TRANSPORT GLOBAL PRACTICE

ROADS TO SCHOOLS AND HEALTHCARE FACILITIES:

IDENTIFYING ACCESSIBILITY GAPS IN BURKINA FASO

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ABBREVIATIONS AND ACRONYMS

ACLED	Armed Conflict Location & Event Data Project
ARV	antiretroviral
BEPC	Brevet d'Etudes du Premier Cycle
BRT	Bus rapid transit
CEP	Certificat d'Enseignement Primaire
CM	Centre Médical (Health Center)
CMA	Centre Médical avec Antenne chirurgical (Health Center with a Surgical antenna)
CONASUR	Conseil National de Secours d'Urgence et de Réhabilitation (National Emergency Relief and Rehabilitation Council)
CPF	Country Partnership Framework
CPIA	Country Policy and Institutional Assessment
CSPS	Centre de Santé et de Promotion Sociale (Center for Health and Social Promotion)
DALY	Disability adjusted life year
EHCVM	*Enquête Harmonisee sur les Conditions de Vies des Ménages* (Harmonized Survey on Household Living Conditions)
EMC	*Enquête Multisectorielle Continue* (Continuous Multisectoral Survey)
FCV	Fragility, conflict, and violence
GDP	Gross Domestic Product
GFDRR	Global Facility for Disaster Reduction and Recovery
GP	Global Practice
HDI	Human Development Index
IDP	Internally Displaced Person
INSD	Institut national de la statistique et de la démographie (National Institute for Statistics and Demography)
LMIC	Low-to-middle-income country
MDGs	Millennium Development Goals
PPS	Post-primary or secondary school
RAI	Rural Accessibility Index
RMAT	Rayon moyen d'action théorique (average theoretical action radius)
SAE	Small-area estimation
SOTRACO	Société de Transport en Commun de Ouagadougou
SSA	Sub-Saharan Africa
TVET	Technical and Vocational Education and Training
UNDP	United Nations Development Program
UNHCR	United Nations High Commissioner for Refugees

EXECUTIVE SUMMARY

THE WHY: TRANSPORT ACCESSIBILITY AND HUMAN CAPITAL

Burkina Faso is an early adopter country in the World Bank's Human Capital Project, and its priorities in this area are reflected in the various sector-specific strategies. Human capital as an overall Government priority is also reflected in the World Bank Country Partnership Framework (CPF) 2018-2023.

Transport connectivity matters for people to be able to seek essential medical care and to be able to send their children to school. A growing global literature, including from countries in Sub-Saharan Africa, confirms that transport accessibility and affordability have an impact on human capital accumulation, via household behaviors and decisions such as those related to enrolling their children in school, choosing to keep them in school until completion, or seeing a qualified medical specialist at a health facility when in need of care.

Analysis conducted as part of the current study confirms that also in Burkina Faso transport connectivity has a strong and statistically significant association with such intermediate human capital outcomes as primary and post-primary/secondary (PPS) school enrollment, completion, and dropout rates**.** Controlling for household welfare, overall security situation, student-teacher ratios, and unobservable but potentially influential "Region effects", higher average travel time to nearest school is associated with distinctly lower school enrollment and completion rates and higher drop-out rates. In most cases, this is also the case for the Rural Access Index: Provinces with a higher share of the rural population living within 2 km of an all-season road have higher enrollment and completion rates both at the primary and the post-primary level as well as lower primary school drop-out rates. In other words, better transport accessibility to schools is associated with more children starting school and also staying in it.

A decrease in the average motorized travel time to the nearest PPS school by 10 minutes is associated with an increase in post-primary school completion rate by about 3.26 percentage points.

Maternal mortality would be expected to decrease by about 9 per 100,000 deliveries from about 56 per 100,000 deliveries at present, if average motorized travel time to the nearest primary care facility were to decrease by 20 minutes, *all else constant.*

The effect of lowering travel time to nearest school is particularly high and statistically significant for post-primary school completion rates. Moreover, **lowering average travel time to nearest school across nearly all outcome variables of interest has a slightly larger effect for girls specifically.**

The Rural Access Index – defined as the share of the rural population living within 2 kilometers of an all-season road – is found to have a statistically significant association with primary school gross/net enrollment and completion rates. Moreover, **it appears to matter more for girls' than for boys' ability to enroll in school and complete it to be located near a road that is passable throughout the year.**

Transport accessibility is also found to matter for important health outcomes such as maternal mortality. The study finds that the maternal mortality per 100,000 deliveries in Burkina Faso would be expected to decrease by about 9, from about 56 at present (the mean across all health districts except those in the Centre region), if average travel time to the nearest primary healthcare facility at the health district level were to decrease by 20 minutes, all else constant. Given that the current average travel times to the nearest primary care facility exceed two or even three hours in individual Provinces, lowering the travel time by 20 minutes would not be a significant relative change in a large part of the country, albeit would still require significant investment in the road network improvement.

ACCESSIBILITY GAPS IN BURKINA FASO

- *All-season access: population and facilities*

The Rural Access Index estimated for the country overall is about 23.8 percent, assuming that the road works that were ongoing or awaiting start in late 2019 are implemented**.** Clear gaps in accessibility remain particularly in the Sahel region, where the road network tends to be of poor or fair condition and no major rehabilitation works are ongoing or planned.

The country still has some way to go to reach the World Bank's *Sahel Region Strategy* target of 40 percent of basic health centers and primary schools having close access to an all-season road. The share of health and education facilities with direct access to an all-season road varies significantly across Burkina Faso's regions and tends to be better for more "advanced" facilities. Facilities lower in the hierarchy – Centers for Health and Social Protection (CSPS) – tend to lack all-season access, and the CSPS that are currently under construction or planned have *worse* accessibility to the network compared to the already functioning CSPS, suggesting that spatial coordination between road investments and health sector investments needs improvement. The medical centers tend to be well connected by the all-season road network, with nearly universal accessibility in the case of the health centers with a surgical antenna (CMA), although gaps exist in the connectivity between the more basic health centers and the CMAs, which inhibits movement of patients who are referred for more advanced care. Similarly, primary schools tend to be less well connected to the all-season road network compared to post-primary and secondary (PPS) schools.

> ¾ of Burkina Faso's rural population, or nearly 12.9 million people, do *not* have direct access to an all-season road. In parts of the Sahel region, the Rural Access Index is less than 5%.

< 1/3 of CSPS and < ¼ of public primary schools are located within 2 km of an all-season road.

- *Average travel time to nearest health facilities and schools*

Given the existing road conditions, accessibility to CSPS is better than to more advanced health centers – but only because of the wider availability of CSPS facilities across the country rather than due to better road access to these facilities – **with particularly large accessibility gaps observed in the Sahel and East regions.**

In the education sector, because of their wider availability, average motorized travel time is much lower to primary schools than PPS schools. The nearest primary school is about 36 minutes by motorized travel, the same as the nearest public primary school specifically. Average travel times to PPS facilities are comparably much longer. Moreover, it is clear that most children do not commute to school by motorized transport, as also suggested by the household surveys implemented as part of this study in the Boucle du Mouhoun and Centre-Est regions.

Less than 55% of Burkina Faso's inhabitants live within an hour's drive of a CSPS. The share is 58% if also considering the CSPS facilities that are currently planned but not yet functional.

Nearly 12 million people live in areas from which the nearest CM/CMU cannot be reached even within 4 hours of driving.

- *Conditions that further reduce accessibility*

Even where accessibility to schools is acceptable, schooling may not be affordable for the poorest. Indeed, the household surveys implemented in the two regions of Burkina Faso suggest that the affordability of education itself is a primary concern for households. The findings are comparable when it comes to seeking routine medical treatment: the affordability of care itself features more strongly among the constraints as perceived by the interviewed households. Still, travel distance, transport cost, and transport safety and security are also concerning for a significant share of the population.

Accessibility is also reduced during certain parts of the year due to flooding, a risk that is intensifying with climate change due to the increased risk of severe rainstorms, especially in Boucle du Mouhoun, Centre-Nord, and Plateau-Central.

Finally, in several regions, already low accessibility to health and education opportunities is overlapping with an intensifying security crisis, which has stranded thousands of households and imposed additional demands on existing facilities, while others have been closed due to security threats. In addition to increasing the student-teacher ratios in schools in the largest internally displaced person (IDP) recipient regions, the security crisis appears to have also played a significant role in household decisions regarding their children's schooling. The statistical analysis conducted as part of the study suggests that, especially at the primary school level, there is a strong negative association between security related school closures and gross and net enrollment rates and dropout rates.

- *Bus-based accessibility in Burkina Faso's largest city*

In Ouagadougou, accessibility by fixed-route public transport is particularly low to advanced healthcare facilities. As suggested by a recent comparative study covering ten major cities in Sub-Saharan Africa, Ouagadougou also compares unfavorably to its peers (see World Bank, 2020a). Two-thirds of Ouagadougou's population are "accessibility poor" when it comes to accessing hospitals, having to travel over an hour each way. Moreover, even where they are present, the SOTRACO bus lines do not appear to provide any tangible accessibility benefits to the immediately surrounding neighborhoods, explained by the limited speeds and yet more limited headways of the bus service on most routes. In other words, one has to live next to a facility for it to be accessible, while living near a bus line, even if this line connects to a facility, does not make much difference.

Average accessibility to schools in the city is reasonable, although the existing bus system offers little value-added compared to walking. The value-added provided by the SOTRACO network for accessing primary schools is only about a minute of time savings, on average, which is intuitive given that primary schools are widely available in the city and about 84

65% of respondents in rural regions identify transport availability as *the* most important or among the main constraints for accessing healthcare services.

1/3 of respondents consider physical safety & security while traveling as *the* most important or among the main constraints for sending their children to school.

70% of women of reproductive age in the rural regions bike or walk to reach a health facility, compared to only 40% of men.

Flood risk affects 26-29% of the primary, secondary, and tertiary road networks in individual regions of the country.

For the average resident of the city, it takes nearly 1 hour by SOTRACO bus to reach the nearest advanced healthcare facility (CMA/CHU).

This contrasts with an average of only 10 minutes if using a motorcycle.

In Ouagadougou, it takes, on average, 18 minutes and 24 minutes, respectively, to reach a public primary school and a public PPS school by bus.

percent of the population lives within a kilometer of at least one. The presence of PPS schools locally in residential neighborhoods is almost as high; however, only slightly more than a quarter Ouagadougou's residents live within close walking distance of a public secondary school specifically. For those who cannot easily walk to a school, relying on the bus network may not be feasible, either, as only slightly more than half of all primary schools and PPS schools are directly accessible from a bus line especially in the northern and south-western corners of the city, numerous schools are not connected to the bus network.

While among the overall city population 18% can access a hospital within 45 minutes of travel by bus, among the poor population the share is even lower – 10%.

"Accessibility poverty" with respect to schools –defined as travel time in excess of half an hour one way by public transport – affects 5 percent of the city's population in the case of both primary and PPS schools. However, while this share is relatively low, it does not reflect the very limited school *choice* that is also present, especially with respect to secondary schools.

The poorly spatially planned and inefficient bus network of Ouagadougou appears to reach the poorest neighborhoods of the city equally to the more well-off ones, although its effectiveness in terms of ensuring accessibility to health and education facilities is also equally low. The differences in accessibility between the overall population and the city's poor are greater with respect to healthcare facilities, especially the more advanced ones. These accessibility differences vis-à-vis the overall population appear to be mostly driven by the lack of advanced healthcare facilities and the few public secondary schools in the secteurs of the city where the poverty incidence and/or the density of the poor per area is high.

IDENTIFYING PRIORITY INTERVENTIONS

The very low RAI and high average travel times to schools and, especially, healthcare facilities in the Sahel and Est regions suggest that **road improvements there, coordinated with the provision of additional schools and healthcare facilities, would make the biggest impact in terms of potential beneficiaries, including internally displaced populations, helping to reduce fragility and conflict.** In the case of the Sahel region in particular, areas with very low accessibility to healthcare facilities but relatively high population density could be targeted for providing additional facilities; this is the case of part of the Soum province.

Given that communicable diseases, maternal, neonatal, and nutritional illnesses account for about 57% of all deaths and 62% of DALYs in Burkina Faso, improving access to primary care facilities (CSPS, CM) appears to be the most urgent priority.

In order to reach the Rural Access Index target of 30 percent established in the World Bank's *Sahel Region Strategy*, up from less than 24 percent today, a minimum of nearly 1,330 km of primary, secondary, and tertiary roads currently in a poor condition would need to be improved to a fair-to-good condition, primarily in Centre-Est, Nord, Centre-Nord, Plateau-Central, and Haut-Bassins regions. The cost per person connected would be several times higher if the RAI is to be improved to the 30-percent level in individual regions, such as Sahel, where population densities tend to be much below the country's average.

The criticality analysis conducted as part of the study identifies primary, secondary, and tertiary roads that are currently in poor or fair condition and are not slated for rehabilitation but that play a critical role in the local connectivity to health and education opportunities; in particular, long segments of such priority roads are identified in the Est, Centre-Est, and Sahel regions. **A comparison of the roads that should be**

prioritized for improvement if considering their criticality in providing connectivity to health and education opportunities to those that should be targeted in order to improve the country-wide Rural Access Index at minimum cost suggests that the overlap is only partial. Most notably, nearly all of the primary, secondary, and tertiary roads in poor condition in the Est and Sahel regions should be prioritized according to the first criteria, but only a few of those – according to the second. To a large extent this is also the case in Boucle du Mouhoun and Sud-Ouest. On the other hand, in Nord, while many of the roads would be prioritized for improvement based on their role in increasing the national RAI (due to relatively high surrounding population density), only some of these roads are highly critical for connectivity to key social services. The alignment between the two criteria is the closest in regions such as Centre-Nord, Haut-Bassins, and Centre. If raising accessibility to schooling and healthcare opportunities is a priority, the RAI should not be the sole criterion for the prioritization of investments in the rural road network.

Improving accessibility to advanced healthcare opportunities in Ouagadougou will likely require quite fundamental and costly improvements in the city's transport system and strategic changes in land use planning at the metropolitan scale to ensure that future population growth is channeled into areas that are – or that could be – served by efficient public transport or that surround existing or potential new health facilities**.** Simulations conducted as part of this study suggest that a well-planned mass transit system (likely, a trunk Bus Rapid Transit with appropriate feeder services) will significantly reduce travel times for many people, even if only marginally reducing the average travel times in the city overall. Nevertheless, institutional coordination between, on the one hand, transport and housing sectors and, on the other hand, the health sector will be essential to ensure that any new health facilities that are built are served by current and the planned bus services or are located directly within rapidly densifying neighborhoods, such as on the city's western periphery. As proposed in SSATP (2020), a Transport Council for the Greater Ouagadougou metropolitan area should be operationalized to bring together the city of Ouagadougou and the seven neighboring municipalities and thus ensure efficient, metropolitan scale transport and urban planning.

Improving accessibility to schools in the city could be achieved through targeted siting of a few additional school facilities in the (relatively limited) areas currently characterized by excessive travel times or through the provision of school bus services to allow the children living in these areas to reach the existing school facilities within a reasonable travel time. Considering the importance of biking, walking, and motorcycle transport in Ouagadougou's mobility, especially of the poorest residents, investments in non-motorized transport infrastructure and safe space for motorcycles on the existing road network would help improve accessibility to both health and education facilities for many of the most vulnerable residents. In particular, well-lit and safe pedestrian infrastructure is essential to improve the safety of girls on their road to school.

1. STUDY BACKGROUND AND OBJECTIVES

Education and health are important dimension of wellbeing. Education allows individuals to acquire the necessary skills and tools to better meet their needs and those of their children, which promotes household productivity and increases their living standards (Agbodji *et al*. 2013), and differences in access to both schooling and healthcare lead to impacts that persist for generations. The Sub-Saharan Africa (SSA) region has the largest return on education of any continent, with each additional year of schooling raising earnings by 11 percent for boys and 14 percent for girls. However, while the region's countries have made tremendous progress in ensuring equal access to education and healthcare for their people, many – including Burkina Faso - continue to rank towards the bottom of the World Bank's Human Capital Index (HCI) or the United Nations Human Development Index (HDI). The existing data also suggests that gender gaps, while diminishing, persist, especially in access to secondary education.

With Burkina Faso's continuing urbanization, also inequalities in access to schooling and healthcare are becoming increasingly urban issues while at the same time the most extreme access gaps are likely to remain concentrated in the country's most rural, isolated regions. Moreover, for people living in both rural and urban parts of the country, geographic distance to health and education facilities may not be the only or primary constraint to accessing schooling or healthcare; education and healthcare services, even when accessible, may be of poor quality or unaffordable. Making progress in closing the education and health gaps in the country requires robust evidence on the full set of constraints that prevent people from realizing their education and health potential.

Transport connectivity and human capital indicators in SSA are highly correlated at the country level; for example, there are strong correlations between a country's Rural Access Index (RAI)– or the share of the rural population living within 2 km of an all-season road – and adult literacy, primary school completion rates, and maternal mortality ratios. While less is generally known about the specific accessibility gaps in African cities or how these affect household decision-making regarding schooling or healthcare, it is clear that, with the rapid growth of cities, also urban transport connectivity is becoming increasingly central to equal physical access to education and healthcare.

The current Country Partnership Framework (CPF) for Burkina Faso defines human capital development and reduction of spatial inequalities as one of their core pillars. Progress on the ground, however, requires a more fine-grained understanding of gaps in accessibility to schools and health centers and their linkages to actual health and education outcomes, in order to be better able to plan and target physical connectivity investments and policies.

This analytical study aims to generate knowledge on the current state of physical accessibility to health and education services in rural Burkina Faso and in Ouagadougou – and inequality in accessibility across space and by population group – and to provide insights on the linkages between physical gaps in accessibility and actual intermediate outcomes in household education and health behaviors, Specifically, the study addresses the following questions:

1. How well does the existing public transport system in Ouagadougou connects people to education and healthcare opportunities?

2. How well connected are rural households to education and healthcare facilities, via the existing road network, considering the available rural transport (formal or informal) services, the climate-related impediments to road usability, and the additional constraints associated with the prevailing security situation?

3. Are there spatial and socio-demographic inequalities in accessibility within the city and within the country?

4. What are the transport sector and cross-sectoral interventions that could improve accessibility to education and health opportunities in the country overall and in Ouagadougou specifically?

5. Are there spatial associations between inequality in the physical accessibility to schools and health centers and inequality in intermediate human capital outcomes?

2. CONTEXT

2.1. Population, poverty, and human development

Burkina Faso is one of the poorest countries in the world. Gross Domestic Product (GDP) per capita was just US$787 in 2019, according to the World Bank World Development Indicators, and 80 percent of the population lives on less than US$3 per day. The country is among the least urbanized in West Africa, with less than a third of population living in urban areas; nevertheless, it is catching up, with impressive urban population growth of nearly 6 percent annually (Nguyen and Dizon, 2017). Nonetheless, at present, most of Burkina Faso's provinces can be characterized as *ultra-remote rural* localities, with fewer than 50 people per square kilometer (Uchida and Nelson, 2010), with *rural* areas (population density of between 50 and 150 people per km^2) concentrated in the central and southeastern part of the country, and only the region around Ouagadougou qualifying as an *ultra-dense urban* locality (>300 people per km^2). Overall population density averages 64 people per km^2, among the lowest in the world.

Burkina Faso is landlocked and located in one of the most fragile regions of the world. These challenges are compounded by climate change, which has increased the risk of natural hazards – limited and unreliable rainfall, increased frequency of droughts and floods – exposing key economic and social development sectors to greater vulnerability. Flooding also poses challenges to mobility by rendering many roads and bridges impassable. Flood risk across the country, including in the most populated urban areas, has increased significantly over time not only due to climate change but also human factors. In Burkina Faso overall, while approximately three flood events per year were recorded over 1986–2016, the number increased to 5 per year in the 2000s (Tazen *et al.*, 2018).

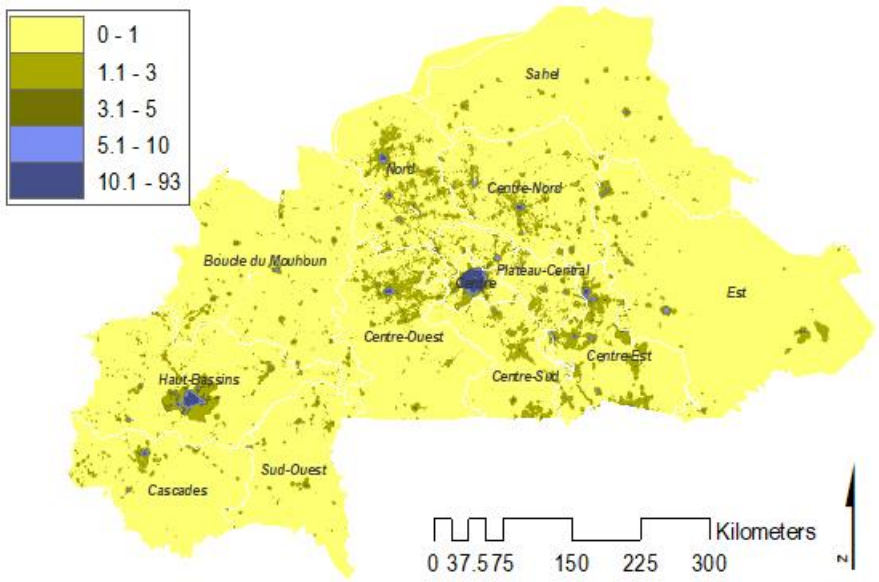


***Figure 1**: Population density per 100m x 100m*

Source: World Pop (2020) data

Burkina Faso has made significant progress in poverty reduction in the last 15 years. The poverty rate fell from 53 percent in 2003 to 40.3 percent in 2014, and growth has been pro-poor. The bottom 40 percent of the population reported an increase in consumption twice as large as that of the top 60 percent, as annual GDP growth averaged over 6 percent during this period. However, poverty remains high in certain regions, exceeding 60 percent in Nord and Centre-Nord regions, according to a poverty assessment completed in 2021 with World Bank assistance, compared to less than 10 in the Centre region where Ouagadougou is located. Moreover, the *poverty mass*—the number of poor people—is highest in low-density areas, which suggests that the cost of service delivery programs to physically reach the poor is relatively high (Nguyen and Dizon, 2017).

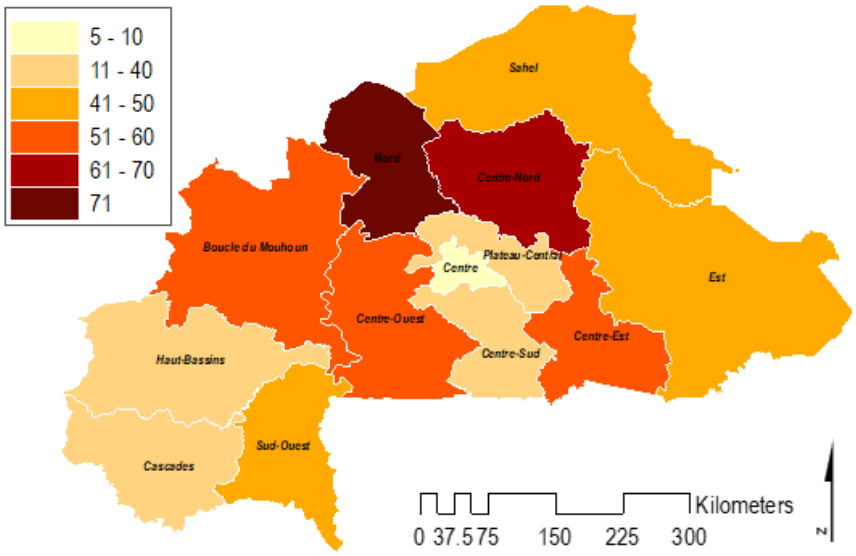


Figure 2: *Poverty rate at the regional level considering the national poverty line, 2020*

Source: World Bank (2021)

Human capital accumulation – education and health – play a central role in Burkina Faso's strive to eliminate poverty. According to a multi-dimensional poverty analysis conducted by the World Bank a few years ago, overall, individuals in Burkina Faso are the most deprived in *education*, with a deprivation rate of about 72%; women are significantly more deprived than men, and rural residents – significantly more than urban (Agbodji *et al*. 2013).

Burkina Faso has the lowest mean years of schooling of all countries for which data is available – a mere 1.4 years – explaining its ranking as only 185th among the 188 countries ranked in the United Nations HDI. At the primary level, the gross enrollment rate increased from 81.3 percent in 2012/2013 to 88.8 percent in 2018/2019, equivalent to actual enrollments increasing from 2.4 million to 3.2 million. Nevertheless, Burkina Faso remains among the countries with the lowest rates of access to primary education (World Bank, 2017). Moreover, the probability that a child remains in school after the primary level remains low: only a quarter of the 13-16-year old children are still enrolled at school and only 5 percent of those between ages 17 and 19 (World Bank, 2016).

The poor performance of the education sector is explained by both supply- and demand-side factors. On the supply side, lack of financial resources and limited autonomy among the public education providers have prevented the development of appropriate infrastructure, the provision of equipment and the recruitment and deployment of qualified staff. Quality issues are increasingly of concern, as the quantitative expansion has not been matched by comparable achievements in the quality of service delivery and student learning (World Bank, 2017). The ratio of qualified teachers to the population, meanwhile, is among the lowest in the world. Since poverty in Burkina Faso is mostly concentrated in rural areas, it is thus the poor that have disproportionately lower coverage. The poorest households enjoy very limited access to secondary education and even less to tertiary education. Private services have emerged, but the quality is sometimes poorer than that of public services, and these are generally beyond the means of the poorest households. In addition to the spatial disparities in coverage, disparities between girls and boys persist in accessing and completing secondary schooling in particular. Moreover, even when children attend primary school, only half of graduates have acquired basic reading and mathematics skills. Finally, the recent insecurity in certain regions of the country has negatively impacted the performance of education, a topic this study addresses in detail in section 5.3.

On the demand side, many families suffer from financial constraints, exacerbated by the distance between homes and schools. The uneven level of education quality, combined with cultural bias, continues to discourage many parents from investing in their children's education, particularly after the primary cycle. Affordability and financial considerations are clearly influential factors: very few household heads in the lowest income quintile have ever attended school, compared to at least half of the highest quintile ones.

According to the most recent poverty assessment, Burkina Faso has a relatively good track record in the health sector, with maternal mortality having declined over time and compared to the average of the Africa region (371 against 547 per 100,000 live births). Similarly, the under-5 child mortality has declined, from 168 per 1,000 in 2003 to 81 in 2018. Despite this progress, governance issues in the health sector have contributed to inequalities in staffing and infrastructure across regions and across socio-economic groups. Since 2003, health has received at least 10 percent of the government budget each year, reaching 12 percent in 2017 (Ministère de la Sante *et al*., 2020a). However, the allocative and technical efficiency challenges constrain progress, and the fragmentation of financing through targeted and donor-driven approaches weakens health sector governance and accountability. Despite a threefold increase in health financing over the past years, Burkina Faso remains off track in terms of meeting the Millennium Development Goals (MDGs), and recent assessments of the sector performance have concluded that the spending level of US$11.9 per capita should bring much better results in health outcomes than have been observed.

According to 2019 data,[1] over 56 percent of deaths and 62 percent of disability adjusted life years (DALYs) in Burkina Faso overall and even higher shares specifically among women were attributed to diseases that could be treated at the primary care level, including communicable diseases, maternal and neonatal disorders, and nutritional diseases. The importance of improving maternal and infant care is highlighted by the fact that maternal and neonatal diseases account for over 11 percent of all deaths and over 13 percent of DALYs, and it is the fourth single largest cause of death in the country.

Gaps in access to healthcare services, both in terms of distance and affordability, are generally considered to be a key contributor to poor health outcomes. Some progress has been made in reaching the policy goals defined in the earlier National Health Development Plan 2001-2010: in urban areas, the ratio of population per Health and Social Promotion Center (CSPS) – offering basic healthcare services – decreased from 14,177 to 9,835 in 2001-2009 (compared to the defined goal of 10,000) (Ministère de la Sante, 2011). However, the ratio is many times higher with respect to any of the more advanced medical facilities (medical centers and hospitals).

Table 1: *Key indicators of current health and education status in Burkina Faso*

HEALTH	
Child mortality (<5) per 1,000 live births	81
Infant mortality per 1,000 live births	51
<5 children with suspected pneumonia taken to health provider (%)	52
Infants who receive 3 doses of DTP vaccine	91
Children who received the 2nd dose of measles containing vaccine	50
Antenatal care coverage four at least 4 visits (%)	47
Proportion of births attended by skilled medical personnel (%)	80
Births who had their first postnatal checkup within the first 2 days after birth (%)	33
Maternal mortality per 100,000 live births	371
EDUCATION	
Attendance in early childhood education (%)	3
Adjusted net attendance rate, primary education	52
Adjusted net attendance rate, lower secondary education	18
Adjusted net attendance rate, upper secondary education	5
Completion rate, primary education	31
Youth (15-24) literacy rate	50
Adult literacy rate, male	37
Adult literacy rate, female	22

Source: UNICEF (https://data.unicef.org/country/)

[1] https://vizhub.healthdata.org/gbd-compare/

2.2. Overview of relevant policy goals and strategies

The education system in Burkina Faso is divided into pre-school education, primary education, secondary education, and tertiary education. Pre-school education is limited to a few private kindergartens generally located in major cities. Primary school comprises a cycle of six grades that ends with receipt of the primary school certificate *Certificat d'Enseignement Primaire* (CEP). Secondary school consists of a lower secondary cycle of four years, culminating in the lower secondary certificate BEPC (*Brevet d 'Etudes du Premier Cycle*), and an upper secondary cycle of three years, which successful students complete with the attainment of the Baccalaureate. Tertiary education comprises the formal post-secondary sub-sector. Technical and Vocational Education and Training (TVET) is provided at the secondary and tertiary levels of education. The ministry of National Education, Literacy and Promotion of National Languages ensures the implementation and monitoring of the government's policy on pre-school education, primary and secondary education, technical and vocational training, and non-formal education. The Technical Directorates of the Ministry are in charge of operationalizing and coordinating the strategy of the Ministry while the deconcentrated Regional Directorates supervise the activities at the local level.

Burkina Faso's Education Policy Act provides for free schooling and mandatory attendance for students, reducing gender gaps and increasing enrolment,[i] and children with disabilities who have a disability card have the right to education based on Act No. 012-2010/AN of 1 April 2010.[ii] The Act also requires that schools themselves be "adequately equipped to accommodate pupils with disabilities," and also provides that transport companies must make transport accessible to persons with disabilities.[iii] Nonetheless, difficulties to access public services continue, particularly affecting girls' school attendance.[iv] Free primary health care in Burkina Faso is guaranteed, but not all medical procedures are free of charge,[v] and infant and child mortality remains high. Persons with disabilities have the right to free consultations and treatment.[vi]

The National Study for "Burkina 2025" (Conseil National de Prospective et de Planification Stratégique, 2005) defined a Vision 2025 for Burkina Faso as a nation that ensures access for all to quality education and healthcare services. The National Health Policy (Ministère de la Santé, 2011) presents a vision that is aligned with the National Study for "Burkina 2025". The earlier National Health Development Plan 2001-2010 (Ministère de la Santé, 2001) specifically acknowledged the limited financial and geographic access to health services and defined specific targets with respect to the most basic healthcare facilities: in rural areas, there should be a Health and Social Promotion Center (CSPS) within a 10-km radius; in urban/dense areas, one CSPS should be available for 10,000 people.

The Government's National Plan for Economic and Social Development *(Plan National de Développement Economique et Social*, PNDES) (Government of Burkina Faso, 2016) has three strategic axes, including development of human capital. Specific strategic objectives include the promotion of population health and acceleration of the demographic transition, which is expected to guarantee access to quality health services for all. Another objective is to increase the supply and quality of education, including access to quality higher education. Furthermore, the Basic Education Strategic Development Program (*Programme de Développement Stratégique de l'Education de Base, PDSEB*) 2012-2021 clearly establishes the Government's education sector priorities, namely, to: (a) fully operationalize the principles of compulsory and free public education (to be gradually extended to the lower secondary education); (b) improve the transition from primary to lower secondary education; (c) reduce overcrowding; and (d) strengthen school management (see Ministère de l'Enseignement de Base et de l'Alphabétisation, 2012). The Sectoral Program for Education and Training 2012-2021 (Ministères en Charge de l'Education, 2013) goes further in that it specifically recognizes the role of transport accessibility in reaching education goals. Under the theme of access to formal education and training, the document notes the need to improve the study conditions for students, including transport to schools; with respect to higher education, it proposes acquiring dedicated bus transport.

Most recently, in response to the COVID-19 crisis, the Government has developed a strategy for education service delivery in high security risk areas. This strategy commits to the continued education of affected children and offers options where education can be delivered in host communities and in areas of residence according to various alternative education delivery models such as school shifts reorganized by taking into account non-classroom activities;

modular catch-up programs and accelerated courses to make up for the time lost by internally displaced persons and refugees; alternative education programs (Koranic, education for nomadic groups); and expansion of the Franco-Arab Education Program according to community demand. The Government has also engaged in discussions with private firms providing digital solutions to ensure continuity of education in the affected areas.

The National Housing and Urban Development Policy (Ministère de l'Habitat et de l'Urbanisme, 2008) envisions that urban planning should provide people with access to transport infrastructure, education and health facilities, while recognizing the so-far poor implementation of urban planning guidelines. In 2014, the Ministry of Housing embarked on the "Preparation of the National Habitat III Report" of Burkina Faso (2015). Among the issues addressed by the report were the need to respond to the needs of the youth in the urban environment and the need to integrate gender equality in urban development, including by removing barriers for girls to enroll in- and complete- school. The National Urban Mobility Policy 2030, which is part of the current National Economic and Social Development Plan (2016–2020), intends to improve access to health and education services for as many people as possible. To this end, the Commune of Ouagadougou has developed an Observatory for Urban Movement, a mechanism of coordination and collaboration that aims to centralize information regarding the mobility practices of the city's residents and brings together various transport stakeholders. In the rural roads sector, the Government's *Strategie de Developpement du Secteur des Transports au Burkina Faso 2011-2025* has set a goal of building 400 km of roads per year in order to reach a total length of 21,300 km fully engineered roads by 2025 and 40 percent of the population having access to an all-season road.

As demonstrated by the above summary of the key strategies and sector-specific policies, the Government is clearly committed to improving Burkina Faso's human capital outcomes. Moreover, the World Bank and other development partners have been supporting these objectives through both national-scale and region-specific projects in the transport, education, health, and governance sectors, as well as, more recently, cross-sectoral projects addressing the overall security and fragility issues (to be discussed in section 5.5). The analysis presented in the following sections aims to provide further – *spatially* anchored and detailed – evidence to support this sustained commitment and to help guide the formulation of targets and priority interventions going forward.

3. THE STATE OF TRANSPORT CONNECTIVITY IN BURKINA FASO

3.1. Road conditions and Rural Access Index

Despite its importance for the country's economic development and human development objectives, the transport sector faces multiple issues, ranging from inefficient services, to inadequate infrastructure, and insufficient institutional capacity to adequately manage the sector issues. One of the core issues of the transport sector is the lack of funds to finance priority investment in national and rural roads to improve connectivity and mobility, including insufficient funds allocated to the Special Fund for Road maintenance. The lack of funding contributes to poor road asset preservation – a critical issue due to the non-enforcement of the axle load control on Burkina Faso's roads. The poor state of the road network leads to overall low rural and urban mobility that prevents the country from opening its agricultural production zones; improving access to education and health services; and spurring economic development. Especially in the context of limited funding, there is also a need to more effectively prioritize and target road improvements and to coordinate them with policy actions and investments undertaken in sectors such as education, health, and rural and urban development.

The state of transport infrastructure in Burkina Faso is weak, and the provision of transport services remains altogether absent in rural areas. The rural inhabitants, which represent about 80 percent of the country's population, face particularly severe accessibility constraints due to the low coverage of good-quality roads. Of the country's classified road network of about 15,300 km only 20 percent are paved. About half of the non-classified road network of about 46,000 km (mostly rural roads) is impassable during the rainy season. Figure 3 illustrates the known condition of the main roads, based on data received from the Ministry of Transport in late 2019, which also illustrates the road segments that were either under construction or awaiting construction.

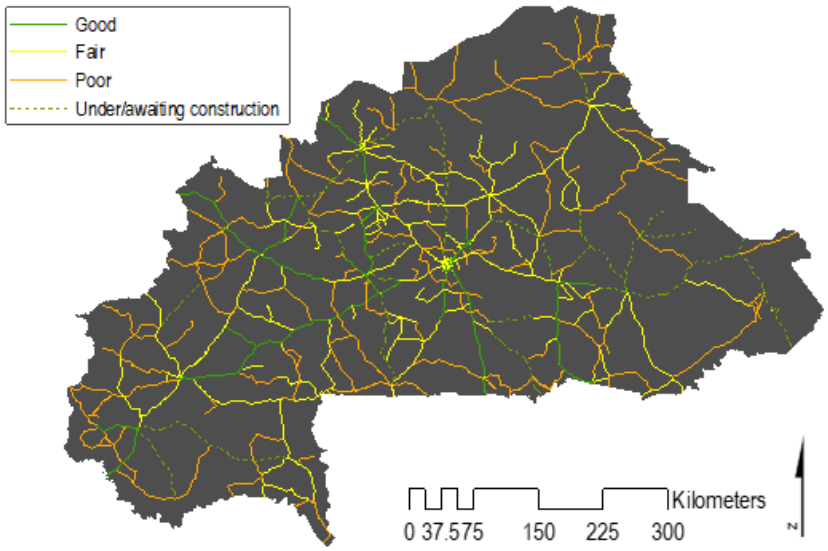


Figure 3: *Known condition of the classified road network*

Source: DGNET / DNP

Based on this data on the road conditions and the 2020 population estimates available from World Pop, the Rural Access Index (RAI)[2] is only about 23.8 percent for Burkina Faso overall – out of the country's 16.89 million rural inhabitants, only 4.01 million live near a road that can be considered all-season while nearly 12.9 million remain unconnected. Moreover, the RAI varies quite

[2] In estimating the RAI, roads more minor than tertiary (such as cycleways or tracks) are not considered to be all-season since they are mostly unpaved; main roads known to be in a "poor" condition are not considered to be all-season either. Roads under/awaiting construction as of November 2019 (marked by dotted lines in Figure 3) are considered to be all-season in this analysis.

significantly across the Provinces (see Figure 4): in the central areas, it exceeds 35 percent, compared to less than 15 percent in many peripheral areas. By region, RAI ranges from just 8.5 percent in Sahel to nearly 50 percent in Centre (Table 2). In fact, the high RAI in the Centre region drives up the overall average RAI for the country, while in five of the thirteen regions RAI is actually below 20 percent. Sahel has the lowest *percentage* of rural residents that can easily access an all-season road; however, the highest *absolute* unconnected rural population is in Haut-Bassins, Est, and Boucle du Mouhoun, exceeding 1.35 million in each.

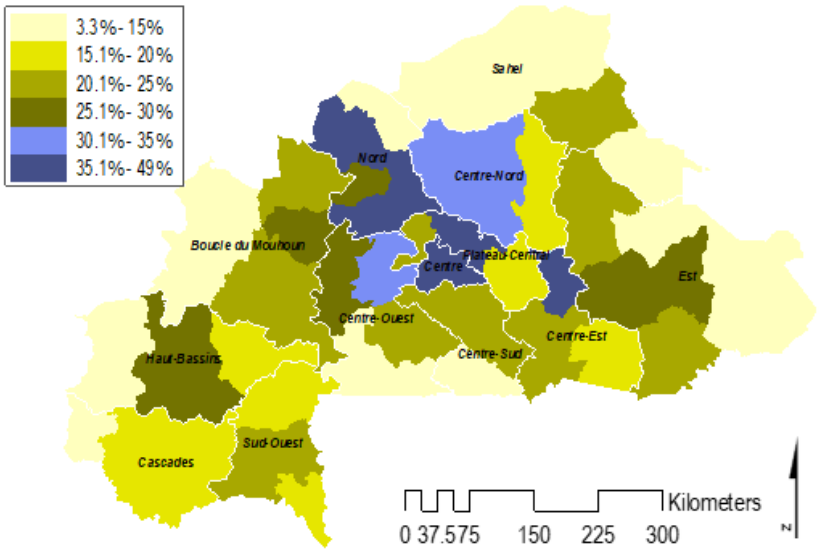


***Figure 4**: Rural Access Index, by province*

Source: Estimated using World Pop (2020) population data and available road network condition data

***Table 2:** Rural Access Index and unconnected rural population, by region*

	RAI (% OF RURAL POPULATION)	UNCONNECTED RURAL POPULATION
BOUCLE DU MOUHOUN	18.3	1,366,571
CASCADES	15.3	821,472
CENTRE	49.4	604,002
CENTRE-EST	26.4	1,038,077
CENTRE-NORD	27.2	1,089,502
CENTRE-OUEST	25.5	1,044,340
CENTRE-SUD	18.6	630,776
EST	20.2	1,425,467
HAUT-BASSINS	22.7	1,462,801
NORD	32.7	897,329
PLATEAU-CENTRAL	24.3	598,657
SAHEL	8.5	1,219,203
SUD-OUEST	18.2	679,639

Source: Estimated using World Pop (2020) population data and available road network condition data

3.2. Public transport in Ouagadougou

Ouagadougou makes up roughly 45 percent of Burkina Faso's urban population, concentrating about 2.5 million inhabitants, and is growing at a staggering 9 percent annually, with associated challenges to efficient mobility. Ouagadougou almost tripled its built-up area between 1983 and 2005, according to *Schéma Directeur du Grand Ouagadougou* of 2008, expanding in the form of urban sprawl and informal housing development in the periphery. As a result, travel demand is increasing rapidly: the flow of people moving into and out of the city center each day was estimated to

have reached 1 million in 2014 and is expected to double by 2030, while the length of trips is also increasing. Based on the global built settlements dataset, the built-up land area in the Centre region in which Ouagadougou is located increased by about 77 percent between 2001 and 2019, with many of the newly built-up areas located along the major roads. Beyond the boundaries of Centre, significant new development in the two decades emerged in the communes of the Grand Ouagadougou, around nearby towns such as Loumbila and Ziniare to the northeast and Kombissiri to the southeast.

