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Review Article

The use of mobile phone surveys for rapid mortality monitoring: A national study in Burkina Faso

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Review Article

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Abstract

BACKGROUND

In low- and middle-income countries, death registration remains low, and mortality estimation is heavily based on surveys and censuses conducted through face-to-face interviews. These operations are costly and time-consuming, and are difficult to conduct during health and security crises. Taking advantage of the rapid increase in cell phone network coverage, mobile phone surveys (MPS) have recently started to be used to collect mortality data.

OBJECTIVES

We computed mortality levels obtained from a national MPS conducted in 2021–2022 in Burkina Faso and compare them to estimates from censuses, surveys, and modeled estimates developed by United Nations agencies.

METHODS

The MPS included three modules adapted from standard questionnaires to reduce interview length: (1) truncated birth histories, (2) summary sibling histories, and (3) parental survival histories. We applied direct and indirect mortality estimation methods and used post-stratification weights to account for sample selectivity.

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RESULTS
Indirect estimates of under-5 mortality aligned with UN estimates, but direct estimates extracted from truncated birth histories provided lower mortality rates. However, these lower direct estimates were consistent with the latest Demographic and Health Surveys, conducted in 2021. MPS estimates of ${}_{35}q_{15}$ derived from the sibling histories were about half of those published by the UN. This downward bias is likely due to errors in reporting siblings' ages and timing of death. Mortality levels at older ages (${}_{30}q_{50}$) from the parental survival histories were also substantially lower than model-based UN estimates (with a relative difference of –20% among men and –34% among women).

CONTRIBUTION
MPS are a promising tool for the rapid measurement of age-specific mortality in settings where face-to-face surveys are difficult to implement. However, our findings also indicate that further research is needed to evaluate and improve on the quality of data collected over the phone.

1. Introduction

Death registration is the gold standard for regular monitoring of mortality at different geographic and administrative levels, at a relatively low cost. However, in most low- and middle-income countries (LMICs), death registration coverage remains too low to accurately estimate mortality. This is particularly the case in sub-Saharan Africa. Apart from a few island states and a number of large urban areas, only a few countries (e.g., South Africa and Zimbabwe) have complete or near-complete death registration (Mikkelsen et al. 2015). Mortality levels and trends in this region are therefore mostly derived from sample surveys and censuses. These are generally conducted face-to-face, infrequently, and are expensive. As a result, there is a lack of reliable and up-to-date estimates of mortality for children, adults, and the elderly. In particular, the COVID-19 pandemic highlighted the limitations of face-to-face data collection at a time when timely mortality estimates were sorely needed. Many Demographic and Health Surveys (DHS) were postponed for several months due to lockdowns or health concerns during the first waves of the pandemic. Data collection through face-to-face surveys is also difficult to implement during or in the aftermath of natural disasters or during political crises.

There is a need for faster, cheaper, and more flexible data collection for mortality estimation, and the rapid expansion of cell phone network coverage and use opens up new opportunities. Mobile phone usage has seen remarkable growth globally, especially in LMICs, where approximately 8 out of 10 individuals now own a mobile device (World Bank 2022). In sub-Saharan Africa, mobile phone ownership rates range between 61%

and 73%, with a consistent upward trend (Gallup 2016). Burkina Faso, for instance, has experienced a notable surge in mobile subscriptions, from 46 per 100 inhabitants in 2011 to 112 per 100 inhabitants in 2021, while the number of fixed-line subscriptions continues to decline (World Bank 2022).

Various national surveys document the widespread adoption of mobile phones in Burkina Faso. The 2010 DHS revealed that 59.2% of households owned at least one mobile phone, with urban areas exhibiting higher ownership rates than rural regions (INSD 2012). The 2014 Continuous Multisectoral Survey reported that approximately 64.3% of individuals in the country aged 15 and above possessed a mobile phone (EMC 2015). More recently, the 2021 DHS revealed that mobile phone ownership among individuals aged 15 to 49 stood at 75% for women and 90% for men (INSD 2021). In addition, in recent years there have been significant advances in telecommunication infrastructure, coupled with reduced call costs and enhanced communication quality.

Mobile phone surveys (MPS) have several advantages that render them promising for data collection (Chasukwa et al. 2022; Kuehne et al. 2016; Soullier, Legleye, and Richard 2022). They are less expensive, quicker to deploy, can be conducted at higher frequencies than traditional face-to-face surveys, and allow for flexibility in questionnaire design to meet changing data needs (Leo et al. 2015; Brubaker, Kilic, and Wollburg 2021; Gibson et al. 2017; Labrique et al. 2017). In sub-Saharan Africa there has been a proliferation of MPS in recent years. However, these are often small-scale surveys, such as opinion surveys (GeoPoll 2015). MPS have also been used in health and demographic surveillance systems to evaluate health interventions with specific populations and for interim updates between household visits (Brinkel et al. 2014; Debrah et al. 2020; Jennings et al. 2015; Pariyo et al. 2019; van Heerden, Norris, and Richter 2010). More recently, MPS have been used to study the impact of the Ebola and COVID-19 crises on household living conditions and to assess prevention behaviors (Headey et al. 2020; PMA 2023; Vinceti et al. 2020; World Bank Group 2020). However, few MPS have focused explicitly on measuring mortality, with a few notable exceptions. For example, an MPS carried out in Monrovia by Doctors Without Borders showed that this collection method was a feasible and acceptable alternative to face-to-face data collection, and enabled the capturing of excess mortality resulting from deaths associated with Ebola (Kuehne et al. 2016). Jha and colleagues also used an independent MPS of adults in India to demonstrate that cumulative COVID deaths in India in September 2021 were 6 to 7 times higher than officially reported (Jha et al. 2022). Similarly, an MPS-based study in Matlab, Bangladesh, showed a 28% increase in excess deaths among the elderly in the early months of the pandemic (Hanifi et al. 2021). Another study conducted in a collaboration between Médecins Sans Frontières (MSF) and Cameroon’s Ministry of Health in the country’s Far North region revealed that the crude mortality rate (CMR) calculated from telephone interviews was higher than the rate derived from face-to-face surveys (Gignoux et al. 2020). Yet these previous studies mostly based their estimates on reports of recent household deaths, and there is a need to assess to what extent other instruments, such as birth or pregnancy histories and sibling histories, can be used or adapted for an MPS.

Compared to face-to-face interviews, MPS may be more prone to sampling and non-sampling bias. First, selection biases are expected due to inequalities in cell phone ownership (Leo et al. 2015; Chasukwa et al. 2022; Ellis and Krosnick 1999; Kreuter et al. 2010; Lau et al. 2019). More specifically, younger, urban, and male respondents with higher levels of education tend to be overrepresented in MPS (L'Engle et al. 2018). Further, data quality and non-response may be affected by network connectivity and quality, and the limitations of a mobile phone interview for the establishment of a trusting relationship between enumerator and respondent (Aquilino 1994; Blumenstock and Eagle 2012; Ekholm et al. 2010; Greenleaf et al. 2020; Lynn and Kaminska 2013; Sinclair et al. 2012). MPS might, however, improve data quality regarding sensitive topics. For example, MPS offer the advantage of allowing greater privacy, as the respondent is able to choose where and when to take the call (Aquilino 1994; Dabalen et al. 2016; Groves 1979; Roberts, Jäckle, and Lynn 2006).

Few studies have compared the data quality of mortality indicators derived from face-to-face and MPS surveys. This research aims to compare mortality levels and trends derived from MPS with those derived from face-to-face surveys in Burkina Faso. Here we report on mortality levels and trends extracted from a survey conducted in the context of the RaMMPS project (Rapid Mortality Mobile Phone Surveys). We compare the RaMMPS estimates with those obtained from the 2019–2020 census and the latest DHS available in the country, in addition to mortality estimates derived from United Nations agencies. This comparison covers under-5 mortality (${}_{5}q_{0}$), captured in the MPS through truncated birth histories; mortality in adults aged 15–49 (${}_{35}q_{15}$), measured through summary sibling survival histories; and old-age mortality (${}_{30}q_{50}$), measured through a new survey module collecting parental survival histories.

2. Data and methods

2.1 The RaMMPS national study in Burkina Faso

RaMMPS is an innovative survey program designed to estimate mortality during the COVID-19 pandemic in five middle- and low-income countries: the Democratic Republic of Congo (DRC), Malawi, Mozambique, Bangladesh, and Burkina Faso.[5] In

[5] https://www.lshtm.ac.uk/research/centres-projects-groups/rapid-mortality-mobile-phone-survey.

