder, 2003) highlight this channel. Moreover, the direct skills acquired by Gurkha soldiers may also have an effect on this channel[9]. *A priori*, however, Gurkha recruitment might not always affect the home community in a positive way. As documented in Mexico (McKenzie and Rapoport, 2011), when a male household head serves abroad, his children may have to work at home more instead of going to school. Yamada (2016) finds that in the long term, migration may impede the development of migrant-sending countries if migrants' wages depend little on education[10], inducing a negative impact of past migration on education investment. Beyond educational preferences, years abroad may also have affected a range of other types of preferences, including but not limited to contraception use, family size, and marital age. Hypothesizing that migrants adopt and diffuse the values and norms of their host countries in their origin countries, Lodigiani and Salomone (2015) investigate the effect of migration to countries with higher shares of women in the parliament on female political empowerment, measured by parliamentary participation, in the home country. Our paper finds that Gurkha recruitment is associated with marrying later, increased women-run non-farm businesses, and a greater share of women currently using contraceptives.

Lastly, this paper contributes to a large literature that estimates the long-term impact of colonial institutions. Dell and Olken (2020), for example, find that villages forced to grow sugar cane as part of the Dutch Cultivation System in 19th century Java, an extractive colonial institution, have persistently higher industrialization, education, and household consumption even today[11]. Similarly in Nepal, the persistent

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[6] See Rapoport and Docquier (2006) for more on remittances and the demand for education in home countries.

[7] Chauvet and Mercier (2014) and Beauchemin and Shoumaker (2009) study the effects of migrant associations on local development in Mali and Burkina Faso respectively.

[8] Additionally, there is no differential effect of schools constructed under the Gurkha Welfare Fund on Gurkha caste members over others.

[9] Vanden Eynde (2016) finds evidence consistent with the informal acquisition of literacy skills by Punjabi soldiers who fought in World War 1. Such informal learning of literacy skills on the job could be sensitive to the composition of army units. Costa and Kahn (2008) provide evidence of how company diversity affected the acquisition of literacy skills by black soldiers in the American Civil War. Jha and Wilkinson (2012) show that the human capital effects could have less benign components: they argue that World War II veterans helped to carry out violence during India's partition.

[10] Reminder that no formal education was required to join the British Gurkha Army prior to 1993.

[11] Caicedo (2019) finds that the religious missions in 1609 in modern-day Argentina, Brazil, and Paraguay resulted in

demand shock for military labour from particular rural communities, i.e. the Gurkha communities, is often qualitatively credited with transformative impacts. Our paper will test this hypothesis for education and specific female empowerment outcomes.

The rest of this paper is organized as follows. Section 2 provides a background on Gurkha recruitment by the British Army. Section 3 outlines the empirical strategy of the paper. Section 4 discusses the data sources. Section 5 presents and discusses the results. Section 6 concludes.

2   Background

Gurkha recruitment into foreign armies traces its roots back to the Gurkha War (1814-1816), fought between the East India Company and the Kingdom of Gurkha. Even though the British emerged victorious, they were impressed by the tenacity and fighting techniques employed by their former foes. Consequently the British started recruiting Gurkha warriors, along with fighters from other areas of the Himalayan region, to fight in the British Indian Army. The Nepalese government was originally hostile to British recruitment of Gurkha soldiers, meaning that British recruitment agents acted in secret. In 1885, the Nepalese government relented, resulting in a surge of Gurkha recruitment. This was further intensified when the British established two recruitment depots in Nepal in 1902. By 1904, the British Indian Army had 16 battalions of Gurkha troops, up from three in 1816. Most of the Gurkhas from Western Nepal were Gurungs and Magars, while those from Eastern Nepal were Rais and Limbus.

Gradually, the British set up several more recruitment depots, and many Gurkha soldiers came to fight for British colonial armies. In the World Wars, some 200,000 Gurkha soldiers fought for the British, of whom 50,000 died. After Indian independence in 1947, a tripartite agreement between the United Kingdom, India, and Nepal mandated that Gurkha units that were once part of the British Indian Army were split between the Indian and British armies. Six units became part of the newly established Indian military, while another four joined British ranks. Gurkha recruitment depots were also moved closer to Nepal.