Figure 5: *Growth in built-up settlements vis-à-vis the SOTRACO bus network, 2001-2019*

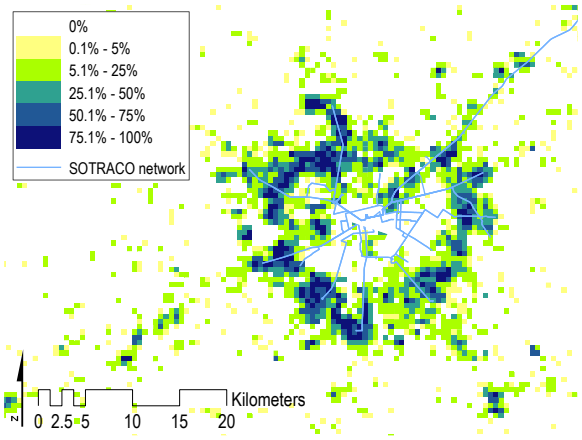
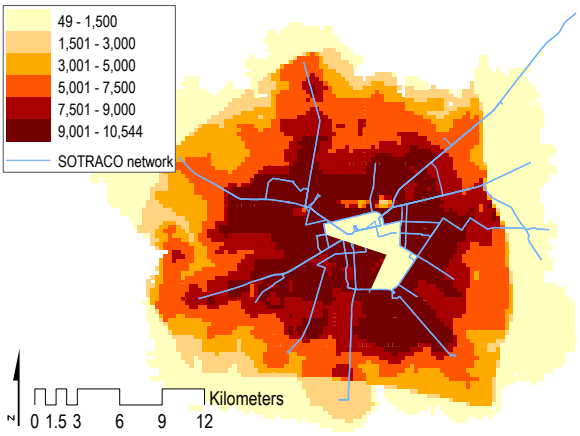


Figure 6: *SOTRACO bus network and population density per km², 2020*



The share of public transport in Ouagadougou's mobility is declining, and two-thirds of all trips in the city are made by motorcycle. This is in contrast to other West African capital cities where transport services are dominated by paratransit – moto-taxis, minibuses, and similar. Bus ridership is very low and represents less than 1 percent of total trips; half of all trips in the city are made on foot. Bus transport services are provided by SOTRACO (*Société de Transport en Commun de Ouagadougou*). In 2012, it operated about ten lines with about 30 functional buses at a modest frequency of one bus every 20 or 30 minutes. In 2017, the bus frequency was reduced further, to one bus every 45 minutes, on average. The buses still in operation are overloaded and unreliable (Commune of Ouagadougou, 2019). The spatial coverage of the bus system is low considering the population distribution, with only the very central city relatively well served (Figure 6). As a result, only about 47 percent of the residents of the city of Ouagadougou live in direct proximity – "walking distance" – to the bus network, as measured by a 1-km radius. This is in contrast to cities like Nairobi or Kampala, where the respective shares approach 90 percent (see World Bank, 2020a).

Thus, the ability of the existing public transport system to ensure efficient accessibility to schools, clinics, and other key destinations is presumably low. Given these trends, the Government is considering options for improving public transport services in the city, possibly introducing new, efficient mass transit. Details on these planned improvements – and their likely impacts on accessibility to schools and healthcare facilities specifically – are presented later in the analysis, drawing on feasibility studies produced as part of the World Bank financed Ouagadougou Urban Mobility Project (under preparation).

4. THE SPATIAL DISTRIBUTION OF HEALTH & EDUCATION FACILITIES

4.1. Rural Burkina Faso

Primary and post-primary/secondary (PPS) schools and their public versus private status were manually geo-located by the study team based on preliminary data from the Ministry of Education. Vast – albeit sparsely populated – rural areas in the country do not have any schools in their proximity. Only 7,065 villages and towns (hereafter "localities") have any type of primary school, out of a total of over 11,500.

Of all the localities, 6,974 have at least one public primary school present; their distribution vis-à-vis the classified road network is shown in Figure 7. Large parts of the Sahel and Est regions have no availability of public primary schooling; however, also many of the existing public primary schools in the other regions are located in areas far from the classified road network or near roads in poor condition: only about a quarter are within 2 km of an all-season road.

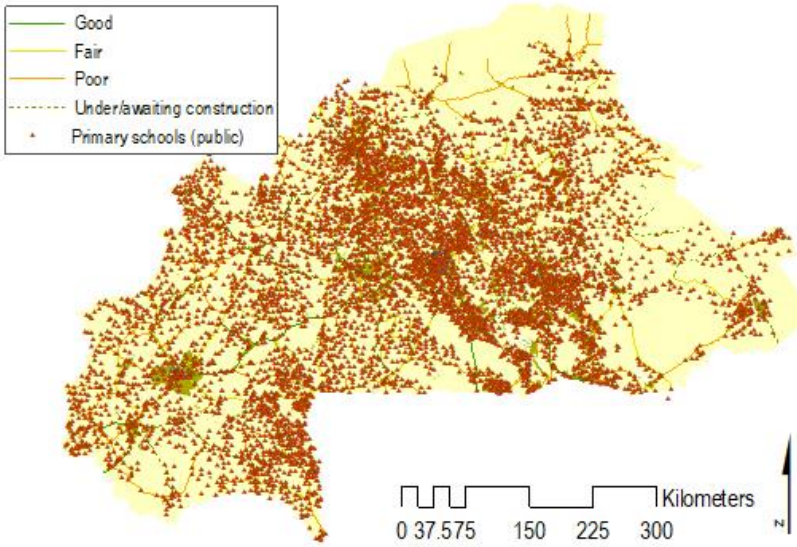


Figure 7: *Public primary schools vis-à-vis the road network and population*

Source: Geo-located by study team based on data provided by Ministry of Education

Private primary schools are comparatively less common, present in only about 14 percent of all localities. With some exceptions, the private primary schools are located along the classified road network; however, in many cases – especially in the Sahel and Est regions – the connecting road (i.e., the "last mile") is in poor condition. While significantly more likely to be near an all-season road than public primary schools, still, less than half of all the private primary schools are.

Approximately 15 percent of all localities have any type of PPS school present, whether public or private (secular or with a religious affiliation). Of the public PPS schools, nearly all are located in direct proximity to the classified road network; however, only 46 percent are within 2 km of all-season roads. Similarly to the primary schools, a significantly larger share of private PPS schools compared to public PPS schools are directly accessible to the all-season road network. The regions where accessibility of the existing private PPS schools to the all-season network is the most problematic are Centre-Est, Est, Hauts-Bassins, Centre-Sud, and Boucle du Mouhoun.

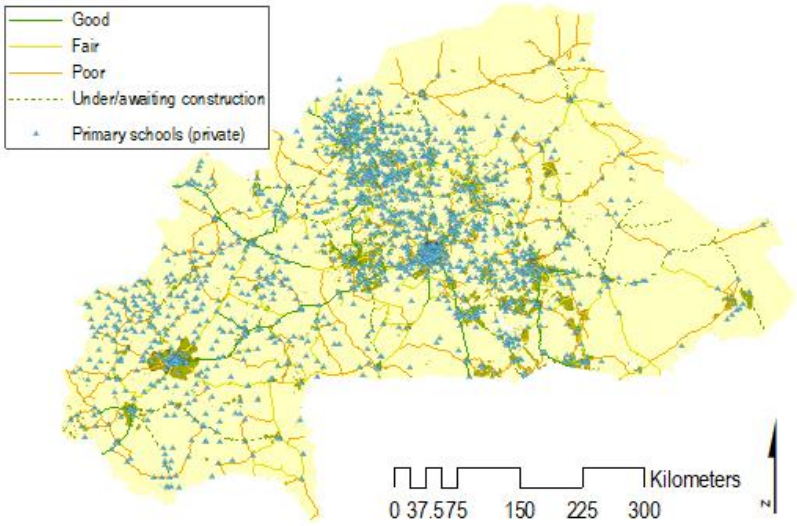


Figure 8: *Private primary schools vis-à-vis the road network and population*

Source: Geo-located by study team based on data provided by Ministry of Education

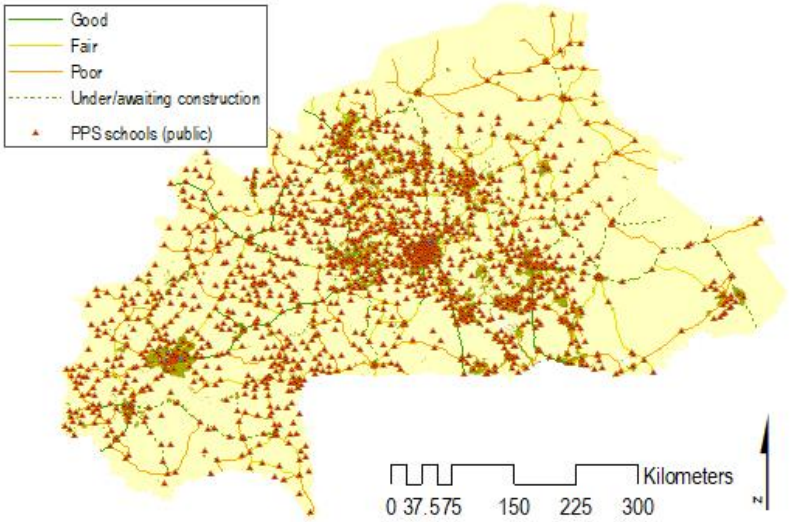


Figure 9: *Public PPS schools vis-à-vis the road network and population*

Source: Geo-located by study team based on data provided by Ministry of Education

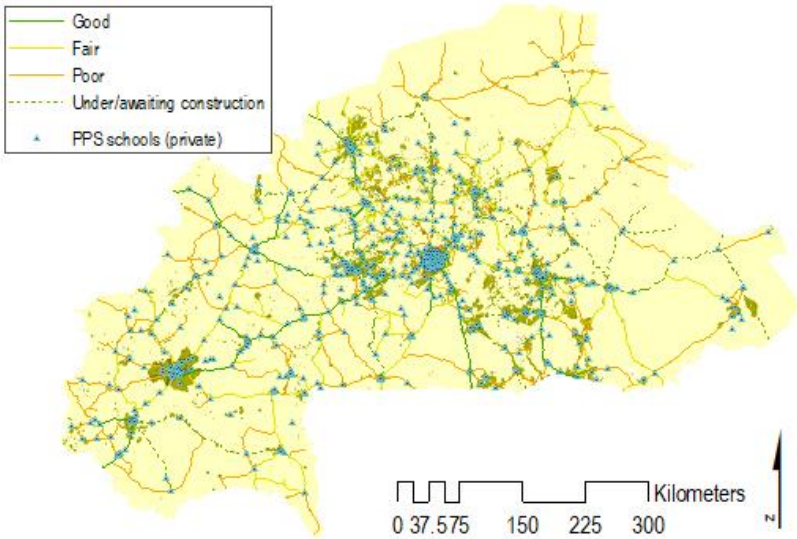


Figure 10: *Private PPS schools vis-à-vis the road network and population*

Source: Geo-located by study team based on data provided by Ministry of Education

Private PPS institutions are further divided into secular and religious. In only 5 percent of all localities there is a private secular PPS school – with their spatial distribution roughly similar to the overall distribution of PPS schools – of which three quarters are within 2 km of an all-season road. Less than 1 percent of all localities have any private Protestant PPS schools, of which 83 percent are directly accessible to the all-season road network. Approximately the same number of localities have a private Catholic PPS school, of which, too, the vast majority are located close to an all-season road. Very few private Muslim PPS schools are present in the country (26), most of them concentrated in Haut-Bassins and Centre. Most of these schools are near an all-season road; exceptions are schools in Ouagadougou, Bobo-Dioulasso, and Ouargaye.

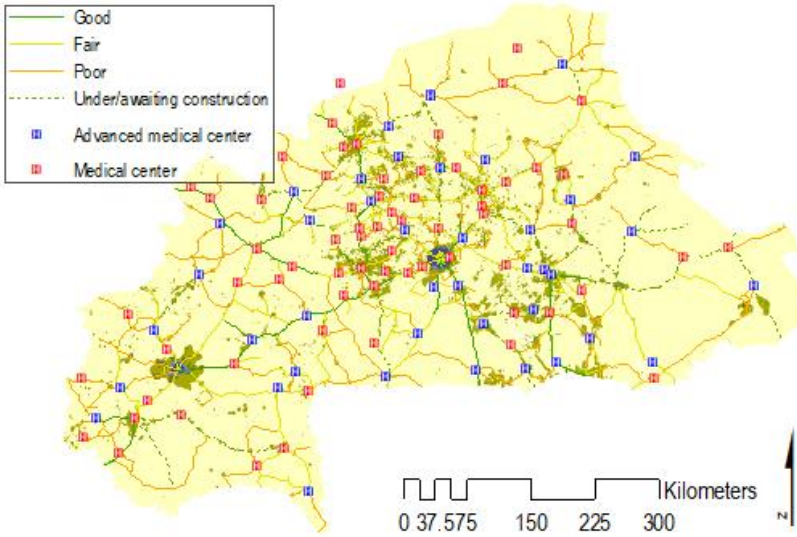


Figure 11: *Health centers vis-à-vis the road network and population*

Source: Geo-located by study team based on data provided by Ministry of Health

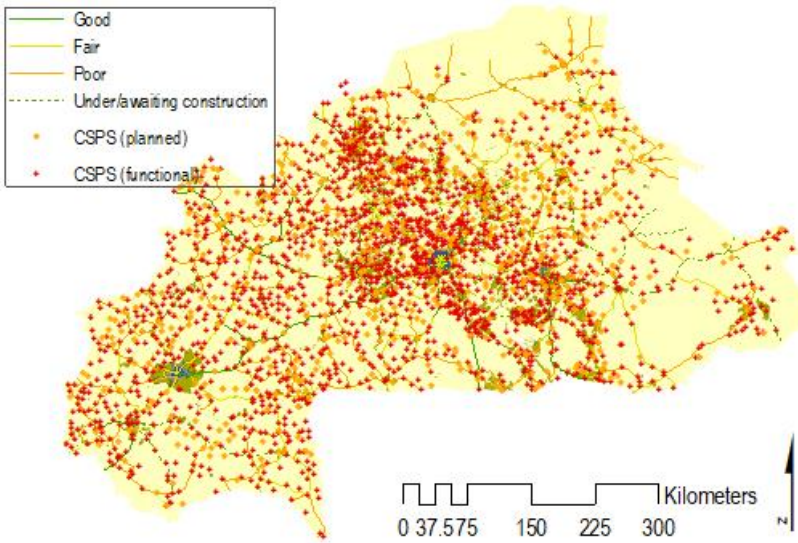


Figure 12: *Small-scale community-level health centers (CSPS) vis-à-vis the road network and population*

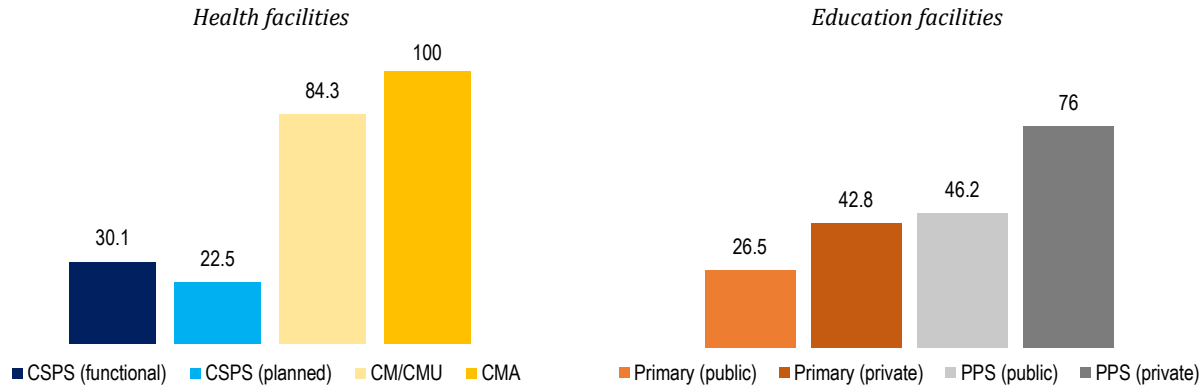
Source: Geo-located by study team based on data provided by Ministry of Health

Health facilities, especially those providing services that can be considered "advanced" or "comprehensive" – such as any surgical interventions – are comparatively much more sparsely distributed than schools. Only 70 localities across the country have a health center (*Centre Médical*, or CM/CMU), while 42 localities have a medical center that also has a surgical antenna (*Centre Médical avec Antenne chirurgical*, or CMA); these types of medical facilities are typically located in the main towns of Communes. While a health center can be found in nearly all parts of the country

– except for significant areas of the Est region and the eastern part of Cascades, corresponding to areas with very low population density – they are frequently connected only by roads in a poor condition. This is particularly common in the Sahel region. In Centre-Est and Sud-Ouest, the medical facilities are connected by roads in a fair condition. Finally, in individual regions, such as Sahel and parts of Haut-Bassins, a good-condition road (or a road being improved to a good condition) connects to a CMA; however, access to the CM/CMU is only available via roads in poor condition, if at all: of the 70 CMs/CMUs, 11 are not directly accessible to an all-season road. Moreover, not all CMs/CMUs are connected by a good or fair quality road to the nearest CMA, which is problematic given that the village-scale CMs/CMUs are supposed to refer more complicated cases to the Commune-scale CMAs.

Lower-level health facilities – Centers for Health and Social Promotion (*Centres de Santé et de Promotion Sociale*, or CSPS) – are small-scale community level healthcare institutions offering relatively limited medical services. Functioning CSPSs are found in 17 percent of all localities across the country, and in 4 percent of localities, CSPSs are under construction or are planned. Notably, neither functioning nor planned CSPSs are available in large areas of the Sahel region. However, also in large parts of other regions, such as Est, Boucle du Mouhoun, Cascades, and Sud-Ouest, the CSPSs that do exist are located along roads in poor condition. In fact, what is notable is that the CSPS that are currently being planned are even *less* likely to be connected to an all-season road than the existing ones (Figure 13), suggesting that there is room for improvement in the spatial coordination of rural roads and health infrastructure investments.

Figure 13: *Share of facilities within 2 km of all-season road network (%)*



Source: Authors' estimates based on data received from GNET and Ministries of Education and Health

4.2. Ouagadougou

Primary and PPS schools and health facilities in Ouagadougou were geo-located in March 2020 using data from systematic ground surveys and exchanges with various sectoral stakeholders, such as Districts and basic education inspectorates. Altogether, 1,690 school facilities were geo-located, of which primary schools represent about 54 percent. The remaining schools are PPS schools and school complexes, the latter referring to a grouping of several levels of education including primary, post-primary and secondary in the same compound. Private schools represent the majority of all schools, especially so in the case of PPS schools, of which only about 12 percent are public, compared to 24 percent of primary schools. There is also a small number of so-called "mixed schools" that are semi-private (under State agreements). Approximately 85 percent of all schools are secular; 7 percent Muslim, 6 percent Protestant, and the rest – Catholic.

There is a high concentration of schools in Ouagadougou's 9th arrondissement (nearly 19 percent of all schools), while it is comparatively low in the 12th (less than 3 percent). A number of factors explain this spatial disparity, such as the fact that some arrondissements concentrate industrial and commercial zones (low concentration) while others are residential areas (high concentration). While schools are generally widely present directly in residential neighborhoods, many schools are not

directly accessible from the fixed-route public transport (SOTRACO) routes – this is especially the case in the northern and south-western corners of the city, where numerous schools are located but no routes are present (Figures 14 and 15).

In addition, a total of 108 health infrastructures were geo-located, including CSPS, CM, CMA, and hospitals (CHU). CSPSs are the most numerous (59), followed by MCs (31), MCAs (13), and CHUs (only 5). The 3rd arrondissement concentrates the largest number of health establishments (19), while the 12th has only 3.

Figure 14: *Primary schools and SOTRACO network*

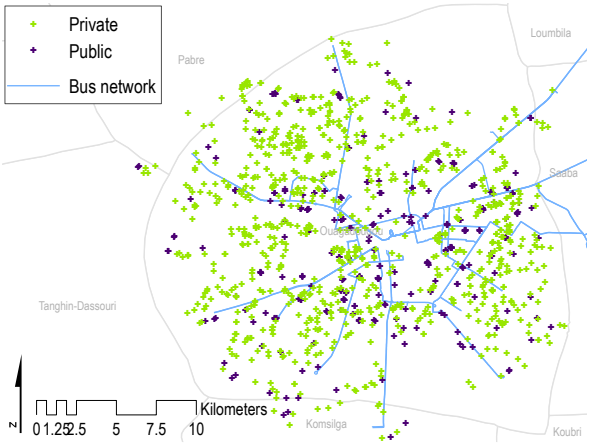


Figure 15: *PPS schools and SOTRACO network*

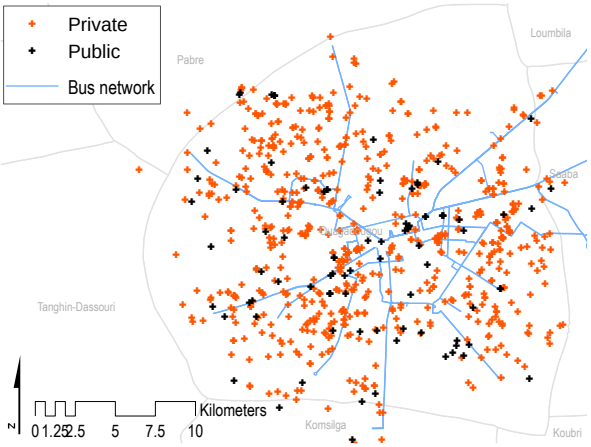
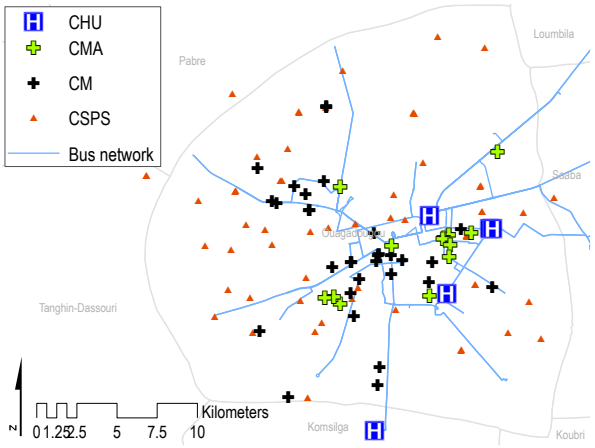


Figure 16: *Health facilities and SOTRACO network*



While the hospitals and most health centers are located in the central part of Ouagadougou and appear relatively well-connected to the SOTRACO bus network, these types of facilities are comparatively absent in the more peripheral parts of the city, especially in the north and south-east corners. The distribution of CSPSs is more balanced, but many of these facilities are far removed from the bus network. On average, advanced healthcare facilities, especially hospitals, are better accessible from the SOTRACO network compared to either primary or secondary schools. While 94 percent of all advanced facilities and all five hospitals are within 2 km of a bus route, this is the case for only 57 percent of primary schools and 59 percent of PPS schools (and, interestingly, more common among the public schools than the private ones).

On the other hand, a significantly higher share of the city's population lives within 2 km of the nearest school – 84 percent live near a primary school and 81 percent – a PPS school, although the share is much lower specifically for public schools (52 percent and 27 percent, respectively). In contrast, less than 7 percent of all people live near any advanced healthcare facility and less than 2 percent – specifically near a hospital.

In sum, accessing advanced medical care for the vast majority of people in the city necessarily involves using some type of (likely) motorized transportation, including possibly the fixed-route bus service, given its relatively good spatial alignment with the health facility locations. In contrast, the bus network does not appear to be aligned with the school access needs. While walking and biking appear to be a feasible alternative for many students, this is not the case for a sizable share of them (15-20 percent) who do not have a school nearby, and it is less feasible for those who do not necessarily want to attend the school nearest to them, for quality or other reasons.

5. ACCESSIBILTY IN RURAL BURKINA FASO

Based on the rural road conditions as reported in late 2019, physical accessibility to schools and healthcare facilities was estimated using an assumption of some motorized transport being available to the household. This assumption, while not universally true, is grounded in the existing and newly collected household survey data which suggests that the vast majority of households have access to a vehicle (most likely a motorcycle) when needed, either their own or borrowed. This assumption also aims to simplify the analysis while acknowledging that many households remain dependent on non-motorized transport, especially for school access needs.

Using the most recent road condition and planned road works data provided by DGNET, the following speed assumptions were made when estimating the travel times:

- Trunk or primary roads: good condition – 80 km/h, fair condition – 40 km/h, poor condition – 25 km/h;
- Secondary or tertiary roads: good condition – 70 km/h, fair condition – 30 km/h, poor condition – 10 km/h.

Two separate analyses were conducted to identify how accessibility can be expected to improve once the works are completed on the roads that are currently being rehabilitated or are awaiting rehabilitation. In the first scenario, these roads were assigned speeds corresponding to "poor" condition (by road class); in the second, they were assigned the speeds corresponding to "good" condition – these are the speeds assumed to be feasible once the roadworks are completed.

5.1. Accessibility considering road conditions in place at the end of 2019

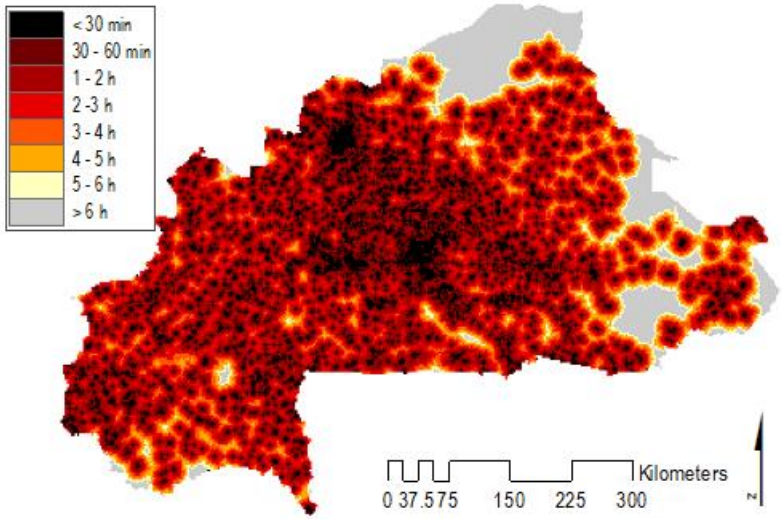
Analysis based on the road conditions present in late 2019 suggests that most of Burkina Faso's territory lies within six or less hours of motorized travel to the nearest CSPS facility, although populations in large areas in the Sahel and Est regions remain unable to reach the nearest CSPS even within six hours (Figure 17). About 95 percent of the country's estimated total population of 20.84 million (World Pop estimate for 2020) live within a four-hour drive of a functioning CSPS; about 54 percent live within an hour's drive. If also considering the CSPS facilities that are currently planned but not yet functional, the share of the population within 1-hour drive increases to just over 58 percent. For Burkina Faso overall, motorized travel time for the average person to the nearest functioning CSPS is 77 minutes, and 67 minutes if also considering the planned CSPSs. Figure 18 summarizes the results, per type of facility, in terms of average travel times to nearest facility; Figure 19 provides a summary in terms of population served within a certain travel time threshold (i.e., expressing it in terms of service areas).

Accessibility is considerably lower when it comes to higher-level health facilities such as CM/CMU and, especially, CMA. Nearly 12 million people (58 percent) live in areas from which the nearest CM/CMU cannot be reached even within four hours of driving, and over 65 percent are not able to reach a CMA within that time threshold. Even if considering CMs/CMUs and CMAs jointly, only about a quarter of the population is able to access any of these facilities within an hour – again, assuming a motorized vehicle is available.

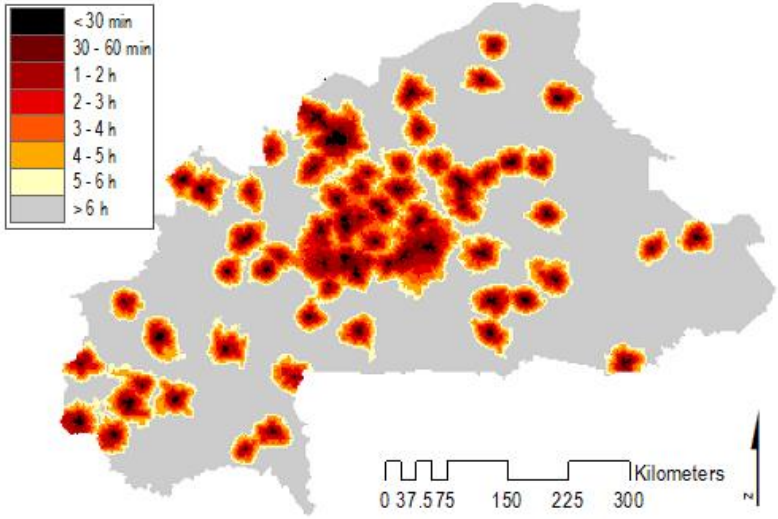
Accessibility to schools, at least on average, is significantly better compared to health facilities, essentially a function of the much wider presence of schools. Of course, even the average travel times may be excessive for many households to be able to send their children to school, and for many other households the actual travel times are much longer. Across the country, the average population-weighted travel time by motorized transport to the nearest primary school is 36 minutes. It is the same also specifically for public primary schools, while for private primary schools the average is three times longer. Approximately 16.28 million people (78 percent) can reach a primary school of some type within an hour of motorized travel. However, not a single primary school is accessible even within four hours of motorized travel for over half a million people.

Figure 17: *Travel time by motorized transport to nearest facility, given road conditions present at the end of 2019*

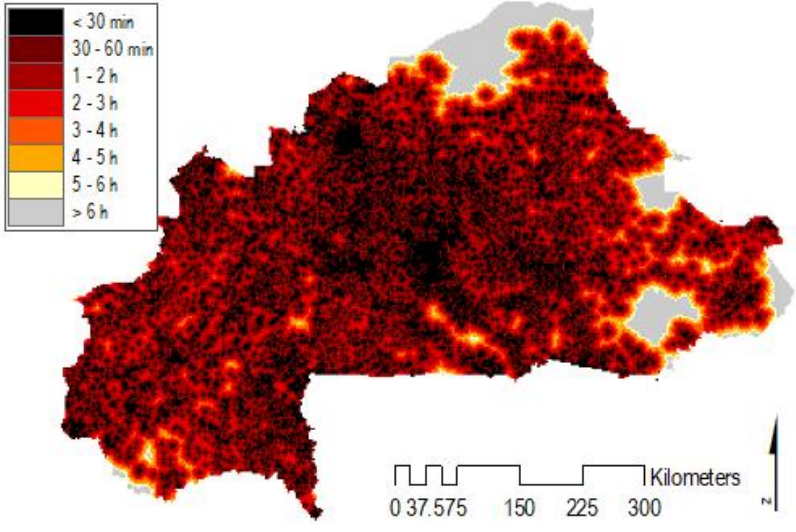
a. Functioning CSPS



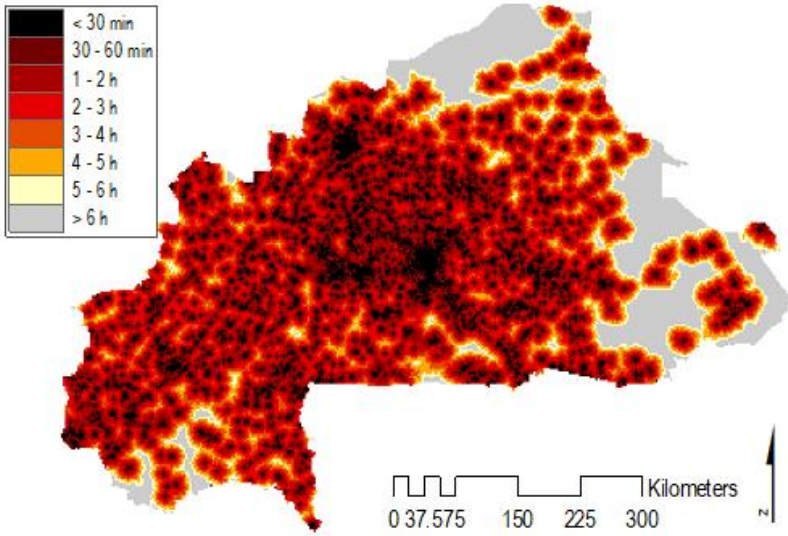
b. CM or CMU



c. Any primary school



d. Any PPS school



Source: Team estimates based on road condition data provided by DGNET and facility data from Ministries of Health and Education

Accessibility to schools beyond the primary level is significantly worse, with the average motorized travel time to the nearest PPS facility at 78 minutes. The average is roughly the same also specifically for public PPS schools but about twice as high for private PPS schools. About 8 percent of the population are beyond even a four-hour drive from *any* PPS school. "Acceptable" accessibility to PPS schools – here defined as less than an hour of motorized commute – is estimated for about 55 percent of the population the case of public PPS schools and for 40 percent of the population in the case of private PPS schools.

The above estimates for both primary and PPS schools should be interpreted in light of the fact that, in reality, families with school-aged children may choose to live disproportionately closer to specific types of schools compared to the overall population. However, such spatially detailed data on family structures is not readily available.

***Figure 18**: Average population-weighted travel time by motorized transport to nearest facility considering road conditions present at the end of 2019, Burkina Faso overall (min)*

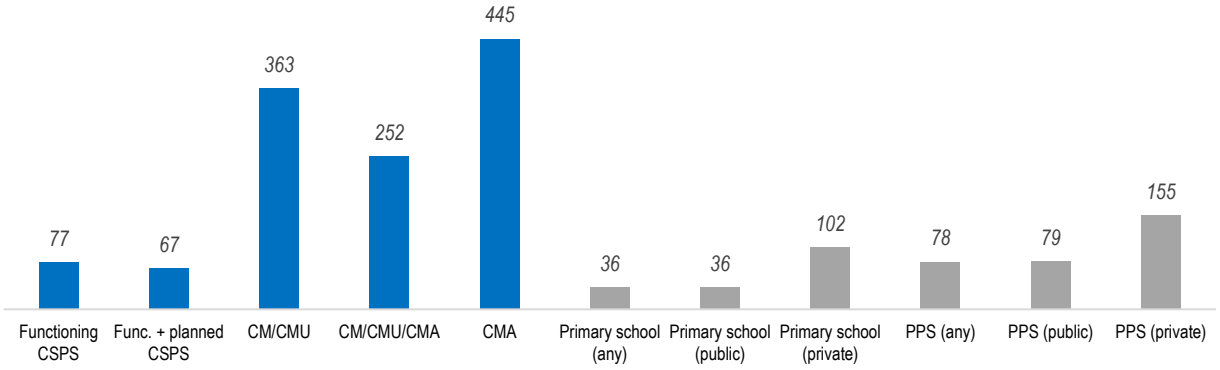
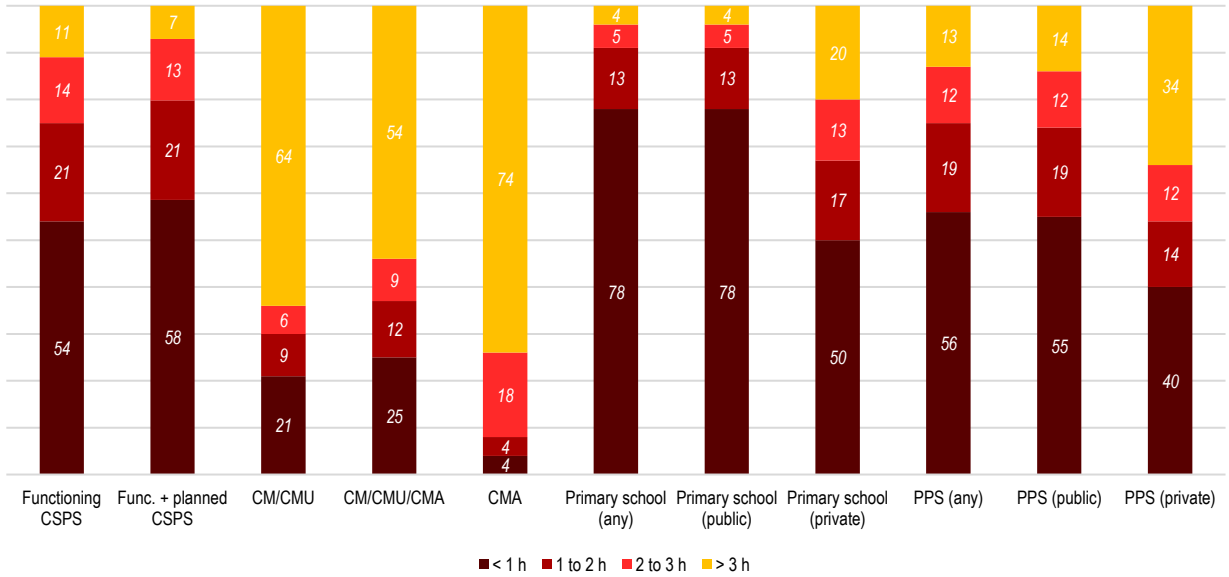


***Figure 19:** Population within a certain motorized travel time threshold to a specific type of facility (% of Burkina Faso pop.)*



Source: Team estimates based on road condition data provided by DGNET and facility data from Ministries of Health and Education

The average travel times in Burkina Faso overall are inevitably skewed by the much better performance in cities than rural areas. At the regional level, travel time by motorized transport to the nearest functioning CSPS ranges from just 20 minutes for the average resident of the very urbanized Centre region to over four hours for the average resident of Sahel. Travel times to more advanced healthcare facilities

are much higher across all the regions; nevertheless, the range is substantial, from about 50 minutes to the nearest CM, CMU or CMA in the Centre region to over 7 hours for the residents of Sahel, Est, and Cascades. Figure 20 illustrates the population share in each Province that is within a 1-hour service area from a CSPS or a CM/CMU – the facilities providing primary care services, corresponding to the type of needs that are associated with the country's predominant burden-of-disease profile. While in a few provinces in Centre, Nord, Plateau-Central, and Centre-Ouest regions upwards of 80 percent of people are within the 1-hour service area, in Sahel and Est and the Houet province in Haut-Bassins, the share is below 20 percent. In absolute terms, the size of the population living beyond the one-hour travel time to a primary care facility is estimated to be the highest in the Houet province (Haut-Bassins), Comoe (Cascades), and Soum (Sahel) provinces, exceeding 400,000 people in each.

Figure 20: *Population able to reach a primary care facility – CSPS or CM/CMU – within an hour of travel (%) and the size of the population beyond the 1-hour service area*

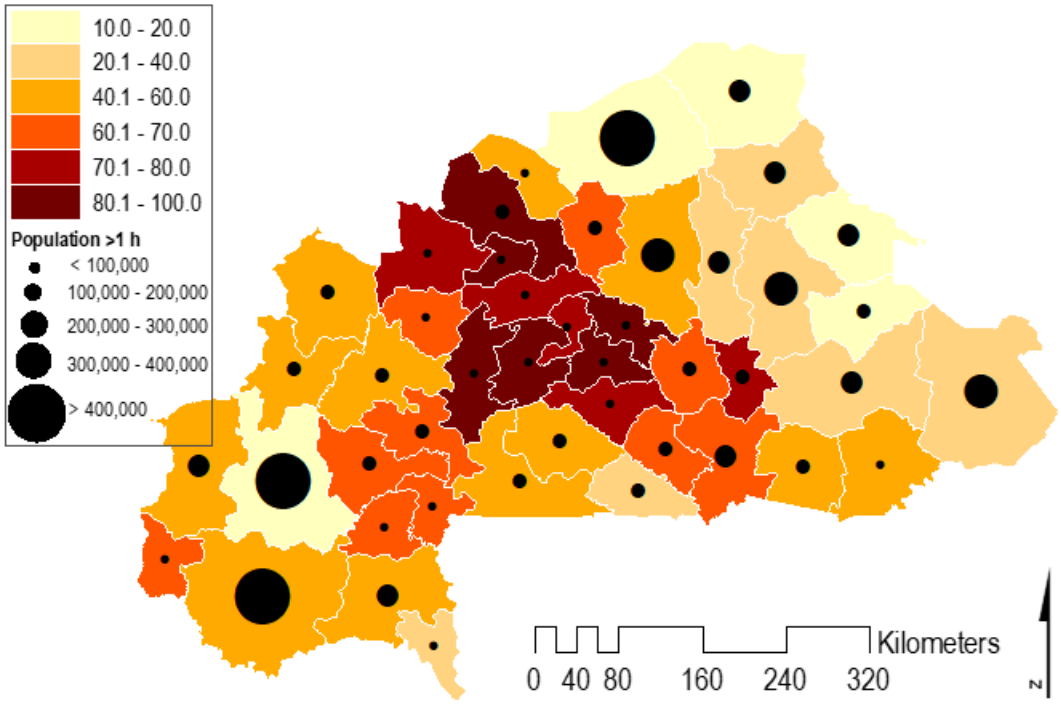
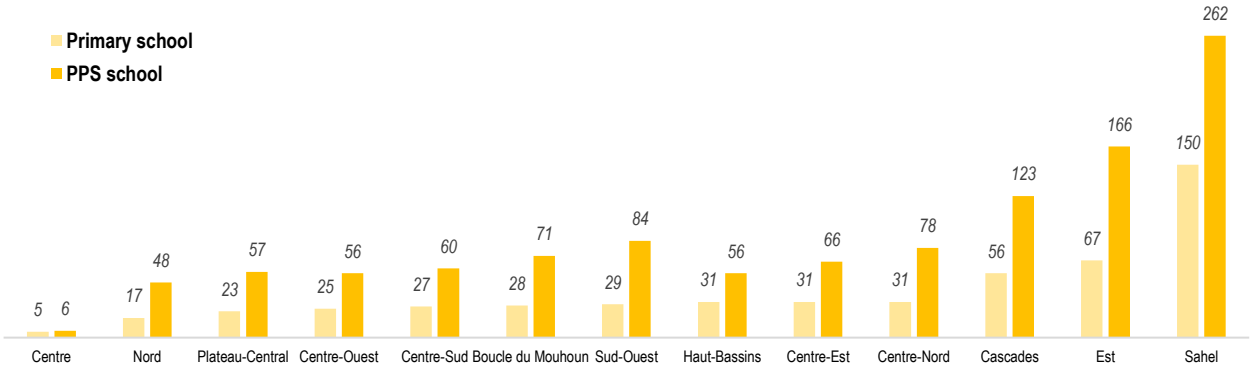


Figure 21*: Average population-weighted travel time by motorized transport to nearest school considering road conditions present at the end of 2019, by region (minutes)*



Source: Estimates by study team

At the primary school level, motorized travel times typically average around half an hour in most regions; exceptions are the Centre and Nord regions – with considerably lower average travel times – and Cascades, Est, and Sahel regions, where the average travel times are much higher. Moreover, this assumes travel by a motorized vehicle which is likely not the case for most primary school age children.[3]

Average travel time to the nearest PPS school of any kind varies from just 6 minutes in the Centre to 50-60 minutes in the Nord, Plateau-Central, Haut-Bassins, Centre-Ouest, and Centre-Sud, to over four hours in the Sahel. Across all regions except Centre, average travel times to the nearest PPS school are at least twice as high as to the nearest primary school.