Burkina Faso the survey was implemented by the Institut Supérieur des Sciences de la Population (ISSP) at Joseph Ki-Zerbo University. Data collection began in September 2021 and ended in October 2022. The sample included 21,339 respondents aged 15+ and residing in Burkina Faso at the time of the survey. Interviews were conducted by mobile phone and recorded via tablet using SurveyCTO. Standard procedures were followed, including comprehensive training, consistent supervision, and refresher courses for enumerators to maintain data quality. A call center was established and equipped with the appropriate tools to ensure clear communication between interviewers and respondents. Prior to the main survey, a month-long pilot survey was conducted to refine the questionnaire and optimize strategies for building rapport with respondents. Prior to their interview each respondent gave their verbal informed consent to participate. Respondents were informed about the purpose of the call, the nature of the survey, and their right to refuse participation or withdraw consent at any time. These explanations were provided in the language that the respondent spoke and understood best. The study protocol was approved by Burkina Faso's Health Research Ethics Committee.

Data collection was based on quarterly cross-sectional surveys organized over a period of twelve months. The aim of this strategy was to limit bias due to seasonality in mortality. Two sampling strategies were used: (1) a sample of approximately 6,000 individuals based on phone numbers retrieved from the face-to-face Harmonized Survey on Household Living Conditions (EHCVM – Enquête harmonisée sur les conditions de vie des ménages) and (2) a sample of 9,000 individuals obtained through random digit dialing (RDD). We henceforth refer to these two sub-samples as the EHCVM and RDD arms, respectively. The purpose of using these two sampling procedures was to compare estimates derived from these two recruitment modalities.

The original EHCVM survey was a national survey on household living conditions conducted face-to-face between September 2018 and July 2019. It was based on a two-stage stratified survey and provided representative indicators at the regional administrative level (13 regions) and by type of residence (urban or rural). A total of 7,010 households were included in the sample, and telephone numbers through which the head of household could be reached directly or through a close relative were collected for approximately 6,575 households. As part of the RaMMPS survey, each head of household previously interviewed in the face-to-face EHCVM survey, and who had consented to be contacted for future surveys, was contacted by telephone to respond to a questionnaire. Then, with the consent of the head of household, we randomly selected a woman from the pool of women of reproductive age 15–49 residing in the household at the time of the MPS. These selected women were also invited to give their informed consent before the data collection.

The second arm of the RaMMPS survey relied on 11,250 mobile phone numbers, randomly generated each trimester, to ultimately survey 9,000 individuals. First, numbers were randomly generated from all possible telephone numbers in Burkina Faso based on the prefixes of the different cell phone operators operating in the country, namely Moov Africa, Telecel Faso, and Orange. Next, the non-functional numbers were eliminated thanks to the technical support of the company Viamo. This company called all the selected numbers to ensure that they were functional. The number of calls needed to reach 9,000 individuals was estimated based on a similar study of women of reproductive age in Burkina Faso, which suggested that the non-response rate was around 25% (Greenleaf et al. 2020). This study arm also provides representative indicators across administrative regions and by urban or rural residence.

In both study arms, respondents were informed that they would receive a call credit incentive at the end of the interview. Several studies have shown that monetary motivation improves survey participation and facilitates the constitution of a large sample over a short period of time (Cheung et al. 2019; Gibson et al. 2019, 2022; Singer and Ye 2013). In addition, interviewers were instructed to call individuals not picking up calls at least seven days in a row at different times of the day before deciding that respondents could not be reached.

Information on household composition, household deaths in the past 3 months, survival of close relatives (children, siblings, and parents), and COVID-19 vaccination was collected through both study arms. On average, the survey lasted 23 and 17 minutes for the EHCVM and RDD arms, respectively.

2.2 Post-stratification weighting

The compositions of the two samples for the MPS are likely to differ substantially from that of the general population, due to the selectivity of mobile phone owners and differential rates of non-response.

To obtain representative samples of the population, data on basic household assets, place of residence, age, and education were collected from respondents during the MPS and used to compute post-stratification weights, using the census data as the benchmark (Table 1) (Leo et al. 2015). The post-stratification weights were computed by adjusting the existing weights, based either on the original weights of the EHCVM face-to-face survey or on the quotas for the RDD sample, in such a way that the marginal distribution of the key variables listed above in the weighted sample matched the distribution in the national census conducted in 2019–2020. To avoid high variability and loss of precision when using weights, we capped the maximum weight per individual at 2 (DeBell et al. 2009).

2.3 Mortality estimation

Large-scale surveys such as the DHS or Multiple Indicator Cluster Surveys (MICS) generally include full birth histories (FBH) for estimating under-5 mortality (and fertility), and some also include full siblings' survival histories (SSH) for estimating adult mortality. Collecting FBH consists of asking a sample of women about their reproductive life, specifying the sex and date of birth of each child, his/her survival status, and, in the case of death, the child's age at death. SSH are obtained by asking each respondent the name of each of his or her siblings born to the same mother, their sex, age, survival status, and, in the case of death, their age at death and time since death (Helleringer et al. 2014). In the RaMMPS survey we revised these two instruments to limit interview length and added a new module to measure old-age mortality.

To measure under-5 mortality we used truncated birth histories (TBH). Truncated birth histories involve asking questions about only recent births (defined according to a reference period prior to the survey) or latest births (based on birth order), rather than a complete history of all past births. They have the advantage of being faster to collect, but they also pose additional risks in terms of recall error and selection bias (Hill 2013). For example, respondents or interviewers might move births out of the reference period in order to end the interview more quickly. There could also be genuine difficulties in placing births within the reference period. For the MPS we limited the data collection to births that had occurred in the last seven years only. Prior to this truncated history, we also collected the total number of children born alive and the total number of surviving children, by sex. The estimation of infant and child mortality can therefore be based on direct methods (from the truncated birth histories) or indirect methods (from the summary data). Direct estimates were obtained by dividing the deaths by the corresponding exposure times, by age and period since data collection, converting death rates into probabilities of survival, chaining survival probabilities together, and converting these cumulative probabilities into summary indices such as ${}_5q_0$. We used the *demogsurv* package available for the R statistical software.[6] Indirect estimates were obtained by converting the proportions of surviving children classified by maternal age at the time of the survey into survival probabilities at various ages of childhood, which in turn can be transformed into standard mortality indicators such as the ${}_5q_0$ index using model life tables (Hill 2013).

To estimate mortality among adults aged 15–49, we designed a shortened version of the sibling module used in DHS. We limited the information collected to the total number of living siblings born to the respondent's biological mother, the number of deceased siblings, and the number of siblings who had died since the beginning of 2019. For siblings who had died since 2019, additional details about the date, place, and

[6] https://github.com/mrc-ide/demogsurv.

circumstances of death were collected. Because age at survey of surviving siblings and age at death of deceased siblings were not collected, we imputed dates of birth based on information available in the DHS conducted in 2021, which collected full sibling histories. We sampled from the full SSH an age difference between respondents and their siblings, using distributions of age differences in the DHS, classified by the respondent's sex and age group, and the sex and survival status of his or her siblings. These age differences allowed us to impute the age at survey of surviving siblings. For siblings who had died, but whose age and time since death were unknown, we cross-tabulated the age at death of siblings and the time since death from the 2021 DHS survey, again by 5-year age group of respondents. From these matrices we proportionally sampled an age at death and a time since death, taking into account the age group of the respondent and the sex of the siblings. From the time since death and the date of the interview, we then imputed the date of death and deduced the date of birth of the deceased siblings.

To measure mortality among older adults, which is likely to be more affected by excess mortality caused by COVID-19, we used a new tool, that of parental survival histories (PSH) (Masquelier et al. 2024). Adults reported on the survival status of their mother and father, their current age, or their age at death and the number of years since their death if deceased. Although full parental survival histories have seldom been collected, except in a survey conducted in Vietnam in the early 1990s (Hirschman, Preston, and Loi 1995), they are one of the few data collection instruments to measure mortality in older age groups. Again, they can provide direct estimates (dividing the deaths by the corresponding exposure time tabulated by age and period), or indirect estimates, using the classical orphanhood method, which converts proportions of respondents with surviving parents into survivorship probabilities (Timæus 1992).

3. Results

3.1 Sample characteristics and phone call outcomes

Table 1 presents the composition of the RaMMPS samples and provides a comparison with the characteristics of the population enumerated in the 2019–2020 census. For the EHCVM study arm we compare our sample with the population of household heads in the census, while our comparator for the RDD sample is the population aged 15–64. There are several notable differences between the national population and our unweighted samples. First, while rural respondents made up nearly 43% and 63% of the EHCVM and RDD samples respectively, they represented 69% of the national population of household heads (and the same percentage of adults aged 15–64 in the census). Second, the population without any formal education was underrepresented by at least 20 percentage points in each study arm. Third, the proportion of the population residing in small households of fewer than 9 members was lower in our sample (respectively 70% and 63%) compared to the national population in the census (86%), even though our samples overrepresented the urban population. These large deviations are due in part to selectivity in cell phone ownership, but that selectivity is not the only factor involved. We also compared the characteristics of RaMMPS respondents (for the EHCVM arm) with those of heads of households with cell phones in the original 2018–2019 face-to-face survey (Appendix Table A-1). Compared to the latter, the population re-interviewed by telephone in 2021–2022 was younger, better educated, more urban, more concentrated in larger households, and residing in households better equipped in terms of electricity, roof type, and water access. There was therefore double selection, as among mobile phone owners those who answer the calls and agree to participate in the MPS are themselves a selected sub-sample.