Over time, Gurkha recruitment has likely impacted the Nepali economy through a variety of means. For instance, after Gurkha recruitment increased at the start of the 20th century, Nepalese agricultural production suffered as a result of so many able-bodied men being away from home. However, for many Gurkha soldiers, fighting for foreign militaries has long represented the opportunity for better economic prospects for themselves and their families. Indeed, Gurkhas send home remittances to their families, and when they return home they bring with them their experiences from abroad. Historically, Gurkha fighters return home upon retirement, where they might be more likely to be involved in social infrastructure projects like opening schools or playing an active role in community agencies. In this manner, they might positively impact public good provision and in turn the economy. Recent changes to British law now make it possible for Gurkha veterans to settle in the UK. It remains to be seen how this will affect the economy of Nepal. As they are now necessarily educated, Gurkha soldiers have the effect of raising the education

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higher educational attainment that remains persistent 250 years later. Huillery (2009) and Dell (2010) are additional examples.

level of their home country. This could potentially have a spillover effect on the greater community. This paper focuses on quantifying the long-term impact of Gurkha recruitment on contemporary educational and female empowerment outcomes in Nepal, but remains agnostic on the extent to which this impact is a direct effect. These effects take place simultaneously over a long period of time; it is unclear whether there is, say, a direct effect of recruitment on the age at which a Gurkha woman first marries or if this effect is mediated through education. Similarly, we remain agnostic on the mechanisms through which we see a persistent impact on education. While we are able to confirm that there is more than a pure aspirational effect at play, we cannot comment on, say, the importance of remittances to observed effects.

3 Empirical Strategy

Our empirical strategy exploits plausibly exogenous, historical constraints on Gurkha recruitment. British Army recruiters had only a limited number of recruitment depots accessible to them, with five out of six main depots located in British India. Figure 1 displays a map of British recruitment depots in 1885. With political constraints compelling 19th century recruiters to largely operate from the Indian border, they importantly relied on networks of existing soldiers to find new recruits. As a result, the recruitment patterns established in the 19th century remained persistent over the long term. A priori we expect that areas closer to recruitment depots experienced higher recruitment as they were easier to access. We assume that, conditional on key geographical characteristics[12], distance to historical recruitment depots impacts our outcomes of interest exclusively through a location's recruitment intensity. In other words, for our instrument to satisfy the exclusion restriction it needs to be the case that the only way in which the effect of distance to recruitment depots on education and female empowerment outcomes differs between Gurkhas and non-Gurkhas is through a differential effect on recruitment intensity.

3.1 Pseudo First Stage

3.1.1 Overview

We demonstrate the relevance of our instrument for recruitment intensity, distance to historical recruitment depots in the following manner: We obtained a World War era casualty dataset from which we extracted information on Nepali soldiers' place of birth. We then did a fuzzy match by name between the place of birth and georeferenced "settlements" — in turn matched by geolocation to modern VDCs — to calculate the number of World Wars casualties by VDC[13]. These casualties serve as a proxy for VDC-level recruitment intensities in the "pseudo" first stage[14]. Figure 2 shows a map of Nepal with these recruitment intensities.

Equation (1) formalizes the pseudo first stage specification:

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[12]Namely, distance to the Indian border, distance to Kathmandu, elevation, and rainfall.

[13]VDCs were only introduced in 1971, and we need to rely on a georeferenced "settlements" map to track recruits from a subsample of VDCs.

[14]Our first stage is a "pseudo" one because it is at the between-VDC level while our main reduced form specification is at the within-VDC level. Nonetheless, our "pseudo" first stage is consistent with our main specification because only Gurkha caste members were "recruitable" into the British Army.
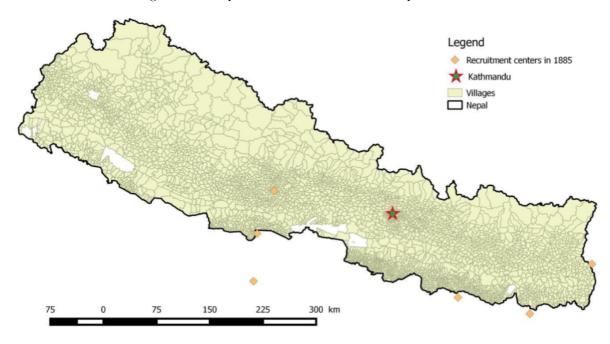
Figure 1: A map of the British recruitment depots in 1885

$$Recruits_v = \alpha_d + \beta(Gurkha\ Share_v \times Distance\ to\ Closest\ Depot_v) + \gamma Gurkha\ Share_v +$$
$$\psi Distance\ to\ Closest\ Depot_v + \delta \mathbf{X}_v + \zeta(Gurkha\ Share_v \times \mathbf{X}_v) + \epsilon_v \tag{1}$$

where $Recruits_v$ is a count of the number of recruits at the VDC level (based on World Wars casualties matched to VDCs), α_d indicates district fixed effects, $Gurkha\ Share_v$ is the share of Gurkha caste members in the VDC, and $\mathbf{X}_v$ is a vector of key geographical characteristics, i.e. distance to the Indian border and distance to Kathmandu, at the VDC level.