The regions with the highest average travel times to education and health facilities are not, overall, those with the highest poverty incidence, as measured by the most recent poverty assessment. For example, poverty incidence is by far the highest in the Nord region, exceeding 70 percent, while the average population weighted travel time to schools and healthcare facilities in that region is among the very lowest. On the other hand, poverty rates in the lowest-accessibility regions of Sahel and Est are less than 50 percent, below several other regions. Still, despite the *average* poverty incidence and *average* accessibility not appearing very correlated for the country overall, it is possible that the pattern holds more strongly at the sub-region level, with poorer Communes seeing lower accessibility, on average, or having larger shares of people with extremely poor accessibility (i.e., travel times exceeding several hours). Moreover, it is likely that people living in the highest poverty – Nord and Centre-Nord – regions have much lower access to motorized vehicles and therefore the actual travel times are, in fact, much higher.

5.2. Accessibility constraints posed by flood risk

Certain parts of Burkina Faso are exposed to elevated flood risk, which, in combination with the sparsity of roads in good condition, makes accessibility to opportunities difficult during parts of the year. According to data from CONASUR, Burkina Faso's National Emergency Relief and Rehabilitation Council, in the last fifteen years, the annual number of persons affected by flooding across the country has ranged from about 6,000 (in 2014) to over 180,000 (in 2009) and generally reaches several tens of thousands every year. In the worst year of flooding – 2009 – the Centre region was affected the most, which can at least partly be attributable to its much higher population density than that present in the rest of the country. However, several tens of thousands of people were affected also in the Est, Boucle du Mouhoun, Centre-Nord, Sud-Ouest, and Centre-Est regions.

Figure 22 shows the information on the relative severity of flood risk at the district level estimated during the Integrated Context Analysis run in Burkina Faso in 2018 performed by the World Food Programme (WFP). The main indicators used for the analysis were the percentage of district surface at flood risk and the maximum expected frequency of flood events with a 100-year return period.[4] According to this assessment, the most exposed to risk are the Sahel, East, and Boucle du Mouhoun regions, where upwards of 14 percent of the territory is exposed to flood risk. Especially in the Sahel region (but also Boucle du Mouhoun, to a large extent), the road conditions, too, are mostly poor or fair, with few major road improvement projects in the works.

More spatially detailed (90-meter-resolution) estimates of flood risk distribution and severity, by flood type and flood return period, are available from the FATHOM v.2 Global Flood Hazard Data database. The maximum expected water depth from ***fluvial*** flooding – or flooding caused by rivers overtopping their banks – is in the Centre-Sud and Centre-Est regions (and in the Centre region around the capital city), where the maximum flood depth is expected to exceed 1 meter in several areas with a 5 percent probability in a given year. In Boucle du Mouhoun, the fluvial flood risk is more widely distributed; however, the maximum expected depths generally do not exceed a meter. Similarly, also the greatest maximum expected water depths from ***pluvial*** flooding – or flooding caused by extreme local rainfall – are in the Centre-Sud and Centre-Est regions and around Ouagadougou.

[3] Data-based evidence on this point is provided in the discussion of the household survey results for Boucle du Mouhoun and Centre-Est regions.

[4] Equivalent to a 1-percent chance in a given year to see a flood this severe.

***Figure 22**: Share of territory facing flood risk vis-à-vis the road network (%)*

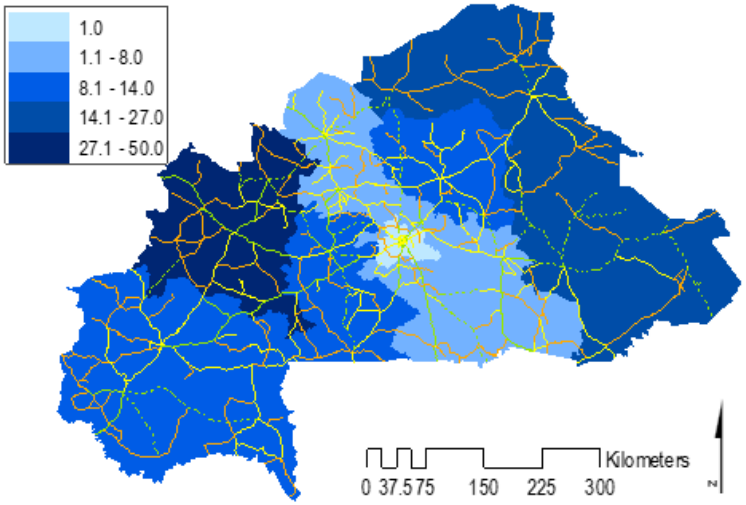


***Figure 23:** Flood exposure of CM/CMA and road network at 20-year return period*

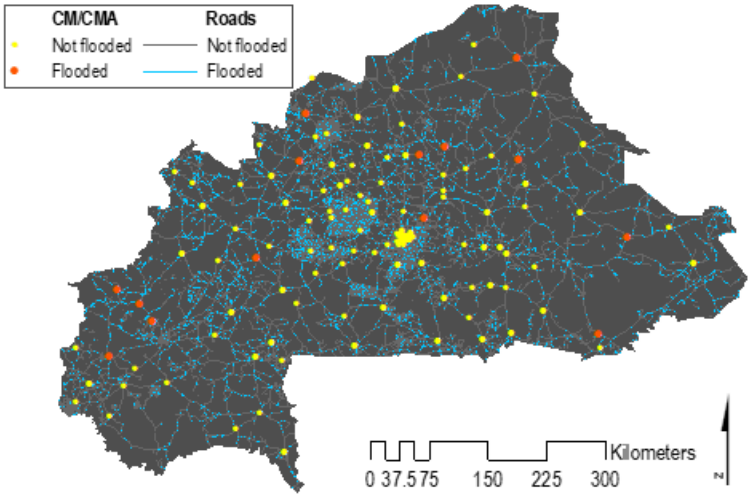


***Figure 24:** Share of the total primary, secondary, and tertiary road network length exposed to 20-year flood (%)*

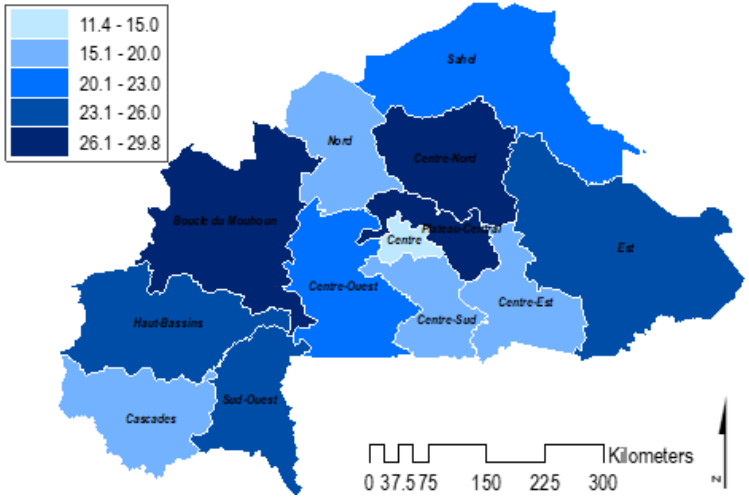
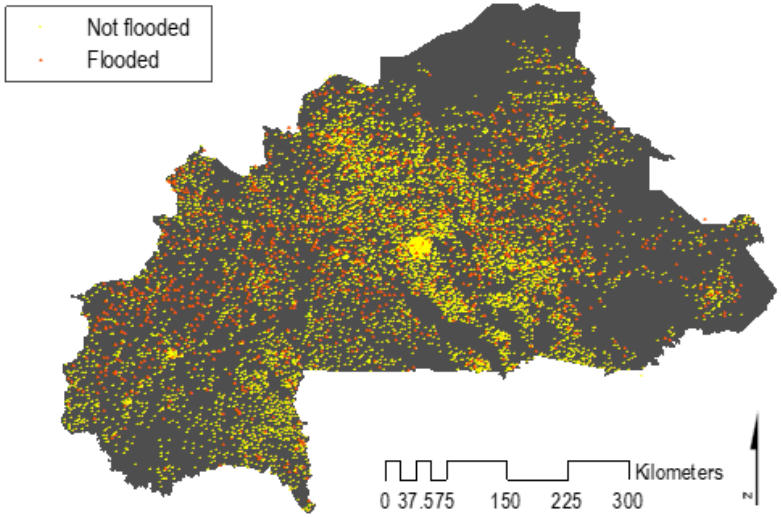


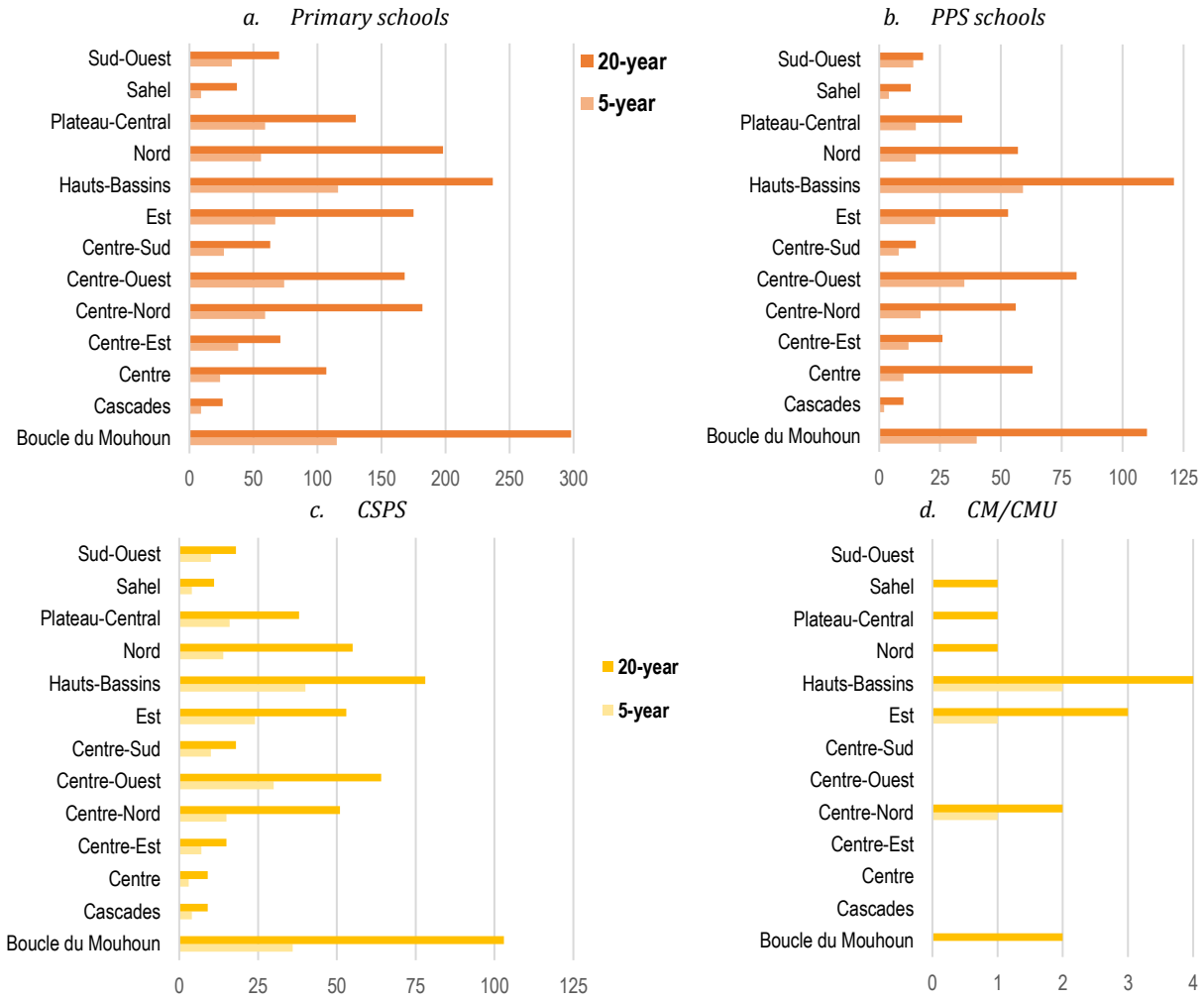
***Figure 25:** Flood exposure of primary schools at a 20-year return period*



Source: Data from UNEP/UNISDR/WFP (2020), Fathom v.2

Although insufficiently spatially detailed for flood modeling in urban areas (where the human-made structures potentially significantly modify water flows), this data is useful for understanding the risk distribution in broad terms at least at the sub-province level in rural Burkina Faso. Specifically, the spatial data on flood risk distribution can be used in conjunction with the road network data in order to identify roads that may become impassable during certain times of the year with a high level of certainty and the critical infrastructure facilities – schools, clinics – that can be expected to be flooded.

Figure 26: *Number of villages with flood risk exposed schools and healthcare facilities per region, by flood return period*[5]



Source: Authors' estimates based on FATHOM v.2 global flood risk data

At both low- and high-return periods (5 years and 20 years, respectively), the largest number of villages with primary and PPS schools exposed to flood risk are in Haut-Bassins and Boucle du Mouhoun; across all regions, the number of villages with schools exposed to risk is two to three times greater in the case of the higher (rarer) return period (Figure 26). Similarly, in the case of healthcare facilities, Boucle du Mouhoun and Haut-Bassins have a large number of villages with risk exposed facilities; in Est, Centre-Ouest, Nord, and Centre-Nord, too, there are over 50 CSPS at risk at the 20-year return period.

In relative terms, facilities in Haut-Bassins are the most vulnerable: for example, about a quarter of the region's villages with primary schools and a third of the villages with CMAs are likely to flood quite regularly (at least once every five years).

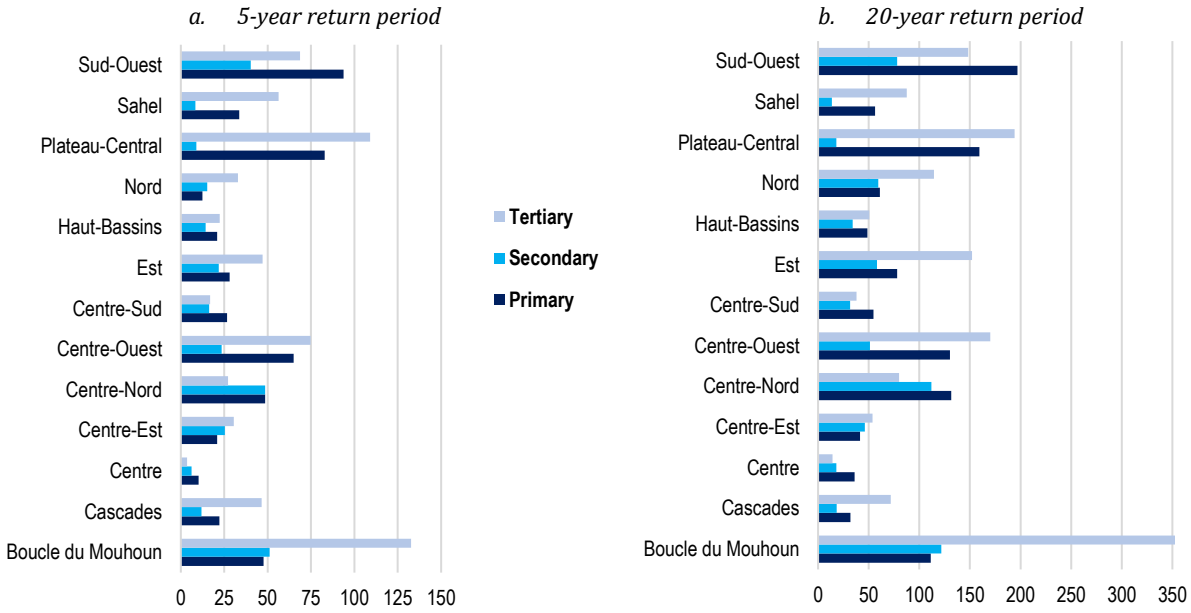
[5] 20-year flood return period is equivalent to a 5-percent probability of a flood of that magnitude being observed in a given year. For a 5-year return period flood, the respective probability is 20 percent.

Even floods that occur fairly regularly affect a large portion of the country's rural road network, and the exposed length increases significantly at higher flood return periods (i.e., more severe and less frequent floods). In total, 513 km of Burkina Faso's overall primary road network, 292 km of the secondary road network, and 669 km of the tertiary road network are at risk of flooding at the 5-year return period; this is equivalent to 9.7 percent, 10 percent, and 12.6 percent of each type of network, respectively. If considering the 20-year return period (more severe floods that occur at a probability of 5 percent in a given year), 1,138 km of primary roads, 661 km of secondary roads, and 1,528 km of tertiary roads are at risk.

Most exposed to risk – in terms of the absolute length – are the primary road networks in Sud-Ouest and Plateau-Central (Figure 27). The flood-risk exposed length of the secondary road network, on the other hand, is highest in Boucle du Mouhoun and Centre-Nord, while the length of the tertiary road network exposed to risk is highest in Boucle du Mouhoun and Plateau-Central. These roads also tend to be unpaved. As a *share* of the network length, both the primary and the secondary road network is the most at risk in Boucle Mouhoun (nearly a third of the length of each type of network), while by far the largest share of the tertiary road network at risk is in Plateau-Central (about a third of the length).

Flood risk also affects numerous bridges that represent the connection points for entire communities to health and education services located across rivers. Recently, several bridges in the Sahel, Nord, Centre-Nord, and Est regions were damaged by rainwater without being repaired, also reducing the access capacity of humanitarian actors to populations in need (see section 5.4).

Figure 27: *Total length of roads exposed to flood risk, by flood return period (km)*



Source: Authors' estimates based on FATHOM v.2 global flood risk data

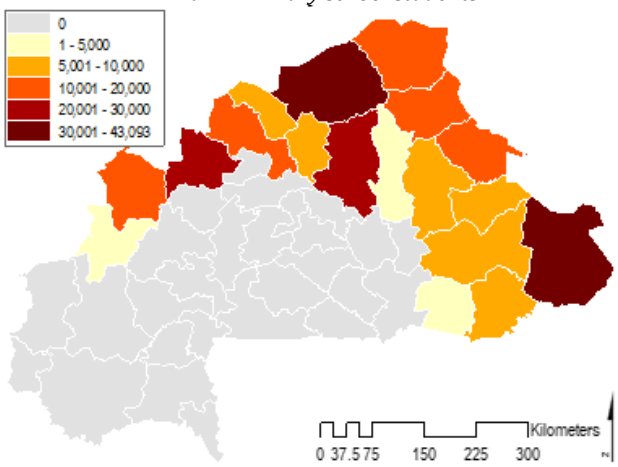
5.3. Accessibility challenges associated with the security situation and internal displacement

Like most Sahel countries, Burkina Faso is exposed to fragility and conflict that in some of its regions has intensified in recent years. 2020 was the deadliest year in the Sahel since the eruption of the Malian crisis over eight years ago, and armed violence is now a persistent threat in five of Burkina Faso's thirteen regions (Sahel, Nord, Est, Centre-Nord, and Boucle du Mouhoun), as reported by the International Crisis Group. A total of 2,272 fatalities were reported in 2020 in Burkina Faso, most of which were in the Sahel region of the country (ICG, 2020a).

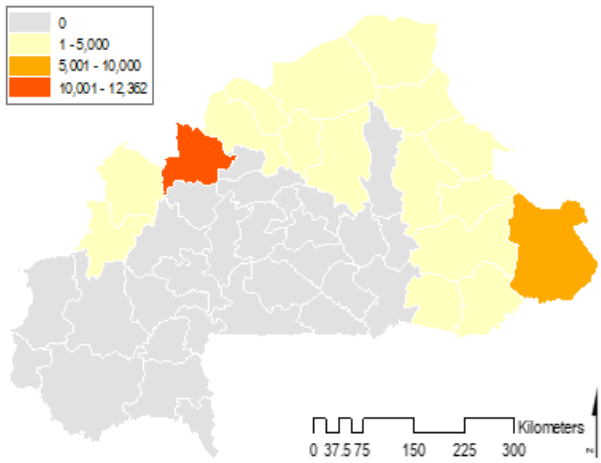
The security situation inevitably affects the functionality of schools and health clinics in these regions and imposes additional demands from facilities in other parts of the country, as conflict-displaced populations migrate and resettle. Armed groups have also reportedly threatened teachers, children, and families, causing fear about attending school, and in some cases, resulting in school closures. In Est, at least four schools were reported to have been burned down in the Tapoa province in mid-2020 as a result of intensification in Jihadist activity (ICG, 2020b) and activity by JNIM or ISIS militants (ICG, 2020c). In Est, some schools closed following attacks in the provincial capitals have been relocated; however, the new locations suffer from insufficient infrastructure (UNHCR, 2020c). Altogether, the Ministry of Education reports that, as of February 5, 2021, 2,212 schools across the country – the vast majority of them primary schools – were closed due to attacks or insecurity. These closures directly affect over 316,000 children and over 12,300 teachers, most of them in Sahel, Est, Centre-Nord, and Boucle du Mouhoun. Since the crisis intensified and mass school closures began about two years ago, some children began to attend schools further from their homes in order to access education, but they are exposed to other dangers during long transits (Human Rights Watch, 2020a).

Figure 28: *Students affected by school closures as of February 2021, by province*

a. Primary school students



b. PPS school students



Source: Based on data available in Ministère de l'Education Nationale (2021)

Also a number of health facilities have reportedly closed due to insecurity: in late 2019, this was the case for 68 health centers, affecting over 800,000 people (OCHA, 2019), while by end-2020 the number of closed health centers had reached 95, affecting at least 1.2 million people. It is therefore clear that the violence has exacerbated the already low level of access to healthcare services in the affected regions. In addition to the five regions of the country where violence is most prevalent, however, also the population in Centre-Est is significantly and increasingly impacted by facility closures. Recent mapping of health infrastructures and the availability of services suggests that the Sahel, Est, Centre-Est, and part of Centre-Nord, Nord, and Boucle du Mouhoun regions have essentially become "health deserts" (World Bank, 2020b).

Besides threatening the functionality of the facilities themselves, security issues also affect physical mobility and, thus, ability *to physically reach* the remaining functional health and education services. For example, in Est, checks of public transportation companies by unidentified armed men were frequent in 2020 in the Gourma and Komondjari provinces on the Fada-Kompienga and Fada-Gayeri axes, reducing freedom of movement by the local populations (UNHCR, 2020c). Numerous attacks on transport infrastructure facilities, especially bridges, occurred also in 2019. According to information collected by OCHA, at least five bridges in the Sahel region, mainly in the Soum province, were the target of attacks that partially or totally damaged them. Over the course of 2020, the proportion of security incidents related to explosive devices left on roads increased further (World Bank, 2020b).

Detailed spatial data on attacks as recorded by the Armed Conflict Location & Event Data Project (ACLED) is available only until February 2020, so,

not reflecting the most intense phase of violence. Analysis of the attacks – battles, explosions, and violence against civilians – recorded throughout 2019 and the first two months of 2020 suggest that a total of 724 events occurred during this time period, resulting in over 2,600 fatalities. The events were highly concentrated in the Sahel, Nord, Centre-Nord, and Est regions; however, at least several violent events were registered in each of the 13 regions. Most violent events occurred close to major roads, thus directly affecting connectivity from populated areas to various centers of opportunity – clinics, schools, markets.

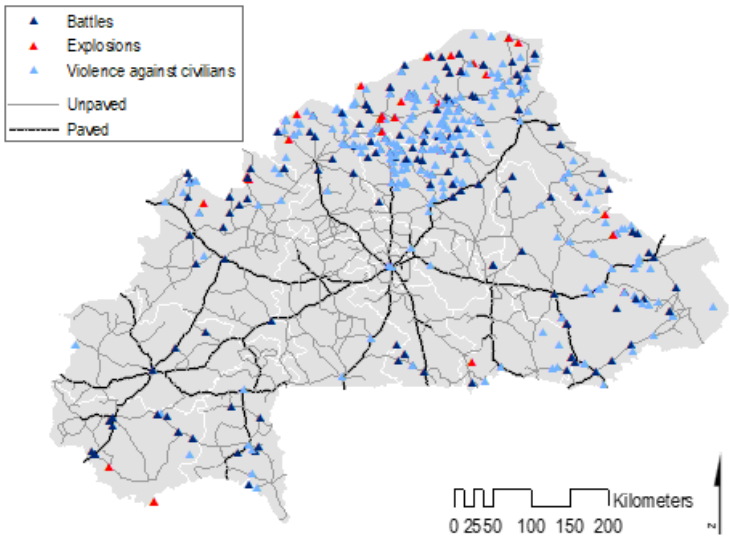


Figure 29: *Violent attacks and battles in Burkina Faso vis-a-vis the main road network, January 2019 to February 2020*

Sources: Based on data from ACLED

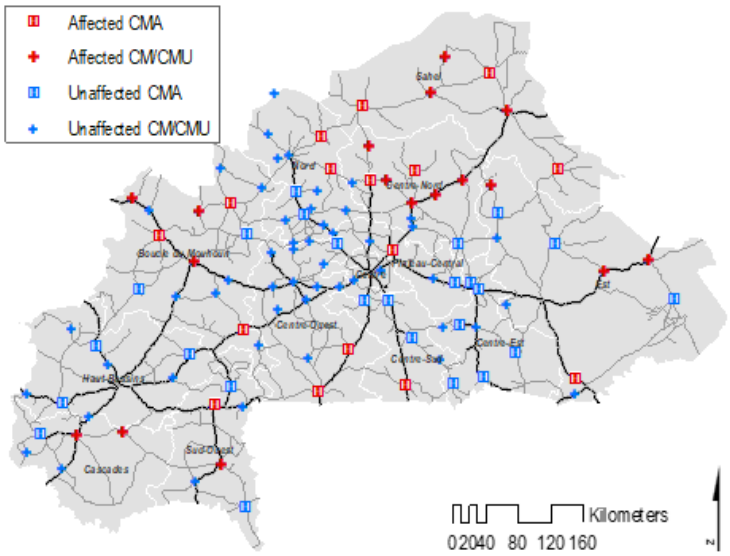


Figure 30: *CM, CMU, and CMA facilities located within 2 km of a violent event recorded between January 2019 and February 2020*

Sources: Based on data from ACLED

Analysis of the spatial pattern of violent attacks during this period and the distribution of key social infrastructure facilities suggests that a large number of schools and healthcare facilities were directly in the harm's way, as defined by having a violent event happen within a 2-km radius.[6] This was the case of 181 PPS schools (about one-tenth of all PPS in the country), 355 primary schools (5 percent of all), and 162 CSPS facilities (6 percent). However, in relative terms, the most affected by

[6] Because the exact coordinates of the facilities are not known, but rather those of the village they are located in, it is not possible to assess exposure at a smaller radius.

violent events were the country's advanced healthcare facilities, with 19 CMs (or 27 percent of all facilities of this type) and 17 CMAs (41 percent) experiencing a violent event in a 2-km radius. In fact, in the Sahel region, *all* of the CM, CMU, and CMA facilities were in the harm's way, as well as nearly all of the facilities in Centre-Nord (Figure 30). This means that over 1.3 million living in the Sahel region alone were no longer able to feel safe accessing such a facility even if they were able to do so in terms of transportation and/or physical proximity.

However, even where facilities themselves were not in close proximity to a violent event, accessibility to them was impaired due to violence happening on the roads *connecting to* the facilities. This is illustrated with the example of the Est region, where only one of the four CMAs – Pama – had a violent attack occur within a 2-km radius during this period; however, numerous acts of violence occurred along the roads via which the remaining CMAs can be accessed, in particular, the Diapaga and Gayeri CMAs (Figure 31).

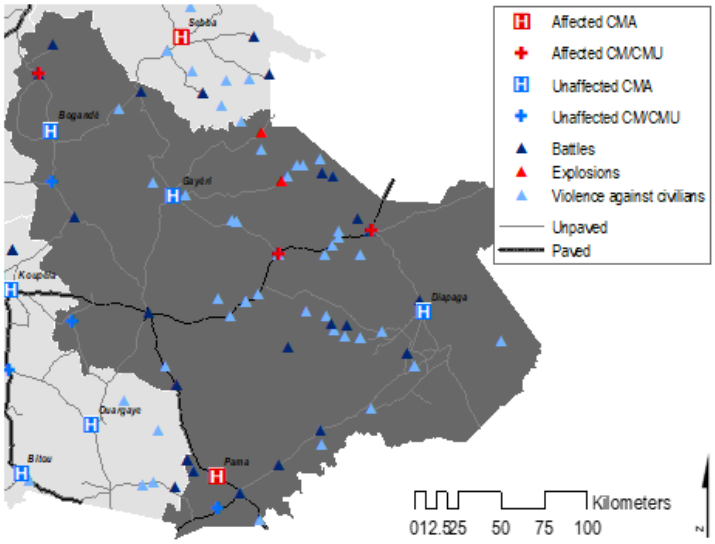


Figure 31: *CM, CMU, and CMA facilities in Est region that are located within 2 km of a violent event recorded between January 2019 and February 2020*

Sources: Data from ACLED

The UN High Commissioner for Refugees (UNHCR) reported in August 2020 that over one-third of Malian refugees living in Burkina Faso opted to return, at least partly due to the increased internal displacement within Burkina Faso, violent attacks, and the compounding impact of the Covid-19 pandemic. The baseline assessment produced by UNHCR in February 2020 had stressed the challenges faced by the Burkina Faso Government to meet the needs of its own population, including internally displaced persons (IDPs) (UNHCR, 2020a). Still, as of mid-2020, nearly 20,000 refugees from various countries, mostly Mali, were present in Burkina Faso, of which over a quarter were primary school-age children (5-11 years old) and another one-fifth – secondary school age (12-17).

Burkina Faso's asylum law provides for refugees to access education. However, refugee school enrolment in the country's Sahel region stands at 52 percent in primary schools and 60 percent in secondary schools. Some refugees in the camps have received vocational training, but the level and scope of this training is not sufficient to meet the overall needs of the refugee population. The country's asylum law also provides for refugees to access the national primary healthcare system, and refugees in urban areas adhere to the country's national health insurance scheme, although UNHCR covers the costs of secondary and tertiary healthcare. Dedicated health centers have been established in the two camps in Burkina Faso's Sahel region for Malian refugees, thus limiting any additional demands on the region's existing health centers that the presence of refugees could cause.

However, adding to the critical infrastructure and services needs of refugees from outside is the massive displacement of people that has occurred *internally* within Burkina Faso in the past two years as a result of the sharp increase in violence. Over a million people have been displaced, and another 3.5 million are in need of assistance, a 60-percent increase from January 2020 to January 2021, according to UNOCHA. Data from the National Council for Emergency Relief and Rehabilitation

(CONASUR) suggests that the largest number of IDPs are in Centre-Nord, accounting for over 40 percent, followed by Sahel (33 percent) and Nord, Est, and Boucle du Mouhoun (each between 4 and 7 percent). A growing number of IDPs are also moving to Cascades and Haut-Bassins, traveling over 600 km from their home communities, in search of more fertile lands and economic opportunities. About 54 percent of all IDPs are children under the age of 15, corresponding to primary and secondary school age.

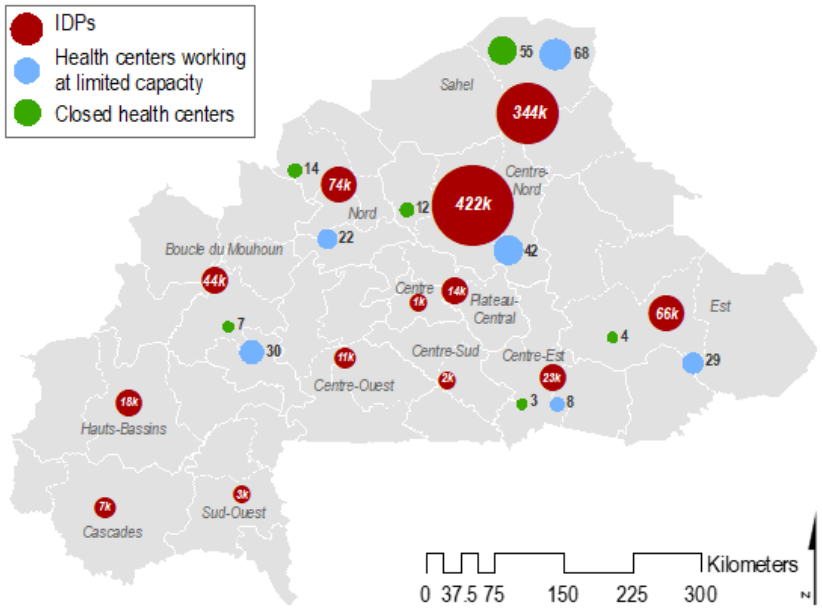


Figure 32: *IDPs and closed or not fully functional health centers as of February 2021*

Source: Data from UNOCHA

In Est, population movements are characterized by the migration of people from outlying areas to urban centers where the security situation is more stable. The capitals of the provinces such as Fada, Pâma, Gayéri, Piéla, Diapaga are the reception areas with the largest numbers of IDPs (UNHCR, 2020c), with commensurate additional demands imposed on their schools and healthcare facilities. In fact, the regions of the country that have seen the most IDP movements have at the same time experienced the most significant reduction in health center capacity, with over 120 health centers in Sahel, for example, either closed or working at sub-capacity (Figure 32). The confluence of these two developments means that the remaining operational health centers have to cope with a large increase in demand: the already limited physical accessibility to health opportunities as a function of the sparsity of health centers and the road network in northern Burkina Faso is now further exacerbated by the reduced availability of medical staff and facilities per population resulting from the IDP movements and facility closures.

The Ministry of Education in early February 2021 reported that 2,557 primary schools across the country were hosting a total of 85,594 IDP children. At the post-primary level, this was the case for 574 schools that were recipients of altogether 18,840 IDP children. At the province level, the highest numbers of primary-school-age IDPs are enrolled in schools in Tapoa in the Est region (nearly 30,000), Yatenga in Nord, Gourma in Est, Sourou in Boucle du Mouhoun, and Soum in Sahel (each above 5,000) (Figure 33). The Soum province is by far the most affected in terms of the additional students (IDPs) *per receiving primary school* (nearly 190 students received, on average, by each school that received any students at all). Primary schools that are hosting IDP students in the Komandjoari province in Est region and the Yagha province in the Sahel are also significantly affected, seeing an influx of 120-140 IDP students per school, on average (Figure 34). The Soum province is seeing not only the highest average number of IDP primary school students per receiving school but also the largest number of primary schools closed, with significant implications for school crowding, resources available per student, and, likely, schooling quality.

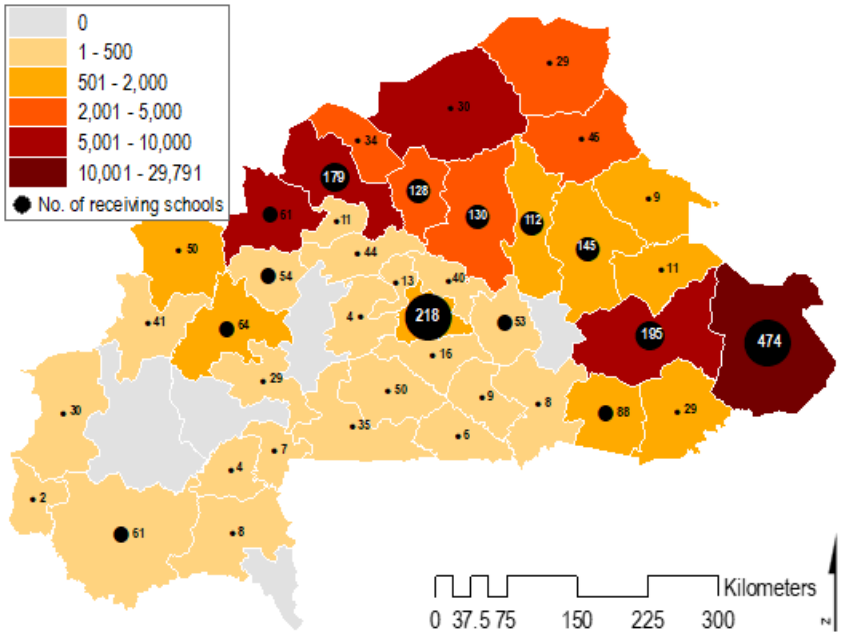


Figure 33: *Number of IDP students and number of primary schools that were hosting IDP students as of February 2021, by province*

Source: Data from Ministère de l'Education Nationale (2021)

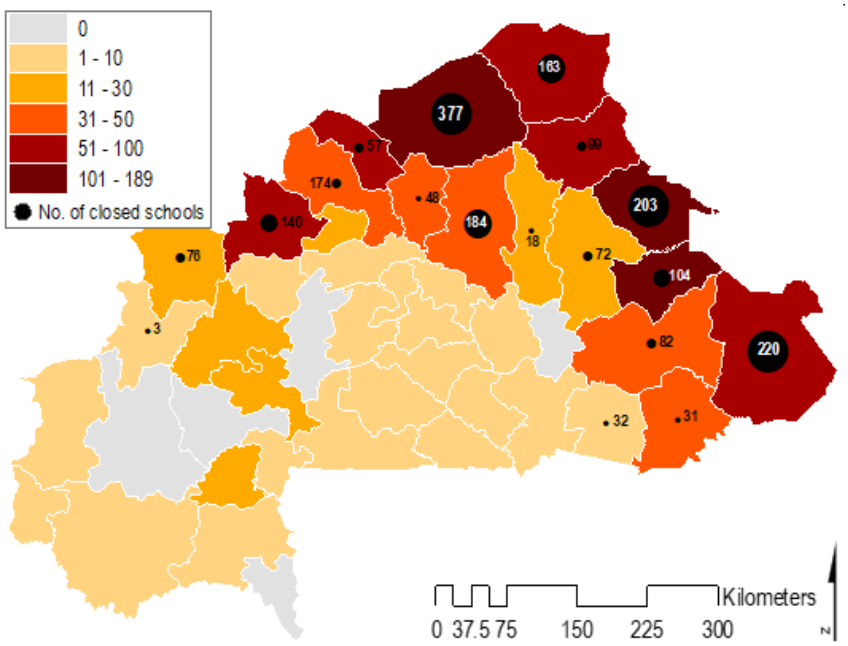


Figure 34: *IDP students received per hosting primary school (average) vs. closed primary schools as of February 2021, by province*

Source: Data from Ministère de l'Education Nationale (2021)

IDP children are reported by UNHCR to face numerous challenges that lead to dropping out of school or never enrolling in it – including due to lack of birth certificates that are needed for the children to be included in the education system and due to the lack of knowledge by the parents that schooling to IDPs in public schools is free of charge. In Nord, access to education for IDP children is reportedly hindered also by inadequate public infrastructure and health problems due to the difficulties of access to health facilities because of distance and cost (UNHCR, 2020b). In Est, students whose schools were closed due to the security situation in the areas of departure are struggling to reintegrate into the school system in the reception areas due to insufficient classrooms and lack of financial means for school fees in secondary schools (UNHCR, 2020c). In Plateau-Central, basic social services, including schools and health clinics, are functional and, on paper, accessible to IDPs; however, in practice, difficulties such as the distance to school, lack of space in host schools, and lack of school canteens present obstacles to access (UNHCR, 2020d).

Another reported challenge – and reason why many IDP children in practice do not attend school – is the preference for the parents of many IDP children for Koranic schools over secular schools (UNHCR, 2020d), which is not always feasible to satisfy in the host community. For example, while privately run Islamic PPS schools are more widely accessible in Nord, Centre, and Plateau-Central, there are none present in Centre-Nord, the largest single IDP recipient region.

Access to health services is a particular issue for the IDPs in Sahel. A recent assessment suggests that at least a quarter of the IDP households there perceive access to healthcare to be challenging, due to the inability to reach a health facility within a walking distance, cost, long queues, and unavailability of medicines (World Bank, 2020b).

Finally, the already precarious situation of IDPs in terms of their access to education and healthcare is further exacerbated by challenges to physical mobility caused by seasonal flooding. For example, this was reported to be the case in several communes in Boucle du Mouhoun in September 2020.