Table 1: Composition of the RaMMPS sample in Burkina Faso, by study arm, compared with the population enumerated in the 2019–2020 census

	EHCVM arm (heads of households)			Census	RDD arm (population aged 15–64 years)			Census
Respondents' characteristics	Unweighted	Weighted			Unweighted	Weighted		
	%	%	95% CI	%	%	%	95% CI	%
Sex								
Men	76.7	84.0	[82.0–85.7]	84.0	34.3	46.2	[44.7–47.8]	46.3
Women	23.3	16.0	[14.3–18.0]	16.0	65.7	53.8	[52.2–55.3]	53.7
Age group								
15–29 yrs	17.5	22.9	[20.7–25.1]	22.6	41.5	43.7	[42.2–45.3]	43.7
30–49 yrs	52.0	49.3	[46.8–51.9]	49.1	46.8	42.2	[40.7–43.8]	42.2
50+ yrs	30.6	27.8	[25.6–30.2]	28.3	11.7	14.1	[13.0–15.2]	14.1
Education								
None	52.0	69.5	[67.1–71.8]	72.2	44.9	67.6	[66.1–69.0]	69.8
Primary	20.2	11.2	[9.7–12.9]	10.0	16.5	11.5	[10.5–12.5]	9.6
Secondary	21.4	13.7	[12.1–15.6]	13.5	29.5	15.7	[14.6–16.8]	15.9
Tertiary and higher	6.4	5.6	[4.5–6.9]	4.2	9.0	5.2	[4.6–5.9]	3.6
Marital status								
Married	83.6	83.3	[81.3–85.1]	84.2	75.4	77.5	[76.2–78.8]	72.5
Widowed	5.5	5.0	[4.0–6.2]	1.1	3.3	3.6	[3.1–4.3]	3.4
Divorced/separated	0.8	0.7	[0.4–1.3]	5.6	0.8	0.7	[0.5–1.0]	0.9
Single	10.1	11.0	[9.5–12.7]	9.1	20.4	18.2	[17.0–19.4]	23.2
Type of place of residence								
Ouagadougou	11.1	13.0	[11.4–14.8]	14.4	15.8	11.5	[10.6–12.4]	14.5
Bobo-Dioulasso	6.1	3.4	[2.6–4.4]	5.0	6.7	3.8	[3.3–4.4]	5.2
Other town	40.2	13.5	[12.0–15.3]	11.9	14.3	9.3	[8.5–10.2]	11.4
Rural area	42.6	70.1	[67.7–72.3]	68.7	63.2	75.4	[74.1–76.6]	69.0

Table 1: (Continued)

Respondents' characteristics	EHCVM arm (heads of households)			Census	RDD arm (population aged 15–64 years)			Census
	Unweighted	Weighted			Unweighted	Weighted		
	%	%	95% CI	%	%	%	95% CI	%
Region of residence								
Boucle du Mouhoun	7.1	10.5	[9.0–12.2]	9.6	6.8	10.6	[9.6–11.7]	9.5
Cascades	7.4	4.3	[3.4–5.5]	3.9	4.1	4.1	[3.5–4.8]	4.1
Centre	15.7	16.8	[14.9–18.8]	18.4	24.3	13.4	[12.5–14.5]	18.0
Centre-Est	7.8	7.9	[6.6–9.4]	7.7	6.9	8.1	[7.3–9.1]	7.4
Centre-Nord	7.9	7.6	[6.4–9.1]	7.0	9.2	8.5	[7.6–9.4]	7.3
Centre-Ouest	6.8	7.4	[6.1–8.9]	7.8	7.6	8.3	[7.5–9.2]	8.0
Centre-Sud	5.6	4.5	[3.6–5.7]	4.0	4.3	4.6	[3.9–5.3]	3.9
Est	7.1	8.5	[7.2–10.1]	7.5	4.0	8.3	[7.5–9.3]	7.8
Hauts-Bassins	12.7	12.0	[10.4–13.7]	11.8	14.2	11.0	[10.1–11.9]	12.0
Nord	6.5	7.7	[6.4–9.2]	7.8	7.4	8.5	[7.6–9.4]	8.1
Plateau-Central	6.3	4.5	[3.6–5.7]	4.6	6.2	4.8	[4.2–5.6]	4.7
Sahel	2.9	3.8	[2.9–4.9]	5.3	1.7	5.4	[4.7–6.2]	4.6
Sud-Ouest	6.2	4.4	[3.5–5.6]	4.8	3.4	4.3	[3.7–5.0]	4.6
Household size								
1–4 members	21.5	32.9	[30.5–35.3]	49.4	28.5	39.2	[37.6–40.7]	49.4
5–8 members	43.0	37.4	[34.9–39.9]	36.5	41.9	33.7	[32.3–35.3]	36.5
9+ members	35.4	29.7	[27.4–32.1]	14.1	29.6	27.1	[25.7–28.6]	14.1

Note: EHCVM: Enquête harmonisée sur les conditions de vie des ménages; RDD: random digit dialing.

Table 2 presents the phone call outcome rates by study arm, using the final disposition codes established by the American Association for Public Opinion Research (AAPOR 2016). We obtained higher response rates, cooperation rates, and contact rates in the EHCVM study arm, in which the respondents had previously been interviewed face-to-face, than via the RDD approach. With the EHCVM study arm, to survey 5,087 heads of households we called 8,809 telephone numbers, or around 2 phone numbers to complete a questionnaire. By contrast, for the RDD approach we called 43,841 different numbers to reach 11,176 eligible people, or around 4 telephone numbers to complete a questionnaire. The response rate was 45% in the RDD arm, against 59% in the EHCVM arm. This is much lower than in a similar survey of women of reproductive age in Burkina Faso (Greenleaf et al. 2020). The low response rate, especially in the RDD arm, is largely explained by people not picking up calls from interviewers. The vast majority of eligible people who responded to the calls participated in the interview; i.e., 84% and 91% respectively for the RDD and EHCVM arms. Refusal rates were low and similar for the two arms (around 6% to 7%). The time needed to complete an interview was longer for the EHCVM arm (23 mins on average) than the RDD arm (17 mins). This may be because respondents in the EHCVM arm reacted to the fact that some questions had already been asked in the original face-to-face survey. We analyzed audio recordings and noticed that when the basic questions were asked, some respondents from the EHCVM branch interrupted the interview to remind the interviewer that they had already provided this information when interviewers visited their household in 2018–2019.

Table 2: Final disposition code and phone call outcome rates by study arm and heaping indices

	EHCVM	*RDD*
Total number of phone numbers used	8,809	43,841
I=Complete interviews (1.1)	5,087	11,176
P=Partial interviews (1.2)	100	4,063
R=Refusal and break-off (2.1)	457	2,181
NC=Non-contact (2.2)	3,039	15,035
O=Other (2.0, 2.3)	46	736
UH=Unknown household (3.1)	0	0
UO=Unknown other (3.2–3.9)	60	881
Response rates		
Response rate 1: I/(I+P)+(R+NC+O)+(UH +OU)	0.58	0.33
Response rate 2: (I+P)/(I+P)+(R+NC+O)+(UH+OH)	0.59	0.45
Cooperation rates		
Cooperation rate 1[&3]: I/((I+P)+R+O)	0.89	0.62
Cooperation rate 2[&4]: (I+P)/((I+P)+R+O))	0.91	0.84
Refusal rates		
Refusal rate 1: R/((I+P)+(R+NC+O)+UH+UO))	0.05	0.06
Refusal rate 3: R/((I+P)+(R+NC+O))	0.06	0.07
Contact rates		
Contact rate 1: (I+P)+R+O/(I+P)+R+O+NC+(UH+UO)	0.65	0.53
Contact rate 3: (I+P)+R+O/(I+P)+R+O+NC	0.65	0.55
Survey length, cost, and productivity		
Average survey length (mins) [min–max]	23 [7–55]	17 [7–45]
Average estimated cost per interview (USD)	4	3
Telephone numbers used to get an interview	2	4
Data quality on age of respondents		
Whipple index	122	175
Myers index	18	33
Whipple index in census	142	145
Myers index in census	18	19

Note: EHCVM: Enquête harmonisée sur les conditions de vie des ménages; RDD: random digit dialing. The Whipple and Myers indices in the census are calculated for heads of households for the EHCVM comparison, and among adults 15–64 for the RDD comparison.

In terms of data quality, the longer duration of calls for the EHCVM arm did not result in higher rates of misreporting errors. We analyzed the quality of age reporting using the Myers index. This attraction index can be interpreted as an estimate of the percentage of people whose ages would need to be corrected to erase the bias towards certain ages (Siegel and Swanson 2004). This index was 18% in the EHCVM arm against

33% in the RDD arm, thus reflecting a more pronounced heaping on certain ages in the RDD arm. The Whipple index confirms this and highlights the more frequent attraction to round digits in the RDD arm. When comparing these indices with those calculated from census data, we noticed a similar quality of age declaration in the census and the EHCVM arm, but a stronger attraction to round digits in the RDD arm.