To lend support to the exclusion restriction assumption necessary for a good instrument, we test the correlation between distance to recruitment depots and other geographical characteristics, conditional on our key set of geographical control variables (distance to the Indian border, distance to Kathmandu, elevation, and rainfall).

3.2 Reduced Form

3.2.1 Overview

Our preferred specifications use the distance instrument in a reduced form regression run on the full sample of VDCs. Given both our absence of data on local, long-term recruitment intensities and the previously discussed limitations of our proxy measure, we do not opt for a 2SLS strategy.

Our main specification comprises a difference-in-difference estimator that captures the differential impact of distance to historical recruitment depots between recruited groups, i.e. the Gurkha castes, and non-recruited groups. Our analysis uses individual-level data from two sources. First, data on educational
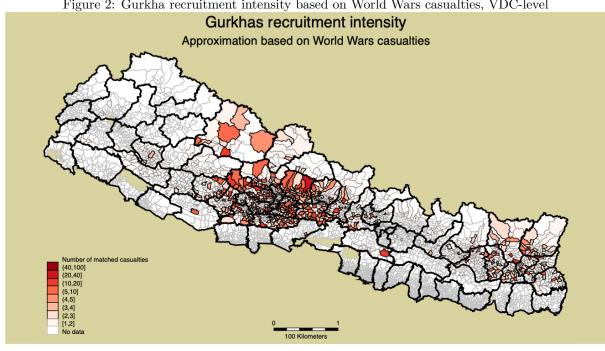
Figure 2: Gurkha recruitment intensity based on World Wars casualties, VDC-level

outcomes and age at first marriage from the 2011 census. Second, data on specific sex and marriage-related 'female empowerment' outcomes, such as contraceptives use, from three waves (1995/96, 2003/04, and 2010/11) of the Living Standards Survey (LSS). Equation (2) and Equation (3) formalize the specifications for census and LSS outcomes respectively:

$$
\begin{aligned}
Y_{i,v} =& \alpha_v + \beta(Gurkha_i \times Distance\ to\ Closest\ Depot_v) + \gamma Gurkha_i + \\
& \psi Distance\ to\ Closest\ Depot_v + \delta \mathbf{X}_v + \zeta(Gurkha_i \times \mathbf{X}_v) + \epsilon_i
\end{aligned}
\tag{2}
$$

$$
\begin{aligned}
Y_{i,v} =& \alpha_v + \mu_t + \lambda_m + \beta(Gurkha_i \times Distance\ to\ Closest\ Depot_v) + \gamma Gurkha_i + \\
& \psi Distance\ to\ Closest\ Depot_v + \delta \mathbf{X}_v + \zeta(Gurkha_i \times \mathbf{X}_v) + \epsilon_i
\end{aligned}
\tag{3}
$$

where μ_t and λ_m are time and month fixed effects to account for the survey wave and survey month, respectively.

These main specifications employ fixed effects at the VDC level — which relies on the within-VDC comparison of Gurkhas and non-Gurkhas — and cluster standard errors at the district level.

We allow not only the distance to historical recruitment depots but also all geographical controls to have a Gurkha-specific impact on outcomes. Table 1 shows summary statistics for the Gurkha share and key geographical variables at the VDC level.

To separate the effects of urban inmigration and urban education dynamics from the effect of Gurkha recruitment, we restrict the sample to rural regions. More specifically, we drop observations from the

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Table 1: Summary Statistics, VDC level

	Mean	SD	Min	Max
VDC Gurkha share	0.201	0.249	0.000	1.000
Distance to closest depot (km)	113.547	84.723	0.410	370.694
Distance to India (km)	56.046	40.152	0.322	212.254
Distance to Kathmandu (km)	198.565	130.812	0.000	531.721
Log avg elevation	6.362	1.333	3.829	8.583
Log avg rainfall	7.471	0.192	5.906	7.996

The logarithm of elevation in m and rainfall in mm per year was taken

already few officially defined urban areas in Nepal for three reasons. First, Gurkhas are typically rural ethnic groups and were predominantly historically recruited from rural areas. Second, urban areas receive a lot of inmigration while the same is not true for rural areas. Given that we are interested in long-term persistence, taking this migration into account becomes important[15]. Third and last, both the demand for[16] and the supply of education in urban areas may respond to different dynamics than in rural areas.

3.2.2 Additional Tests

For educational outcomes, we test two additional variation to our main specification. First, we run the regression in Equation (2) separately for men and for women. Finding an educational impact for not only men but also women suggests that there is not just a pure aspirational effect at play, in contrast to Shrestha (2016). Second, we explicitly control for an asset-based wealth indicator in order to assess if the positive impacts on education remain after accounting for wealth differences between Gurkha caste members and non-Gurkha caste members in historical recruitment grounds.