5.4. Access constraints as reported by households in select regions

In December 2020, a household survey was implemented as part of this study in two rural regions of Burkina Faso – Boucle du Mouhoun and Centre-Est. *A priori*, these regions share some of the same accessibility challenges, as suggested by the spatial accessibility analysis, and are both vulnerable to flooding; however, Boucle du Mouhoun faces more severe fragility and violence issues. The survey aimed to identify spatial and seasonal gaps in household physical connectivity to primary and secondary schools and to healthcare facilities and to understand the relative importance of transport connectivity among the wider range of constraints that might affect the households' decisions to send their children to school or to seek medical treatment at a facility.

A total of 817 individuals – each from a unique household – were surveyed, of whom 437 in Boucle du Mouhoun and 380 in Centre-Est. The respondents are distributed quite evenly across different age groups, with 36-45 year-olds representing the largest individual group, and two-thirds of all respondents are men. The vast majority of respondents (73 percent) belong to households earning less than CFA 50,000 per month,[7] and approximately the same share have no formal education. Most respondents characterize themselves as farmers, with the second single largest group being independent workers. Less than 2 percent of respondents' households have a car, 59 percent have a motorcycle and 91 percent a bicycle.

The results from the survey are presented for the survey sample overall and, at times, disaggregating by region or another characteristic. Subsequently, with regard to healthcare access in particular, the accessibility challenges as perceived by women of reproductive age are presented separately.

Accessing healthcare services

53 percent of the people surveyed seek routine healthcare once a month or more frequently, while 12 percent report never seeking treatment. Not seeking treatment is more common among Centre-Est respondents, where the share exceeds 15 percent. About 82 percent of respondents seek treatment at a CSPS, with CM being the second most commonly named (8 percent). The respondents in Centre-Est are more likely than the respondents in Boucle du Mouhoun to rely on dispensaries and hospitals and less – on CSPS. 93 percent of respondents report seeking medical treatment as frequently as they need it. This share is somewhat lower in Centre-Est than in Boucle du Mouhoun, among women than men, among the poorest respondents than among other income groups, and among respondents who do not own a personal vehicle than among those who do.

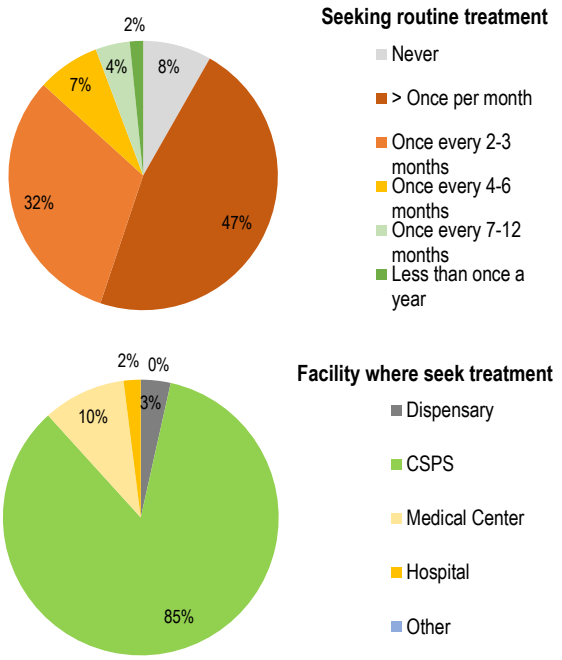
Across all respondents, the single most common mode used to get to a medical facility is a motorcycle (39 percent), followed by bicycle (36 percent), walking (13 percent), and a borrowed vehicle (11 percent). Less than half a percent of the respondents rely on public transport of any kind or on transport provided by the medical facility. The modal breakdown for traveling to medical facilities is quite similar across the two regions. However, significant

[7] Equivalent to about US$92 according to the official exchange rate on March 1, 2021.

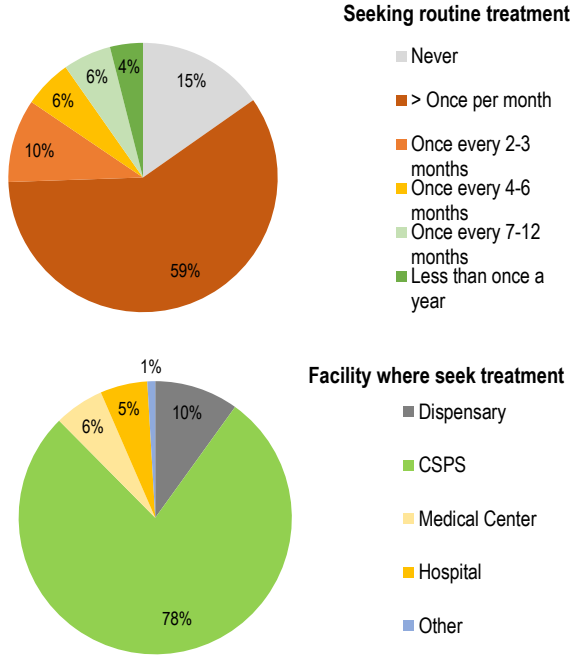
differences emerge depending on the respondents' gender and income: women are much more likely to walk or to bike, while men predominantly use motorcycles; and, while over half of the respondents belonging to the lowest income group rely on walking or biking, respondents from households earning over CFA 200,000 per month rely exclusively on motorized modes (motorcycles and cars). Still, even among the poorer income groups, traveling by motorcycle is common.

Figure 35: *Share of respondents seeking treatment, by frequency and type of facility (%)*

a. Boucle du Mouhoun



b. Centre-Est

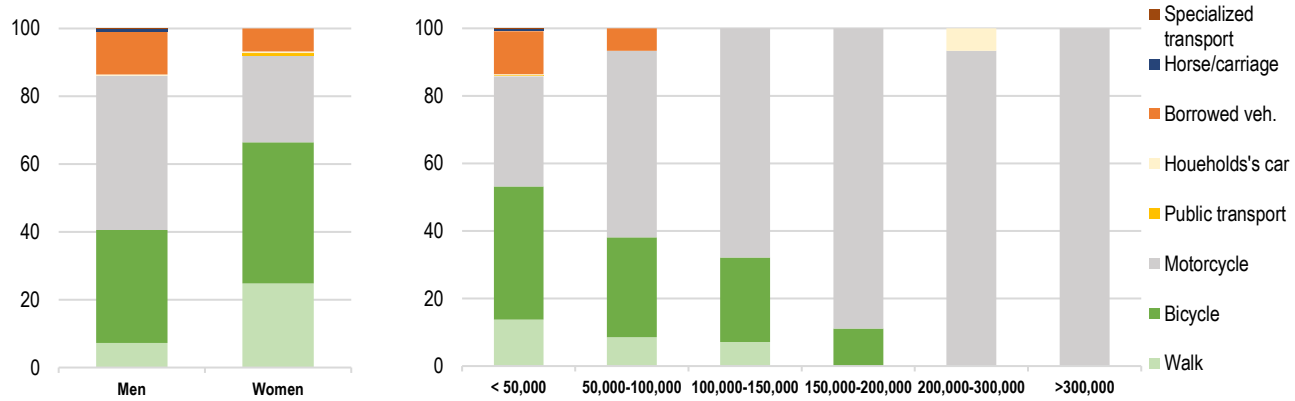


Across all respondents, it takes, on average, 22 minutes to get to the medical facility they attend for routine needs; however, for some individuals the required time is up to four hours. Reported average travel time is lower in Boucle du Mouhoun than in Centre-Est (19 minutes versus 24 minutes), and none of the respondents in that region report traveling more than 1.5 hours. The average travel time reported by men is lower than by women (20 minutes vs. 24 minutes), which can be explained by the much higher dependence of women on non-motorized modes.

Figure 36: *Mode typically used to travel to medical facility, by gender and income of respondent (%)*

a. By gender

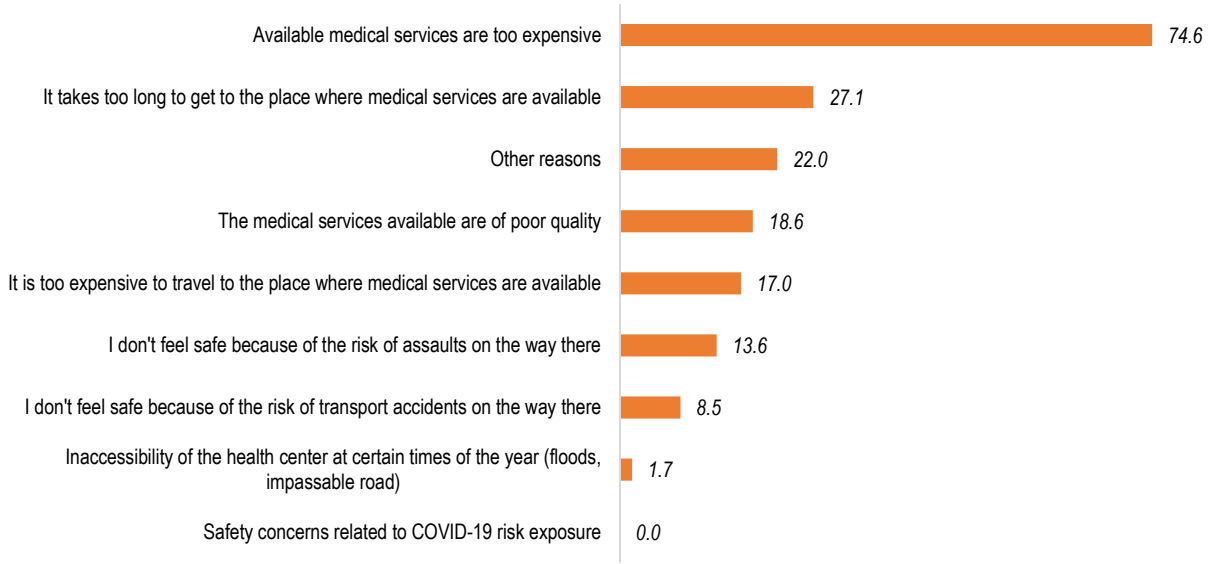
b. By income of respondent's household



Source: Data collected by study team, December 2020

When asked to identify the top five challenges that prevent them from seeking treatment as frequently as they would like to, three in four respondents named the cost of medical services. However, transportation-related challenges, too, were named by a sizable share, with over one-quarter identifying travel time to the medical facility as among the top reasons for not seeking medical treatment (reaching one-third among respondents whose households do not own any type of motorized vehicle); 17 percent of respondents named the cost of travel as among the top reasons. Both travel time and travel cost feature among the top challenges much more commonly among the respondents in Boucle du Mouhoun (44 percent and 28 percent, respectively) than in Centre-Est (15 percent and 9 percent).

***Figure 37**: Reasons for not seeking medical treatment as often as would like to (% of respondents who list the reason among top five most important ones)*



Source: Data collected by study team, December 2020

Security issues while traveling (i.e., due to risk of violence) and road safety concerns were among the main reasons named by 14 percent and 8.5 percent, respectively, of all respondents, while inaccessibility of the health facilities due to issues like flooding were listed among the main challenged by only 2 percent. In fact, security issues rank among the key challenges only among Boucle du Mouhoun respondents, which is intuitive given the much greater presence of conflict and violence in this region. However, also road safety concerns feature more prominently in the responses of Boucle du Mouhoun residents than Centre-Est residents (16 percent vs. 3 percent).

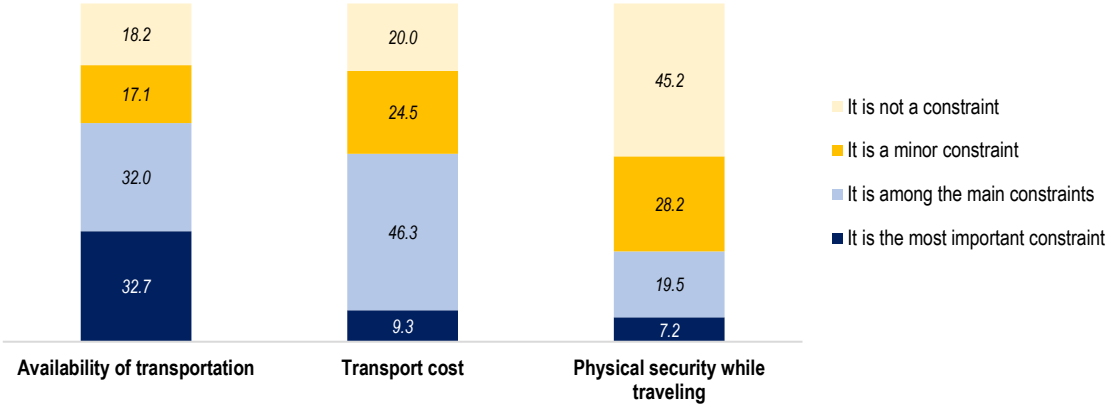
On the other hand, the residents of Centre-Est were much more likely to identify the cost of medical services themselves as a top-five reason for not seeking treatment as often as they would like to (85 percent, compared to 60 percent in Boucle du Mouhoun). It does not appear that COVID-19 risk-related concerns matter in the decision to seek treatment in either region.

Finally, the respondents were asked to evaluate the relative importance of transport related constraints among the broader range of constraints that prevent them from accessing health services as often as they would like to. The responses indicate that availability of transportation is the main constraint or among the main constraints for nearly two-thirds of the respondents. In comparison, transport cost is much less likely to be named as the most important constraint, while physical security during the trip is mostly characterized as a minor constraint or not a constraint at all; still, more than a quarter of respondents see it as among the main constraints or the most important one.

The prominence of the three transport related constraints differs slightly between the two regions. Transport availability is more frequently named as *the* most important constraint for accessing healthcare in Centre-Est than in Boucle du Mouhoun (by 38 percent vs. 28 percent of respondents). On the other hand, transport cost and security while

traveling are named as the most important constraints by 14 percent and 10 percent, respectively, of Boucle du Mouhoun respondents compared to just 4 percent and 4 percent, respectively, of Centre-Est respondents.

***Figure 38**: Relative importance of transport related constraints for accessing health services (% of respondents)*



Source: Data collected by study team, December 2020

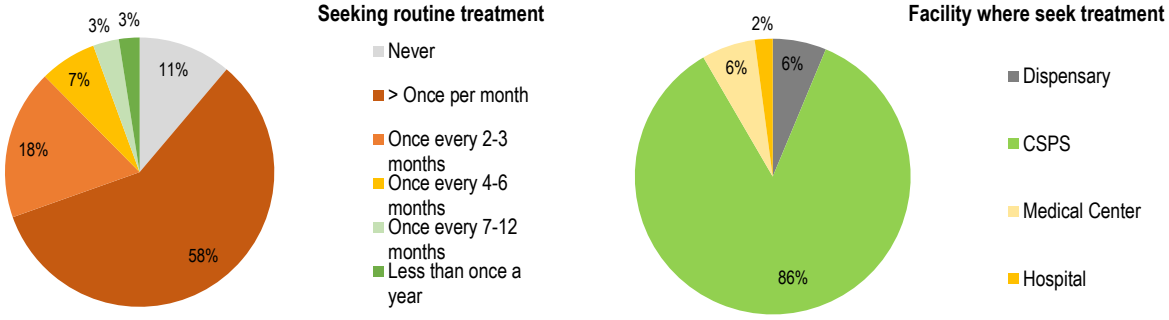
❖ ***Healthcare access challenges specific to women of reproductive age***

Maternal and child health are key priorities for the country's overall healthcare policy, given the continuing – albeit declining – maternal and neo-natal mortality. It is therefore important to understand if this particular demographic faces specific accessibility challenges that could be addressed through targeted interventions.

Of the overall survey sample, women of reproductive age represent nearly one-fifth (161). Nearly 70 percent of these women belong to the lowest-income households, earning less than CFA 50,000 per month. Nearly 63 percent of them live in Centre-Est and the others in Boucle du Mouhoun. While only one of the women in the sample belongs to a household that has its own car, about 56 percent belong to households that own at least one motorcycle, and 91 percent – a bicycle.

While a large share of the women seek medical care at a healthcare facility quite frequently, over 11 percent of them say they never do. All of the women who belong to this latter group live either in Banwa province in Boucle du Mouhoun or Boulgou province in Centre-Est. However, it appears that the reason why they don't seek routine care is not due to an inability to do so, as all of the women who report never seeking care also report that they receive care as frequently as they would like to.

***Figure 39:** Share of women of reproductive age seeking treatment, by frequency and type of facility (%)*



Source: Data collected by study team, December 2020

The 13 women (8 percent) in the sample who report that they do *not* receive medical care as frequently as they would like to live in the Mouhoun, Nayala, Sourou, Boulgou, Koulpelogo, and Kouritenga provinces. Compared to the overall sub-sample, these women belong to larger households, households earning less than CFA 100,000 per month, and more commonly to households that do not own a motorized vehicle. It appears that the women in this group do not necessarily live far away from health facilities (i.e., distance does not represent a problem). In fact, a spatial mapping of these women vis-à-vis health facilities in the two regions suggests that the opposite is the case. In other words, factors besides distance likely play a more important role in explaining why care is not received as frequently as the women would like to.

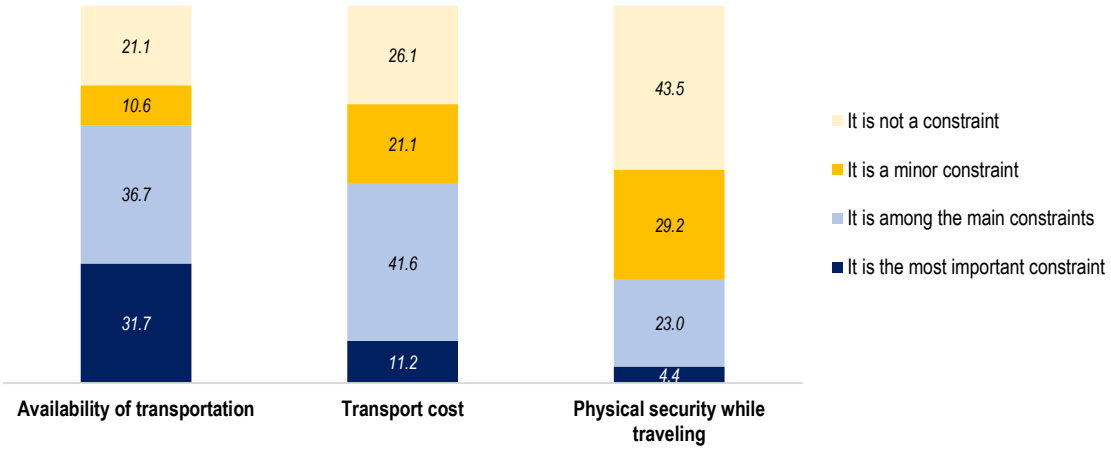
The vast majority of women in the overall sub-sample seek routine medical care at a CSPS, underscoring the importance of this facility type not only for the medical needs of the population overall but also this sociodemographic specifically. A mapping of the women vis-à-vis the health facilities suggests that many women seek treatment at a CSPS even if a medical center might be closer to their home or is equidistant, possibly due to affordability reasons and the type of care needed.

While women in the two regions are more likely than men to rely on non-motorized modes to reach health facilities, it is even more so among women of reproductive age. Nearly 48 percent of women in this sub-group report using a bicycle, compared to 42 percent among all women surveyed and 33 percent of all men. Over 22 percent of women in this sub-sample walk to a health facility, compared to only 7 percent of all the surveyed men. In other words, the availability of roads that are safe for pedestrians and bicyclists is even more important for this sociodemographic compared to the overall surveyed population.

When asked to identify the top five challenges that prevent them from seeking treatment as frequently as they would like to, the most commonly named by reproductive-age women are the cost of medical services (69 percent), the length of the journey to the health facility (23 percent), the poor quality of the medical services available (15 percent), safety while traveling (15 percent), and transport cost for getting to the medical facility (8 percent). These reasons are very similar to the overall surveyed population; however, safety while traveling to the medical facility is more commonly named by reproductive-age women than the overall sample.

In the overall ranking of constraints that inhibit access to health services, women of reproductive age more commonly consider availability of transportation as "the main constraint" or "among the main constraints" (68.4 percent, compared to 64.7 percent in the overall survey sample). This is also consistent with the modal share breakdown for this group of respondents, which showed a much higher dependence on walking and biking than in the overall survey population, possibly due to the prioritization of the use of the households' other (motorized) vehicles by their other members (men).

***Figure 40**: Relative importance of transport related constraints for accessing health services (% of women in reprod. age)*



Source: Data collected by study team, December 2020

The importance of transport cost and physical security while traveling is approximately the same for this sociodemographic as for the overall survey population. However, the salience of physical security while traveling is much higher for women of reproductive age living in individual provinces; for example, 50 percent of the women in Mouhoun province and 42 percent of the women in Koulpelogo province consider this as the most important or among the main constraints for accessing health services.

There are also some differences in the relative importance attributed to these factors depending on the woman's specific age. For example, the availability of transportation and transport cost are much more commonly named as major or the most important constraints by women in the 36-45 age group (80 percent and 62 percent, respectively). On the other hand, younger women appear to find other, non-transport, constraints to be more important.

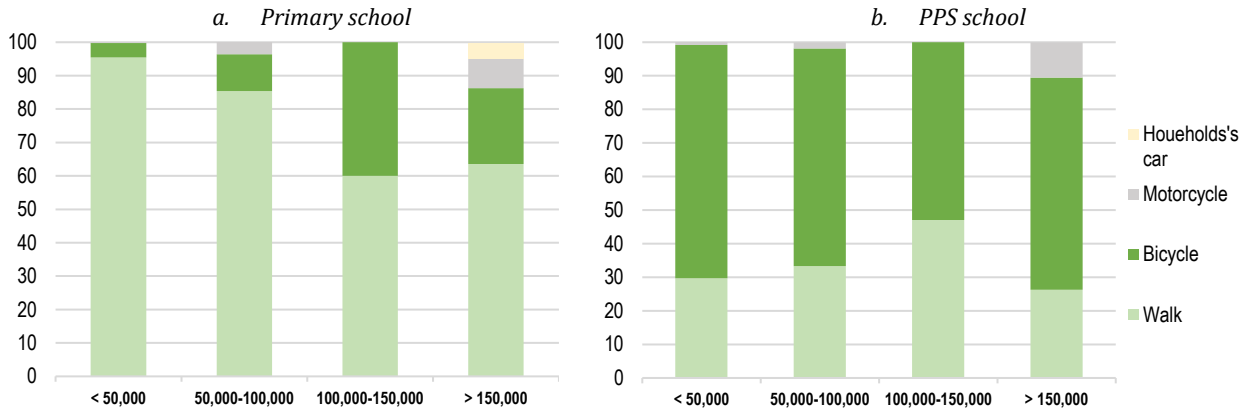
Accessing education

Most of the interviewed people across the two regions (83 percent of all) report having primary or PPS school-age children in their household, with the share being slightly greater in Centre-Est than Boucle du Mouhoun. Among these, 89 percent have children that are enrolled in a primary school, and 50 percent - children enrolled in a PPS school. While the share of households with children enrolled in primary school is approximately the same in the two regions, the share of those with children enrolled in PPS schools is higher in Centre-Est (55 percent) than in Boucle du Mouhoun (46 percent).

The vast majority of respondents with children in primary school (92 percent) report walking as the mode used by the children to get to school, with biking accounting for another 7 percent. Reliance on walking is slightly higher in Boucle du Mouhoun than in Centre-Est, while the opposite is true for reliance on biking. For travel to PPS schools, only a third of respondents' children rely on walking, and nearly everyone else's – on biking. In this case, dependence on walking is higher in Centre-Est (36 percent) than in Boucle du Mouhoun (27 percent).

Similarly to travel to healthcare facilities, the modal breakdown for travel to primary schools is characterized by higher dependence on walking among respondents from lower-income households, with biking and motorcycling being somewhat more common in the upper ones. However, this pattern does not seem to apply to travel to PPS schools: children of all income groups rely on walking versus biking approximately equally.

Figure 41: *Mode used to travel to primary and PPS school, by income of respondent's household (%)*



Source: Data collected by study team, December 2020

The average travel time reported to primary school is 16 minutes, compared to nearly double that (28 minutes) to PPS schools. In both cases, a few respondents report a travel time as long as two hours to reach the school, all of them in Centre-Est.

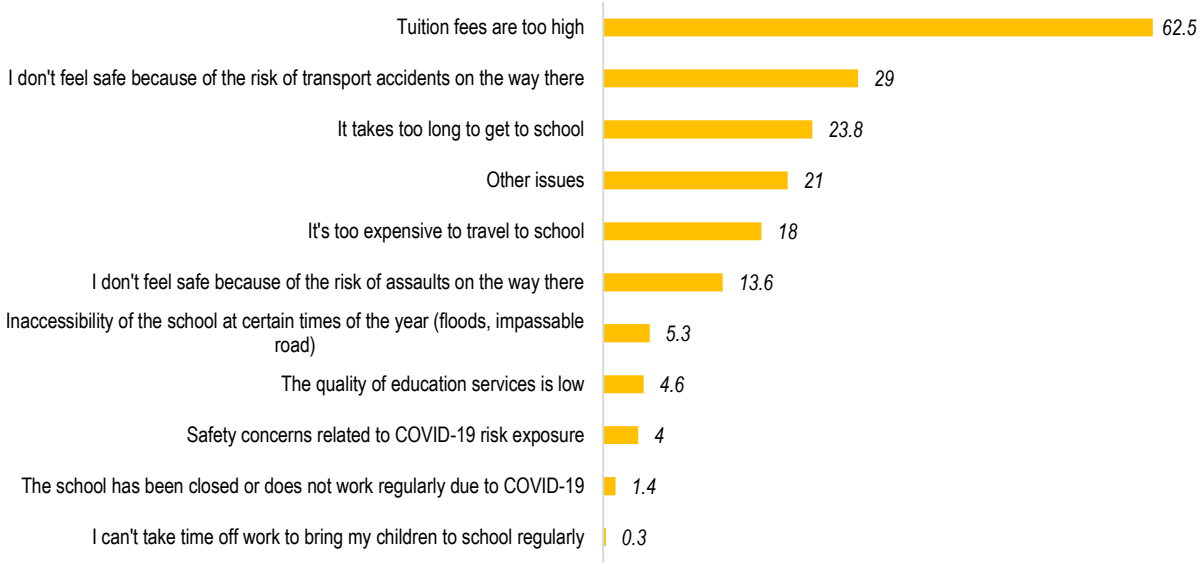
Similarly to medical treatment, the most commonly reported constraint for sending children to school is the cost of school itself (tuition) (Figure 42). The length of the journey is, similarly, among the most common challenges, named by nearly one-fourth of respondents. However, road safety issues are a top concern for a yet greater number of respondents (29

percent) and are thus also more commonly a key concern than in the case of travel to medical facilities. The cost of getting to school is a major concern for 18 percent of the respondents, although this is difficult to explain given the small share of respondents whose children commute to school by motorized modes that have salient ongoing operational costs, indicating that this question may have been interpreted by some respondents to also include the distinct (one-time) cost of purchasing a bicycle.

Personal security concerns – due to the risk of violence or attacks while on the way to school – are a major concern for about 14 percent of the respondents, nearly exactly the same as in the case of travel to medical facilities. Perhaps because of the comparatively greater reliance on walking and biking when traveling to schools compared to healthcare facilities, road impassability due to flooding is a more common concern for sending children to school than for seeking medical treatment. The same is also true with respect to exposure to COVID-19 risk; moreover, 9 people report their children's school being closed or not operating regularly due to COVID-19 as among the main issues. Seven of these respondents live in Boucle du Mouhoun (Kossi, Sourou, and Banwa provinces) and two in Centre-Est (Boulgou province).

The quality of schooling offered is not as common a concern compared to the quality of healthcare services: less than 5 percent of the respondents identify it as among the main issues.

***Figure 42**: Main challenges for sending children to school (% of respondents who list the reason among top 5)*



Source: Data collected by study team, December 2020

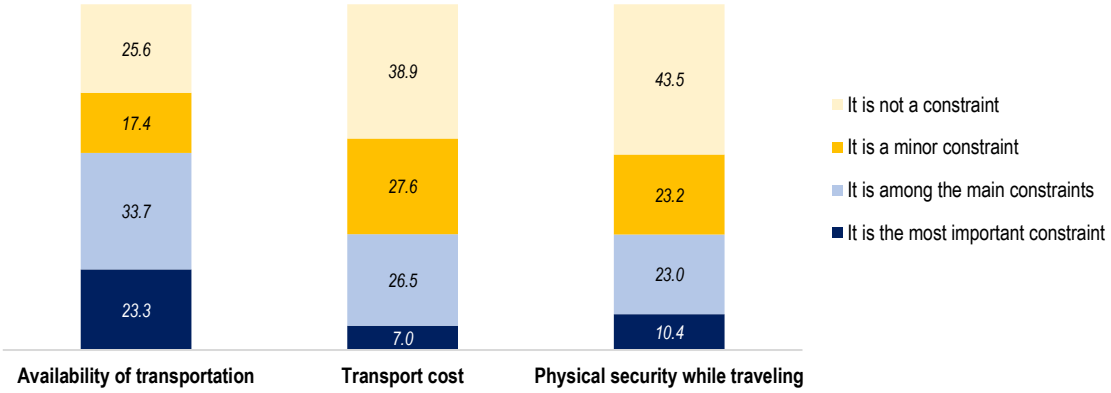
The relative order of importance of the various constraints is the same in both regions. However, respondents in Centre-Est are more likely than respondents in Boucle du Mouhoun to name road safety issues, travel cost, or COVID-19 risk among the major constraints. On the other hand, a greater share of respondents in Boucle du Mouhoun are concerned about the time required to reach the school and COVID-19 related school closures (as well as about "other issues", among which they name the lack or quality of drinking water and food in schools, lack of adequate furniture in schools, lack of teachers, and illness). Issues directly related to schools themselves are much more concerning for the Centre-Est residents: over 72 percent report tuition fees as among the main issues (compared to 54 percent among Boucle du Mouhoun residents), and 5 percent are concerned about school quality (compared to 4 percent in Boucle du Mouhoun).

The importance of the different constraints also differs somewhat according to the age of the children in question. The time required to get to school is a much more commonly mentioned concern among people with children in PPS schools than among those with children in primary schools, as is the travel cost and the tuition fees. On the other hand, respondents with children in primary schools are

more likely to be concerned about COVID-19 related risks, COVID-19 related school closures or interruptions, and "other risks".

Most of the respondents report having children in their household attending school regularly. However, among the 31 respondents who said otherwise (almost all of them Centre-Est residents), nearly half mentioned the impassability of the roads, such as due to floods, among the top challenges, compared to just 5 percent in the overall survey sample. All except one of these respondents live in the Boulgou province in Centre-Est. Also school fees and COVID-19 related risks are a top concern for a larger share of the sub-group of respondents whose children do not attend school regularly.

***Figure 43**: Relative importance of transport related constraints for household's children to attend school (% of respondents)*



Source: Data collected by study team, December 2020

Finally, when asked to rate the importance of the transport related constraints among the overall gamut of issues that present a challenge for their children's school access, the availability of transportation stands out as being *the* most important or among the most important challenges for over a half of all respondents. Transport cost and physical security while traveling are approximately equally important and are identified as among the main challenges by about a third of respondents. These latter two factors, especially transport cost, thus, matter less for school access than health facility access.

5.5. Prioritizing road improvements to improve accessibility

❖ *Identifying overall priority regions*

As shown by the study's findings so far, there are extensive gaps in accessibility to schools and healthcare facilities across the country, with every region having sizable pockets of "accessibility poverty", or extremely long travel times to the nearest facility, in excess of several hours by motorized transport. In terms of average travel time to nearest medical facilities, by far the most disadvantaged are the Sahel and Est regions, which are also additionally affected by the security related school and healthcare facility closures. However, also in the more densely populated Haut-Bassins and Cascades, residents, on average, have to travel over an hour by motorized transport to reach even the nearest CSPS. Also from the perspective of school access, Sahel, Est, and Cascades rank highest in terms of the need for interventions to improve accessibility.

Given the available data on Government plans to establish additional CSPS facilities to those already functioning (Figure 12), the study's estimates suggest that the establishment of the additional CSPS facilities will improve accessibility quite significantly in most regions, especially Sahel, where the average motorized travel time to the nearest CSPS will decrease by nearly 45 minutes. Nonetheless, the planned investments in facilities in the health sector need to be accompanied by further improvements in the road conditions to reduce the average travel

times to anywhere near acceptable. In Sahel, even with the new facilities in place, the average resident will still have to travel over three hours by motorized transport to reach the nearest CSPS, while many others will continue to face travel times in excess of four or more hours. The maps shown in Annex 1 specific to Sahel and Est – by far the lowest-accessibility regions in Burkina Faso – illustrate potential target locations for providing additional health and education facilities as indicated by overlaps of very low accessibility and moderate-to-high population density.

As a result of the road works that were already ongoing as of late 2019 based on DGNET data (shown in Figure 3), country-wide *average* travel time will decrease the most in the case of CMA facilities – by about 8 minutes – but by less than 5 minutes in the case of all other facility types. In the case of CSPS facilities, the realization of the ongoing road works is estimated to mostly improve accessibility for those for whom it was already relatively good. On the other hand, in the case of CM/CMU and CMA, the impact can be expected to be particularly large on those currently living beyond the 4-hour motorized travel time threshold.

Similarly, the planned road improvements will mostly reduce the number of people who are currently 30 minutes to an hour away from the nearest public primary school – by about 107,000 – shifting this population into the <30-minute travel time group. The impacts on accessibility to private PPS schools would be comparatively the smallest in terms of the affected population, and they would mostly occur at the worse end of accessibility, with nearly 63,000 people in the above-4-hour group seeing accessibility improvements, however marginal.[8] At the level of individual regions, the biggest gains in accessibility are expected in Est, where several roads are planned to be improved. While still remaining very high, average motorized travel time to the nearest CM/CMU will decline by 15 minutes, and average travel time to the nearest CMA – by 25 minutes. Average travel times to schools will not decrease as significantly – by about 4-8 minutes, depending on the school type (see Annex 1).

Across most of the country, even the modest accessibility "under normal conditions" as estimated in section 5.1. is further reduced during parts of the year due to roads becoming impassable. As illustrated by the analysis in section 5.2., the road network is particularly at risk of flooding-related disruptions in Boucle du Mouhoun, Centre-Nord, and Platea-Central. However, also in Est, Haut-Bassins, Sud-Ouest, Centre-Ouest, and Sahel, over 20 percent of the primary, secondary, and tertiary road network is at risk. The household survey data collected as part of this study confirms that road impassability ranks high among the constraints for households to send their children to school among those households who admit that their children do not attend school regularly. Addressing the risk – through improving roads to a climate-resilient standard – is particularly important in the Sahel, where less than 10 percent of the rural population currently live near an all-season road, with over 1.2 million people lacking such access. However, the overlap between high flood risk and particularly low Rural Access Index and/or large *absolute* size of the rural population that is not connected to an all-season road is significant also in Boucle du Mouhoun, Sud-Ouest, Centre-Nord, and Est. In the case of Centre-Nord, the combination of low rural access and high flood risk is also posing accessibility constraints for a sizable population of internally-displaced persons, numbering several hundred thousand as of February 2021.

The overlap of the various challenges at the region level is summarized in Table 3. The Boucle du Mouhoun, Centre-Nord, Est, and Sahel regions have the greatest overlap of various challenges that affect accessibility to health and education opportunities. At least relative to the other regions in the country, Centre, Centre-Est, and Nord face fewer/less extreme challenges.

[8] Detailed national-level results on the expected improvements in travel times as a result of the planned/ongoing road improvements are provided in Annex 2.

Table 3: *Summary of the spatial overlap of connectivity and other challenges at the region level*

	RAI (%)	*SIZE OF UNCONNECTED RURAL POPULATION*	*ACCESS GAPS (HEALTH)*	*ACCESS GAPS (EDU)*	*FLOOD RISK (ROADS)*	*FLOOD RISK (FACILITIES)*	*FACILITY CLOSURES*	*IDPS*
BOUCLE DU MOUHOUN	V	V	V	V	V	V	V	V
CASCADES	V	V	V	V	V	V	V	V
CENTRE	V	V	V	V	V	V	V	V
CENTRE-EST	V	V	V	V	V	V	V	V
CENTRE-NORD	V	V	V	V	V	V	V	V
CENTRE-OUEST	V	V	V	V	V	V	V	V
CENTRE-SUD	V	V	V	V	V	V	V	V
EST	V	V	V	V	V	V	V	V
HAUT-BASSINS	V	V	V	V	V	V	V	V
NORD	V	V	V	V	V	V	V	V
PLATEAU-CENTRAL	V	V	V	V	V	V	V	V
SAHEL	V	V	V	V	V	V	V	V
SUD-OUEST	V	V	V	V	V	V	V	V

Note: V – high level of challenge relative to other regions; V – medium level of challenge; V– low level of challenge

❖ *Improving the Rural Access Index*

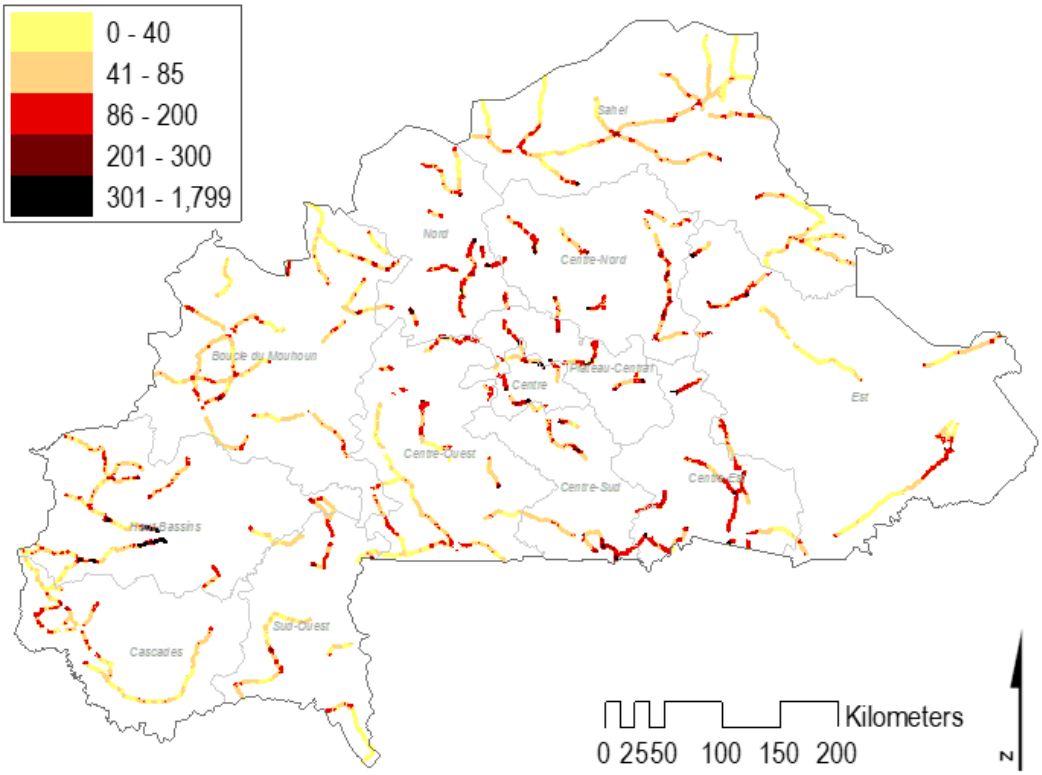
Reaching the target of 30 percent Rural Access Index as established in the World Bank's *Sahel Region Strategy*, up from less than 24 percent today,[9] will require improvement of a significant share of the country's road network, especially considering its relatively low population density. Providing all-season access to an additional 6.2 percent of the rural population means that enough rural roads would have to be improved to serve about 1,055,000 additional people.

Considering the 2020 population distribution, for the target to be achieved at the scale of the country overall, about 21 percent of the length of the combined primary, secondary, and tertiary road network that is currently in poor condition would need to be improved to a good or fair condition – even without prioritizing specifically the roads in lowest-accessibility or highest flood-risk regions – to ensure all-season access for an additional 1.055 million people. Figure 44 illustrates the population density around the major roads that are currently in poor condition (and are not under/awaiting construction). The 30-percent RAI target could be achieved only if all of the roads in poor condition that pass through rural areas with population density above 85 people per km^2 were improved to an all-season standard. The total length of this primary, secondary, and tertiary road network that would need to be improved totals about 1,330 km. The Nord, Centre-Est, Centre-Nord, Plateau-Central, and Haut-Bassins regions would appear to be priority for targeting these investments, based solely on the population density criterion. Some of these, notably Centre-Nord, Plateau-Central, and Haut-Bassins also rank high in terms of the flood risk exposure, whereby improving the rural roads in these regions would likely have a particularly significant benefit.

Nonetheless, the minimum investment required to reach the 30-percent target – estimated by simply prioritizing the road segments that serve the largest number of people – would be substantial. Based on the recent cost estimates of about US$90,000 per km of rural roads rehabilitated and US$700,000 per km of trunk and secondary roads paved, the needed investment amounts to nearly US$230 million, or about US$220 per rural resident connected. The map in Figure 44 also demonstrates that, with the minimum-investment criterion, the length of roads prioritized for improvement in the low-accessibility regions such as Sahel, Est, and Boucle du Mouhoun would be relatively small, due to the lower-than-average rural population densities.

[9] This figure already considers as all-season the roads that in November 2019 were reported to be under construction or were awaiting construction.

Figure 44: *Population per km² around primary, secondary, and tertiary roads currently in poor condition and not under/awaiting construction*



To come closer to reaching the Rural Access target in individual regions, rural roads in areas with much lower population density than 85 people/km² would have to be improved to a climate-resilient standard – and at a much higher overall cost per person connected. In Sahel, the region with the lowest RAI and accessibility to schools and healthcare facilities, the Index would improve to only about 26 percent even if all of the primary, secondary, and tertiary roads that are currently in poor condition were improved (~1,110 km), at a cost of over US$1,960 per person.

❖ *Improving connectivity to facilities*

In order to identify road improvements that could help improve accessibility to schools and healthcare facilities specifically, the study undertook a centrality analysis of the road network using concepts from Graph Theory and network analysis,[10] such as *connectivity, betweenness*, and *closeness*, and considering the location of schools and healthcare facilities vis-à-vis the road network.