3.2 Under-5 mortality rates

Figure 1a presents the mean number of children ever born by woman's age group at the time of data collection, and compares the RaMMPS estimates to those from the 2021 DHS and the 2019–2020 census. All three data sources show the expected rise in parity with age, but at different levels. The mean numbers of children ever born reported in the RaMMPS survey are higher than in the 2021 DHS. The estimates from the latest census are quite a bit lower than those based on the surveys. The same pattern is observed when considering the mean number of surviving children (Figure 1b), although with a smaller gap between the data sources. These numbers are converted to mortality indicators below. Figures A-1a and A-1b in the Appendix also show a comparison with the 2010 DHS, where women reported a higher number of children ever born and surviving. This can be explained in part by the decline in fertility since 2010.

Figure 2 illustrates the trends in under-5 mortality, indirectly calculated from the EHCVM and RDD arms for the period 2001–2021, using coefficients from the Coale–Demeny North model (red lines). Direct estimates from truncated birth histories for the period 2015–2021 are also depicted (blue lines), pointing to noticeably lower levels, particularly from the RDD branch. Mortality indicators derived from the MPS are compared to direct estimates calculated from the 2021 DHS for the periods of 0–3, 4–6, and 7–9 completed years before data collection (green lines), under-5 mortality calculated indirectly from the 2019 census (purple lines), and direct estimates of under-5 mortality from recent deaths reported in the 2019 census (violet dots).

There is significant uncertainty surrounding under-5 mortality in Burkina Faso based on these different data sources. Figure 2 also includes estimates developed for Burkina Faso by the United Nations Inter-Agency Group for Child Mortality Estimation (UN IGME), obtained by combining various sources (DHS, MICS, etc.). The UN IGME employs a Bayesian model that adjusts for sampling and non-sampling errors (Sharrow et al. 2022). According to these model-based estimates, out of 1,000 live births, 85 children died before reaching the age of 5 in 2020 (90 UI: 60–123). This aligns with the latest census conducted in 2019, which reported an under-5 mortality rate of 87 per 1,000 (INSD 2019). By contrast, the latest DHS conducted in 2021 suggests that under-5 mortality is much lower (48 per 1,000 deaths over the period 2017–2021). However, the UN IGME excludes this survey from the model fitting due to data quality concerns.

Figure 1a: Mean number of children ever born in the RaMMPS survey, DHS 2021, and 2019–2020 census, by age of women

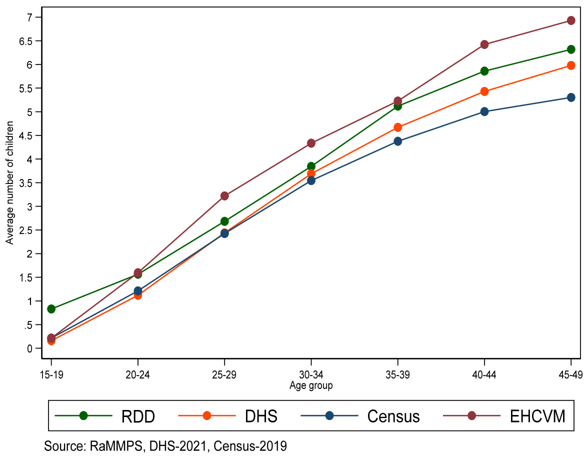
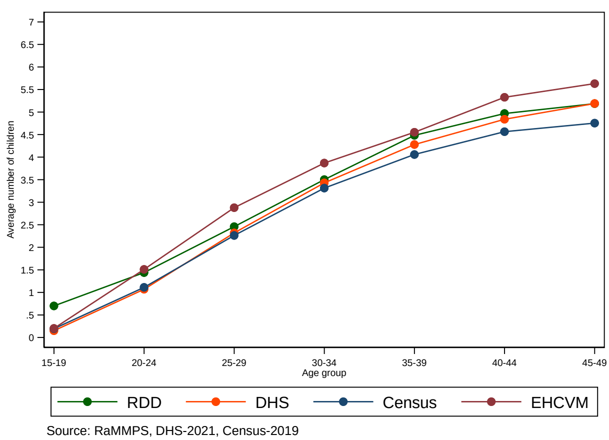
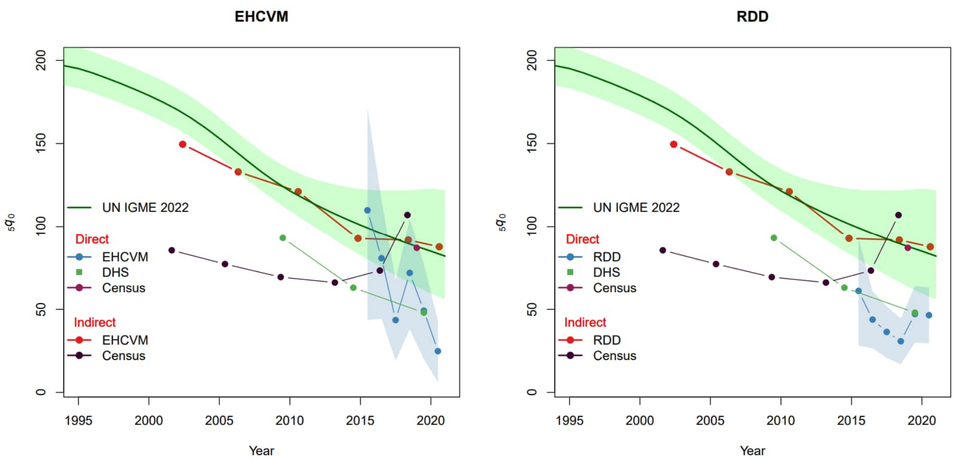


Figure 1b: Mean number of children surviving in the RaMMPS survey, DHS 2021, and 2019–2020 census, by age of women



UN IGME estimates demonstrate a downward trend in mortality over the entire period, also reflected in RaMMPS's indirect estimates. Under-5 mortality decreased from 152 to 83 deaths per 1,000 live births between 2003 and 2020, representing a 45% decline, according to RaMMPS's indirect estimates (Appendix Figure A-2). This percentage varies by survey branch. With the EHCVM branch, child mortality decreased from 158 to 70 deaths per 1,000 live births between 2003 and 2020, indicating a 56% decline, compared to a 41% decline with the RDD branch (150 to 88 deaths per 1,000 live births) over the same period. Although differences exist between RaMMPS indirect estimates and those of UN IGME, these are not significant, as most indirect estimates fall within the 90% uncertainty intervals around UN IGME estimates. By contrast, indirect estimates of under-5 mortality from the 2019 census are much lower, and they indicate an implausible upward trend in child mortality. These indirect estimates are also excluded from the UN IGME curve-fitting procedure due to concerns over data quality.

Figure 2: Trends in under-5 mortality according to the RaMMPS survey (EHCVM and RDD arms), the 2021 DHS, 2019–2020 census, and UN IGME 2022 estimates



The direct estimates from the truncated birth histories collected in RaMMPS for the period 2015–2018 are much lower than the indirect estimates. In the RDD arm, all point estimates fall below the 90% uncertainty interval around the UN IGME trend. These direct estimates are in line with those of the DHS 2021, but, as we indicated earlier, this survey could also be affected by a downward bias.

The use of truncated birth histories could have led to underestimation of mortality in the MPS. We calculated the proportion of children who died before the truncation date and divided this proportion by the proportion calculated after the truncation date (Hill 2013). These calculated ratios by age are all above 1.55 in the MPS survey, in comparison to less than 1.35 in the DHS survey. This suggests that recent deaths are missing, either because they were omitted or because they were transferred out of the reference period.