4 Data

4.1 Proxy for long-term recruitment intensities

We use data on Nepali casualties from the two World Wars, as found in the Commonwealth War Graves Commission (CWGC), as a proxy for long-term recruitment intensities[17].

4.2 Geographical Characteristics

We obtained coordinate (latitude and longitude) data for recruitment depots, the Indian border, and Nepali districts and VDCs to calculate the distance between a VDC/district and each of: recruitment depots, the closest point in India, and Kathmandu, using the ASTER digital elevation model and applying the Aitgen-Langmuir formula in GRASS GIS. We use satellite data on elevation and Tropical Rainfall Measuring Mission (TRMM) 3B43 data on rainfall products. All geographical and environmental variables are at the VDC level.

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[15] Acharya and Leon-Gonzalez (2019) discuss how searching for better education is one important motivation for migrating to urban areas among rural Nepali households having members abroad.

[16] For example, because of the higher return in expectation to education in urban settings compared to rural ones.

[17] Note that this proxy is specifically used in the pseudo first stage.

4.3   Census Outcomes

We use data on educational attainment, literacy status, age at first marriage, and ethnicity (caste identity) from the 2011 Nepal Population and Housing Census.

4.4   Nepal Living Standards Survey

We use cross-sectional data on specific female empowerment outcomes, including contraception use and the presence of non-farm woman-run businesses from three waves of the Nepal Living Standards Survey (1995/96, 2003/04, and 2010/11).

5   Results

5.1   Pseudo First Stage

We find that a 100 km decrease in the distance between a VDC and the closest historical recruitment depot increases the difference in the number of recruits (proxied by World Wars casualties) between that VDC and another VDC with an identical share of Gurkha caste members by 1.3 men (Table 2, column 1). These results support our interpretation of 'distance to recruitment depots' as a valid proxy for historical recruitment intensity of Nepali regions and villages. Even though the pseudo first stage is not identified at the within-VDC level by comparing Gurkhas with non-Gurkhas, this specification remains consistent with the reduced form specifications because the Gurkha castes are the "recruitable" castes. Columns 2-5 of Table 2 offer some support for the exclusion restriction. Conditional on our set of key geographical controls, distance to the closest historical depot does not appear to be associated with a differential effect on temperature, snow cover, or the distance to a main river between two VDCs with an identical Gurkha share.

Table 2: Pseudo First Stage

	(1) Number of Recruits	(2) Mean temperature	(3) Mean snow cover	(4) Log snow cover	(5) Dist to main river	(6) CDD	(7) Cooling days below 0
Gurkha sh. X dep	-0.0125***	-0.0129*	0.00000893	0.00000891	4.850	0.119	0.0138
	[-3.12]	[-1.95]	[0.47]	[0.48]	[0.54]	[1.26]	[0.67]
Village Gurkha share	-10.07	59.36***	0.110	0.106	-28959.9	400.6	84.72
	[-0.91]	[2.87]	[1.41]	[1.40]	[-1.21]	[0.88]	[1.01]
Gurkha sh. X India	0.0187*	-0.00223	0.0000106	0.0000100	34.36*	0.177	0.0519
	[1.90]	[-0.10]	[0.19]	[0.18]	[1.75]	[0.69]	[1.10]
Gurkha sh. X KTM	0.00349*	-0.00292	-0.0000146	-0.0000143	-0.427	0.0256	0.00370
	[1.76]	[-0.71]	[-1.25]	[-1.26]	[-0.10]	[0.40]	[0.31]
Distance to closest depot	0.00425	-0.000654	0.0000131	0.0000127	-13.88	-0.0256	0.00155
	[1.09]	[-0.09]	[0.70]	[0.69]	[-0.85]	[-0.37]	[0.08]
Distance to Kathmandu	-0.00254	-0.0132**	0.0000411**	0.0000401**	4.409	0.0577	0.0255
	[-0.79]	[-2.07]	[2.04]	[2.05]	[0.38]	[0.84]	[1.13]
Distance to India	-0.00951**	-0.0241**	0.000105***	0.000102***	-68.08***	0.233*	0.0763***
	[-2.11]	[-2.11]	[3.38]	[3.39]	[-4.96]	[1.83]	[2.70]
Log avg elevation	0.0776	-3.633***	0.00307***	0.00302***	2271.1***	4.265	1.540*
	[0.57]	[-8.14]	[3.48]	[3.49]	[4.18]	[1.09]	[1.86]
Log avg rainfall	-0.0934	8.454***	-0.0256***	-0.0250***	-4460.7*	-69.39	-20.48**
	[-0.18]	[4.34]	[-3.84]	[-3.86]	[-1.91]	[-1.40]	[-2.03]
Environment variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3913	3913	3913	3913	3913	3913	3913

Standard errors clustered at the district level

t statistics in brackets, * p<0.10, ** p<0.05, *** p<0.01

CDD := Cooling Degree Days: the number of degrees that a day's average temperature is above 0 Celsius, average over 2011

Cooling days below 0 := the number of days in 2011 for which the average temperature is below 0 Celsius)

Environmental variables: Log avg rainfall, Log avg elevation, Log avg rainfall X Gurkha sh., Log avg elevation X Gurkha sh.