For example, each road segment was characterized in terms of its role in providing the shortest (most direct) route between two points in the region, allowing to identify roads that are major connectors and critical routes for access – and therefore associated with high accessibility losses in case they becomes impassable. The criticality measures were estimates separately for each region of Burkina Faso, given the purpose of identifying critical roads for local-level accessibility to health and education opportunities rather than roads that matter the most in national or international level connectivity. Figure 45 illustrates the overall "importance" of individual roads when considering their centrality in the region's road network and their proximity to schools and healthcare facilities. It suggests that there are several roads of critical importance for connectivity, such as in the Est region's Kompienga province, that should be prioritized for improvement given their currently poor condition and high centrality score. In addition, several roads in the Soum province (Sahel) and the Boulgou province (Centre-Est) appear to be especially important yet are currently in poor or fair condition without immediate plans for rehabilitation.

[10] Described in, e.g., Crucitti et al. (2006) and Zhang et al. (2011)

Figure 45: *Importance score of the road segment considering its centrality in the region's road network and its proximity to health and education facilities*

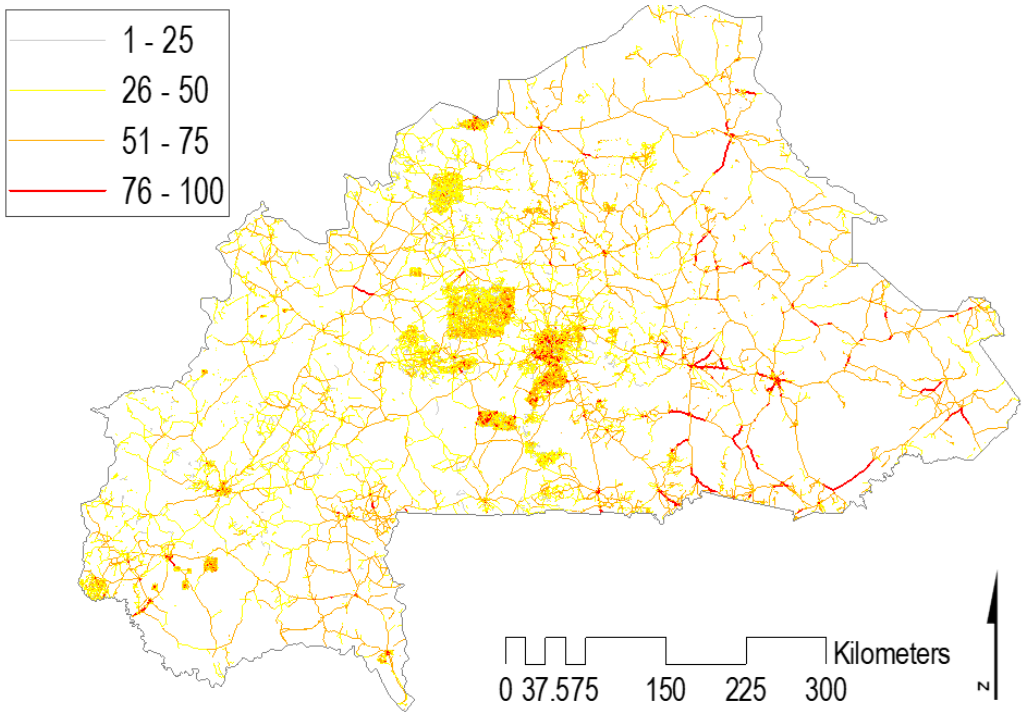
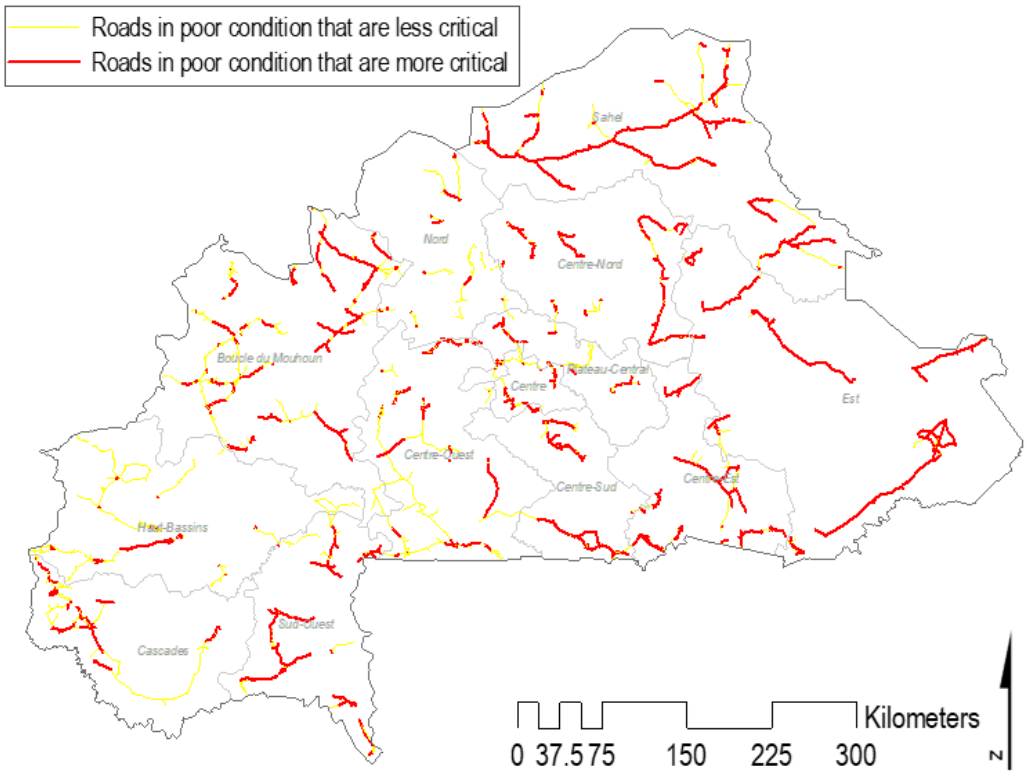


Figure 46: *Importance of the road segments that are currently in poor condition and not under/awaiting construction, considering their centrality in the region's road network and proximity to health and education facilities*



Looking only at the primary, secondary, and tertiary road network that is currently in poor condition and not under/awaiting construction, Figure 46 illustrates which of those roads should be prioritized for improvement if considering their criticality in providing connectivity to health and education opportunities (the half of the road segments that are more critical are colored red). Comparing this map to the one shown in Figure 44, it can be seen that the priority segments are not necessarily the same – in other words, the segments that would be prioritized in order to increase the country's overall Rural Access Index at minimum cost are not always the same as those that should be improved given their criticality for accessing schools and healthcare facilities in a specific region. Most notably, nearly all of the primary, secondary, and tertiary roads in poor condition in the Est and Sahel regions should be prioritized according to the latter criteria, but only a few of those would be targeted if improving the country's overall Rural Access Index at minimum cost were the guiding objective. To a large extent this is also the case in Boucle du Mouhoun and Sud-Ouest. On the other hand, in Nord, while many of the roads would be prioritized for improvement based on their role in increasing the national Rural Access Index (due to relatively high surrounding population density), only some of these roads are highly critical for connectivity to key social services. The alignment between the two criteria is the closest in regions such as Centre-Nord, Haut-Bassins, and Centre.

The half of the poor-condition road network segments that are more critical for connectivity to health and education facilities (marked in red in Figure 46) total about 4,460 km in length. Of this total length, 19 percent is in Sahel and 17 percent in Est. Improving the 4,460 km of high-criticality roads from their current poor condition to an all-season standard would require over US$1.5 billion; however, the improvement in the country-wide RAI would be relatively small, from the current 23.8 percent to 26.3 percent. This also suggests that the Rural Access Index is an imperfect metric for selecting roads for improvement if raising accessibility to schools and healthcare facilities is a key priority.

- ***World Bank supported interventions***

A number of recently closed or currently ongoing World Bank supported projects are already contributing to addressing the issues identified above. For example, the recently approved Emergency Local Development and Resilience Project adopts a cross-sectoral approach to holistically address the accessibility gaps in Boucle du Mouhoun and Est, two of the regions affected by the security crisis and influx of IDPs. While at a relatively small scale, the projects are also addressing the demand side of schooling and healthcare, for instance, by decreasing the number of students for whom education is beyond reach due to affordability issues. Examples of relevant projects are summarized in Box 1.

Box 1: *Examples of recent World Bank financed projects supporting health and education accessibility goals*

EMERGENCY LOCAL DEVELOPMENT AND RESILIENCE PROJECT (P175382): The project aims to improve inclusive access of communities (including IDPs) to critical infrastructure and essential social services, primarily in *zones under pressure* which have medium-intensity conflict and are where the majority of IDPs are living and in *prevention zones* which are at risk of conflict. The menu of project interventions depends on the needs on the ground based on the participatory planning process and on the accessibility of the geographical zone from a security standpoint. The first phase of the Program will be implemented in 15 communes in the Kossi, Banwa, Sourou (Boucle du Mouhoun) and Gourma, Komondjari, Gnagna (Est) provinces, addressing three broad areas of needs: (i) lack of service delivery; (ii) missing critical infrastructure; and (iii) limited employment opportunities. Its expected outcomes include:

- ✓ 300,000 people will receive improved essential social services (of which 30% IDPs)
- ✓ 105 newly built or rehabilitated education and health infrastructures
- ✓ Increase in adequately staffed and equipped schools and health centers from 0% to 95%
- ✓ 1,100 km of rural or inter-urban roads rehabilitated or improved to an all-season standard

EDUCATION ACCESS AND QUALITY IMPROVEMENT PROJECT (P148062): The project is improving early childhood education in the Est and Centre-Est and contributes to increased access to secondary education in three additional high-poverty regions.

Supply side:

- ✓ 327 classrooms have already been built in lower and upper secondary levels, providing access to secondary education to approximately 20,595 students, including 10,010 girls
- ✓ Helping improve the quality of teaching and learning through teacher training

Demand side:

- ✓ 1,000 selected students, predominantly girls from poor households, have received subsidies to support the costs of their school fees

Under the recently approved Additional Financing (AF) for the project, new schools will be built in regions affected by the security crisis, such as the Nord, Sahel, and Est, in areas closer to students who have been affected by school closure. In addition, the AF will provide targeted support to an additional 10,000 students, mostly disadvantaged girls from poor households across all 13 regions of the country.

6. ACCESSIBIILITY IN OUAGADOUGOU

6.1. Overall accessibility to schools & healthcare facilities

In the case of Burkina Faso's largest city, the analysis focuses in on the level of accessibility offered by the existing fixed-route bus system and its value-added above and beyond commuting on foot. For comparison purposes, bus-based travel times were estimated both with respect to healthcare facilities and schools, while acknowledging that most school access in practice takes place via non-motorized transport. Given the current *de facto* dependence on motorcycle transport in the city for most motorized trips, accessibility estimates for motorcycle-based travel to individual types of facilities are provided for illustrative purposes, to exemplify the advantages provided by this mode in the context of the poorly spatially planned and low-capacity public transport system.

Average accessibility to primary schools using the existing bus system is estimated to be relatively good. Out of the 1,212 primary schools, residents, on average, are able to reach 20 schools within 30 minutes of travel using the SOTRACO bus services. At least one primary schools is accessible within 30 minutes of travel for the vast majority (94 percent) of people, and within an hour at least one school is accessible for everyone.

In the case of PPS schools, of which there are 763 overall, accessibility is slightly lower but still acceptable if all schools (public and private) are considered together. Within 30 minutes of travel by bus, 13 secondary schools are accessible to the average city resident, with 93 percent of the population being able to reach at least one school. Within an hour of travel, accessibility is universal.

However, once disaggregating by the private versus public status of schools, accessibility is considerably lower. This matters in particular for those residents who cannot afford to send their children to private schools. In the case of public primary schools (of which there are significantly less than private ones, as discussed earlier), only 5, on average, are accessible within 30 minutes of travel by bus, compared to 15 private primary schools. As many as 15 percent of the city's residents cannot reach even a single public primary school within that time threshold, and for 2 percent of the population not a single public primary school is reachable even within an hour of travel by bus.

Similarly, residents of several *secteurs*, such as in the city's northeast, are not able to reach even a single public PPS school within 30 minutes. On average, Ouagadougou residents can access only one public PPS school within that travel time threshold, compared to 11 private PPS schools.

Figure 47: *Travel time by SOTRACO bus to nearest primary school (minutes)*

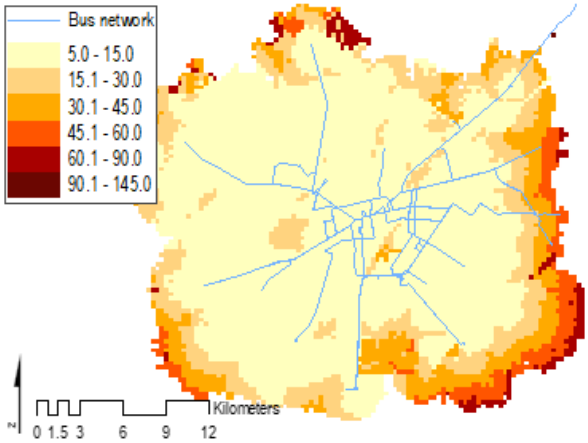
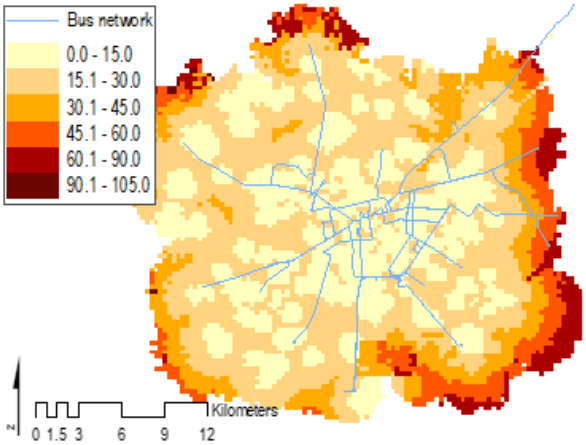


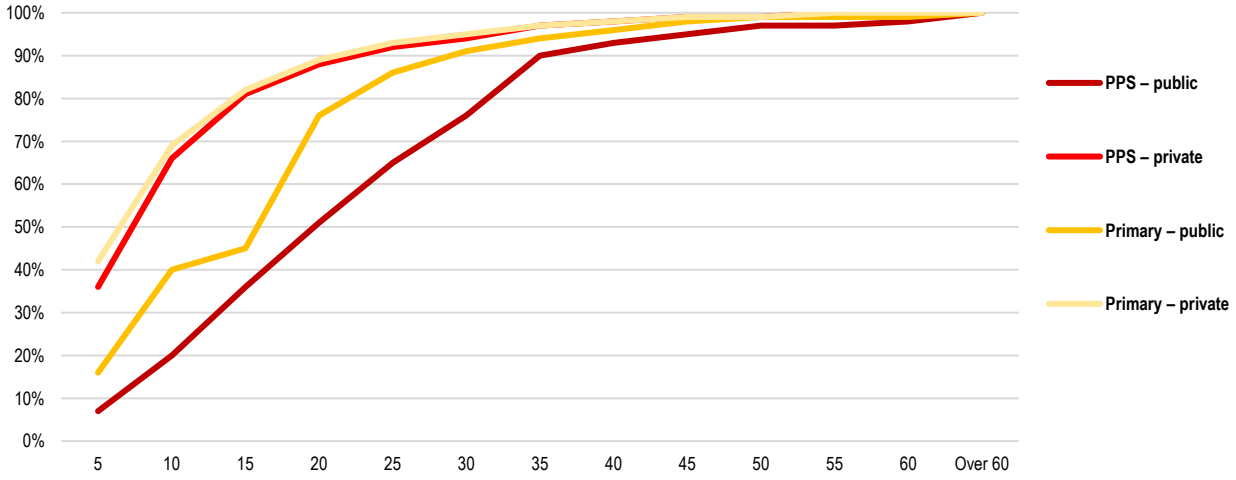
Figure 48: *Travel time by SOTRACO bus to nearest public primary school (minutes)*



Source: Author's estimates based on data from SOTRACO and facility data provided by Ministry of Education

Inequality of bus-based accessibility to schools of different types can be measured using indicators and graphics similar to those used in economics to measure income inequality (e.g., Gini coefficient and Lorenz curves). Figure 49 provides a visual comparison of "accessibility distribution" across Ouagadougou, showing the cumulative share of the population able to reach the nearest school of a particular type within the given travel time. Some of the metrics here that can be used to infer the extent of accessibility inequality include the time threshold that corresponds to 50 percent of the population and the rate at which the curve relating population share and travel time approach 100 percent (indicating universal accessibility). In the case of Ouagadougou, both of these metrics are better in the case of private primary schools and private PPS schools, especially compared to public PPS schools. This is explained by the fact that there are quite a few areas throughout the city from which even the nearest public PPS school is beyond reach within a 30-minute travel time threshold but where population density is relatively high.

Figure 49: *Share of population able to reach the nearest school by bus within a certain time threshold (minutes)*



Source: Author's estimates based on data from SOTRACO and facility data provided by Ministry of Education

Across all types of schools, the "added value" of the existing bus system appears to be quite low, if comparing the above results with estimates based on the assumption that the person relies on walking only. This is not surprising given the limited number of bus routes and the very large headways, sometimes exceeding two or more hours. So, for example, under the walking-only assumption, the average resident of Ouagadougou is able to reach 19 primary schools within 30 minutes, compared to only one more (20) in the public transport scenario. The share of the population being able to reach at least one primary school within this time threshold is identical under the two scenarios. Also for PPS schools the results are similar, with the existing fixed-route public transport system providing only limited additional accessibility benefits.

In the case of healthcare facilities, bus-based accessibility varies depending on the level of care the facility offers. Assuming a travel time threshold of 30 minutes, the average resident of Ouagadougou is not able to reach even a single CHU or CMA and only one CM and one CSPS. Even assuming travel time of an hour, still, roughly two-thirds of the city's population are not able to reach a hospital by bus, while nearly half are not able to reach even a CMA.

In Ouagadougou overall, the average person has to travel approximately 22 minutes by bus to reach the nearest healthcare facility of any kind; however, the average time to the nearest facility is much longer if specific level of care is needed, ranging from 28 minutes to the nearest CSPS, about 45 minutes to a CM, an hour to a CMA, and over 1.5 hours to a hospital. In comparison with bus-based travel, motorcycles provide a clear advantage, with average travel times to nearest advanced healthcare facility (CMA or CHU) estimated at only 10 minutes, and about than 5 minutes to reach the closest CSPS.

Figure 50: *Travel time by bus to nearest advanced healthcare facility (CMA or CHU) (minutes)*

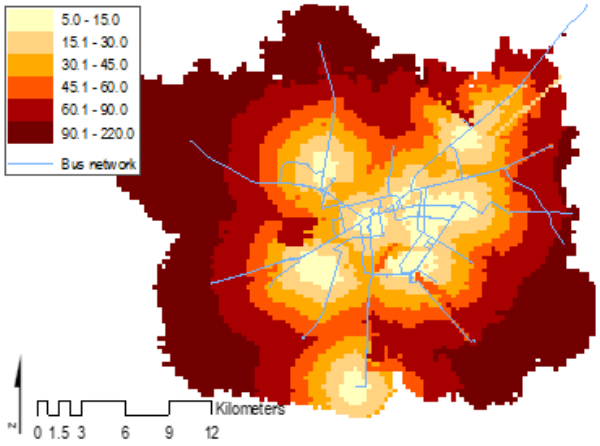


Figure 51: *Travel time by bus to nearest CSPS (minutes)*

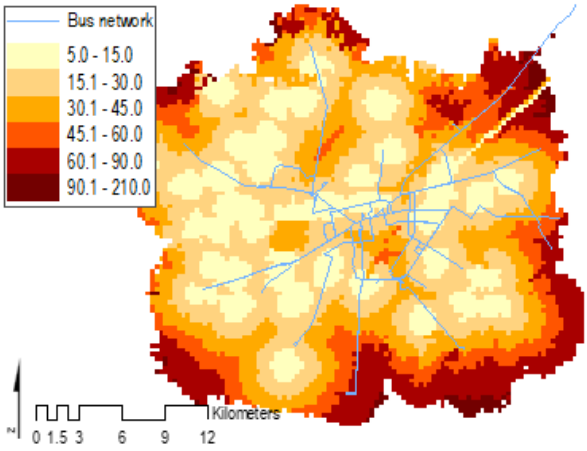


Figure 52: *Travel time by motorcycle to nearest advanced healthcare facility (CMA or CHU) (minutes)*

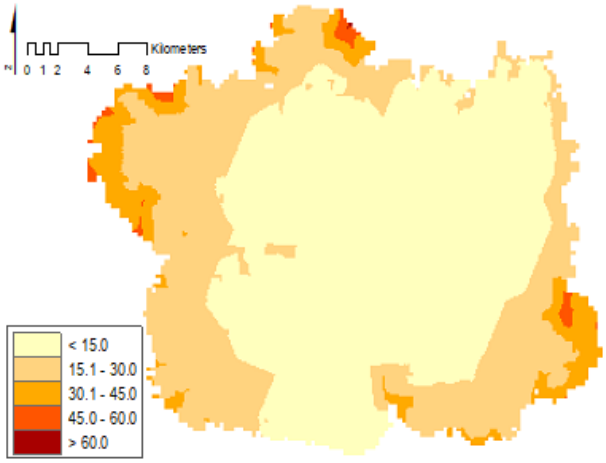
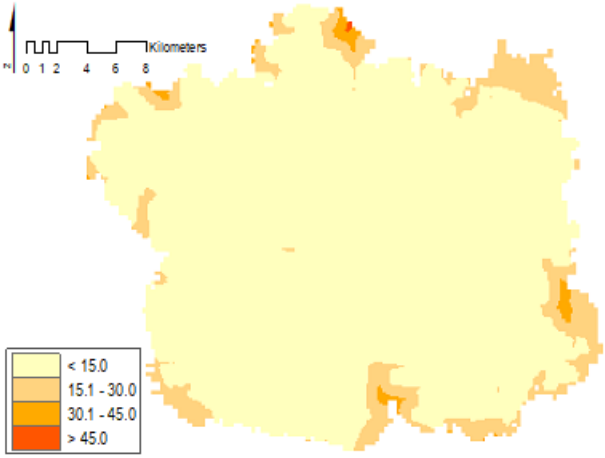


Figure 53: *Travel time by motorcycle to nearest CSPS (minutes)*



Source: Author's estimates based on data from SOTRACO and facility data provided by Ministry of Health

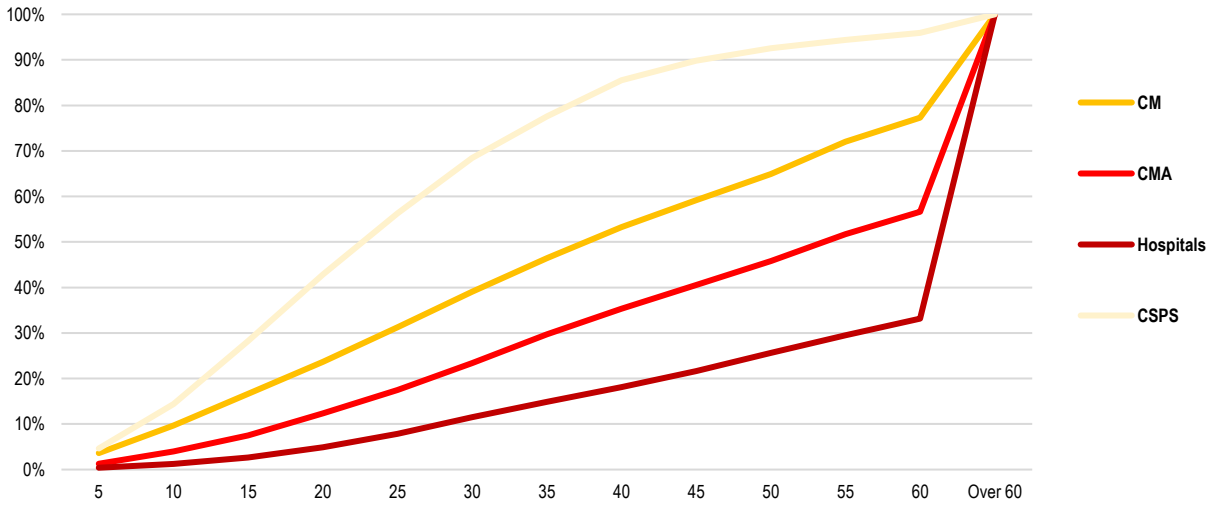
Spatial inequality in bus-based accessibility to health facilities is generally much more significant than to schools although this again varies by type of facility (Figure 54). The travel time thresholds at which at least half of the city's population are able to reach at least one facility range from 20-25 minutes in the case of CSPS, to 35-40 minutes for CM, 50-55 minutes for CMA, and significantly over an hour for hospitals.

Similarly to education facilities, also for accessing clinics and hospitals the existing bus system does not appear to provide much additional value over what could be reached by walking. The difference between walking-only and bus-based accessibility is slightly larger for more advanced facilities, also because there are fewer of them in the city and their distribution is less even. So, for example, while 34 percent of the population can reach at least one hospital within an hour by bus, only 21 percent can by walking-only. In comparison, for CSPS and CM the difference is only a couple of percentage points.

While the identified accessibility patterns are influenced to some extent by the public transport route allocation across the city, the accessibility benefits the bus system provides – even where it does extend – are very limited. Nearly all of the advanced medical facilities are connected to a bus route; however, this immediate proximity to bus service does not translate into significant

accessibility gains. This is intuitive given the very limited speeds on some routes, as low as 11-15 km/h on SOTRACO lines 6 and 16 which connect Naaba Koom in the city center to Terminus Koulw Toghin (north, half way between city center and the city boundary) and Terminus Eau Maman (near the north-western edge of the city), respectively. Moreover, the headways on line 16 is reported at 140 minutes, which means that the residents of the entire north-western quadrant of Ouagadougou are served by a single route that can accommodate the needs of at most 50-80 people every 2.5 hours. Headways on the bus network are an hour or more on many of the routes in the city's central and northern part; however, also the most frequent bus service – on routes traveling from the city center east and south-east – is only available every 25-30 minutes.

Figure 54: *Share of population able to reach the nearest health facility by bus within a certain time threshold (minutes)*



Source: Author's estimates based on data from SOTRACO and facility data provided by Ministry of Health

The paved road network in Ouagadougou is extremely sparse, limited to seven radial national-importance roads. Based on the Global Road Inventory Project (GRIP) 2018 data, which suggests that there are about 360 km of paved roads in the city, the estimated paved road density is thus only 0.52 km per km^2 of area, which is about a quarter of the level in Accra, Douala, Conakry, and Abidjan. The existing bus transport is limited almost entirely to this paved network, and even neighborhoods that are relatively central and have population densities that are moderate to high by Ouagadougou standards do not have direct access to a paved road. While in other SSA cities – where public transport provision is dominated by informal public transport (minibuses) – the limitation of the service to paved roads can be attributed to the *private* operators' lack of incentives to operate their vehicles in sub-standard road conditions, this explanation applies less to Ouagadougou.

Another driver of the limited accessibility, especially to advanced healthcare facilities and for the city residents who live in the outlying secteurs, is the urban form of Ouagadougou and its evolution over time. Ouagadougou almost tripled its built-up area between 1983 and 2005, according to *Schéma Directeur du Grand Ouagadougou* of 2008, expanding in the form of urban sprawl and informal housing development in the periphery. As was identified in the study by Lall *et al*. (2017), Ouagadougou, similarly to many African cities, is characterized by disconnectedness, spatial dispersion, and the so-called *leapfrog* outward development, whereby new, previously disconnected neighborhoods are absorbed by the growing sprawling city while new development near the center is lacking. In the decade between 2000 and 2010, leapfrog development accounted for nearly 40 percent of Ouagadougou's overall expansion, an increase compared to the previous decade and much above the shares of leapfrog development observed in many other major African cities.

As a result of the outward sprawl during the last few decades, already today the average population

density of the Ouagadougou metropolitan area is low, at only about 5,200 inhabitants per square-kilometer, which is half of the average density of Douala and Kampala, for example. Moreover, Ouagadougou lacks a distinct density gradient or peak even in its very center, which implies that providing public services is costly, as any given facility or transport link directly serves only a limited number of people. For example, only 7 percent of the city's population lives within a kilometer of an advanced healthcare facility (hospital or CMA), and any additional facilities or bus routes to be located in parts of the city where they are currently lacking would, similarly, serve only a limited population in their direct vicinity.

6.2. Inequality in accessibility depending on household poverty status

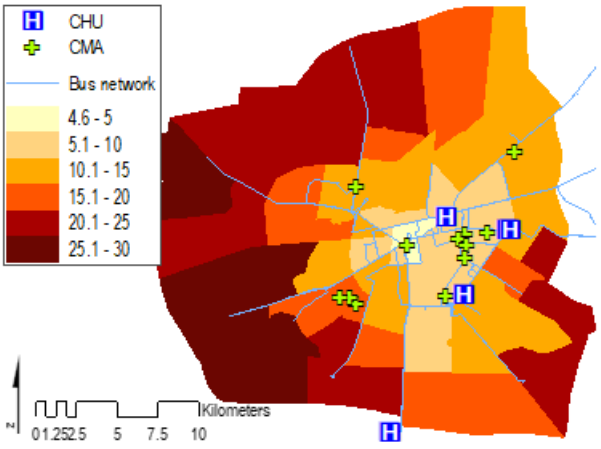
In the absence of a readily available poverty map for Ouagadougou, the study team generated poverty estimates using existing household survey data and supplementary high-resolution geospatial data. Survey data were obtained from the 2017/2018 version of the Harmonized Survey on Household Living Conditions (*Enquête Harmonisee sur les Conditions de Vies des Menages*, EHCVM), which, among others, includes an indicator for the consumption aggregate for each household that adjusts for regional and temporal differences in prices. Using these data, indicators for poverty were constructed using poverty lines defined by the Burkina Faso National Institute for Statistics and Demography (INSD), which are also adjusted for regional and spatial differences in prices.

Small-area estimation (SAE) methods were then applied to estimate poverty at the city scale as well as at the level of individual secteurs, combining survey data with census data. Because accurate census data for Ouagadougou could not be accessed, a pseudo census was constructed using estimates of the size of the population using population density estimates created by Facebook's Data for Good project. To further increase the precision of poverty estimates, the team also incorporated additional geospatial data on land cover classification (built-up, vegetation, and water) and the presence of forced displacement. The approach also incorporated sample weights when estimating the prediction model and accounted for differences in the estimated population density, giving populated grids more weight.

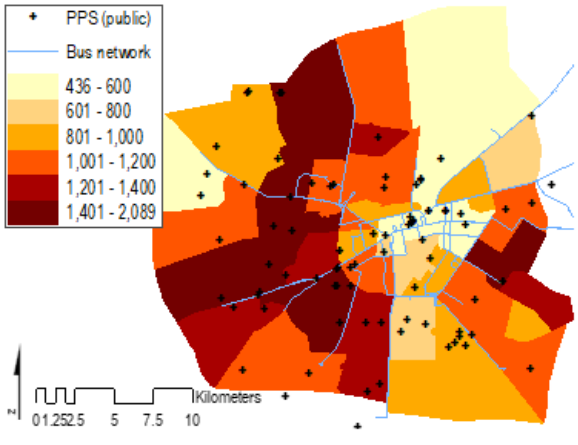
The resulting estimated poverty incidence in Ouagadougou overall is about 17 percent but exceeds 25 percent in individual secteurs in the city's southwest. The lowest levels of poverty are in the city center (less than 5 percent of the population). When expressed in human density terms, the poverty distribution is fairly similar, with the exception of individual high-density secteurs in the city's north and east.

Figure 55: *Poverty distribution in Ouagadougou and distribution of specific types of facilities*

Poverty rate in secteur (%) and advanced medical facilities



Poor people per km² and public PPS schools



Source: Constructed by study team based on EHCVM 2017/18 and complementary spatial data

The poorly spatially planned and inefficient public bus network of Ouagadougou appears to reach the poorest parts of the city to the same extent as the better-off ones, but its effectiveness in terms of ensuring accessibility to health and education facilities for the poor is also comparably low. In the case of schools, some differences in bus-based accessibility for the poor compared to the overall city population emerge at the PPS school level, where 56 percent of the city's poor population are estimated to be able to access at least one public PPS school within half hour of travel by bus, compared to 60 percent among the overall population, and accessibility for the poor is also slightly lower for private PPS schools with Catholic or Muslim affiliation specifically. The value-added of the bus system as compared to just walking is equally low for the poor as for the overall population, with only a very marginal improvement for accessing some education facilities (e.g., public PPS schools) and none for others.

The differences in accessibility between the overall population and the poor are greater with respect to healthcare facilities, especially the more advanced ones (CHU, and CMA). Compared to the overall city population of whom 18 percent can access a CHU within 45 minutes of travel by bus, among the poor population the share is only 10 percent. Similarly, for accessing CMAs, the share of the poor able to access at least one within this time threshold is only 22 percent, compared to 34 percent among all city residents combined. Either a hospital or a CMA is accessible within 45 minutes for one-fourth of the city's poor, compared to more than one-third of the overall population. These accessibility differences vis-à-vis the overall population appear to be mostly driven by the absence of advanced healthcare facilities and relative sparsity of public PPS schools in the secteurs of the city where the poverty incidence and/or the density of the poor per area is high (Figure 55).

Figure 56: *Overall population vs. the poor able to access at least one facility within 45 min of travel by bus (%)*

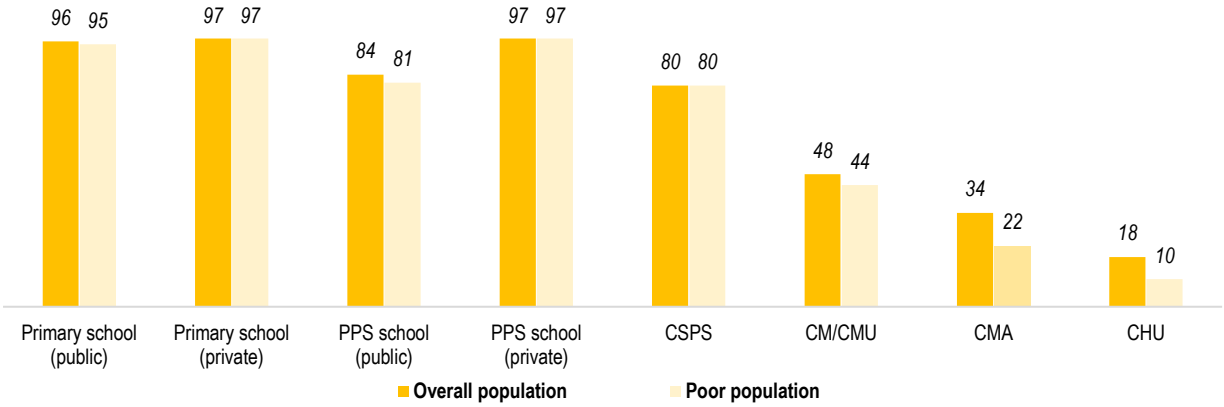
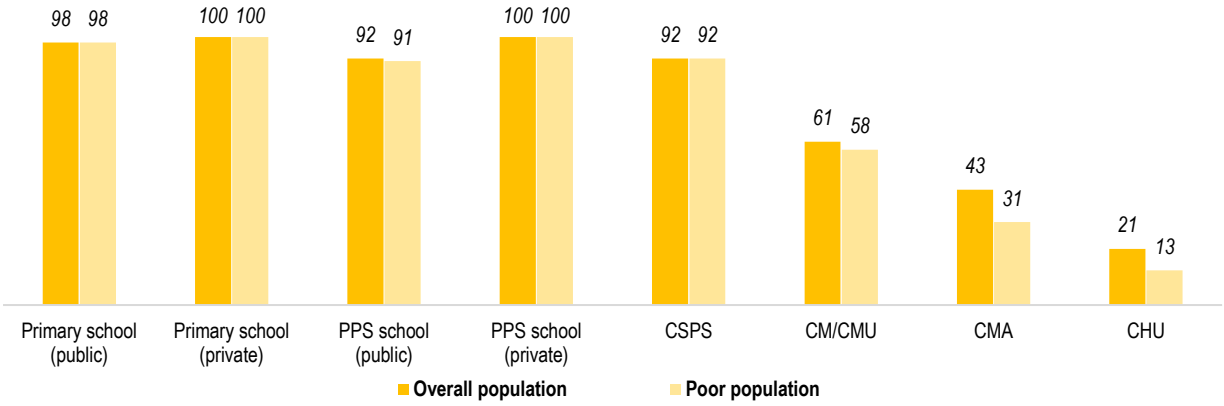


Figure 57: *Overall population vs. the poor able to access at least one facility within an hour by walking (%)*



Source: Estimates by study team based on SOTRACO network data and facility data from Ministries of Health and Education

The accessibility improvements over walking-only provided by the bus system for the poor specifically emerge at the higher travel time thresholds: for example, while 39 percent of the poor can access at least one CMA within an hour of travel by bus, only 31 percent can by walking. Compared to the overall population of Ouagadougou, the poor appear to be nearly equally able to rely on walking for accessing schools and lower-level medical facilities, but are at a clear disadvantage for accessing advanced medical facilities.

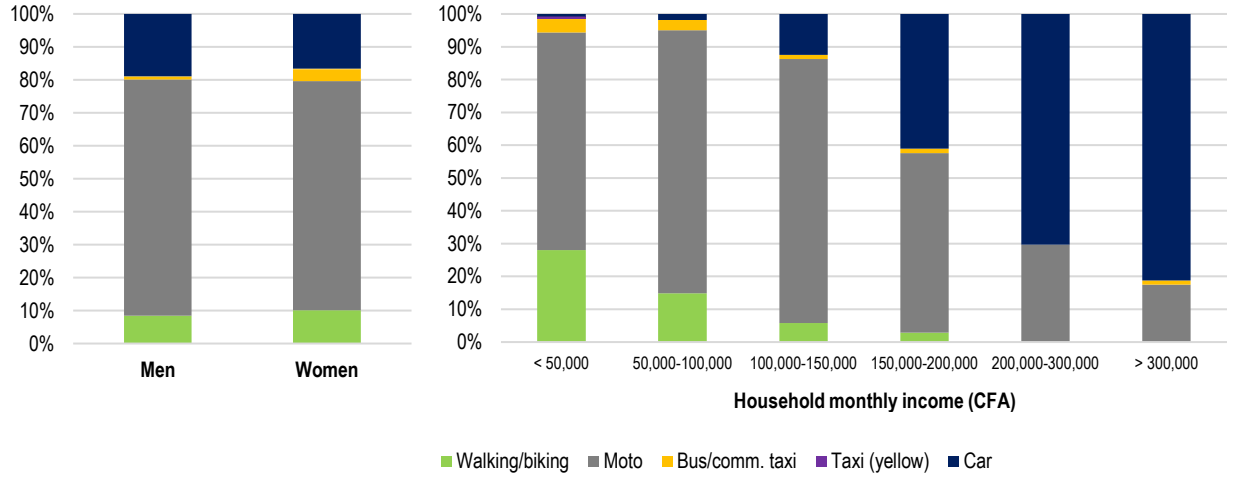
6.3. Access constraints as reported by Ouagadougou residents

To gain broader insights into the transport and other constraints faced by Ouagadougou residents for accessing education and health services, a field survey was conducted as part of the study during the month of June, 2020. Altogether, 2,086 individuals were interviewed, of whom 63 percent are male. By age group, about one-third of all respondents are 18-25 years old and another third – 26-35 years old. About 13 percent of all respondents come from households that earn less than CFA 50,000 per month, and another 15 percent belong to households earning between CFA 50,000 and 100,000; less than 4 percent come from households that make more than CFA 300,000 per month. About 22 percent of respondents declined to report the income group to which their household belongs, while 23 percent do not know the answer to this question.

While most (70 percent) of all respondents do not have any private cars owned by their household, an even greater share (93 percent) report having at least one motorcycle or scooter. This is the case even among 72 percent of respondents belonging to the < CFA 50,000 households, indicating that a motorcycle is perceived by households to be an absolute necessity to move around in the city.

To all of the respondents, questions were posed regarding the general role of transport constraints in their ability to access healthcare opportunities and, for those who have children in primary or secondary school, ability to access education facilities. The respondents were also asked what transport modes they (or their children) typically use to arrive to the medical facilities they use regularly or the schools they or their children frequent, as well as which specific medical facility or school they or their children typically travel to. The latter question is important for understanding how the spatial accessibility gaps identified earlier – i.e., to *nearest* facility – relate to the actual travel preferences of the city's residents.

Figure 58: *Travel to medical facilities for regular needs, by mode (by gender and household income)*



Source: Data collected by study team, June 2020

In the case of travel to healthcare facilities for medical needs, only about 3 percent of all respondents rely on walking, another 6 percent bike, and less than 2 percent use public bus or communal taxi. The vast majority (71 percent) typically use a motorcycle or a scooter. A slightly greater share of

women than men rely on walking and biking to reach medical facilities (10 percent vs. 8 percent), and women also rely somewhat more on buses and communal taxis (4 percent vs. 1 percent). Differences in modal shares are yet more distinct depending on the respondents' household income, with walking and biking dominating in the low-income groups, but being entirely absent in the upper ones (Figure 58).

In terms of the preferred medical facilities, the single most commonly named ones include CHU de Bogodogo, CHU-Yalgado Ouedraogo, Hopital Saint Camille de Ouagadougou (HOSCO), Hopital Paul VI, CMA de Pissy, CMA de Saaba, and CM Shicphra. Over 40 percent of respondents report usually going to a CSPS for their regular medical needs, while only about 10 percent report going to a hospital. Preference for hospitals is much more common among the higher-income respondents: in the > CFA 300,000/month sub-sample, nearly one-third report going to a hospital rather than a less sophisticated medical facility.