Table 3: Ratio of proportions of deceased children by whether the birth occurred before or during the TBH date window

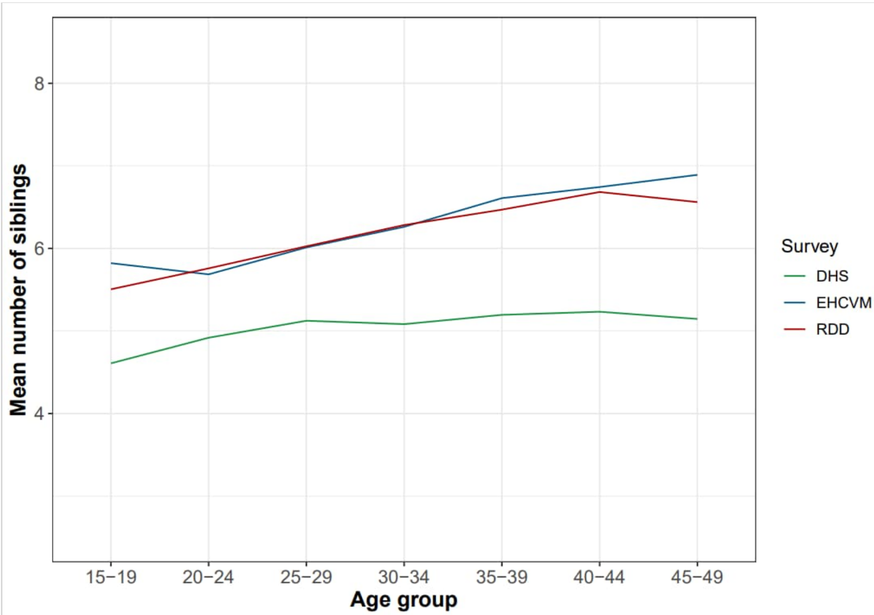
Age group	Proportion of children declared deceased before the truncation date (1)	Proportion of children declared deceased after the truncation date (2)	Both arms combined (1/2)	EHCVM only	RDD only	DHS 2021
15–19	0.14	0.05	2.87	3.14	1.22	0.00
20–24	0.07	0.03	2.36	2.60	1.70	1.32
25–29	0.09	0.05	1.71	1.73	1.66	1.23
30–34	0.10	0.06	1.56	1.48	1.68	1.16
35–39	0.13	0.06	2.23	3.39	1.48	1.26
40–44	0.16	0.10	1.60	1.99	1.24	0.99
45–49	0.18	0.09	1.98	1.86	2.24	0.46

Note: EHCVM: Enquête harmonisée sur les conditions de vie des ménages; RDD: random digit dialing; MPS: mobile phone survey; DHS: Demographic and Health Survey.

3.3 Mortality at reproductive ages (15–49)

To evaluate the quality of reports on sibling survival, we analyzed the mean number of siblings reported and the distribution of sibling survival status, according to the sex of siblings. Figure 3 presents the mean number of siblings by respondent's age group for the two study arms and the 2021 DHS, while Table A-2 (Appendix) presents a similar comparison for both arms combined with the 2010 DHS. Respondents in the 2010 DHS tended to report a slightly higher number of siblings up to the 35–39 age group, while the reverse is true for older respondents. However, these differences are quite small (less than 0.5 of a sibling on average). By contrast, the average number of living siblings is higher in both the EHCVM and RDD arms across all age groups when compared to the more recent DHS conducted in 2021. The patterns observed in the two study arms are consistent.

Figure 3: Mean number of siblings ever born by age group of respondent and study arm, compared to the 2021 DHS



Source: MPS–EHCVM, MPS–RDD, DHS 2021.

Figure 4 depicts the proportion of surviving siblings by age group of respondents in the MPS and DHS. Because we asked additional questions on recent deaths, Figure 5 also shows the proportion of siblings who had passed away within the last 3 years. As expected, there is a steady decline in the proportion of surviving siblings across age groups in all three data sources. Overall, the proportions of siblings still alive are significantly lower in the EHCVM and RDD phone surveys compared to the DHS, with consistent patterns in both arms. However, the proportions of deaths that occurred within the 3 years preceding the surveys are also much lower, and this is likely to substantially affect recent mortality estimates. For instance, the proportions of sisters reported as recently deceased are 24% lower in the EHCVM than in the DHS, and 13% lower in the RDD than in the DHS. There is no clear pattern of deviation from the DHS based on respondent age, and the two study arms show similar patterns.

Figure 4: Proportion of surviving brothers and sisters in MPS and DHS, by age group of respondent

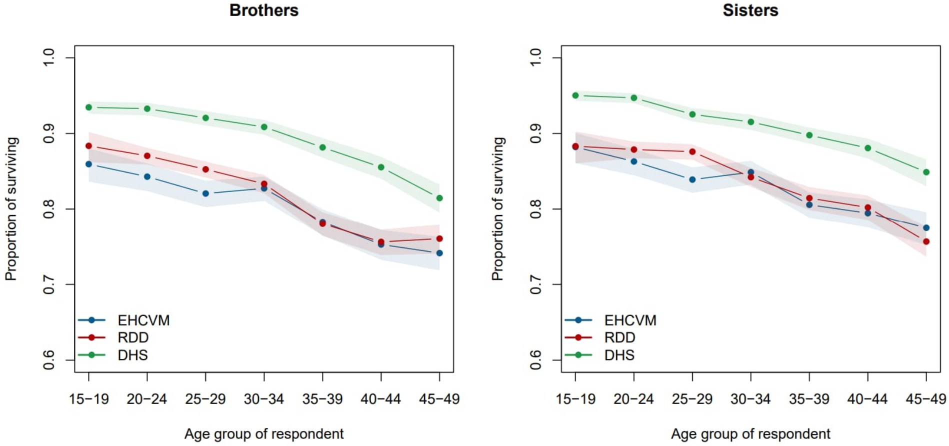
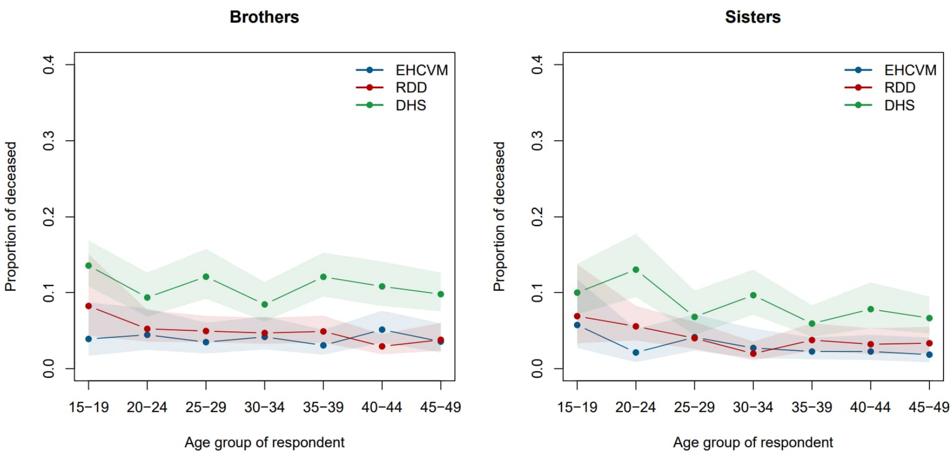


Figure 5: Proportion of deceased brothers and sisters who died in the previous 3 years in DHS and since January 2019 in MPS, by age group of respondent



This comparison with the 2021 DHS suggests that the summary data collected on sibship size and the proportion of surviving siblings in MPS are of acceptable quality, but there are important differences in the timing of death.

Table 4 presents estimates of the probability of a 15-year-old dying before age 50 ($_{35}q_{15}$) in the past 3 years by study arm and sex of respondent, as estimated based on sibling data collected in the RaMMPS survey. These estimates are again compared to those extracted from the 2021 DHS survey, based on the full sibling histories (and referring to the period 0–3 years before data collection). A second source of comparison comes from the World Population Prospects (WPP) (United Nations 2022), based on a wide variety of sources (including sibling survival but also parental survival, recent household deaths, the relationship between adult and child mortality, etc.). The WPP estimates refer here to the year 2019.

Overall, the MPS led to underestimates of recent adult mortality when compared to rates extracted from the DHS and the WPP. For 2019, the WPP estimated the probability of a 15-year-old male and female, respectively, dying before their 50th birthday at 178 and 138 deaths per 1,000, compared to an estimate of 81 and 60 per 1,000 with the MPS. This corresponds to a relative difference in the probability $_{35}q_{15}$ of −54% for men and −57% for women. Estimates disaggregated by the respondent's gender show that women provide higher estimates for their sisters (compared to men), while men provide higher estimates for their brothers (compared to women). For male mortality, when the MPS estimates are disaggregated by study arm (EHCVM or RDD) and the gender of the respondent, the downward bias appears particularly pronounced in the reports of women in the EHCVM arm (−67%) and men in the RDD arm (−60%).