KTM := Kathmandu

5.2 Reduced Form

5.2.1 Education

Table 3: Educational Outcomes, VDC level

	(1)	(2)	(3)	(4)
	Can read and write	Attending school	Education level 18+	Education level 40+
Gurkha X dist dep	-0.000374***	-0.000156***	-0.00603***	-0.00266**
	[-7.36]	[-4.38]	[-5.22]	[-2.54]
Gurkha	1.169***	0.534***	19.63***	12.39***
	[6.05]	[3.76]	[6.55]	[4.93]
Gurkha X dist India	0.000102	-0.00000853	0.00500	0.00198
	[0.42]	[-0.04]	[1.54]	[0.87]
Gurkha X dist KTM	0.000242***	0.0000524*	0.00400***	0.00183***
	[7.44]	[1.89]	[5.98]	[3.23]
Individual variables	Yes	Yes	Yes	Yes
Environmental variables	Yes	Yes	Yes	Yes
VDC Fixed effects	Yes	Yes	Yes	Yes
Observations	2497897	874723	1550756	655350

Standard errors clustered at the district level

t statistics in brackets, * p<0.10, ** p<0.05, *** p<0.01

Individual variables: Age, Dummy for Female

Environmental variables: Log avg rainfall X Gurkha, Log avg elevation X Gurkha

Table 3 displays the reduced form results on the relationship between distance to historical depots and educational outcomes. We find that a 100 km decrease in the distance between an individual's VDC and the closest historical recruitment depot increases the difference in the literacy rates and in the probability of attending school between Gurkha and non-Gurkha castes by 3.7 percentage points (column 1) and 1.6 percentage points (column 2), respectively. The difference in years of schooling for the 18+ year old cohort is about 0.6 years (column 3), and for the 40+ year old cohort is about 0.3 years (column 4). Results for all four educational outcomes are significant at the 1% level. Importantly, the 40+ year old cohort in 2011[18] were not subject to the educational requirements introduced by the British Army in the 1990s, indicating that the educational impacts of Gurkha recruitment go beyond the aspirational investments in education documented in Shrestha (2016).

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[18]As a reminder, we use data from the 2011 census.

Table 4: Educational Outcomes by Sex, VDC level

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Male				**Female**			
	Can read and write	Attending school	Educ level 18+	Educ level 40+	Can read and write	Attending school	Educ level 18+	Educ level 40+
Gurkha X dist dep	-0.000356***	-0.000137***	-0.00672***	-0.00429***	-0.000395***	-0.000173***	-0.00524***	-0.000986
	[-6.20]	[-4.37]	[-5.34]	[-2.85]	[-6.82]	[-3.77]	[-4.81]	[-1.64]
Gurkha	0.920***	0.256*	21.10***	18.70***	1.430***	0.810***	18.48***	5.784***
	[4.67]	[1.89]	[6.11]	[4.98]	[6.89]	[4.56]	[6.95]	[4.31]
Gurkha X dist India	-0.0000834	-0.0000405	0.00135	0.00125	0.000282	0.0000105	0.00796***	0.00248**
	[-0.36]	[-0.22]	[0.36]	[0.35]	[1.09]	[0.05]	[2.73]	[2.03]
Gurkha X dist KTM	0.000235***	0.0000589**	0.00446***	0.00314***	0.000244***	0.0000444	0.00353***	0.000634*
	[6.75]	[2.37]	[6.04]	[3.81]	[6.76]	[1.31]	[5.73]	[1.98]
Individual variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Environmental variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
VDC Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1181594	437288	709106	322516	1316303	437435	841650	332834

Standard errors clustered at the district level

t statistics in brackets, * p<0.10, ** p<0.05, *** p<0.01

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Table 5: Educational Outcomes by Sex (Accounting for Wealth Differences between Gurkha and non-Gurkha Caste Members), VDC level