When asked how important is the travel distance as a constraint in accessing health services as often as they would like, over 20 percent of respondents report it as being either *the* most important constraint or one of the main constraints. Among men, 19 percent say that it is the main constraint or among the main constraints, compared to 22 percent of women. The importance of travel distance as a constraint is somewhat higher among women of reproductive age (in this survey: 18-45 years old), of whom 23 percent characterize it as the main constraint or among the main constraints. The share is higher yet among the younger age group within this sub-set of respondents – 27 percent of women aged 18-25.

Among the respondents belonging to low-income households, travel distance presents a much more common constraint to accessing healthcare services, with 38 percent of respondents in the <CFA 50,000/month sub-group saying it is the most important or one of the main constraints. However, travel distance represents a serious constraint even for many of the upper-income respondents. Finally, it also appears to be more concerning for older respondents compared to younger ones, with about one-third of the individuals older than 55 reporting it as among the main constraints or the most important one.

Figure 59: *Travel distance vs. transport cost as "the most important constraint" or "one of the main constraints" in accessing health services, by household income (% of respondents)*

Source: Data collected by study team, June 2020

Transport cost appears to be a somewhat less important obstacle than travel distance in the ability of Ouagadougou's residents to access healthcare services, with 16 percent of the respondents saying it is either the most important constraint or one of the main ones. Unlike in the case of travel distance, equal shares of women and men consider transport cost as a major constraint. Transport cost is more commonly perceived as a constraint by the older respondents (about 29 percent of the 55+ individuals reporting it as among the main or *the* main constraint). However, it is particularly high also among the younger tier of women of reproductive age (18-25), of whom 19 percent consider transport cost either as the most important or among the main constraints for accessing healthcare services.

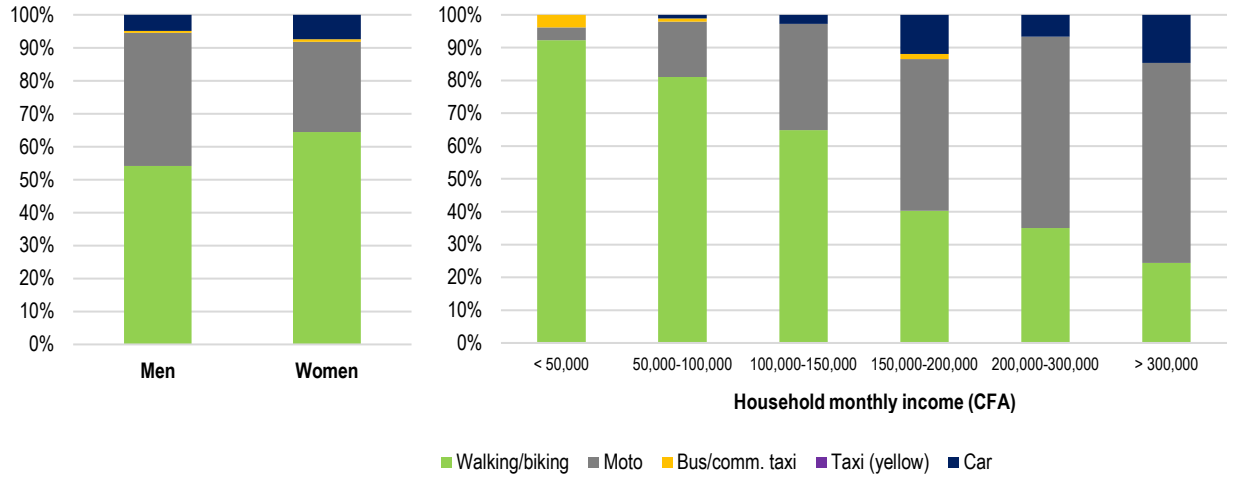
As with travel distance, transport cost as a barrier to accessing healthcare is more important for the respondents belonging to households in the lowest income group compared to upper-income ones. However, even for the low-income respondents travel distance represents a more important constraint than transport cost. Within the lowest-income group, both transport availability and cost in fact appear to be constraining for a larger share of men than women; in other words, a higher share of low-income women than men consider *other* constraints to be more important in their ability to access healthcare services.

Among the individuals surveyed, 28 percent have children who attend school in Ouagadougou. About 35 percent of these respondents report using a motorcycle or a scooter for their children to get to school (either by themselves or transported by others), and another 31 percent bike. Walking is also a common mode for children to arrive to school, reported by 27 percent of the respondents. It is interesting to note that nearly nine-tenths of these respondents have at least one motorcycle/scooter or car available in the household; however, it appears to not be available specifically for the transport of children to school or the school may simply be conveniently close to home. In contrast, only 6 percent of respondents with children in school report using a car and less than 1 percent take public transport.

Looking at differences by gender in this case is not meaningful, as the survey does not record the child's gender but only the parent's. Nevertheless, some differences in modal shares emerge, with women reporting their children using a bike or walking more commonly than men. On the other hand, women parents are much less likely to report using a motorcycle or scooter in their children's daily travel to school.

As with medical needs, also with regard to children's travel to school the poorer households rely on walking and biking much more than the upper-income ones. In the <CFA 50,000 sub-group, children walk or bike to school in 92 percent of the cases, compared to 24 percent in the > CFA 300,000 sub-group. Still, unlike in the case of travel for medical needs, walking and biking are important modes for children to get to school even for the better-off households, which may be explained by the fact that households send their children to schools relatively nearby, given the relatively dense distribution of primary and secondary schools in Ouagadougou, while this is not always possible with medical facilities. On the other hand, similarly to travel for regular medical needs, using a bus or communal taxi for children to get to school is not common in any household income group.

Figure 60: *Travel by children to school, by mode (by parent gender and household income)*



Source: Data collected by study team, June 2020

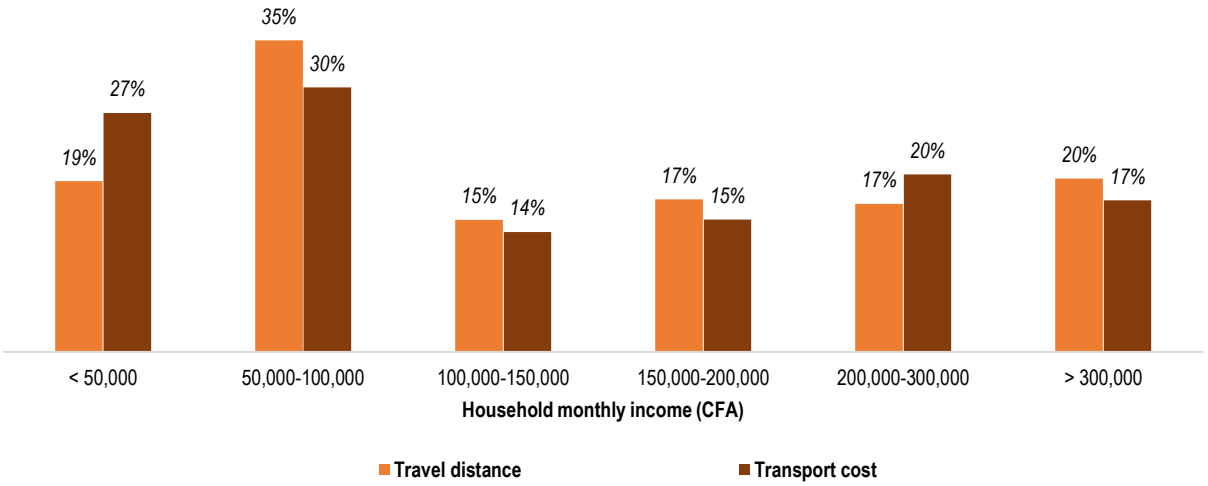
Nearly one in four respondents with school-aged children report that travel distance is *the* main constraint or among the main constraints affecting their children's schooling. Thus, it appears to be a slightly more common constraint for children's schooling than for the ability to attend to regular

medical needs. Female parents are somewhat more likely than male ones to perceive travel distance as an important constraint, perhaps reflecting the fact that it is more commonly the households' women who are responsible for bringing the children to school. In contrast to travel for regular medical needs, travel distance as a constraint for children to attend school is not clearly related to household income, possibly again due to the more even spatial distribution of schools across the neighborhoods.

Compared to travel for medical needs, transport cost appears to be a more important constraint for children to attend school, *relative to other constraints*, and also somewhat more important than travel distance: for 26 percent of the respondents transport cost is either the most important constraint or one of the main ones. Female parents are more likely to report transport cost as an important constraint compared to male parents (30 percent vs. 22 percent) and also more likely to report it as a constraint compared to travel distance.

The number of respondents in each household income bracket is relatively small, and a large share of those respondents who reported transport cost to be an important constraint either declined to report their household income or did not know it. Nevertheless, some differences can be observed across the household income spectrum, with the respondents in the lower-income groups much more likely than those in the upper-income ones to report transport cost as an important constraint for their children to attend to school.

Figure 61: *Availability/distance of transportation vs. transport cost as "the most important constraint" or "one of the main constraints" affecting children's schooling, by household income (% of respondents)*

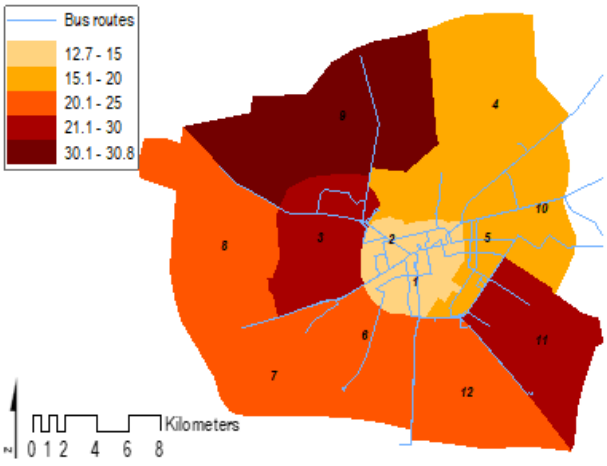


Source: Data collected by study team, June 2020

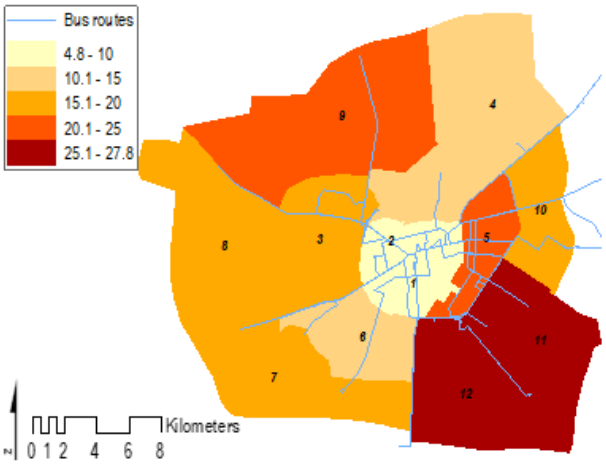
At the level of the individual arrondissements of the respondents' home locations, Nr. 9 stands out as having a particularly high share of residents who perceive travel distance as a major constraint for attending to regular medical needs and also for children's schooling (Figure 62). On the other hand, respondents from arrondissements Nr. 11 and 12 are particularly likely to report transport cost as being a major constraint for both types of needs, especially for children's schooling. Respondents living in arrondissement Nr. 10 are much more concerned with transport – travel distance and transport cost – as a constraint to children's schooling than as a constraint to attending to regular medical needs; to a lesser extent this is also the case for respondents from arrondissements Nr. 2, 5, and 8. As expected, individuals living in arrondissement Nr. 1, the most central area of Ouagadougou are the least likely to say that transport represents a major constraint to satisfying either medical or schooling needs. Still, over 10 percent of these centrally located respondents perceive travel distance as a major constraint for accessing medical needs, and about 5 percent see it as a key obstacle for their children's schooling.

Figure 62: *Transport as "the most important constraint" or "among the main constraints" affecting access to regular medical needs or schooling, relative to other constraints, by respondents' arrondissement (%)*

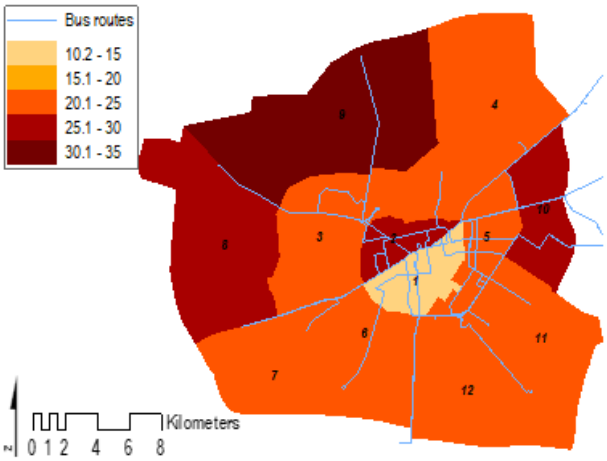
Travel distance – regular medical needs



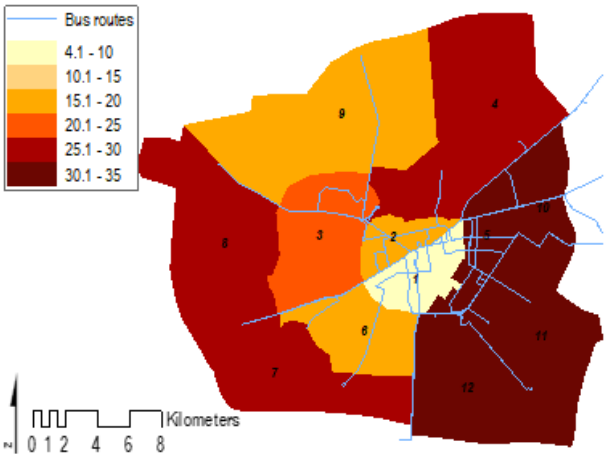
Transport cost – regular medical needs



Travel distance – children's schooling



Transport cost – children's schooling



Source: Data collected by study team, June 2020

6.4. Expected accessibility improvements due to the planned new routes

In light of the planned improvement of Ouagadougou's public transport system via the implementation of several mass transit lines (likely, Bus Rapid Transit, or BRT) and feeder services in the central part of the city, the study developed several scenarios to understand how the planned improvements will affect accessibility to schools and health facilities. The additional fixed-route network is proposed to have five routes, with Route 3 in Figure 63 likely to be developed first. The accessibility tests consider each combination of routes to prioritize the order of development, and a final model including all the routes. For all the scenarios tested, the existing SOTRACO bus network is included and is also considered as the baseline scenario. The analysis considers how the addition of the BRT lines will affect not only overall travel time but also specifically the portion of the trip that would be spent walking. As already discussed, the existing SOTRACO network, while relatively widely distributed, operates on extremely low frequencies. This means that, for most destinations, it is more optimal to bypass the network entirely because reaching the destinations is faster just by walking. However, the walking times are typically long, which impacts health, wellbeing and safety, and is likely more burdensome than would be an equal amount of time spent in public transport.

The scenarios assume travel speeds on each of the lines at about 18-20 km/h, with headways at about 5 minutes and stations spaced at 400 meters. All the BRT lines are through-lines, and vehicles make a single trip end to end without requiring passengers to disembark in the city center (unless they are switching lines).

Given the location of the planned system in the central part of the city where accessibility is already relatively good, the estimated reduction in *average* travel times to the nearest advanced healthcare facility (CHU or CMA) for the overall city population is not large, at about 2 minutes. However, the average effect includes within it both those living far from the new routes and those already close to health facilities. A more disaggregated look at the results suggests that the reductions in travel time will be more significant for individual population groups that currently have low accessibility. For example:

- Even with only Route 3 implemented, the share of the population that would take any part of the trip to the health facility by public transport (rather than walk) would increase quite significantly, from 4 percent at the current scenario to about 21 percent with the Route 3 in place. Nearly 30,000 people would see their trip duration to the nearest facility reduced by at least 15 minutes.

- With the entire planned system in place, over half of the population (54 percent) would take transit for at least a part of their trip, and the population size for whom the trip to the nearest facility lasts over an hour would decline by over 175,000. Nearly 337,000 people would see their trip duration decline by at least 15 minutes, and about 12,500 would see a travel time reduction of over 30 minutes.

- The overall travel time reductions to the nearest advanced healthcare facility will be the greatest for the residents living in arrondissements Nr. 4 and 12.

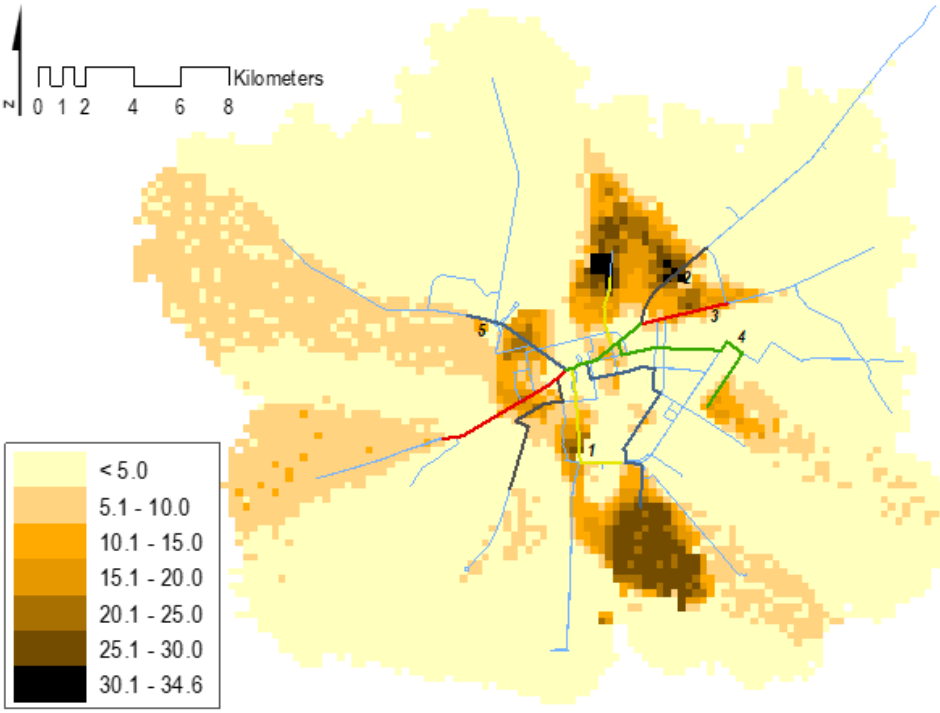


Figure 63: *Estimated reduction in travel time to nearest CMA or CHU due to the implementation of the planned mass transit system*

Source: Authors' estimates based on Transitec (2021)

In addition to reduction in overall travel time, the planned system would also reduce the walking time component, which may be important from a comfort and safety perspective. In fact, the simulations suggest that the effect of the new system on walking time would be stronger than on overall travel time. For example, just with the implementation of Route 3, the share of population having to walk over 30 minutes as part of their overall trip to the nearest advanced healthcare facility will decline from 80

percent to 77 percent, so by over 110,000 people. With the implementation of the entire planned system, the share of population having to walk over 30 minutes would decrease to 67.5 percent (a decline by nearly 450,000 people compared to now). Access to primary or PPS schools is likely to be minimally affected by the introduction of the planned BRT. Even in the scenario where all five BRT routes are constructed, in only a handful of locations does this improve travel time to the nearest secondary school. This is because schools are already relatively well distributed within the city, and it is almost always quicker to simply walk. However, it may be that there is a benefit in being able to access *more remote* schools, because they are better suited to the needs of the specific household (e.g., because of a specific religious affiliation), cheaper or of better quality, in which case the transport network can play a more significant role.

7. LINKAGES BETWEEN ACCESSIBILITY TO SCHOOLS AND HEALTHCARE FACILITIES AND HEALTH AND EDUCATION OUTCOMES

7.1. Evidence from the global literature

Transport accessibility affects health and education outcomes via its impact on individuals' decisions and behaviors regarding healthcare and schooling. On the demand side, transport accessibility matters for such behaviors as student enrollment and attendance and for patient usage of medical centers and regular anti-natal visits. On the supply side, examples of intermediary factors that are influenced by physical accessibility include the adequate provision of medical and school supplies and the rate of turnover of medical and teaching staff.

Global evidence suggests that transportation barriers matter for healthcare access. They can lead to rescheduled or missed appointments, delayed care, and missed or delayed medication use; these consequences may lead to poorer management of chronic illness and thus poorer health outcomes. Poor physical access to health facilities has been identified as an important contributor to reduced uptake of preventive health services, including in SSA, where it thereby negatively affects child and maternal mortality (Rutherford *et al*., 2010).

Many studies have assessed the link between transportation access and health outcomes in developed countries. Arcury *et al*. (2005) analyzed the association of transportation and healthcare utilization in rural U.S., finding that, controlling for personal characteristics, health characteristics, and distance, those who had a driver's license had 2.29 times more healthcare visits for chronic care and 1.92 times more visits for regular checkup care than those who did not. Athas *et al*. (2000) and Nattinger *et al*. (2001) found increasing travel distance to be associated with decreased utilization of breast cancer treatment.

Healthcare policymakers have cited transportation barriers as key obstacles to providing healthcare to low-income populations in particular, especially recent immigrant communities. Rask *et al*. (1994), for example, found that lack of transportation was one of the key predictors of delaying care for a new medical problem among ethnic minority patients in an urban setting.

In the low-to-middle-income country (LMIC) context, a study covering 21 countries, including Burkina Faso, estimated the relationship between distance to health facilities, service utilization, and child mortality (see Karra *et al*., 2017). Its findings were striking: compared with children who live within 1 km of a facility, children living within 5 km of a facility had 25-percent higher odds of neonatal mortality. A study in western Uganda established that the distance and availability of transport were more important factors in the choice of place of delivery compared to cost and quality of health services in the health facility (see Parkhurst & Ssengooba, 2009). A similar study in Mali showed that reducing transport time and eliminating financial barriers doubled the utilization of major obstetric interventions and led to increased utilization of health centers for deliveries (see Fournier *et al*., 2009).

Difficulty obtaining reliable transportation to a clinic and the cost of transportation for monthly clinic visits have been identified as a potential barrier to antiretroviral (ARV) adherence in African countries (see, e.g., Lankowski *et al*., 2014).

Studies that have explored the impact of school accessibility on intermediate education outcomes have found evidence that it is positive and especially so for the children on the edge of failing. For example, Falch *et al*. (2013) found that reduced commuting time has a positive effect on graduation from upper secondary schools, and this effect is larger for students with low academic achievement.

A World Bank team led by Barrett *et al*. (2019) reviewed the research on how school infrastructure affects children's learning outcomes. Among others, the key conditions identified by the authors as most effective in improving educational outcomes include ensuring that schools are locally distributed to maintain reasonable travel-to-school distances.

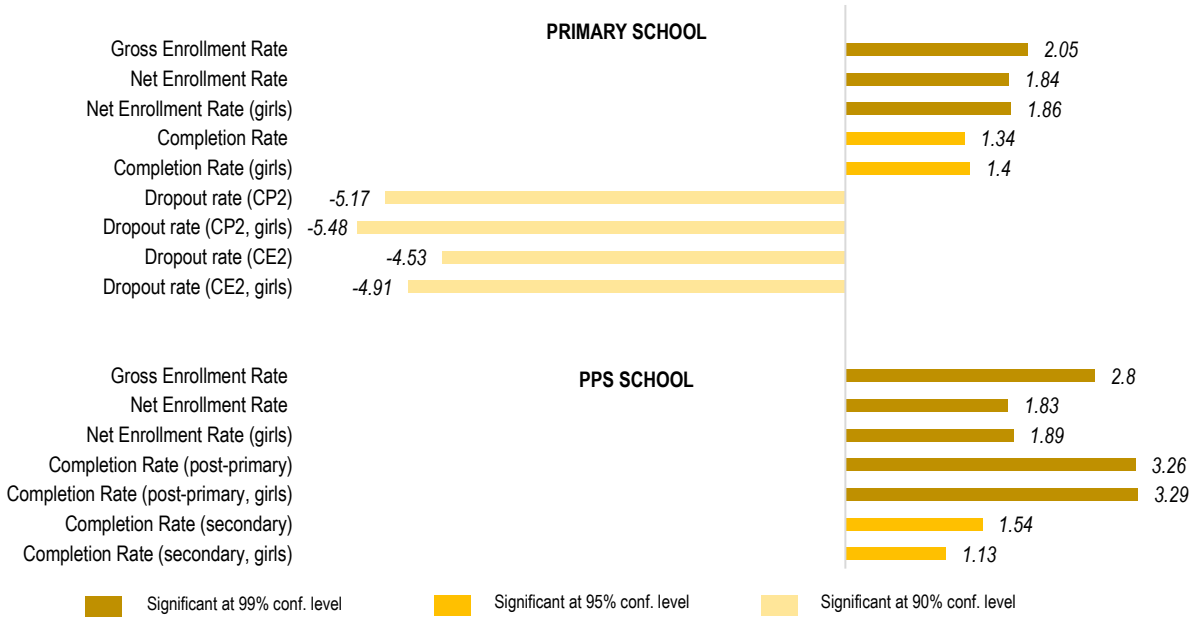
7.2. Findings specific to Burkina Faso

❖ ***Linkages between accessibility and schooling behaviors***

Combining the accessibility analysis results presented previously and data at the Province level from the Ministry of Education's Annual Statistics (*Annuaire Statistique*) document for primary and post-primary and secondary schools for school year 2019-2020, the current study conducted statistical analysis to establish whether a statistically significant association exists in Burkina Faso between transport accessibility to schools and school enrollment, completion, and drop-out rates. The transport variables included not only the average travel times by motorized transport to the nearest schools (presented in section 5.1.) but also the share of population in each province living near an all-season road (Rural Access Index, presented in Figure 4). The latter indicator is important to capture given the predominance of walking in travel to schools across the country. Given that households may choose not to enroll or keep their children in school not only due to transport accessibility gaps but also other factors, such as household monetary poverty or general security threats in the area, the statistical analysis included these variables as "controls." The statistical regression models also controlled for so-called fixed affects at the Region level – or characteristics that are specific to the Region in which the Province in located and might affect household schooling decisions but that are not observable or possible to capture with the available data.

Statistically representative indicators of household monetary welfare at the Province level were not available from the most recent (2021) poverty assessment for the country; however, it was considered that the welfare estimates as reported in the data from the 2014 *Enquête Multisectorielle Continue* (EMC) are sufficiently recent and likely still capture the relative distribution of household wealth across Provinces. Security threats in the analysis were characterized on a binary scale (yes/no), based on whether or not security-related school closures were reported for the specific Province in 2020. In the case of primary schools, the statistical analysis also included a student-teacher ratio, given that it might matter for education quality and/or peer-to-peer learning. In the case of PPS schools, this indicator was not provided in the Annual Statistics.

Figure 64: *Percentage-point-change in outcome variable given a 10-minute reduction in average motorized travel time to nearest school (observations = Provinces)*



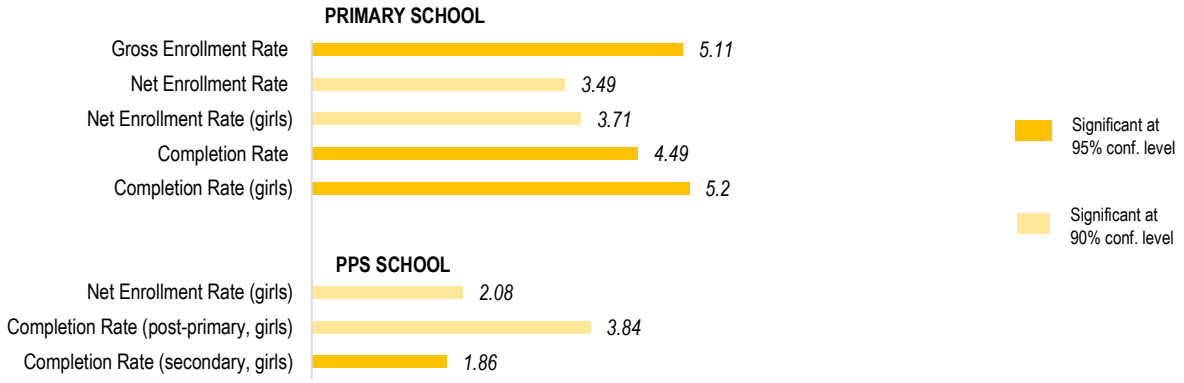
Source: Authors' estimates based on accessibility study conducted in this study and Ministry of Education (2019/20) data

Despite the relatively small sample size (45), the analysis confirms that accessibility to schools – as measured by the average motorized travel time to the nearest school – has a statistically significant association with not only school enrollment (gross and net), but also school completion and drop-out rates, with lower accessibility associated with distinctly lower enrollment and completion rates and distinctly higher drop-out rates.[11] In most cases, this is also the case for the Rural Access Index: Provinces with a higher share of the rural population living within 2 km of an all-season road have higher enrollment and completion rates both at the primary and the post-primary level as well as lower primary school drop-out rates. In other words, better transport accessibility to schools is associated with more children starting school and also staying in it.

The statistical association with lowering travel time to nearest school is particularly high and significant for post-primary school completion rates: a decrease in the average motorized travel time to the nearest PPS school by 10 minutes is associated with an increase in post-primary school completion rate by about 3.26 percentage points (pp). The association is somewhat lower (but still highly statistically significant) for gross and net enrollment rates at both the primary and the PPS level. The association is quantitatively large but statistically only marginally significant for primary school drop-out rates. The only outcome variable of interest that does not appear to have a statistically significant association with average travel time to nearest school is the drop-out rate at the PPS school stage ("sixieme"), and therefore isn't shown in the graph.[12] The results presented in Figure 64 also suggests that lowering average travel time to nearest school across nearly all outcome variables of interest has a slightly larger effect for girls specifically. The only exception is the secondary school completion rate, where the effect of lowering travel time to school is slightly lower for girls than for the overall secondary school student population.

Some of the outcome variables of interest appear to be related to transport accessibility in a linear way (a straight-line correlation), while for other outcome variables the relationship with accessibility is non-linear: at extremely long average travel times to school, each additional minute of travel has a decreasing marginal effect on the schooling indicators. The linear relationship with travel time to nearest school is observed for primary school gross and net enrollment rates and primary school completion rate. On the other hand, the relationship appears to be non-linear (with a diminishing effect of each additional travel minute) in the case of primary school drop-out rates as well as gross and net enrollment and completion rates at the PPS level.

Figure 65: *Percentage-point-change in outcome variable given a 10-percentage-point improvement in Rural Access Index (observations = Provinces)*



Source: Authors' estimates based on accessibility study conducted in this study and Ministry of Education (2019/20) data

In addition to the average motorized travel time to the nearest facility, also the Rural Access Index has a statistically significant association with primary school gross/net enrollment and completion rates. For example, a 10-pp improvement in the RAI at the Province level is associated with an increase in the

[11] Detailed results are provided in Annex 3.

[12] For all outcome variables of interest, the statistical models also tested the association with travel time to the nearest school for the top-10% population in the Province (incurring the longest travel times). This variable did not appear to have a statistically significant effect.

primary school completion rate in the Province by 4.49 pp (Figure 65).

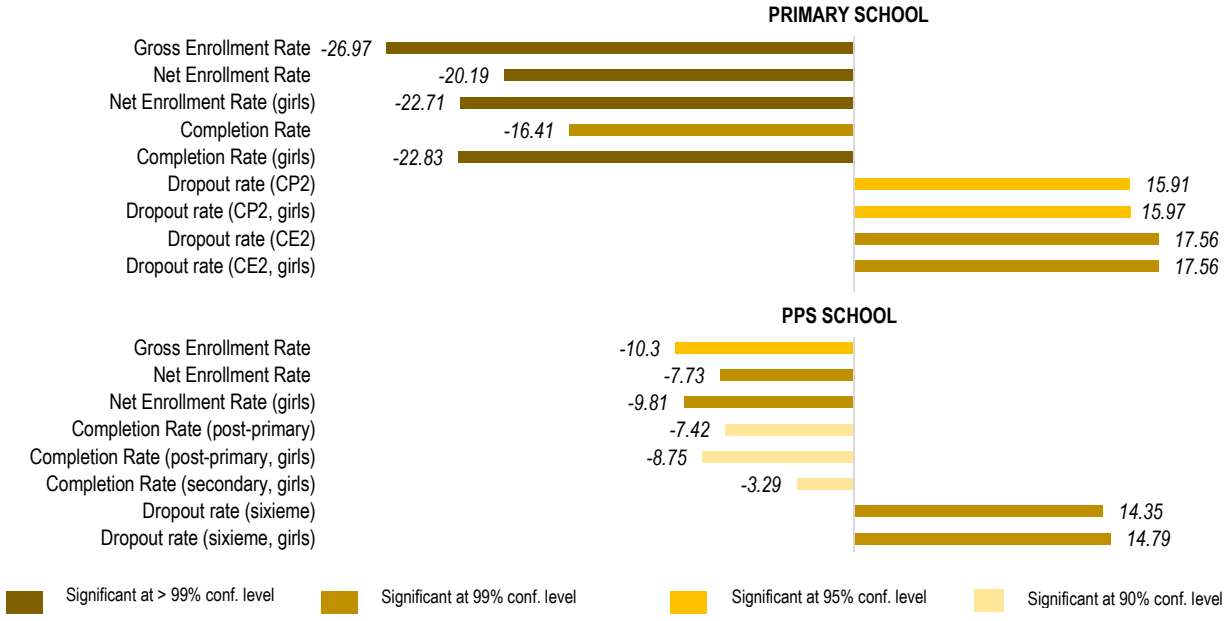
In contrast to the average motorized travel time to nearest school, the effect of the RAI appears to be stronger at the primary school level, perhaps because of the higher reliance on walking and biking for accessing school at this level. It is interesting to note that at the PPS level, the RAI has a statistically significant effect only for the net enrollment and completion rates of girls specifically.[13] In other words, living near a road that is passable throughout the year appears to matter more for the girls' than boys' ability to enroll in PPS school and complete it.

Neither at the primary nor PPS level does the RAI have a significant association with dropout rates, when controlling for all the other factors that may have an effect on children dropping out.

The statistical analysis also provides at least tentative evidence on the role played by the overall security situation in the differences in schooling rates across Burkina Faso, especially at the primary school level where the association is particularly strong, possibly explained by the fact that security threats have resulted in the closure of a much larger number of primary schools than PPS schools. Controlling for the differences in transport connectivity and household welfare (and Region fixed effects), provinces in which any schools have been closed due to security issues see about 27-pp lower gross primary enrollment rates, 20-pp lower net primary enrollment rates, and between 16-pp and 18-pp higher primary school dropout rates (Figure 66). Moreover, security threat related school closures appear to have a much stronger (negative) association with primary school completion rates for girls specifically: controlling for the other factors, provinces in which any schools have been closed see about 16-pp lower primary completion rates overall but as much as 23-pp lower completion rates specifically among primary school girls.

Also at the PPS level, the security situation has a strong association with net enrollment and dropout rates in particular. Again, the security threats appear to have a stronger association with girls' schooling rates.

Figure 66: *Percentage-point-change in outcome variable if any schools in Province have been closed due to security issues (observations = Provinces)*



Source: Authors' estimates based on accessibility study conducted in this study and Ministry of Education (2019/20) data

[13] The effects reported in Figure 65 are from the same regression models are those reported in Figure 64 even if RAI might have a higher coefficient in a different regression model specification.

Household welfare, as measured by the index available from the 2014 EMC, does not have a statistically significant association with any of the schooling rates at the primary level. On the other hand, it appears to matter across all of the schooling indicators at the PPS level: controlling for all the other factors, Provinces with higher household wealth have higher gross and net enrollment and, especially, completion rates as well as lower dropout rates at the *sixieme* level.

- ***Accessibility and health behaviors & outcomes***

Based on the findings presented earlier on the estimated average motorized travel times to nearest primary care facility (CSPS + CM/CMU); the share of the population in each Province that lives within a 1-hour service area of a primary care facility; and the Rural Access Index at the Province level, the study analyzed whether a statistical relationship exists between these transport related indicators and health behaviors or outcomes. The main sources of data for the latter were the Ministry of Health's annual statistics (*Annuaire Statistique*) document for 2018 and the recently completed study on health facility condition and needs by the Ministry of Health and the World Health Organization (Ministère de la Sante *et al*., 2020b). These documents provide various types of summary indicators at the health district level, such as:

- *Facility characteristics* (e.g., average theoretical radius of action (km),[14] stockout rates of tracer drugs, share of facilities meeting basic staffing standards, population served per facility, facility public vs. private status, availability of cold chain equipment, and availability of blood banks;
- *Intermediate health behaviors* for the health district, such as the share of assisted deliveries and the share of children receiving post-natal consultation at 6th day and at 6th week; and
- *Health outcomes:* maternal mortality per 100,000 births, and mortality rate from malaria for children under 1 year of age.

The study conducted statistical analysis examining the association between the transport connectivity variables at the province level (RAI, average travel times to nearest facility, and population living within 1-hour service area of a facility) and (1) each of the two intermediate health behaviors and (2) each of the health outcomes. It is conceivable that transport accessibility directly affects household health behaviors, such as the ability to seek an assisted delivery or to bring in a child for a post-natal consultation. However, there is likely also a broader association between the extent to which populations are connected or isolated from healthcare opportunities and the ultimate outcomes such as As in the case of schooling behaviors, the statistical analysis also controls for household welfare as measured by the index derived from the 2014 EMC.

The analysis finds that, among the examined ***intermediate health behaviors***, neither the share of assisted deliveries nor the share of post-natal consultations on the 6th day after delivery appear to have a statistically significant association with either of the transport connectivity variables when controlling for the other factors that might affect these behaviors and the Province-level fixed effects. The detailed results and graphs for the analysis are provided in Annex 4. These suggest that at least the share of post-natal consultations does appear to have a negative correlation with average travel time to the nearest facility and a positive association with RAI and the share of population living within the 1-hour service area from a facility; however, the association is not statistically significant when also controlling for other variables. In the case of the share of assisted deliveries, there does not appear to be a visible correlation with any of the transport accessibility variables.

In the case of the examined ***health outcomes***, visually, there does not appear to be a correlation between child mortality from malaria and either of the transport connectivity variables (Annex 4), and the association is not statistically significant, either, when controlling for the other variables that might affect this health outcome. In other words, other factors besides transport connectivity are at play in determining the likelihood of a child under 1 year of age dying from malaria, or there might be more specific transport constraints, not measured in this study, that matter more.

On the other hand, the other key health outcome examined in this study – maternal mortality per

[14] *Rayon moyen d'action théorique (RMAT)* - this is calculated jointly for CSPS, CM, dispensaries, and isolated maternity units, and is expressed as the square root of (area / (3.14 X number of health facilities)).

100,000 deliveries[15] – appears to be quite strongly associated with average travel time to the nearest primary care facility, although not with the Rural Access Index or the population share living within 1-hour service area of a primary care facility.[16] As shown in the results table in Annex 4, which shows the results for five different model specifications, the association between maternal mortality per 100,000 deliveries and average travel time to the nearest facility is quite consistent, regardless of the model specification.

The results show that the maternal mortality per 100,000 deliveries increases by between 0.44 and 0.46 for each additional minute of average travel time to the nearest facility, with the association being highly statistically significant. In other words, if the average travel time to the nearest facility decreased by 10 minutes, all else constant, maternal mortality rate for that health district would be expected to decrease by about 4.4 to 4.6 per 100,000 deliveries, while lowering the travel time by 20 minutes would be expected to decrease maternal mortality by about 9 per 100,000 deliveries. As noted earlier, the current average travel times to the nearest primary care facility exceed two or even three hours in individual Provinces in the Est and Sahel regions although are less than an hour in about half of the country's Provinces. Thus, lowering the travel time by 10 or even 20 minutes would not be a significant relative change in a large part of the country, albeit would still require significant investment in the road network improvement.

The results also suggest that maternal mortality is strongly associated with the primary health facility theoretical radius of action (*rayon moyen d'action théorique, RMAT*), another distinctly spatial variable. Namely, maternal mortality increases by between 11 and 14 per 100,000 deliveries for each additional kilometer of RMAT, all else equal. In other words, the higher the average RMAT at the health district level, the distinctly higher the maternal mortality, even when controlling for the various other factors that might affect maternal mortality.

The share of assisted deliveries and the share of post-natal consultations (here both included as a potential influencing factors on maternal mortality) do not have a highly statistically significant association with maternal mortality; however, they are almost significant at the 90 percent confidence level. All else equal, a higher share of assisted deliveries and a higher share of women who have a post-natal consultation by the 6th day after delivery are both associated with lower maternal mortality.

In contrast to the schooling rates, household welfare as measured by the score derived from the 2014 EMC does not appear to have a statistically significant association with maternal mortality when controlling for the other factors that may affect maternal mortality. Similarly, the regression models did not find most of the characteristics of the facilities themselves – such as the rate of drug stockouts, availability of cold chain facilities, presence of a blood bank at the health district level, or the share of facilities meeting basic staffing standards – to have a significant effect. However, it is premature to conclude that these characteristics do not matter in maternal mortality rates, given that the analysis could only be conducted at the health district level – thus significantly reducing the overall sample size – rather than at the health facility level.

[15] Across the health district of Burkina Faso (except those in the Centre region, which were not included in the analysis), the average mortality is about 58 per 100,000 deliveries.

[16] The study also examined associations between each of the health behaviors and outcomes and accessibility to CMA facilities (i.e., facilities providing more advanced healthcare services); none of these were anywhere close to statistically significant.

8. CONCLUSIONS AND POLICY IMPLICATIONS

Transport connectivity matters for people to be able to seek essential medical care and to be able to send their children to school, eventually contributing the accumulation of human capital and better quality of life. Burkina Faso has demonstrated its commitment to increasing the human capital outcomes for its people, as evidenced by its various sector-specific strategies and the positioning of human capital in the center of its current CPF. Nonetheless, data tracked over time for health and schooling outcomes suggests that significant gaps remain, and that especially the more fragile and spatially isolated regions of the country are falling short on the targets such as school enrollment and completion.