Table 4: Estimates of the probability $_{35}q_{15}$ over the period 0–3 years before data collection, by source and sex of respondent, with 95% confidence intervals

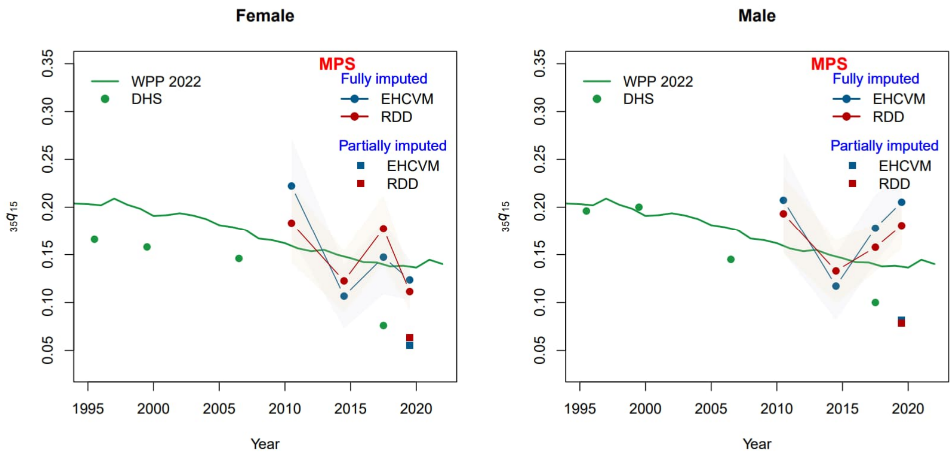
Sex of sibling		**Men**		**Women**		**Relative difference with DHS (%)**		**Relative difference with WPP (%)**	
Source	*Sex of respondent*	$_{35}q_{15}$	95% CI	$_{35}q_{15}$	95% CI	Men	Women	Men	Women
Both arms combined	Female	78	(59–93)	65	(49–80)	–20	–3	−56	−53
	Male	85	(66–103)	58	(42–74)	–12	–13	−52	−58
	Both	81	(68–93)	60	(50–71)	–16	–10	−54	−57
EHCVM	Female	59	(34–83)	58	(31–85)	–39	–13	−67	−58
	Male	101	(70–132)	57	(32–82)	4	–15	−43	−59
	Both	82	(62–101)	55	(38–73)	–15	–18	−54	−60
RDD	Female	88	(63–112)	70	(49–90)	–9	4	–51	–49
	Male	72	(53–90)	58	(40–77)	–26	–13	–60	–58
	Both	79	(64–94)	64	(50–77)	–19	–4	–56	–54
DHS 2021		97	(83–110)	67	(55–80)				
WPP		178	– –	138	–				

Note: EHCVM: Enquête harmonisée sur les conditions de vie des ménages; RDD: random digit dialing; WPP: World Population Prospects; DHS: Demographic and Health Survey.

Because we used a shortened data collection instrument, such differences observed in adult mortality levels between the MPS and the DHS could be caused by misreporting errors when identifying siblings who died recently, and their age at death. It is possible that some recent deaths were omitted or transferred outside the truncation window (last 3 years). To detect dating of errors, we produced another set of estimates. Instead of imputing dates of birth only for the surviving siblings and those who died recently, and using the available information on the timing of death and ages at death for those who had died in the last 3 years, we discarded this information entirely and applied our imputation approach to all siblings, including those who died recently.

Figure 6 presents the resulting estimates of the probability ${}_{35}q_{15}$, again compared to estimates from previous DHS surveys and the WPP. The estimates obtained for the last 3 years and calculated with limited imputation are displayed using squares, while those obtained by imputing all ages and dates from the previous DHS are displayed using dots, for four reference periods. The WPP estimates are above the estimates derived from sibling survival data in DHS conducted in 1998–1999, 2003, 2010, and 2021, a pattern observed in other West African countries (Masquelier, Reniers, and Pison 2014). The direct estimates obtained with limited imputation from the EHCVM and RDD arms, while conspicuously low, are in line with the latest DHS survey. Annual estimates based on recent deaths were calculated but confidence intervals around these estimates were large. We did not observe any significant increase in mortality in this age group over the period 2019–2021 (Appendix Figure A-3). Estimates based on the fully imputed ages and dates are much higher than and more consistent with the estimates from the WPP. This suggests that respondents provided inaccurate information on ages at death and timing of deaths in the shortened sibling survival module. For males, we observe an upward trend in mortality starting from 2015, which coincides with the onset of insecurity in Burkina Faso. For females, trends are more erratic, as the rise from 2015 is followed by a decline. However, it should be noted that with imputations based on the 2010 sibling survival data, we do not observe this upward trend in mortality levels during the period of insecurity (Appendix Figure A-4).

Figure 6: Trends in adult mortality ($_{35}q_{15}$) according to sibling survival histories in the RaMMPS survey or DHS and in the WPP

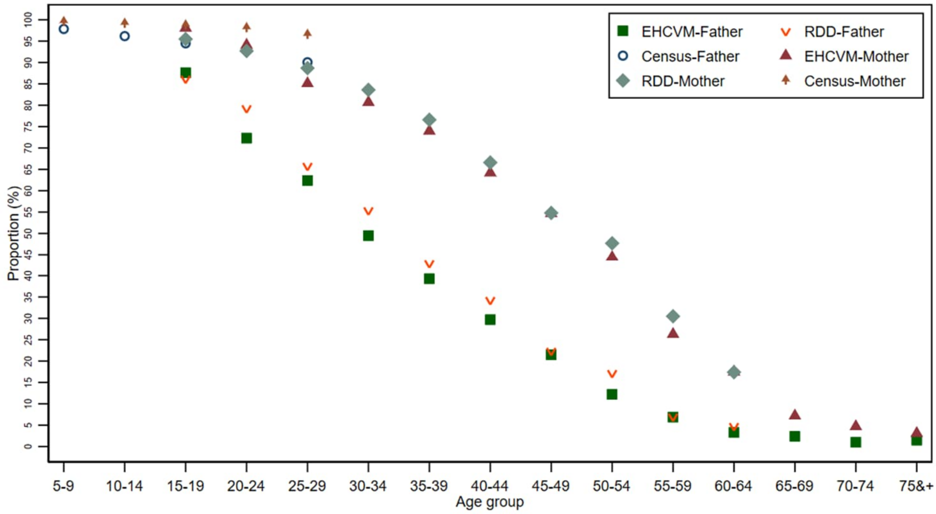


Note: EHCVM: Enquête harmonisée sur les conditions de vie des ménages; RDD: random digit dialing; WPP: World Population Prospects; DHS: Demographic and Health Survey.

3.4 Old-age mortality

On the basis of reported parental survival, we calculated mortality levels above age 50 using direct and indirect approaches. We used a relatively low old-age threshold since we were focusing on a population with relatively low life expectancy, and because the proportion of individuals at older ages (above 65) in our sample was quite small. Figure 7 presents the proportion of surviving parents according to the sex of the parent and the age group of the respondents at the time of data collection, in the 2019 census and each arm of the MPS. Information on parental survival in the census was only collected from respondents under the age of 30, but in the MPS this information was collected from all respondents. In both sources we observe the expected downward trend in the proportion of parents still alive according to the age group of the respondents, with a faster decline for fathers. The proportion of respondents with surviving parents is much higher in the 2019 census data than those calculated from the MPS survey for the age groups 15–19, 20–24, and 25–29 years old, for both mothers and fathers. Censuses and surveys are known to be affected by adoption bias, introducing upward bias in the proportions of surviving parents (Feeney 2001; Robertson et al. 2008), but it is unclear why the census would be more affected by this misreporting error than the MPS.

Figure 7: Proportions of respondents with surviving parents in the 2019 census and 2021–2022 RaMMPS study arms, according to the sex of the parent and the age group of the respondents at the time of data collection



Note: EHCVM: Enquête harmonisée sur les conditions de vie des ménages; RDD: random digit dialing.
Source: RaMMPS 2021–2022, 2019 census.

Estimates of the probability of an individual aged 50 years dying before age 80 ($_{30}q_{50}$) are displayed in Table 5, for each study arm and sex of respondent, for the period 0–3 years before data collection. These estimates are calculated directly from the full parental survival histories in the EHCVM and RDD arms, and are again compared with the levels obtained from the WPP (United Nations 2022). Overall, the MPS tend to underestimate the level of mortality among the elderly when the WPP estimates are used as a benchmark, regardless of the reference period. The difference between the MPS mortality level and the WPP estimates is smaller for men than for women (e.g., −23% vs. −32%; −17% vs. −36%). This underestimation varies by branch of the MPS survey, with a larger underestimation in the RDD arm than in the EHCVM. Mortality estimates also vary according to the sex of the respondent, but with no clear pattern. In the EHCVM branch, mortality levels calculated from male respondents are higher than those estimated from female respondents, while the reverse pattern is observed in the RDD.