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		Male				**Female**		
	Can read and write	Attending school	Educ level 18+	Educ level 40+	Can read and write	Attending school	Educ level 18+	Educ level 40+
Gurkha X dist dep	-0.000200***	-0.0000854***	-0.00329***	-0.00136	-0.000235***	-0.000109**	-0.00290***	-0.0000948
	[-2.89]	[-2.74]	[-4.30]	[-1.54]	[-5.06]	[-2.38]	[-4.89]	[-0.28]
Gurkha	0.569***	0.143	13.34***	11.25***	1.076***	0.671***	13.25***	3.516***
	[3.33]	[1.16]	[5.51]	[4.26]	[5.99]	[3.98]	[6.44]	[4.09]
Asset-based Wealth Index	0.0470***	0.0211***	0.908***	0.890***	0.0474***	0.0252***	0.628***	0.308***
	[6.57]	[5.82]	[10.89]	[15.59]	[8.72]	[4.97]	[15.04]	[24.93]
Gurkha X dist India	-0.000190	-0.0000903	-0.000581	-0.00125	0.000177	-0.0000279	0.00628**	0.00141
	[-0.79]	[-0.50]	[-0.21]	[-0.48]	[0.71]	[-0.13]	[2.62]	[1.44]
Gurkha X dist KTM	0.000127***	0.0000192	0.00220***	0.00140***	0.000144***	0.00000225	0.00209***	0.0000913
	[3.55]	[0.80]	[5.08]	[2.86]	[4.91]	[0.06]	[5.81]	[0.50]
Individual variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Environment variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
VDC Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1181594	437288	709106	322516	1316303	437435	841650	332834

Standard errors clustered at the district level

t statistics in brackets, * p<0.10, ** p<0.05, *** p<0.01

Table 4 runs the main specification separately for men and women. We see that both men and women benefit from exposure to the historical recruitment of Gurkha soldiers. Again, this finding suggests that the observed educational impacts are not the pure result of aspirational investments to improve the prospects of Gurkha service, as such effects would be limited to men.

Table 5 not only runs the main specification separately for men and women but also explicitly controls for an asset-based indicator of wealth[19]. While Gurkha groups tend to hold more assets in historical recruitment grounds[20], the positive impacts on education remain when we account for wealth differences. This finding is consistent with the idea that military recruitment changed the culture and preferences of recruited communities, as historians have long argued.

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[19]We construct this wealth indicator via principal component analysis on Census asset data. An updated version of our paper will account for wealth differences when assessing impacts on not only education but also female empowerment. Because the latter outcome family largely relies on LSS data and not Census data, we will need to use a different wealth indicator for these specifications.

[20]We ran a specification identical to equation (2), with this asset-based indicator of wealth as the outcome variable. The results from this specification – which we will report in the appendix of an updated version of this paper – suggest that in villages that are closer to historical recruitment centres, the Gurkhas hold relatively more wealth than the non-Gurkhas.

5.2.2 Female Empowerment

Table 6: Age at First Marriage, VDC level

	(1)	(2)	(3)	(4)
	Strictly older than 10		Strictly older than 40	
	Male	Female	Male	Female
	Dependent Variable: Age at first marriage			
Gurkha X dist dep	-0.00386***	-0.00297***	-0.00357***	-0.00244***
	[-5.40]	[-3.79]	[-3.29]	[-3.33]
Gurkha	7.825***	-1.410	-1.482	-18.25***
	[2.95]	[-0.58]	[-0.39]	[-4.79]
Age	0.00389*	-0.0245***	-0.0356***	-0.0580***
	[1.72]	[-8.26]	[-9.25]	[-11.60]
Gurkha X dist India	0.0127***	0.0119***	0.0176***	0.0148***
	[3.65]	[4.74]	[3.50]	[3.91]
Gurkha X dist KTM	0.00212***	0.000136	0.00278***	0.000112
	[4.18]	[0.27]	[3.59]	[0.17]
Environmental variables	Yes	Yes	Yes	Yes
VDC Fixed effects	Yes	Yes	Yes	Yes
Observations	626443	813819	317679	328858

Standard errors clustered at the district level

t statistics in brackets, * p<0.10, ** p<0.05, *** p<0.01

All regressions restricted to ever married individuals

Table 6 displays the reduced form results on the relationship between distance to historical depots and age at first marriage[21], split up by gender. For the cohort that is strictly older than 10 years, we find that a 100 km decrease in the distance between an individual's VDC and the closest historical recruitment depot increases the difference in the age at first marriage between Gurkha and non-Gurkha castes by 0.4 years for men (column 1) and 0.3 years for women (column 2) The point estimates are identical for the cohort that is strictly older than 40 years. All results are statistically significant at the 1% level. Particularly in the rural South Asian context, where underage marriage for girls is still rampant, women marrying later is plausibly a sign of empowerment.

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[21]As a reminder, this outcome is from the 2011 census. All remaining female empowerment outcomes are from the LSS (1995/96, 2003/04, and 2010/11).