The current study provides new, policy-relevant insights on the spatial and transport accessibility gaps to health and education opportunities in Burkina Faso and generates evidence on the role that accessibility plays in household decisions such as those related to schooling and in outcomes such as maternal mortality. In addition, it also allows to better understand where transport time, cost, and safety rank among the wider gamut of constraints that households face in seeking medical care or education. Finally, the study illustrates how overall accessibility patterns – and gaps – relate to the spatial distribution of poverty in Burkina Faso overall and specifically within Ouagadougou, and how the already existing accessibility gaps are further magnified by the security issues and internal displacement that particularly affect certain regions. The study's findings could help better plan rural connectivity projects across Burkina Faso and urban transport operations in Ouagadougou, including specifically prioritizing interventions that could help the most marginalized groups, such as the poor and the internally displaced populations.

Among others, the spatially-anchored findings can inform the cross-sectoral planning and coordination between the transport and the human development sectors, to ensure that investments in additional health facilities, for example, are spatially aligned and supported with the targeting of rural roads improvements. In fact, the spatial analysis conducted as part of the study shows that a comparatively *lower* share of the planned CSPS facilities than existing ones will be near an all-season road, which suggests that rural roads connecting these planned facilities should be the ones prioritized for improvement if the addition of CSPS facilities is to really make an impact on accessibility. Accessibility to CSPS is also important from the perspective of the country's overall burden of disease profile, in which communicable diseases and other illnesses that could be treated at the primary care level represent the majority of deaths and DALYs.

The prioritization analysis conducted as part of the study also suggests that road improvement priorities are somewhat different if the transport and the human development sectors' objectives are integrated – i.e., by considering the roads' criticality for access to health and education facilities – compared to what they would be if approached purely from the transport sector perspective (i.e., aiming to maximize the share of the rural population near an all-season road).

Significant accessibility gaps are present in several regions of the country, especially with respect to more advanced healthcare facilities which tend to be more sparsely distributed. This is particularly the case in the Sahel and Est regions, where average motorized travel times to these types of facilities exceed several hours (these low-accessibility regions are analyzed in more detail in Annex 1). Especially in the Sahel region, there are areas where population density is relatively high yet average travel times to nearest health facility exceed four or more hours, notably the Soum province; providing additional facilities in these areas – or improving accessibility to existing ones – would improve the access to health services for a significant number of people.

In the education sector, accessibility gaps are found to be more severe with regard to PPS schools than primary schools, as these tend to be located far from many villages, and this is even more so with respect to *public* schools specifically. In this situation, a child without a family member in the neighboring city where the school is located might drop out even if she or he has the potential to continue. However, even where accessibility to schools is estimated to be acceptable, schooling may not be affordable for the poorest. Indeed, the household surveys implemented as part of this study in the Centre-Est and Boucle du Mouhoun regions suggest that the affordability of education is a primary concern for

households and, for the majority of them, ranks above those related to travel times, travel costs, or road safety. The findings are comparable when it comes to seeking routine medical treatment: the affordability of care itself features highest among the constraints as perceived by the households themselves, even if travel distance, transport cost, and transport safety and security are also concerning for a significant share of the population. (Moreover, it should be noted that in the case of transport safety specifically, the true cost of accidents in Burkina Faso overall is very high even if not perceived as such by most of the surveyed individuals – road crashes cost about 10 percent of the country's annual GDP, according to World Bank estimates.) These findings are also consistent with previous studies, such as by Komives *et al.* (2005), which have shown that bringing infrastructure to people goes beyond simple access; without a clear demand policy, facilities might exist, but people may not be able to use them because the services are not affordable. Still, transport related constraints are identified as *the* most important or among the most important constraints to both seeking medical help and sending children to school by over a quarter of people in both rural Burkina Faso and Ouagadougou. The household surveys as well as the statistical analysis conducted as part of this study suggest that living near an all-season road matters for enrolling in school and being able to complete it, especially at the primary level where most children depend on walking and biking to reach school.

Insecurity related school closures, especially in the Sahel region of Burkina Faso, have affected hundreds of thousands of children and over ten thousand teachers, with implications for educational achievement of entire communities possibly extending years into the future. The strong negative association between insecurity and schooling-related outcomes such as gross and net enrollment and completion rates at both the primary and the post-primary level is also demonstrated by the statistical analysis conducted in this study. To show its willingness to offer a chance to all school-age children affected by insecurity, the Government launched a special schooling program for 250,000 displaced children in October 2020. Initially, however, the program had limited uptake, with less than 60,000 pupils enrolled as of September 2020 (World Bank, 2020b), suggesting that additional policy action might be needed. Schooling goals in the highest-insecurity regions are also being supported through the recently approved World Bank financed Emergency Local Development and Resilience Project.

The country's road network and critical infrastructure facilities are increasingly exposed to climate – especially flood – risk, which affects the all-season accessibility to education and healthcare services. Indeed, as suggested by the household surveys, those households that report their children not to be able to attend school regularly are disproportionately more likely to report impassable roads to be among the top challenges for schooling access. The criticality analysis conducted as part of the study identifies several major roads that are currently in poor or fair condition and vulnerable to flooding but that play a critical role in the local connectivity to health and education opportunities. In particular, long segments of such priority roads are identified in the Est, Centre-Est, and Sahel regions. Indeed, despite the various competing priorities for targeting interventions in rural Burkina Faso, a key one should be to invest in road improvement to raise the Rural Access Index in the Est and Sahel regions closer to the national average. This investment would also contribute to conflict prevention in these border regions, according to the findings of the Sahel Risk and Resilience Assessment (World Bank, 2019). In order to raise the country's overall RAI to the target of 30 percent established in the World Bank's *Sahel Region Strategy*, it is also important to invest in road improvements in high-density regions such as Boucle du Mouhoun and Cascades. At minimum, the needed investment for the country overall amounts to nearly US$230 million, or about US$220 per rural resident connected. In planning and implementing all future road investments, there should be close coordination with the investments in the health and education sectors, and climate data should be consistently factored into the designed standards across Burkina Faso.

In recent years, substantial investments in the road network have been made in Ouagadougou to improve traffic conditions. The city's bypass project is also expected to shift transiting traffic away from city roads. However, given motorization dynamics, the new infrastructures will not resolve congestion problems in Ouagadougou. To optimize public spending, a multimodal mobility strategy is needed (SSATP, 2020). Moreover, both the transport system – infrastructure and, especially, transport services – and land use planning have to be addressed in order to improve the currently low accessibility to advanced healthcare facilities. While the

accessibility landscape is considerably better with respect to schools, targeted interventions are needed to eliminate the "accessibility poverty" (extremely high travel time) pockets that remain or that may be created if residential development continues in the form of unabated outward sprawl rather be concentrated near the existing school facilities and the transport network. In the absence of such interventions, the modal share of private modes, notably motorcycles but also private cars, will continue to rise, given the accessibility advantage that these modes demonstrably provide compared to the poorly planned public transport system.

Improving accessibility to advanced healthcare opportunities will likely require relatively fundamental and costly improvements in the city's transport system and strategic changes in land use planning at the metropolitan scale to ensure that future population growth is channeled into areas that are – or that could be – served by efficient public transport or that surround existing or potential new health facilities. Simulations conducted as part of this study suggest that the planned new mass transit system will significantly reduce travel times for many people, even if only marginally decreasing the average travel times in the city overall. Nevertheless, institutional coordination between, on the one hand, transport and housing sectors and, on the other hand, the health sector will be essential to ensure that any new health facilities that are built are served by current and the planned bus services or are located directly within rapidly densifying neighborhoods, such as on the city's western periphery. As proposed in SSATP (2020), a Transport Council for the Greater Ouagadougou metropolitan area should be operationalized to bring together the city of Ouagadougou and the seven neighboring municipalities and thus ensure efficient, metropolitan scale transport and urban planning.

Improving accessibility to schools could be achieved through targeted siting of a few additional school facilities in the (relatively limited) areas currently characterized by excessive travel times or through the provision of school bus services to allow the children living in these areas to reach the existing school facilities within a reasonable travel time. Considering the importance of biking, walking, and motorcycle transport in Ouagadougou's mobility, especially of the poorest residents, investments in non-motorized transport infrastructure and safe space for motorcycles on the existing road network would help improve accessibility to both health and education facilities for many of the most vulnerable residents. In particular, well-lit and safe pedestrian infrastructure is essential to improve the safety of girls while *en route* to school.

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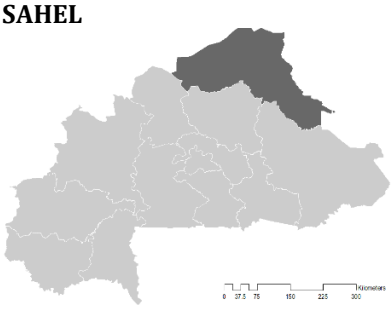
ANNEX 1: REGIONAL LEVEL ANALYSIS (LOWEST-ACCESSIBILITY REGIONS)

SAHEL



Area: 38,683.7 km²
Population (2020 est.) : 1,366,907
Population density (2020 est.): 35.3 / km²
Rural population (2020 est.): 1,329,913

- Nearly none of the classified road network is assessed to be in good condition, and only a limited number of roads are currently being improved or are planned to be improved. Fluvial flooding risk is relatively widespread across the region, especially in areas with roads in poor condition.
- RAI for the region overall is estimated at 8.5%, with 1.217 million rural inhabitants lacking access. RAI ranges from 3.3% in the Oudalan province to 20.8% in Seno.
- Sahel has 62 villages with functioning CSPSs, of which 11 are within 2 km of an all-season road. Another 38 CSPSs are under construction or are planned, of which 3 are near an all-season road.
- Out of 340 villages with public primary schools in the region, 53 have them within 2 km of all-season road; of the 19 villages with a private primary school, 3 are; of the 36 villages with a public PPS school, 8 are; and of the 10 villages with a private PPS school, 2 are.

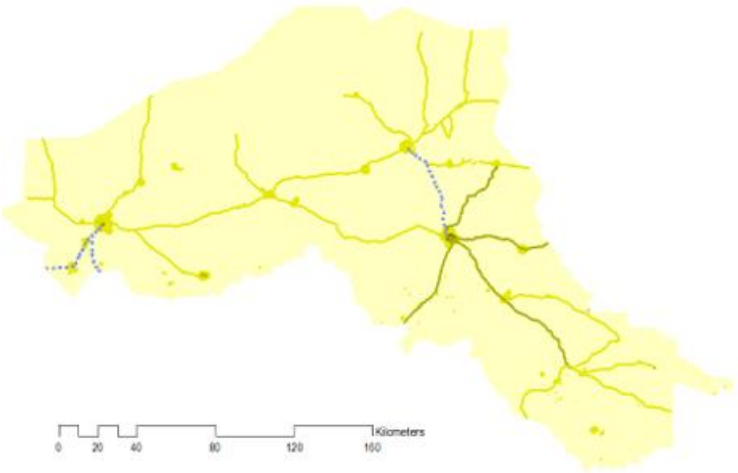


Figure 1.1: *Classified road network condition and population*

0 – 1
1.01 – 3
3.01 – 5
5.01 – 10
10.01 – 12.4

Good
Fair
Poor
Under construction or awaiting construction

Source: DGNET; World Pop (2020)

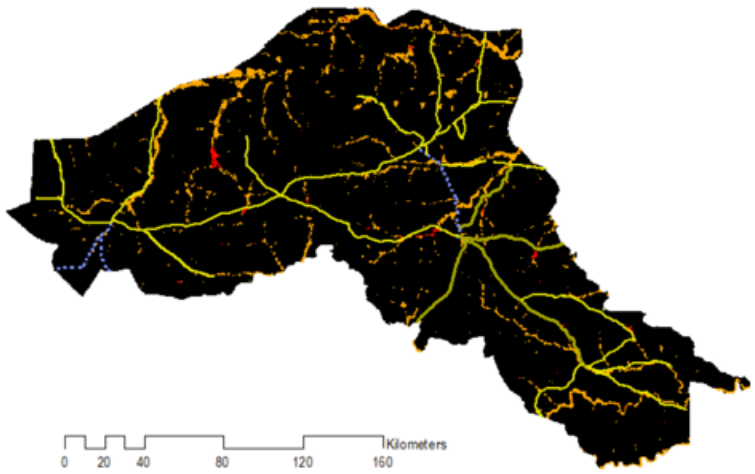


Figure 1.2: *Classified road network condition and risk of fluvial flooding (20-year return period)*

Good
Fair
Poor
Under construction or awaiting construction

Flood

No risk
At risk
Permanent water bodies

Source: DGNET; FATHOM Global Flood Hazard Data

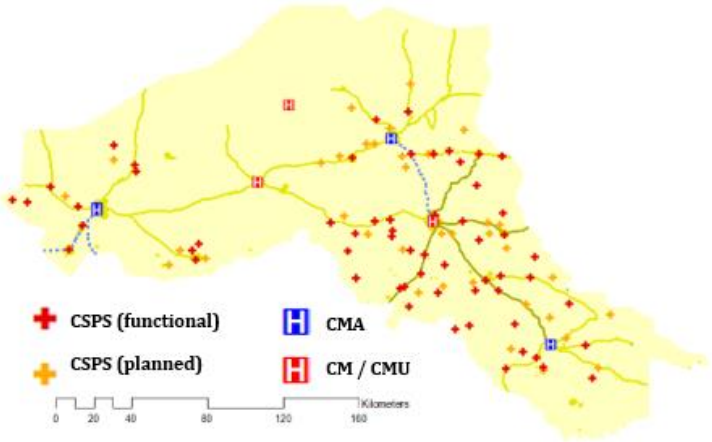


Figure1.3: *Health centers and CSPS vis-à-vis the road network and population*

0 – 1
1.02 – 3
3.01 – 5
5.01 – 10
10.01 – 12.4

Good
Fair
Poor
Under construction/awaiting construction

Source: DGNET; World Pop (2020); MoH

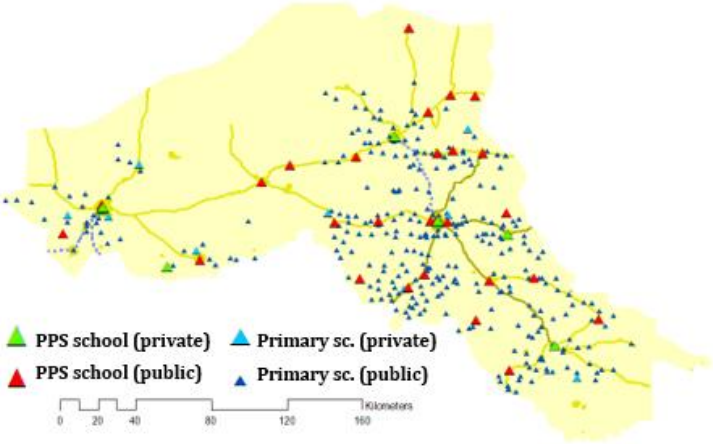


Figure 1.4: *Primary schools and PPS schools vis-à-vis the road network and population*

0 – 1
1.03 – 3
3.01 – 5
5.01 – 10
10.01 – 12.4

Good
Fair
Poor
Under construction or awaiting construction

Source: DGNET; World Pop (2020); MoE

ACCESSIBILITY ANALYSIS MAIN RESULTS

- Under existing road conditions, only 15% of the region's population (or about 209,000 people) can reach a functioning **CSPS** within 1 hour of motorized travel. Over 500,000 people (37%) currently would not be able to reach a functioning CSPS even within 4 hours of travel. The completion of the currently ongoing and planned road works will affect accessibility to CSPSs very marginally.
- only 4.5% of the population can access a **CM/CMU** within 1 hour; nearly 1.15 million people (84%) live over 4-hour drive away from the nearest CM/CMU. Ongoing/planned road works would increase accessibility to CM/CMUs very little.
- A **CMA** is currently reachable within 1 hours for just 2.8% of the population. Over 1.2 million people (89%) are beyond the 4-hour travel threshold, and even with the currently ongoing and planned roadworks the share would be above 88%.
- 496,500 people (36%) can access at least one **primary school** within 1-hour drive. About 308,400 people (23%) cannot reach any primary schools even within a 4-hour drive.
- At least one **PPS school** is accessible within 1 hour to about 173,900 people (13%). For nearly 600,000 people, all PPS schools are more than a 4-hour drive away.
- Ongoing/planned road works will not have any effect on accessibility to public primary schools but will slightly improve accessibility to private primary schools: an additional 6,300 people will be able to access a private primary school within 1 hour. The road improvements will also increase the number of people able to access at least one PPS school in an hour by about 6,300.

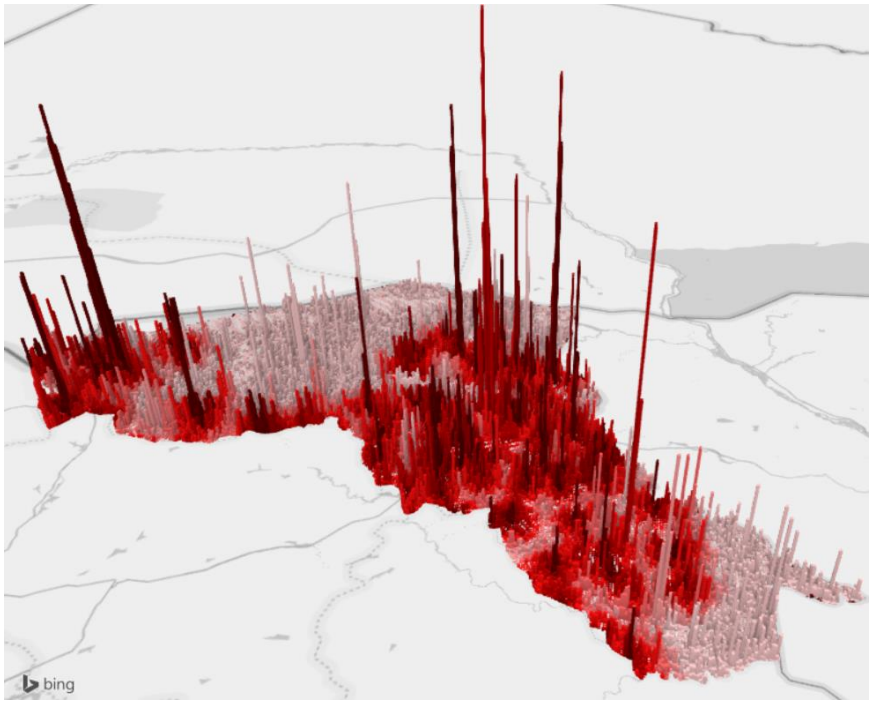


Figure 1.5: *Motorized travel time to a functioning CSPS in the Sahel region vis-à-vis population density*

- <30 min
- 30-60 min
- 1-2 h
- 2-3 h
- 3-4 h
- 4-5 h
- >5 h

Note: Height = population density

Source: Authors' estimates based on road data from Nov 2020 provided by DGNET; facility data from MoH; World Pop 2020 population data

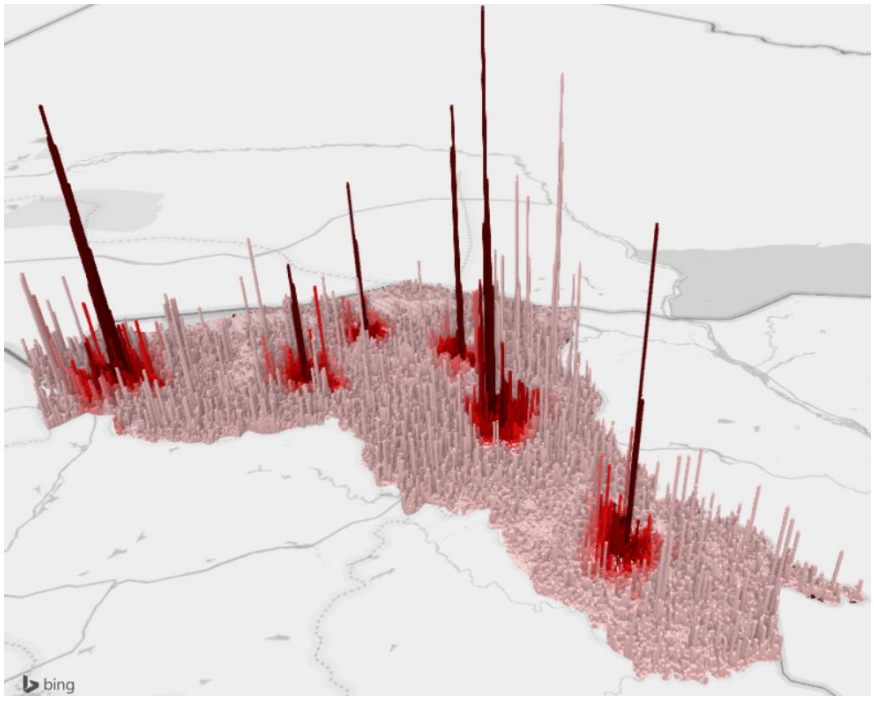


Figure 1.6: *Motorized travel time to a CM, CMU, or CMA in the Sahel region vis-à-vis population density*

- <30 min
- 30-60 min
- 1-2 h
- 2-3 h
- 3-4 h
- 4-5 h
- >5 h

Note: Height = population density

Source: Authors' estimates based on road data from Nov 2020 provided by DGNET; facility data from MoH; World Pop 2020 population data

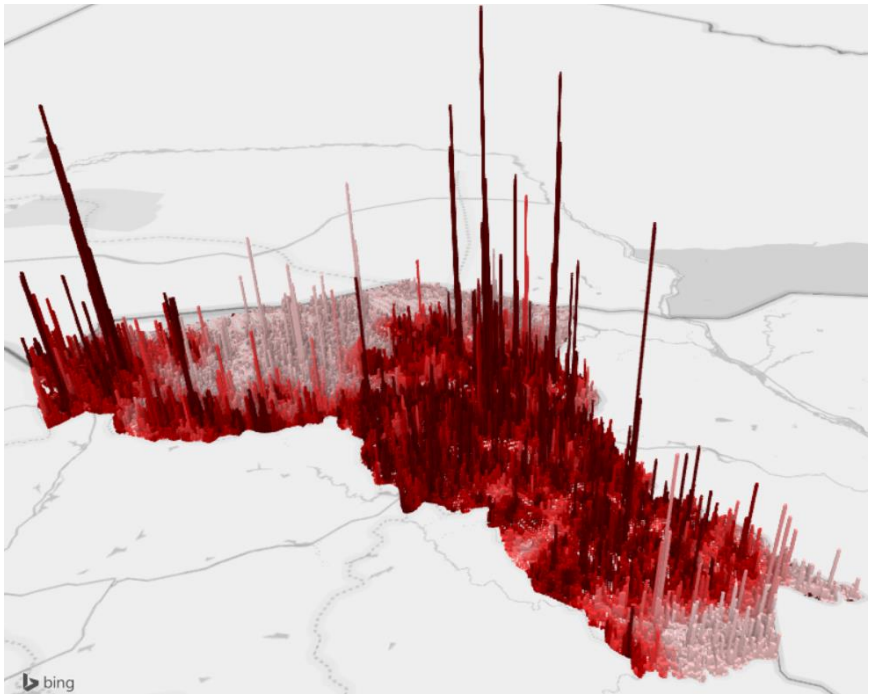


Figure 1.7: *Motorized travel time to a primary school in the Sahel region vis-à-vis population density*

- <30 min
- 30-60 min
- 1-2 h
- 2-3 h
- 3-4 h
- 4-5 h
- >5 h

Note: Height = population density

Source: Authors' estimates based on road data from Nov 2020 provided by DGNET; facility data from MoH; World Pop 2020 population data

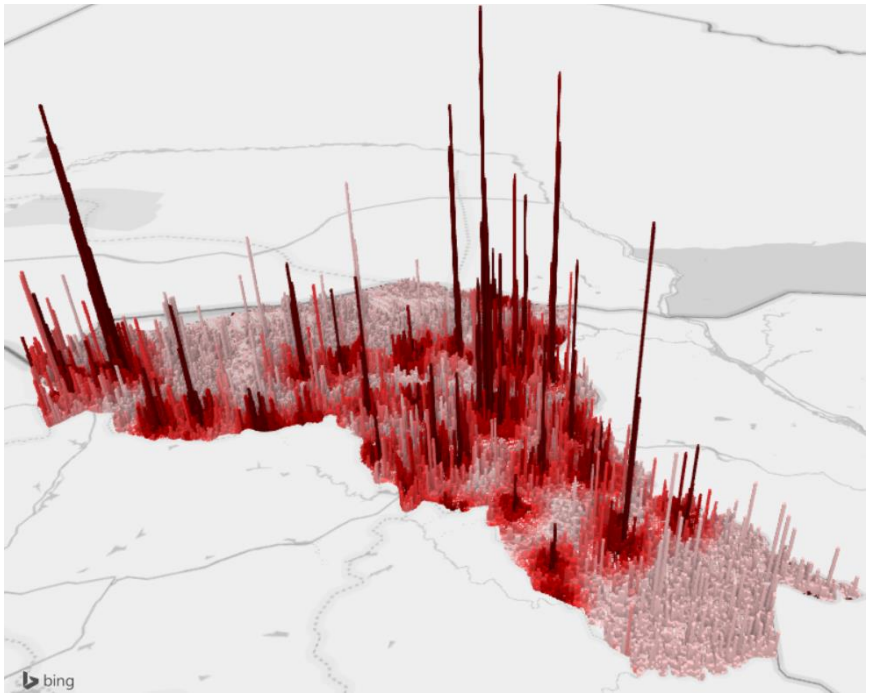


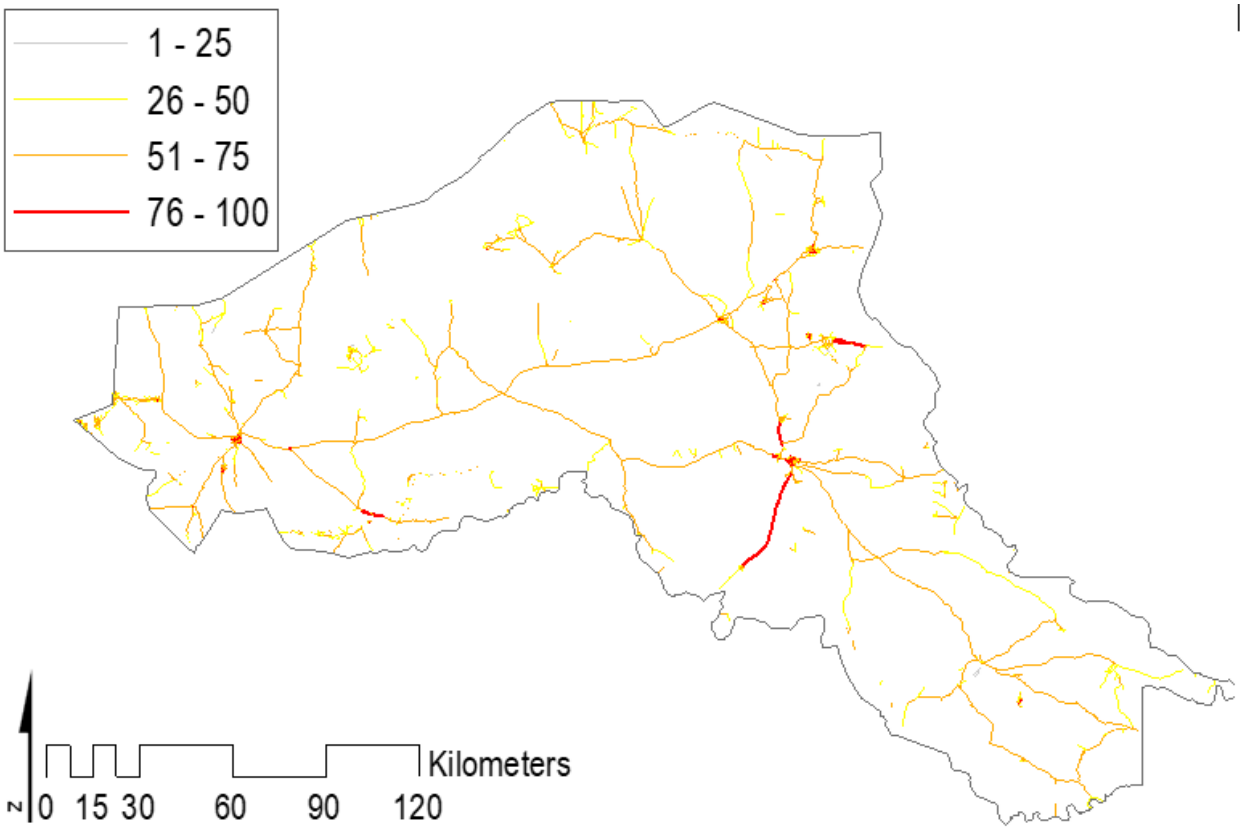
Figure 1.8: *Motorized travel time to a PPS school in the Sahel region vis-à-vis population density*

- <30 min
- 30-60 min
- 1-2 h
- 2-3 h
- 3-4 h
- 4-5 h
- >5 h

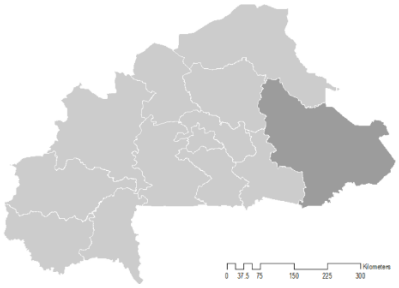
Note: Height = population density

Source: Authors' estimates based on road data from Nov 2020 provided by DGNET; facility data from MoH; World Pop 2020 population data

Figure 1.9. *Roads scored according to their importance in local connectivity and presence of education and healthcare facilities (higher score = more important)*



EST



Area: 49,084.3 km²
Population (2020 est.) : 1,859,413
Population density (2020 est.): 37.9 / km²
Rural population (2020 est.): 1,787,290

- Nearly none of the classified road network is assessed to be in good condition, but several large road segments are currently being improved or are planned to be improved. Fluvial flooding risk is relatively widespread across the region.
- RAI for the region overall is estimated at 20.2%, with 1.425 million rural inhabitants lacking access. RAI ranges from 11.2% in the Tapoa province to 26.9% in Gourma.
- Est has 154 villages with functioning CSPSs, of which 50 are within 2 km of an all-season road. In 45 villages, CSPSs are under construction or are planned, of which 7 are near an all-season road. 5 out of 6 villages with a CM/CMU are near an all-season road; all 4 villages with a CMA are near an all-season road.
- Out of 641 villages with public primary schools, 153 have them within 2 km of all-season road; of the 59 villages with a private primary school, 34 are; of the 101 villages with a public PPS school, 50 are; and of the 41 villages with a private PPS school, 27 are.

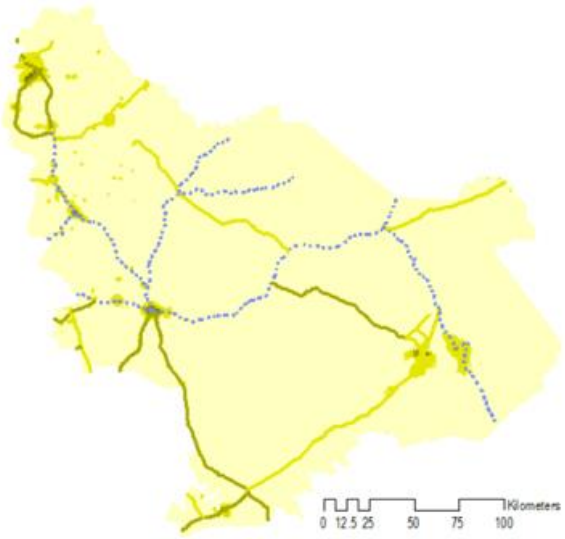


Figure 1.10: *Classified road network condition and population*

Source: DGNET; World Pop (2020)

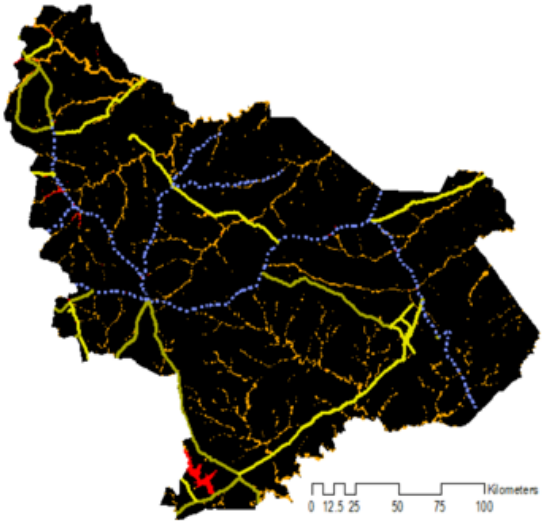


Figure 1.11: *Classified road network condition and risk of fluvial flooding (20-year return period)*

Source: DGNET; FATHOM Global Flood Hazard Data

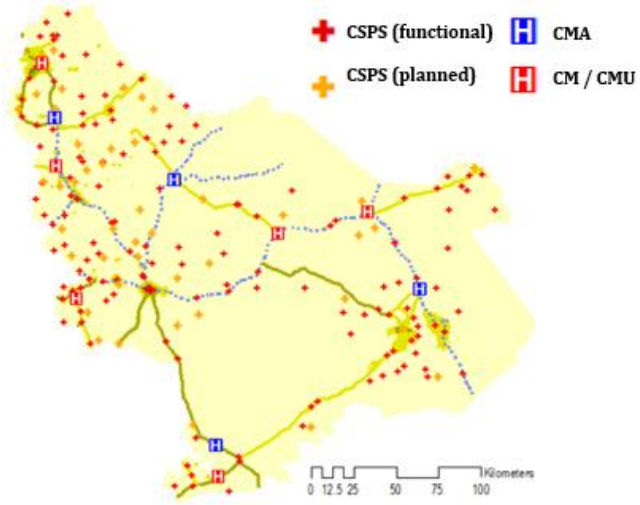
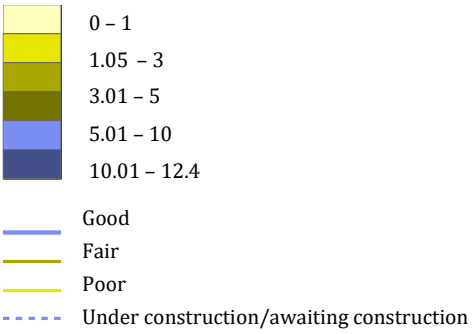


Figure 1.12: *Health centers and CSPS vis-à-vis the road network and population*



Source: DGNET; World Pop (2020); MoH

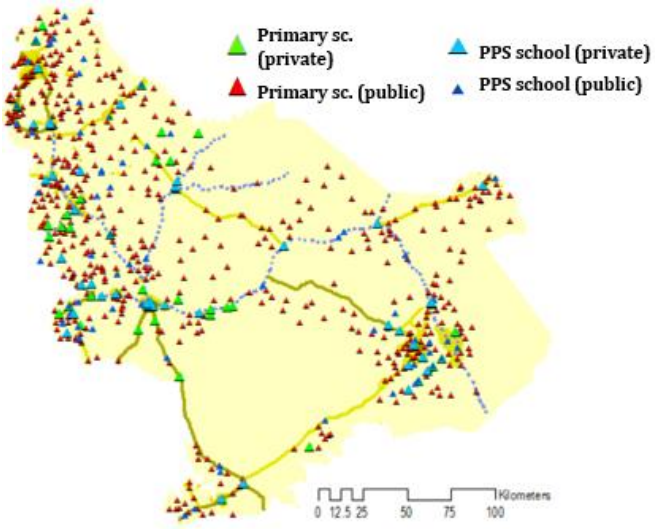
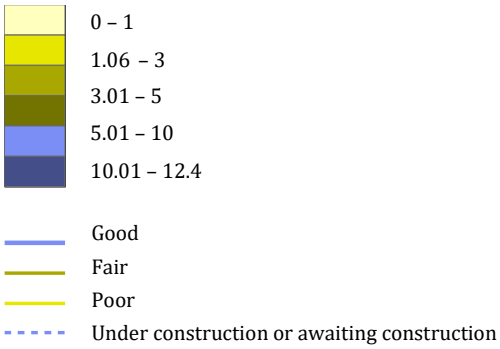


Figure 1.13: *Primary schools and PPS schools vis-à-vis the road network and population*



Source: DGNET; World Pop (2020); MoE

ACCESSIBILITY ANALYSIS MAIN RESULTS

- Currently, 29% of the population (about 531,000 people) can reach a functioning **CSPS** within 1 hour of motorized travel. Nearly 315,000 people (17%) currently would not be able to reach a functioning CSPS even within 4 hours of travel. The completion of the currently ongoing and planned road works will increase the number of people within a 1-hour drive by about 13,000.
- Only 4.2% of the population can access a **CM/CMU** within 1 hour, while bearly 1.57 million people (85%) live over 4-hour drive away from the nearest CM/CMU. Ongoing/planned road works will not change the number of people within 1-hour drive of a CM/CMU.
- A **CMA** is currently reachable within 1 hour for just 1.7% of the population; about 1.7 million people (92%) are beyond a 4-hour travel threshold; the currently ongoing/planned roadworks would reduce that share only marginally, by about 11,000.
- 1.048 million people (57%) could access at least one **primary school** within 1 hour of driving; 147,000 people (8%) cannot reach any primary schools even within a 4-hour drive. At least one **PPS school** is accessible within 1 hour to about 498,000 people (27%); for about 521,000 people, all PPS schools are more than a 4-hour drive away.
- Ongoing/planned road works will improve accessibility to public primary schools and private primary schools about equally, with an additional 8,000 people able to access at least one such facility within 1 hour. The number of people able to access a public PPS school and a private PPS school within an hour will increase by about 12,000 and 10,000, respectively.