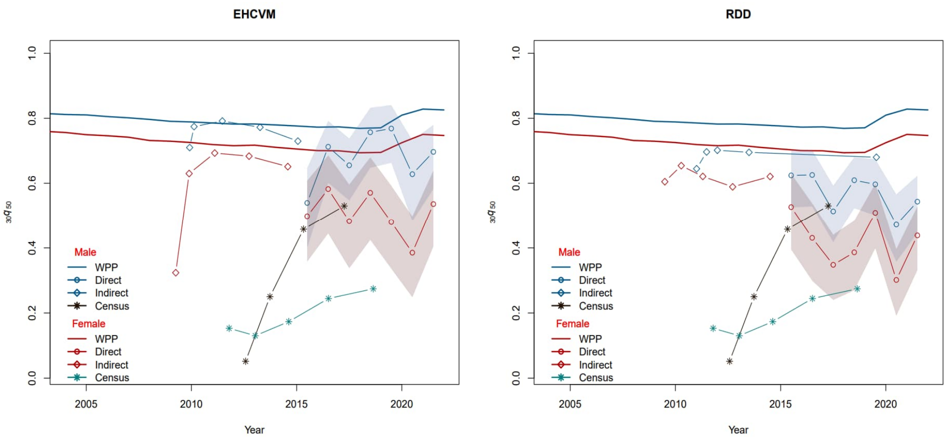
Table 5: Probabilities $_{30}q_{50}$ over the period 0–3 years before the survey, 95% confidence intervals

Sex of parent		**Male mortality**		**Female mortality**		**Relative difference with the WPP**	
Source	*Sex of respondent*	$_{30}q_{50}$	95 % CI	$_{30}q_{50}$	95 % CI	Male mortality	Female mortality
Both arms combined	Male	591	(537–639)	470	(417–519)	−23	−32
	Female	637	(590–680)	446	(377–508)	−17	−36
	Both	616	(583–647)	457	(415–496)	−20	−34
EHCVM	Male	719	(641–780)	522	(435–595)	−7	−25
	Female	694	(614–757)	431	(324–520)	−10	−38
	Both	708	(653–754)	492	(426–550)	−8	−29
RDD	Male	497	(427–559)	430	(355–497)	−36	−38
	Female	602	(542–653)	449	(361–525)	−22	−35
	Both	554	(510–595)	433	(378–483)	−28	−38
WPP		771	-	695	-	-	-

Note: EHCVM: Enquête harmonisée sur les conditions de vie des ménages; RDD: random digit dialing; WPP: World Population Prospects.

Figure 8 shows the trend in old-age mortality probabilities ($_{50}q_{30}$) from the MPS from 2008 to 2022, calculated directly from parental survival histories, and compares them to WPP estimates. It also presents the trend in the same probability estimated indirectly from the proportion of respondents' surviving parents in each arm of the MPS. Both the direct and indirect estimates from the MPS are lower than the rates from the United Nations. The underestimation is again more pronounced in the RDD arm than the EHCVM arm. Indirect estimates from the MPS are plausible (except for the latest estimate for females in the EHCVM arm). By contrast, those extracted from the 2019 census seem inconceivably low. In addition, the indirect estimates refer to a relatively distant period and are therefore of little use in tracking recent mortality trends, including possible excess mortality due to COVID-19. The direct estimates calculated for each calendar year show important fluctuations but do not suggest that mortality increased as a result of the COVID-19 pandemic. However, it should be noted that mortality levels for the elderly are very uncertain in Burkina Faso. A previous study, based on recent household deaths reported in a 2008 survey, indicates that survival beyond age 60 may be higher than the modeled estimates in the WPP (Bendavid, Seligman, and Eagle 2011).

Figure 8: Trends in old-age mortality ($_{30}q_{50}$) according to parental survival in the EHCVM and RDD surveys (direct and indirect methods), the census, and the WPP



4. Discussion

In this study, we use MPS data from Burkina Faso to estimate under-5, adult, and old-age mortality and to compare the resulting estimates with levels and trends from the Demographic and Health Surveys and mortality estimates from the United Nations Population Division and UN IGME. The analyses use both direct and indirect estimation techniques.

Our findings indicate that under-5 mortality estimates from each arm of the MPS are relatively consistent with other estimates derived from face-to-face surveys and censuses. Indirect estimates from the MPS are closer to UN IGME estimates, whereas direct estimates extracted from truncated birth histories appear to be affected by a downward bias, although they are aligned with the latest DHS estimate. Truncated birth histories may be affected by reporting errors such as the transfer of children (alive or deceased) beyond the reference period (Masquelier, Menashe-Oren, and Reniers 2023). Direct estimates over the past 3 years align more closely with UN IGME estimates for the EHCVM arm and with the 2021 DHS estimates for the RDD arm. Estimates derived from truncated birth histories are lower for the RDD arm than for the EHCVM arm, despite the fact that the RDD approach allows us to reach respondents who were not included in the face-to-face survey sample, such as people who are mobile due to insecurity. It is likely that data collected via RDD is affected by higher reporting errors. When listening to the audio recordings of interviews, we noted that respondents in the EHCVM arm, who had previously been interviewed face-to-face, seemed more engaged in the interview, and therefore provided better quality data. Previous studies have also shown that telephone surveys using numbers that were collected through household visits were of better quality than those using random numbers (Oldendick and Lambries 2004).

MPS estimates of adult mortality from summary sibling data are considerably lower than those of the WPP. There is more uncertainty around expected mortality levels in adults (compared to children), as illustrated by the difference between DHS-based estimates and United Nations estimates, and overestimation in the WPP estimates cannot be ruled out (Masquelier, Reniers, and Pison 2014). However, the estimates from the RaMMPS survey seem particularly low, especially when using the reported ages and dates. It is possible that the summary sibling survival histories (without detailed information on ages at interview or ages at death and time since death) are subject to greater error than the full sibling survival histories typically used in face-to-face surveys. Indeed, when considering the sibship sizes and proportions of surviving siblings, we observed only small differences between the MPS and the DHS. In addition, the estimates of adult mortality (${}_{35}q_{15}$) obtained after imputing dates of birth and dates of death for all deaths were closer to those expected from the WPP than those calculated with the reported ages and dates. It is also possible that some deaths were transferred prior to the reference period (2019–2022) in the MPS. Additional details on the date and circumstances of death were collected for brothers and sisters who had died since 2019. Shifting deaths to an earlier period would reduce interviewers' workload.

For mortality among the elderly, the MPS survey produced estimates that were also lower than those of the United Nations, but much higher than indirect estimates derived from the last census. Mortality levels were again higher in the EHCVM branch compared to the RDD, irrespective of the estimation method used. Yet in this age group we are lacking a robust reference to compare our estimates with, as old-age mortality is still subject to a high degree of uncertainty in Burkina Faso, as in other countries in sub-Saharan Africa (Ouedraogo 2020).

In summary, while the MPS is a promising method for collecting mortality data when face-to-face data collection is not possible, the approach has some important limitations. First, the absence of detailed information on the sociodemographic characteristics of the customers of the different mobile telephone networks in Burkina Faso leads to uncertainty as to the representativeness of the sample for the entire national population. From existing DHS data we know that mobile phone owners are more likely to reside in urban areas, have a higher level of educational attainment, be younger, and be better off in terms of household equipment (Sánchez-Páez et al. 2023). Pre- and post-stratification methods may alleviate some of the biases resulting from the selection of respondents in the ensuing mortality estimates, but further work is required to assess whether this applies to all estimates, particularly for adult mortality. In terms of sampling strategy, we observed that the discrepancies between the MPS and UN estimates were generally larger in the RDD arm, and this could reflect a stronger selectivity of respondents, although they could also be less engaged. Additionally, the fact that child mortality is usually estimated from maternal reports may exacerbate selection biases in MPS, as women tend to have lower rates of phone ownership than men. Therefore, when conducting telephone surveys, particularly those focused on women's health or related topics, it is essential to consider and address these gender-specific challenges to ensure the reliability and validity of the data collected. Second, the respondents' location when they participate in the interview could influence the quality of data collected in MPS. Mobile phone respondents may find themselves in situations where participation in the survey is difficult or not possible, or the connection is inadequate. The literature on this diverges, as some studies have shown that the use of mobile phones to collect data does not significantly influence data quality (Pew Research Center 2012) while some show otherwise (Jäckle, Roberts, and Lynn 2010; Triga and Manavopoulos 2019). Third, MPS involve the use of shortened questionnaires to reduce respondent fatigue and limit interruptions due to network loss, and these revised instruments need to be further evaluated. Shorter interview times could also result in less probing and cross-checking of answers, also affecting data quality. A recent analysis of six MPS conducted in the context of the RaMMPS project suggests that age heaping in data collected over the phone is much more pronounced than in household surveys and censuses conducted face-to-face (Helleringer et al. 2023). Another study shows that truncating birth histories results in downward biases in mortality estimates (Masquelier, Menashe-Oren, and Reniers 2023). Here we have also shown that the summary instrument we used for sibling reports may have introduced confusion or encouraged the displacement of deaths to outside the reference period.

Despite these limitations, our study shows that it is possible to carry out a large-scale national survey to collect information on mortality in Burkina Faso from a sample of randomly generated mobile phone numbers, or from numbers pre-registered during a face-to-face survey. Under-5 mortality trends derived from the MPS in Burkina Faso corresponded relatively well with estimates from face-to-face surveys and censuses, especially when considering indirect estimates. For the mortality of the elderly, when estimated indirectly the MPS survey produced estimates for men close to those of the United Nations. But when based on the shortened sibling survival module, the MPS underestimated the level of mortality in adults aged 15–49.

In future MPS, if the sociodemographic and economic characteristics of mobile phone network customers are not available, underrepresentation could possibly be mitigated by an adapted quota sampling strategy. We also suggest developing a good communication strategy to inform the population about the data collection period and the objectives of the survey via TV, radio, and social media ads. This could help to reduce the interview time, increasing the respondents' degree of cooperation and consequently improving the quality of the data ultimately collected. We also recommend evaluating the effectiveness of shortened questionnaires, which are commonly used in telephone surveys to alleviate respondent fatigue and minimize network interruptions. To isolate the effects of remote data collection and assess the impact of different questionnaires, we propose conducting randomized pilot mobile phone surveys that retain standard questionnaires alongside face-to-face surveys with revised modules. This approach could yield valuable insight into identifying the most effective method for collecting mortality data via telephone surveys.