Table 7: Additional Female Empowerment Outcomes (VDC FE), VDC level

	(1)	(2)	(3)	(4)
	Girl HH Members	Non-farm Work	Contraceptives Decision	Children Decision
Gurkha X dist dep	-0.00206***	-0.000431*	-0.00307**	-0.00160
	[-2.71]	[-1.96]	[-2.03]	[-1.07]
Gurkha	2.802	0.548	-0.495	2.325
	[1.47]	[0.91]	[-0.16]	[0.61]
Gurkha X dist India	0.000591	0.000707	0.0125	-0.00129
	[0.25]	[0.86]	[1.36]	[-0.24]
Gurkha X dist KTM	-0.000250	0.0000919	0.000519	0.000209
	[-0.51]	[0.83]	[0.50]	[0.22]
Environmental variables	Yes	Yes	Yes	Yes
VDC, Time, Month FE	Yes	Yes	Yes	Yes
Observations	8580	9219	553	656

Standard errors clustered at the district level

t statistics in brackets, * p<0.10, ** p<0.05, *** p<0.01

The dependent variables are as follows:

Column (1): Number of female children that are members of the household at the time of interview

Column (2): A dummy indicating a non-farm woman-run business

Column (3): A dummy flagging that, as per women, the decision on using contraceptives is made by both the woman and her spouse

Column (4): A dummy flagging that, as per women, the decision on no. of children is made by both the woman and her spouse

Table 8: Additional Female Empowerment Outcomes (District FE), VDC level

	(1)	(2)	(3)	(4)
	Girl HH Members	Non-farm Work	Contraceptives Decision	Children Decision
Gurkha X dist dep	-0.00134*	-0.000651**	-0.00219*	-0.00252**
	[-1.98]	[-2.35]	[-1.91]	[-2.26]
Gurkha	1.718	1.000*	1.674	3.687
	[0.97]	[1.76]	[0.64]	[1.24]
Gurkha X dist India	0.00120	0.000375	0.00358	0.00282
	[0.46]	[0.39]	[0.75]	[0.65]
Gurkha X dist KTM	-0.000454	0.000204	0.000162	0.0000908
	[-1.10]	[1.54]	[0.25]	[0.15]
Environmental variables	Yes	Yes	Yes	Yes
District, Time, Month FE	Yes	Yes	Yes	Yes
Observations	8580	9219	639	728

Standard errors clustered at the district level

t statistics in brackets, * p<0.10, ** p<0.05, *** p<0.01

The dependent variables are as follows:

Column (1): Number of female children that are members of the household at the time of interview

Column (2): A dummy indicating a non-farm woman-run business

Column (3): A dummy flagging that, as per women, the decision on using contraceptives is made by both the woman and her spouse

Column (4): A dummy flagging that, as per women, the decision on no. of children is made by both the woman and her spouse

Tables 7 and 8 display the reduced form results on the relationship between distance to historical depots and: number of female children living in the household at the time of interview; a dummy flagging a non-farm business run by a woman in the household; a dummy flagging that, according to women, the decision to use or not use contraceptives is made by both the woman and her spouse; and a dummy flagging that, according to women, the decision on number of children is made by both the woman and her spouse[22].

We find that a 100 km decrease in the distance between an individual's VDC and the closest historical recruitment depot increases the difference in the number of female children living in the household at the time of interview between Gurkha and non-Gurkha castes by 0.2 (Table 7, column 1), statistically significant at the 1% level. This result also hold with district fixed effects (Table 8, column 1).

Such a 100 km decrease increases the difference in the probability of having a non-farm business run by a woman between Gurkha and non-Gurkha castes by 4.3 percentage points (Table 7, column 2). This result also hold with district fixed effects (Table 8, column 2. A 100 km decrease in distance also increases the difference in the probability of both a woman and her spouse making the decision to use or not contraceptives — versus the woman alone, her spouse alone, or someone else altogether making this decision — *according to the woman*, between Gurkha and non-Gurkha castes by 30.7 percentage points (Table 7, column 3). This result also hold with district fixed effects (Table 8, column 3).

Finally, a 100 km decrease in distance to a historical depot increases the difference in the probability of both a woman and her spouse making the decision on number of children — versus the woman alone, her spouse alone, or someone else altogether making this decision — *according to the woman*, between Gurkha and non-Gurkha castes by 25.2 percentage points when district fixed effects are applied (Table 8, column 4). However, this result does not hold with VDC fixed effects (Table 7, column 4). This might suggest that all women in the VDC are 'empowered', and not just Gurkha women. There could be two eplanations. First, there is a variable at the village level (unknown to us) determining empowerment for women, and this variable is changing within a district and between villages. Second, Gurkha recruitment is empowering women, i.e. not just the wives of recruits but all women.

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[22]Both dummy variables on decision were constructed based on a survey question to women about who in the household makes a decision regarding contraceptives use/the size of the family.