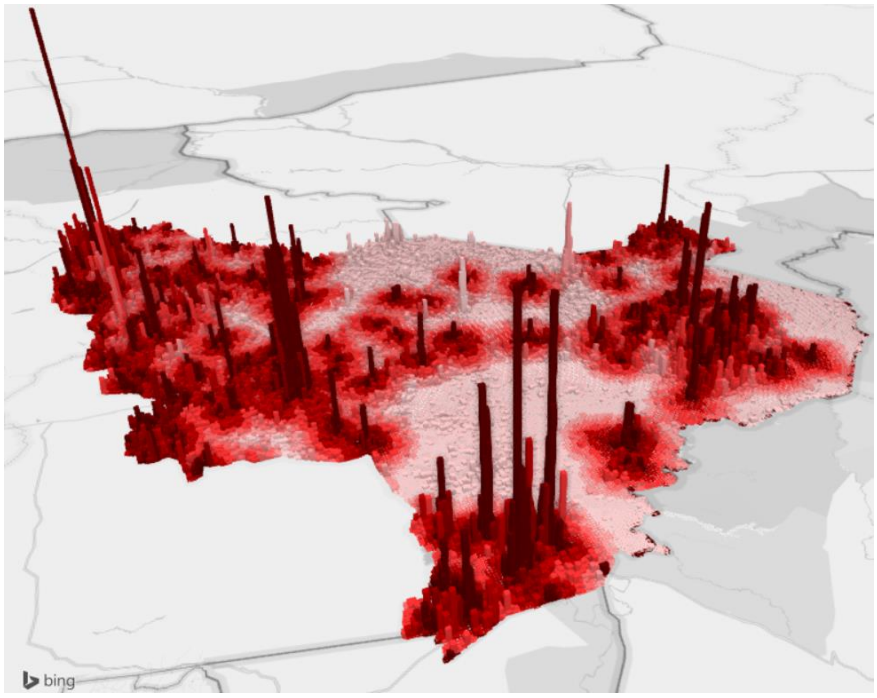


Figure 1.14: *Motorized travel time to a functional CSPS in the Est region vis-à-vis population density*

- <30 min
- 30-60 min
- 1-2 h
- 2-3 h
- 3-4 h
- 4-5 h
- >5 h

Note: Height = population density

Source: Authors' estimates based on road data from Nov 2020 provided by DGNET; facility data from MoH; World Pop 2020 population data

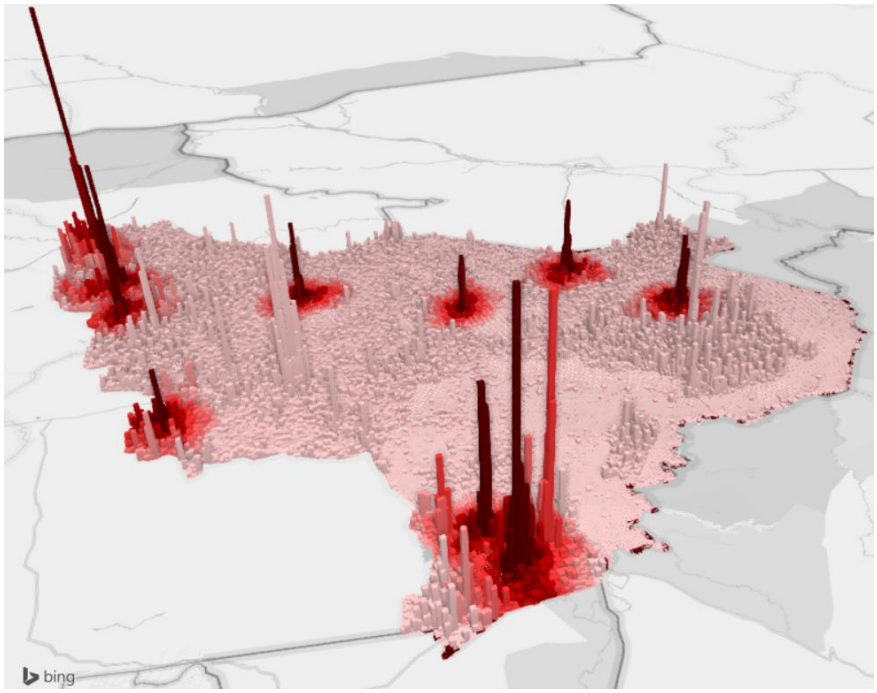


Figure 1.15: *Motorized travel time to a CM, CMU, or CMA in the Est region vis-à-vis population density*

- <30 min
- 30-60 min
- 1-2 h
- 2-3 h
- 3-4 h
- 4-5 h
- >5 h

Note: Height = population density

Source: Authors' estimates based on road data from Nov 2020 provided by DGNET; facility data from MoH; World Pop 2020 population data

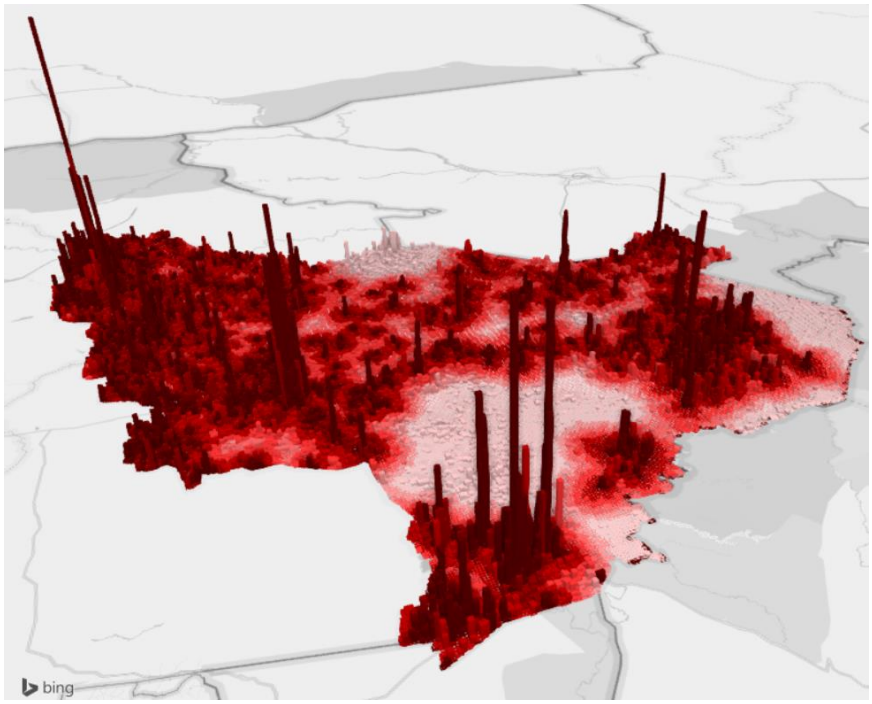


Figure 1.16: *Motorized travel time to a primary school in the Est region vis-à-vis population density*

- <30 min
- 30-60 min
- 1-2 h
- 2-3 h
- 3-4 h
- 4-5 h
- >5 h

Note: Height = population density

Source: Authors' estimates based on road data from Nov 2020 provided by DGNET; facility data from MoH; World Pop 2020 population data

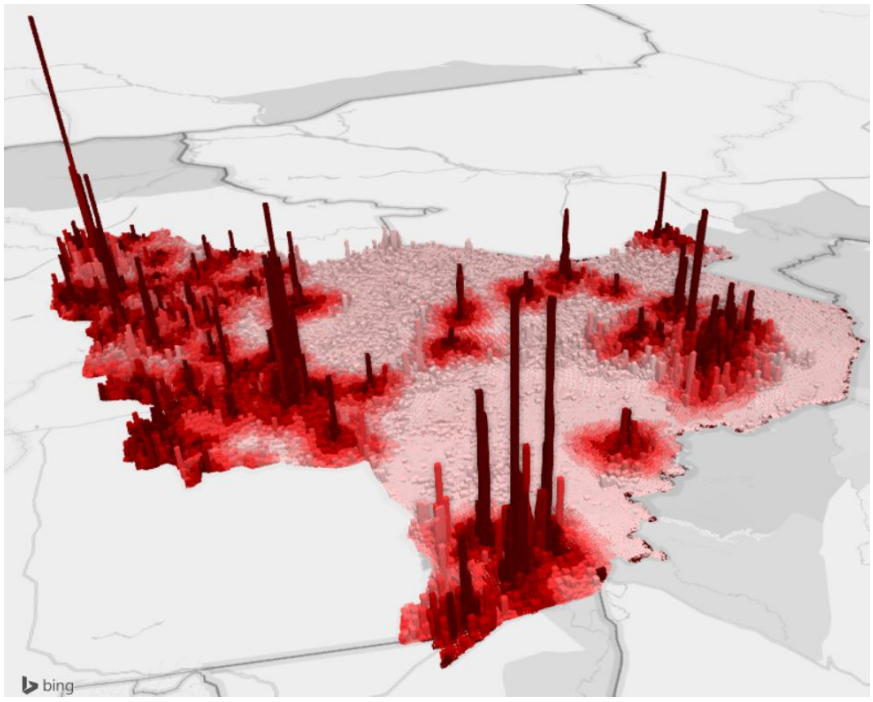


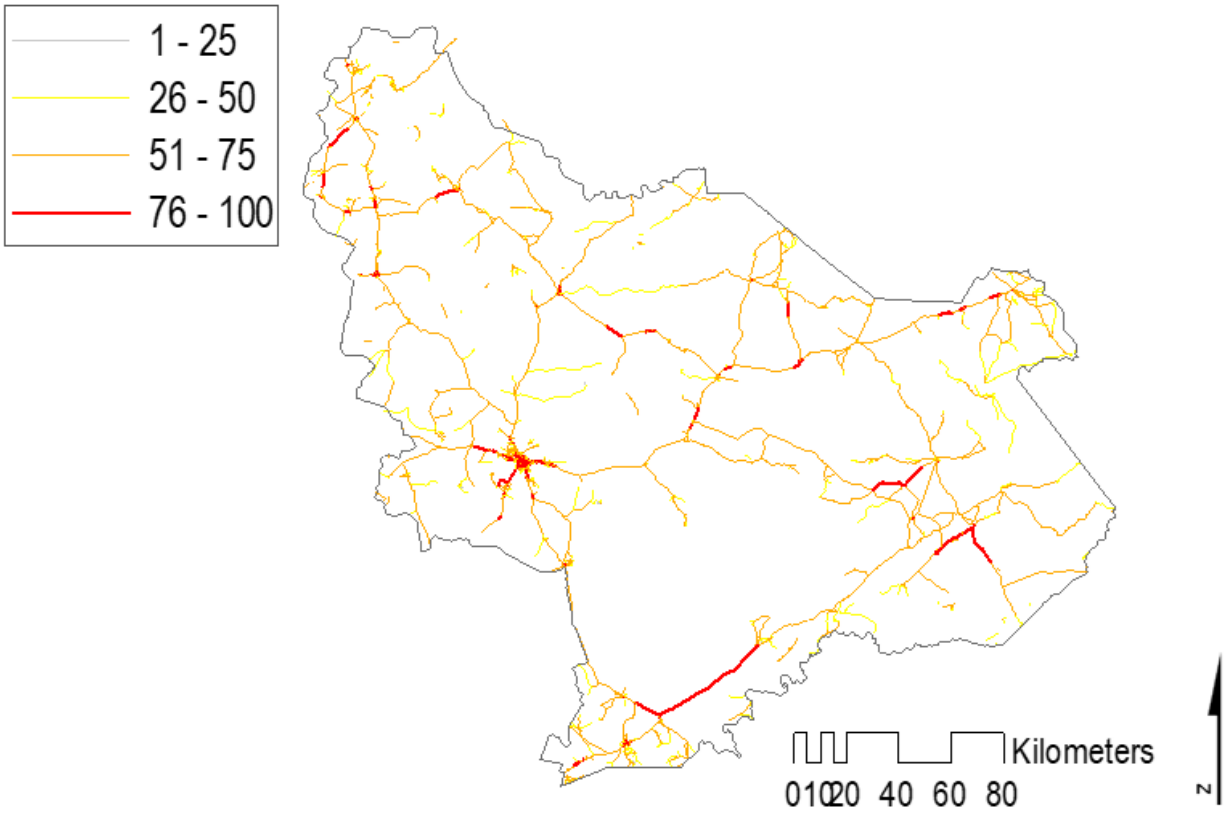
Figure 1.17: *Motorized travel time to a PPS school in the Est region vis-à-vis population density*

- <30 min
- 30-60 min
- 1-2 h
- 2-3 h
- 3-4 h
- 4-5 h
- >5 h

Note: Height = population density

Source: Authors' estimates based on road data from Nov 2020 provided by DGNET; facility data from MoH; World Pop 2020 population data

Figure 1.18. *Roads scored according to their importance in local connectivity and presence of education and healthcare facilities (higher score = more important)*



ANNEX 2: DETAILED RESULTS AT THE NATIONAL LEVEL

Table 2.1: *Motorized travel time to nearest health facility, based on road conditions in place in November 2019 (number of people able to access at least one facility of the specific type within the time threshold)*

Hours	Functioning CSPS	Functioning + planned CSPS	CM/CMU	CMA	CMU/CMU or CMA
0 - 0.5	6,532,532	6,879,351	1,115,844	353,533	1,460,006
0.5 – 1	4,779,671	5,258,161	3,196,991	494,476	3,678,482
1 – 1.5	2,459,039	2,573,729	1,123,521	307,403	1,421,522
1.5 – 2	1,916,178	1,840,409	672,545	451,286	1,051,080
2 – 2.5	1,869,054	1,776,461	621,747	723,956	945,675
2.5 – 3	1,035,781	961,147	684,198	3,005,622	972,487
3 – 3.5	689,178	458,139	731,264	1,256,366	987,274
3.5 – 4	437,032	264,551	704,634	617,231	944,657
>4	1,120,122	826,640	11,986,432	13,627,303	9,375,993

Source: Authors' estimates based on data provided by DGNET, Ministry of Health

Table 2.2: *Motorized travel time to nearest health facility, based on road conditions expected after the completion of currently ongoing or planned works (number of people able to access at least one facility of the specific type within the time threshold)*

Hours	Functioning CSPS	Functioning + planned CSPS	CM/CMU	CMA	CMU/CMU or CMA
0 - 0.5	6,668,477	7,014,600	1,149,995	389,837	1,528,509
0.5 – 1	4,711,053	5,179,546	3,216,493	494,105	3,694,636
1 – 1.5	2,452,581	2,566,961	1,163,185	301,309	1,454,561
1.5 – 2	1,895,790	1,822,060	664,384	467,360	1,038,524
2 – 2.5	1,856,003	1,767,735	630,134	727,960	963,568
2.5 – 3	1,027,150	952,525	686,181	3,048,313	975,620
3 – 3.5	683,555	453,454	722,051	1,261,248	981,627
3.5 – 4	435,401	260,792	708,157	605,954	953,347
>4	1,108,579	820,916	11,896,595	13,541,092	9,246,784

Source: Authors' estimates based on data provided by DGNET, Ministry of Health

Table 2.3: *Motorized travel time to nearest education facility, based on road conditions in place in the end of 2019 (number of people able to access at least one facility of the specific type within the time threshold)*

Hours	Primary school (any)	Primary school (public)	Primary school (private)	PPS (any)	PPS (public)	PPS (private)
0 - 0.5	10,307,345	10,270,138	6,869,387	7,404,143	7,251,718	5,937,485
0.5 – 1	5,975,908	5,992,210	3,518,036	4,172,014	4,159,825	2,366,460
1 – 1.5	1,869,288	1,880,248	2,003,824	2,200,698	2,218,416	1,478,893
1.5 – 2	915,422	919,651	1,637,980	1,763,274	1,807,526	1,501,960
2 – 2.5	791,651	796,006	1,731,558	1,690,263	1,725,694	1,466,808
2.5 – 3	201,238	201,866	925,708	810,390	834,405	1,087,933
3 – 3.5	161,146	160,588	783,212	614,806	624,707	1,013,133
3.5 – 4	102,253	102,625	614,251	482,150	492,027	865,381
>4	516,295	517,215	2,754,089	1,700,768	1,724,189	5,119,123

Source: Authors' estimates based on data provided by DGNET, Ministry of Education

Table 2.4: *Motorized travel time to nearest education facility, based on road conditions expected after the completion of ongoing/planned works (number of people able to access at least one facility of the specific type within the time threshold)*

Hours	Primary school (any)	Primary school (public)	Primary school (private)	PPS (any)	PPS (public)	PPS (private)
0 - 0.5	10,440,447	10,402,872	6,967,831	7,509,444	7,358,816	6,009,013
0.5 – 1	5,868,255	5,884,924	3,473,553	4,121,681	4,109,432	2,365,278
1 – 1.5	1,866,828	1,877,788	2,008,468	2,210,327	2,226,845	1,489,468
1.5 – 2	901,964	906,193	1,642,858	1,740,336	1,784,207	1,490,765
2 – 2.5	788,607	792,962	1,723,029	1,679,162	1,713,786	1,472,735
2.5 – 3	199,597	200,225	916,397	811,132	836,335	1,080,277
3 – 3.5	159,135	158,577	771,515	611,187	620,554	1,009,822
3.5 – 4	101,401	101,772	614,015	477,177	486,729	863,323
>4	514,312	515,232	2,720,380	1,678,060	1,701,802	5,056,495

Source: Authors' estimates based on data provided by DGNET, Ministry of Education

Table 2.5: *Motorized travel time to nearest private PPS school, based on road conditions in place at the end of 2019 (number of people able to access at least one school of the specific type within the time threshold)*

Hours	PPS (private – secular)	PPS (private – Catholic)	PPS (private – Muslim)	PPS (private – Protestant)
0 - 0.5	5,848,644	4,278,569	3,753,643	4,232,401
0.5 – 1	2,286,661	1,521,465	914,783	1,028,985
1 – 1.5	1,419,245	633,572	331,869	575,834
1.5 – 2	1,485,724	733,919	277,635	584,119
2 – 2.5	1,434,657	732,410	274,373	613,792
2.5 – 3	1,080,588	717,704	256,899	593,211
3 – 3.5	1,007,945	762,192	274,525	594,097
3.5 – 4	846,394	740,564	283,035	607,217
>4	5,427,317	10,716,781	14,470,414	12,007,520

Source: Authors' estimates based on data provided by DGNET, Ministry of Education

Table 2.6: *Motorized travel time to nearest private PPS school, based on road conditions expected after the completion of ongoing/planned works (number of people able to access at least one school of the specific type within the time threshold)*

Hours	PPS (private – secular)	PPS (private – Catholic)	PPS (private – Muslim)	PPS (private – Protestant)
0 - 0.5	5,915,941	4,334,915	3,779,242	4,245,597
0.5 – 1	2,288,310	1,507,878	905,279	1,039,804
1 – 1.5	1,428,823	676,019	340,295	601,441
1.5 – 2	1,477,756	732,278	261,454	598,132
2 – 2.5	1,440,979	737,746	282,058	615,682
2.5 – 3	1,069,674	747,639	263,836	582,850
3 – 3.5	1,006,687	767,210	266,555	601,553
3.5 – 4	845,895	759,076	292,965	610,177
>4	5,363,113	10,574,417	14,445,493	11,941,940

Source: Authors' estimates based on data provided by DGNET, Ministry of Education

ANNEX 3: REGRESSION RESULTS: TRANSPORT CONNECTIVITY AND SCHOOLING RATES

PRIMARY SCHOOL

	(1) Gross Enrollment Rate	*(2) Net Enrollment Rate*	*(3) Net Enrollment Rate (girls)*	*(4) Completion Rate*	*(5) Completion Rate (girls)*	*(6) Dropout Rate CP2*	*(7) Dropout Rate CP2 (girls)*	*(8) Dropout Rate CE2*	*(9) Dropout Rate CE2 (girls)*
Avg. motorized travel time to a primary sch. (min)	-.2047 **	-.1839 **	-.1860 **	-.1345 *	-.1398 *	.5192 .	.5500 .	.4548 .	.4923 .
	(-3.27)	(-3.65)	(-3.75)	(-2.45)	(-2.44)	(1.87)	(2.02)	(1.79)	(1.86)
Avg. motorized travel time to a primary sch. (min) squared						-.0020 .	-.0022 .	-.0018 .	-.0020 .
						(-1.75)	(-1.95)	(-1.74)	(-1.83)
Rural Access Index (percent)	.5108 *	.3493 .	.3712 .	.4492 *	.5204 *	.3132	.3050	.2976	.3033
	(2.14)	(1.82)	(1.97)	(2.07)	(2.30)	(1.24)	(1.24)	(1.29)	(1.26)
Schools have been closed due to insecurity (dummy)	-26.9700 ***	-20.1950 ***	-22.714 ***	-16.409 **	-22.826 ***	15.908 *	15.9693 *	17.5649 **	17.5569 **
	(-4.36)	(-4.06)	(-4.64)	(-3.03)	(-4.03)	(2.63)	(2.70)	(3.18)	(3.04)
Household welfare score	.00002	.00002	.00002	-3.78e-06	-9.14e-06	-.00002	-.00002	-.00004	-.00003
	(0.75)	(0.91)	(1.03)	(-0.16)	(-0.37)	(-0.79)	(-0.82)	(-1.37)	(-1.13)
Student-teacher ratio				.5573 *	.6327 *	-.6228 .	-.5356 .	-.4982	-.5299 .
				(2.07)	(2.25)	(-1.94)	(-1.71)	(-1.70)	(-1.73)
Constant	84.22 ***	67.50 ****	68.99 ****	31.87 *	36.77 *	23.35	18.42	21.96	19.89
	(9.06)	(9.03)	(9.37)	(2.17)	(2.40)	(1.17)	(0.95)	(1.21)	(1.05)
Nord	17.75 *	18.46 **	16.28 **						
Centre-Sud				14.22 *					
Plateau-Central				12.29 .					
Est							-16.9 .	-17.13 .	-17.45 .
R-squared	0.9249	0.9213	0.9269	0.8997	0.9136	0.7182	0.7189	0.7013	0.6870
Adj R-squared	0.8820	0.8763	0.8851	0.8366	0.8591	0.5232	0.5243	0.4945	0.4703
Root MSE	10.003	8.0448	7.9228	8.7153	9.1222	9.7401	9.5092	8.8864	9.2886

*Note: t-statistic in parenthesis; . p<0.1, * p<0.05, ** p<0.01, *** p<0.001*

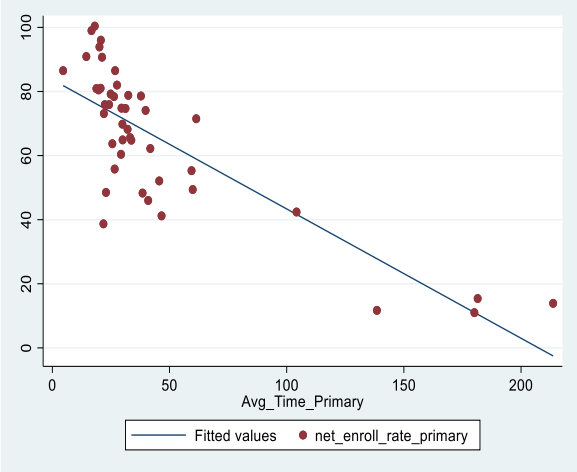
All regression models include Regional fixed effects, with Boucle du Mouhoun as the reference region. Only the statistically significant (p<0.1 or higher) Region fixed effects are shown

POST-PRIMARY AND SECONDARY SCHOOL

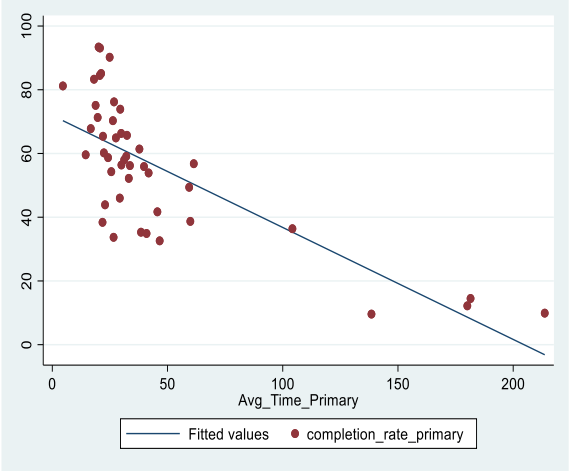
	(1) Gross Enrollment Rate	*(2) Net Enrollment Rate*	*(3) Net Enrollment Rate (girls)*	*(4) Completion Rate (post-primary)*	*(5) Completion Rate (post-primary, girls)*	*(6) Completion Rate (secondary)*	*(7) Completion Rate (secondary, girls)*	*(8) Dropout Rate (sixieme)*	*(9) Dropout Rate (sixieme, girls)*
Avg. motorized travel time to a PPS sch. (min)	-.2804 **	-.1833 **	-.1893 **	-.3263 **	-.3291 **	-.1540 *	-.1130 *	.0139	.0171
	(-3.24)	(-3.15)	(-3.15)	(-3.39)	(-3.29)	(-2.75)	(-2.65)	(0.53)	(0.65)
Avg. motorized travel time to a PPS sch. (min) squared	.0004 **	.0003 *	.0003 *	.0005 **	.0005 **	.0003 *	.0002 *		
	(2.86)	(2.74)	(2.76)	(3.08)	(2.99)	(2.68)	(2.66)		
Rural Access Index (percent)	.1860	.1271	.2078 .	.2179	.3841 .	.1527	.1860 *	-.0543	-.1242
	(1.08)	(1.1)	(1.75)	(1.14)	(1.94)	(1.38)	(2.20)	(-0.28)	(-0.65)
Schools have been closed due to insecurity (dummy)	-10.3018 *	-7.7301 **	-9.8122 **	-7.4160 .	-8.7510 .	-3.1317	-3.2858 .	14.3539 **	14.7887 **
	(-2.63)	(-2.94)	(-3.62)	(-1.71)	(-1.94)	(-1.24)	(-1.70)	(2.92)	(3.00)
Household welfare score	.00004 *	.00003 *	.00002 .	.00006 **	.00006 **	.00004 **	.00004 ***	-.00004 .	-.00004 .
	(2.37)	(2.08)	(1.89)	(2.80)	(2.81)	(3.56)	(4.45)	(-1.88)	(-1.94)
Constant	46.87 ****	33.77 ****	37.02 ****	42.58 ****	43.88 ****	14.58 **	9.53 *	23.10 **	22.56 **
	(6.22)	(6.67)	(7.08)	(5.09)	(5.04)	(3.00)	(2.56)	(3.04)	(2.96)
Centre	-17.04 .		-13.20 .			-10.67 .			
Centre-Est	-8.33 .		-7.61 *		-11.26 *	-5.13 .	-5.91 *		
Centre-Nord	-9.86 .	-6.54 .	-7.27 .			-5.77 .	-6.49 *		
Centre-Ouest			-5.25 .		-9.53 .		-6.23 **		
Haut-Bassins			-6.54 .		-10.05 .	-6.07 .	-5.99 *		
Nord	-9.11 *	-5.30 .	-7.48 *	-8.51 .	-11.90 *		-4.82 *		
Sud-Ouest	-9.06 .		-9.04 *	-13.49 *	-18.93 **	-8.15 *	-9.14 **		
Cascades			-7.32 .				-7.73 *		
Plateau-Central									
Sahel								14.09 .	13.72 .
R-squared	0.8893	0.9021	0.9155	0.8708	0.8912	0.8250	0.8782	0.7224	0.7333
Adj R-squared	0.8196	0.8405	0.8622	0.7894	0.8226	0.7148	0.8016	0.5637	0.5809
Root MSE	6.1899	4.158	4.2935	6.8698	7.1443	3.9934	3.0496	7.9805	7.9951

*Note: t-statistic in parenthesis; . p<0.1, * p<0.05, ** p<0.01, *** p<0.001*
All regression models include Regional fixed effects, with Boucle du Mouhoun as the reference region. Only the statistically significant (p<0.1 or higher) Region fixed effects are shown

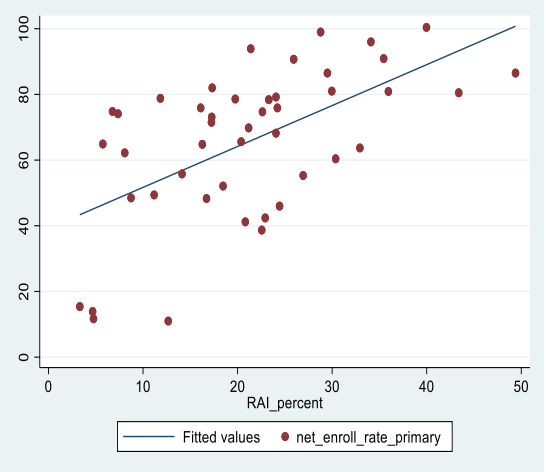
Primary school net enrollment rate vs. avg. motorized travel time to nearest primary school



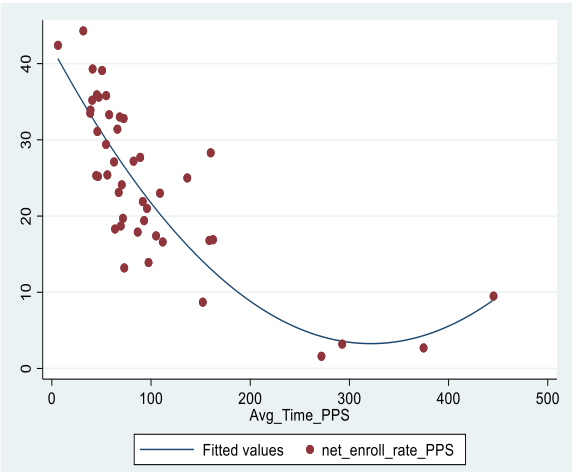
Primary school completion rate vs. avg. motorized travel time to nearest primary school



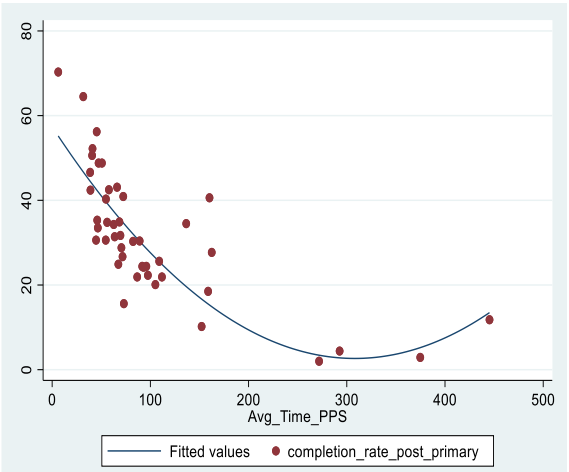
Primary school net enrollment rate vs. Rural Access Index



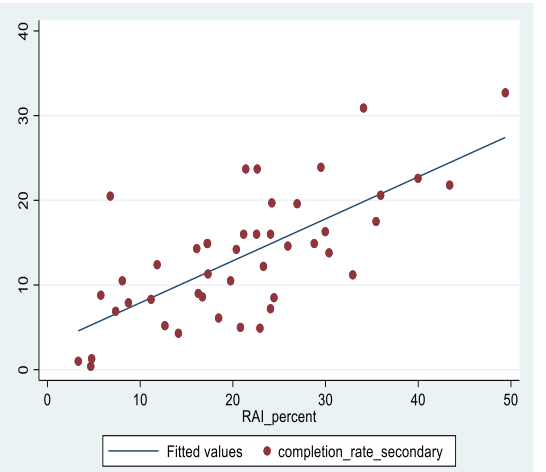
PPS net enrollment rate vs. avg. motorized travel time to nearest PPS school



Post-primary school completion rate vs. avg. motorized travel time to nearest PPS school



Post-primary school completion rate vs. Rural Access Index



ANNEX 4: REGRESSION RESULTS: TRANSPORT CONNECTIVITY AND HEALTH OUTCOMES

MATERNAL MORTALITY PER 100,000 DELIVERIES

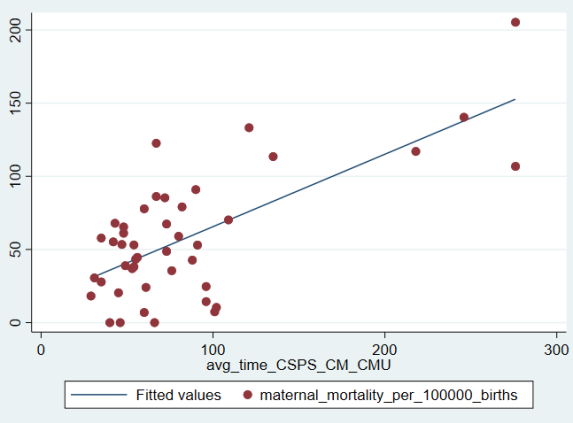
	(1)	*(2)*	*(3)*	*(4)*	*(5)*
Avg. motorized travel time to a primary care facility (min)	.4400 ** (3.16)	.4418 ** (3.20)	.4535 ** (3.31)	.4649 ** (3.35)	.4413 ** (3.11)
Rural Access Index (percent)					-.6376 (-0.87)
Facility average theoretical radius of action (km)	13.5505 ** (3.54)	13.9974 ** (3.67)	13.4543 ** (3.54)	13.1866 ** (3.43)	11.2365 * (2.52)
Household welfare score				-.00006 (-0.75)	-.00004 (-0.45)
Assisted deliveries (%)		-.5131 (-1.20)	-.6275 (-1.45)	-.7221 (-1.59)	-.7786 (-1.69)
Post-natal consultation on 6th day after delivery (%)			-.7677 (-1.29)	-.8044 (-1.34)	-.9406 (-1.51)
Constant	-63.28 * (-2.59)	-26.63 (-0.68)	35.74 (0.58)	58.53 (0.84)	93.51 (1.16)
Est	-67.83 **	48.08 *	-71.82 **	-69.31 **	-61.24 *
Nord	44.86 *		50.38 *	49.48 *	53.90 *
Sahel	-51.61 .	-56.77 *	-70.76 *	-67.91 *	-68.10 *
R-squared	0.7092	0.7228	0.7385	0.7438	0.7511
Adj R-squared	0.5831	0.5890	0.5984	0.5920	0.5884
Root MSE	27.843	27.646	27.33	27.547	27.669

*Note: t-statistic in parenthesis; . p<0.1, * p<0.05, ** p<0.01, *** p<0.001*

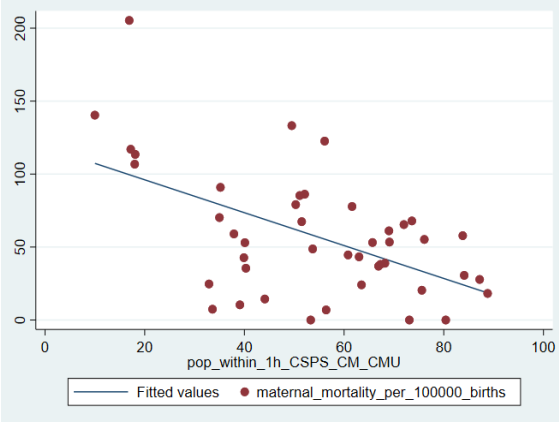
All regression models include Regional fixed effects, with Boucle du Mouhoun as the reference region. Only the statistically significant (p<0.1 or higher) Region fixed effects are shown

HEALTH OUTCOMES: MATERNAL MORTALITY

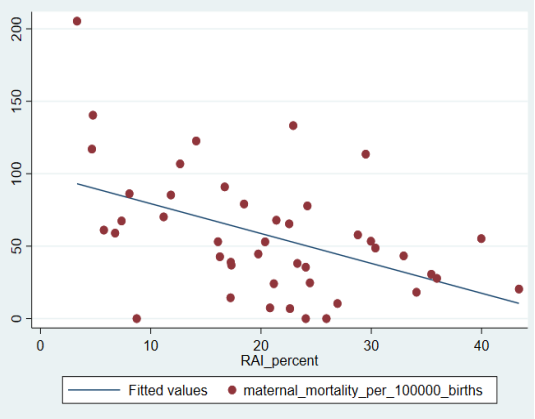
Maternal mortality per 100,000 births vs. avg. motorized travel time to nearest primary care facility



Maternal mortality per 100,000 births vs. share of population living within 1-hour service area of a primary care facility

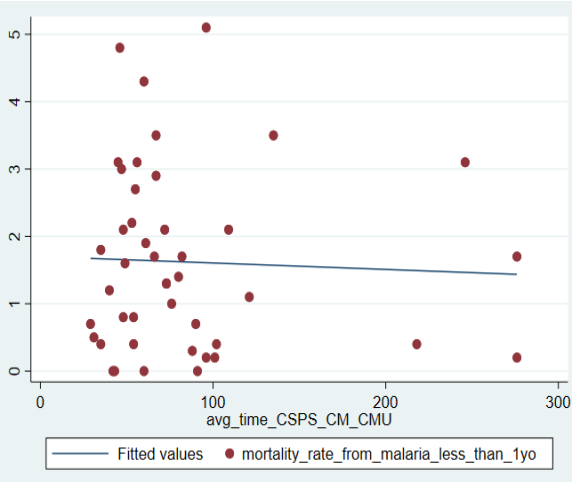


Maternal mortality per 100,000 births vs. Rural Access Index

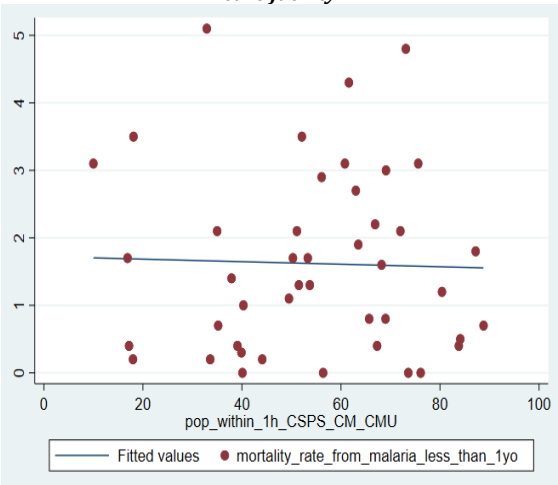


HEALTH OUTCOMES: MORTALITY FROM MALARIA AMONG <1-YEAR-OLDS

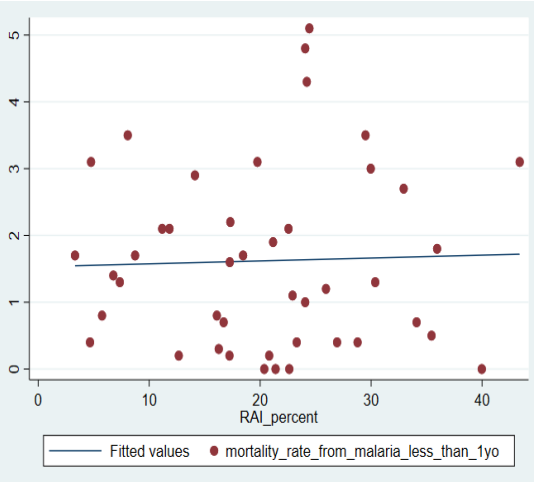
Mortality from malaria among <1-year-olds vs. avg. motorized travel time to nearest primary care facility



Mortality from malaria among <1-year-olds vs. share of population living within 1-hour service area of a primary care facility

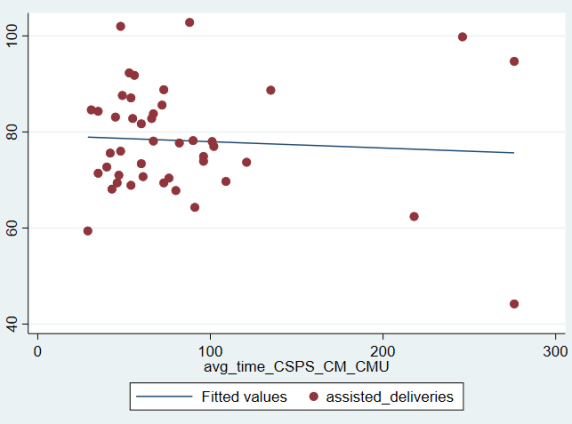


Mortality from malaria among <1-year-olds vs. Rural Access Index

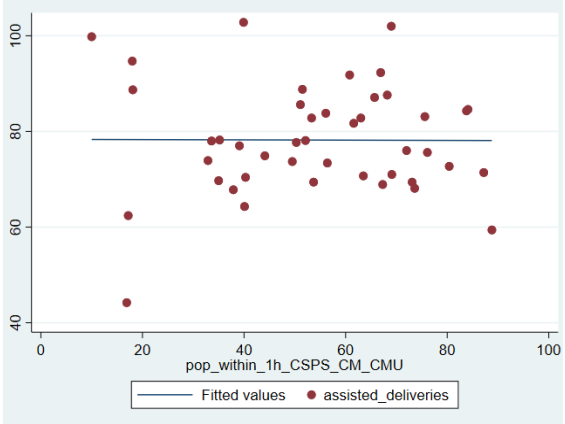


INTERMEDIATE HEALTH BEHAVIORS: ASSISTED DELIVERIES

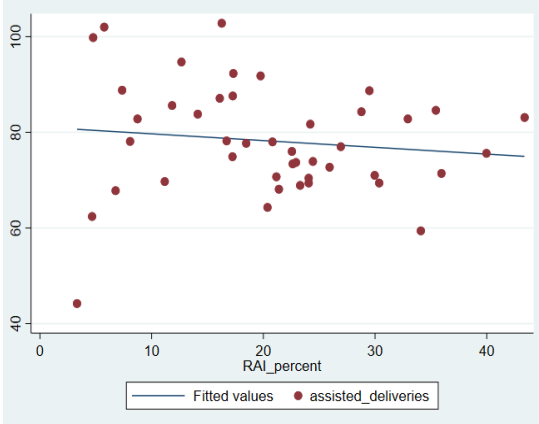
Share of assisted deliveries vs. avg. motorized travel time to nearest primary care facility



Share of assisted deliveries vs. share of population living within 1-hour service area of a primary care facility

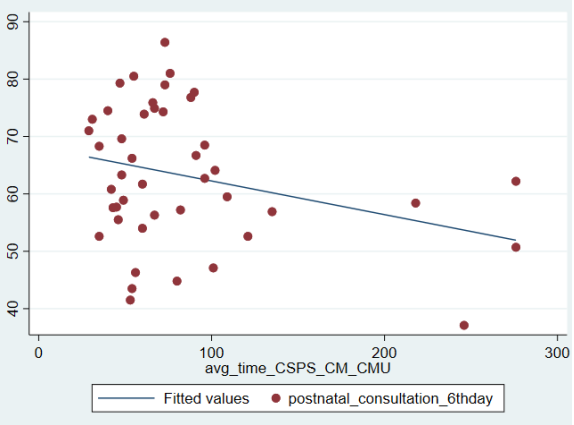


Share of assisted deliveries vs. Rural Access Index

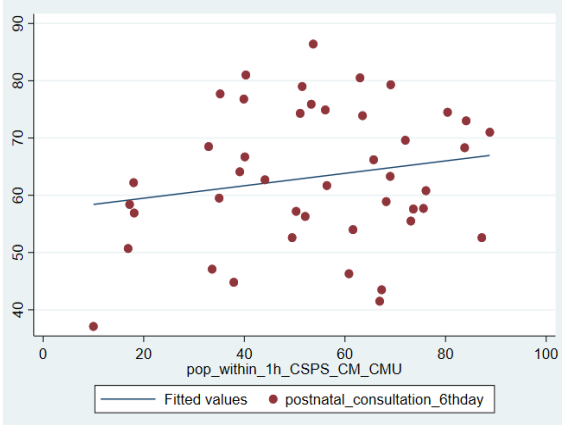


INTERMEDIATE HEALTH BEHAVIORS: POST-NATAL CONSULTATION AT 6TH DAY AFTER BIRTH

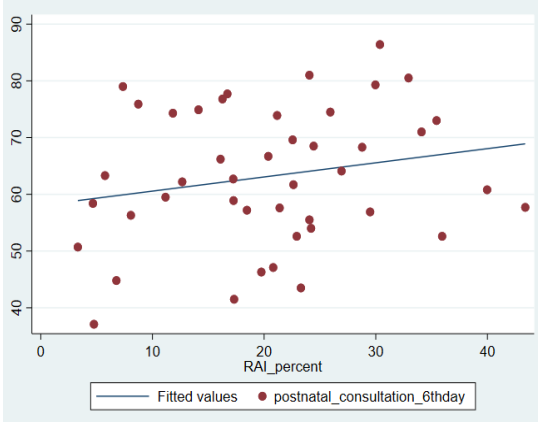
Share of post-natal consultation at 6th day vs. avg. motorized travel time to nearest primary care facility



Share of post-natal consultation at 6th day vs. share of population living within 1-hour service area of a primary care facility



Share of post-natal consultation at 6th day vs. Rural Access Index



[i] Consideration of reports submitted by States parties in accordance with articles 16 and 17 of the International Covenant on Economic, Social and Cultural Rights, Burkina Faso, E/C.12/BFA/1, para. 62 (received February 25, 2015).

[ii] Consideration of reports submitted by States parties in accordance with articles 16 and 17 of the International Covenant on Economic, Social and Cultural Rights, Burkina Faso, E/C.12/BFA/1, para. 141 (received February 25, 2015).

[iii] Initial report submitted by Burkina Faso under article 35 of the Convention, due in 2011, CRPD/C/BFA/1, para. 37, 108.

[iv] CNDH, RAPPORT ALTERNATIF DE LA COMMISSION NATIONALE DES DROITS HUMAINS SUR LA MISE EN ŒUVRE DE LA CONVENTION RELATIVE AUX DROITS DES PERSONNES HANDICAPEES, para. 1, 2. July 2020.

[v] Consideration of reports submitted by States parties in accordance with articles 16 and 17 of the International Covenant on Economic, Social and Cultural Rights, Burkina Faso, E/C.12/BFA/1, para. 230 (received February 25, 2015).

[vi] Initial report submitted by Burkina Faso under article 35 of the Convention, due in 2011, CRPD/C/BFA/1, para. 37, 117 (received November 30, 2018).