Table 9: Share of Women Aged 15-49 Currently using Contraceptives in Female-Headed Households (District FE), VDC level

| | (1) |
	Contraceptives Use
Gurkha sh. X dist dep	-0.00434***
	[-3.06]
Village Gurkha share	6.138
	[1.37]
Gurkha sh. X India	0.00858
	[1.58]
Gurkha sh. X KTM	0.00164*
	[1.82]
Environment variables	Yes
District, Time, Wave FE	Yes
Observations	663

Standard errors clustered at the district level

t statistics in brackets, * p<0.10, ** p<0.05, *** p<0.01

Sample restricted to female headed households

Table 9 displays the reduced form results on the relationship between distance to historical depots and the share of women aged 15-49 currently using contraceptives, in female headed households. Note that in this particular specification, we use the VDC Gurkha share instead of an individual level dummy indicator for Gurkha ethnicity to be consistent with the outcome of interest, which is itself a VDC level share. We find that a 100 km decrease in the distance between a household's VDC and the closest historical recruitment depot increases the share of women aged 15-49 currently using contraceptives between that VDC and a VDC with an identical Gurkha share by 0.4, statistically significant at the 1% level. Given that contraceptives use is importantly affected by women's decision making power and their autonomy within the household, an increase in its current usage could be interpreted as a sign of female empowerment. As before, this is particularly true in a rural South Asian context.

6 Conclusion

Gurkha soldiers in Nepal have been recruited by the Indian and later the British armies for over 200 years. The transformational role that these soldiers played in the development of their home communities is often described informally, but is challenging to quantify. Our paper quantifies the long-term impact

of Gurkha recruitment on contemporary educational and female empowerment outcomes in Nepal, but remains agnostic on the extent to which the observed effects are direct ones.

Using the plausibly exogenous locations of British recruitment depots in the 19th century, we use a continuous difference-in-difference design to show that exposure to historical Gurkha recruitment is associated with improved outcomes for education and indicators of female empowerment today that are specific to the "recruitable" Gurkha castes.

We find that a 100 km decrease in the distance between an individual's VDC and the closest historical recruitment depot increases the difference in the literacy rates and in the probability of attending school between Gurkha and non-Gurkha castes by 3.7 percentage points and 1.6 percentage points, respectively. The difference in years of schooling for the 18+ year old cohort is about 0.6 years, and for the 40+ year old cohort is about 0.3 years. Importantly, the 40+ year old cohort in 2011 were not subject to the educational requirements introduced by the British Army in the 1990s, indicating that the educational impacts of Gurkha recruitment go beyond the aspirational investments in education documented in Shrestha (2016). For the cohort that is strictly older than 10 years, we find that a 100 km decrease in the distance between an individual's VDC and the closest historical recruitment depot increases the difference in the age at first marriage between Gurkha and non-Gurkha castes by 0.4 years for men and 0.3 years for women. The results are identical for the cohort that is strictly older than 40 years. These results using the 2011 Census data are all statistically significant at the 1% level.

Using LSS data from 1995/96, 2003/04, and 2010/11, we find that such a 100 km decrease in distance to a historical recruitment depot increases the difference in the probability of having a non-farm business run by a woman between Gurkha and non-Gurkha castes by 4.3 percentage points, statistically significant at the 10% level. We also find that a 100 km decrease in the distance between a household's VDC and the closest historical recruitment depot increases the share of women aged 15-49 currently using contraceptives between that VDC and a VDC with an identical Gurkha share by 0.4, statistically significant at the 1% level.

While our paper suggests that persistent historical Gurkha recruitment had a positive impact on contemporary local educational and specific female empowerment outcomes in Nepal, because these effects take place simultaneously over a long period of time, it is unclear whether there is, say, a direct effect of recruitment on the age at which a Gurkha woman first marries or if this effect is mediated through education. Similarly, we do not present conclusive evidence on the mechanisms through which we see a persistent impact on education. That being said, by comparing effects for different age groups and by sex, we are able to confirm that there is more than a pure aspirational effect at play. In addition, we find that wealth differences cannot fully explain the effect of military recruitment on education. This result is suggestive evidence on cultural transmission.

Of course, our research does not offer a full cost-benefit analysis of Gurkha recruitment, and we acknowledge that the trauma suffered by soldiers and their families from serving in wars cannot be measured in their analysis. Still, the experience of Nepal's Gurkha soldiers helps us to understand how colonial policies

targeted at particular groups, like the Gurkhas in this case, have contributed to differences in human development outcomes between groups. In addition, the experience of Gurkha soldiers shares many similarities with the one of present-day labour migrants. From that perspective, the long-run evidence provided by the authors of cultural transmission, can help us understand how migration changes the culture in the communities of origin.

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