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Appendix

Table A-1: Composition of the EHCVM (mobile phone) sample in Burkina Faso, compared with the population enumerated in the 2018–2019 face-to-face EHCVM survey

Respondent's characteristics	Household heads in original face-to-face EHCVM survey						Household head in MPS	
	No phone		Phone owner		Both		EHCVM	EHCVM
	%	No.	%	No.	%	No.	%	No.
Sex of respondent								
Men	68.7	298	86.2	5,666	85.1	5,964	76.7	3,908
Women	31.3	136	13.8	909	14.9	1,045	23.3	1,189
Age group								
15–29 yrs	9.9	43	10.7	705	10.7	748	17.5	890
30–49 yrs	36.8	160	51.0	3,355	50.1	3,515	52.0	2,649
50+ yrs	53.3	232	38.3	2,515	39.2	2,747	30.6	1,558
Education								
None	94.9	413	67.8	4,456	69.5	4,869	52.0	2,649
Primary	3.9	17	14.4	950	13.8	967	20.2	1,031
Secondary+	1.1	5	17.8	1,169	16.7	1,174	27.8	1,417
Marital status								
Married	73.8	321	85.7	5,635	85.0	5,956	83.6	4,262
Widowed	21.4	93	8.2	539	9.0	632	5.5	279
Divorced/separated	2.5	11	1.6	106	1.7	117	0.8	41
Single	2.3	10	4.5	295	4.4	305	10.1	515
Type of place of residence								
Ouagadougou	0.2	1	8.2	539	7.7	540	11.1	566
Bobo-Dioulasso	0.5	2	4.2	273	3.9	275	6.1	312
Other town	14.9	65	34.5	2,269	33.3	2,334	40.2	2,048
Rural area	84.4	367	53.1	3,494	55.1	3,861	42.6	2,171
Region of residence								
Boucle du Mouhoun	9.0	39	8.3	548	8.4	587	7.1	361
Cascades	2.1	9	6.6	433	6.3	442	7.4	376
Centre	2.3	10	12.4	818	11.8	828	15.7	800
Centre-Est	11.7	51	8.0	525	8.2	576	7.8	400
Centre-Nord	5.7	25	7.3	479	7.2	504	7.9	405
Centre-Ouest	6.2	27	7.1	465	7.0	492	6.8	349
Centre-Sud	10.6	46	6.4	421	6.7	467	5.6	285
Est	8.3	36	7.7	503	7.7	539	7.1	360
Hauts-Bassins	3.2	14	10.7	705	10.3	719	12.7	645
Nord	3.4	15	6.5	427	6.3	442	6.5	332
Plateau-Central	4.4	19	6.1	400	6.0	419	6.3	323
Sahel	11.7	51	6.2	405	6.5	456	2.9	146
Sud-Ouest	21.4	93	6.8	446	7.7	539	6.2	315

Table A-1: (Continued)

Respondent's characteristics	Household heads in original face-to-face EHCVM survey						Household head in MPS	
	No phone		Phone owner		Both		EHCVM	EHCVM
	%	No.	%	No.	%	No.	%	No.
Household size								
1–4 persons	52.9	230	31.4	2,066	32.8	2,296	21.5	1,098
5–8 persons	39.5	172	45.9	3,020	45.5	3,192	43.0	2,193
9+ persons	7.6	33	22.6	1,489	21.7	1,522	35.4	1,806
Electricity								
Yes	3.2	14	29.0	1,906	27.4	1,920	32.4	1,652
No	96.8	421	71.0	4,669	72.6	5,090	67.6	3,445
Roof								
Improved	57.9	252	86.8	5,704	85.0	5,956	90.2	4,598
Not improved	42.1	183	13.2	871	15.0	1,054	9.8	499
Water source								
Improved	76.1	331	83.9	5,519	83.5	5,850	86.7	4,418
Not improved	23.9	104	16.1	1,056	16.5	1,160	13.3	679
Region and place of residence								
Boucle du Mouhoun urban	1.1	5	3.2	211	3.1	216	3.6	185
Boucle du Mouhoun rural	7.8	34	5.1	337	5.3	371	3.5	176
Cascades urban	0.7	3	3.2	211	3.1	214	4.0	206
Cascades rural	1.4	6	3.4	222	3.3	228	3.3	170
Centre urban	0.2	1	8.2	539	7.7	540	12.7	648
Centre rural	2.1	9	4.2	279	4.1	288	3.0	152
Centre-Est urban	2.3	10	3.0	194	2.9	204	3.5	178
Centre-Est rural	9.4	41	5.0	331	5.3	372	4.4	222
Centre-Nord urban	0.2	1	3.1	203	2.9	204	3.9	198
Centre-Nord rural	5.5	24	4.2	276	4.3	300	4.1	207
Centre-Ouest urban	0.7	3	3.1	201	2.9	204	3.5	178
Centre-Ouest rural	5.5	24	4.0	264	4.1	288	3.4	171
Centre-Sud urban	0.9	4	2.9	188	2.7	192	2.6	134
Centre-Sud rural	9.7	42	3.5	233	3.9	275	3.0	151
Est urban	1.1	5	3.6	234	3.4	239	4.3	217
Est rural	7.1	31	4.1	269	4.3	300	2.8	143
Hauts-Bassins urban	0.5	2	4.9	321	4.6	323	8.1	415
Hauts-Bassins rural	2.8	12	5.8	384	5.6	396	4.5	230
Nord urban	0.7	3	2.9	188	2.7	191	3.4	175
Nord rural	2.8	12	3.6	239	3.6	251	3.1	157
Plateau-Central urban	0.9	4	2.5	163	2.4	167	2.3	115
Plateau-Central rural	3.4	15	3.6	237	3.6	252	4.1	208
Sahel urban	1.8	8	3.2	208	3.1	216	2.1	105
Sahel rural	9.9	43	3.0	197	3.4	240	0.8	41
Sud-Ouest urban	4.4	19	3.3	220	3.4	239	3.4	172
Sud-Ouest rural	17.0	74	3.4	226	4.3	300	2.8	143
Total	100.0	435		6,575		7,010		5,097

Note: EHCVM: Enquête harmonisée sur les conditions de vie des ménages.

Figure A-1a: Mean number of children ever born in the RaMMPS survey, DHS 2010, and 2019–2020 census, by age of women

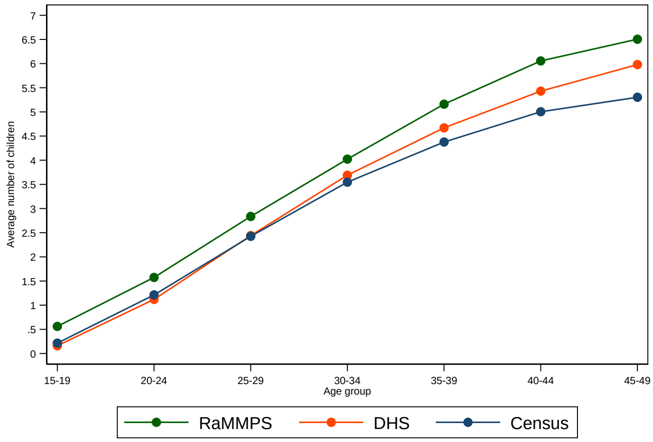
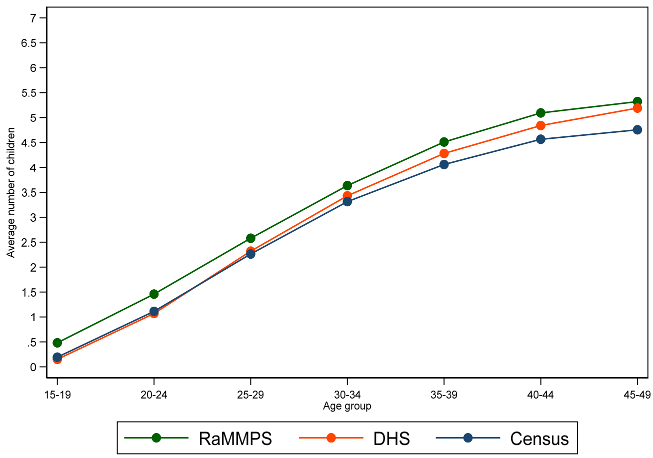


Figure A-1b: Mean number of surviving children in the RaMMPS survey, DHS 2010, and 2019–2020 census, by age of women



Source: RaMMPS, 2021 DHS, 2019 census.

Figure A-2: Trends in under-5 mortality according to the RaMMPS survey, 2021 DHS, 2019–2020 census, and UN IGME 2020 estimates

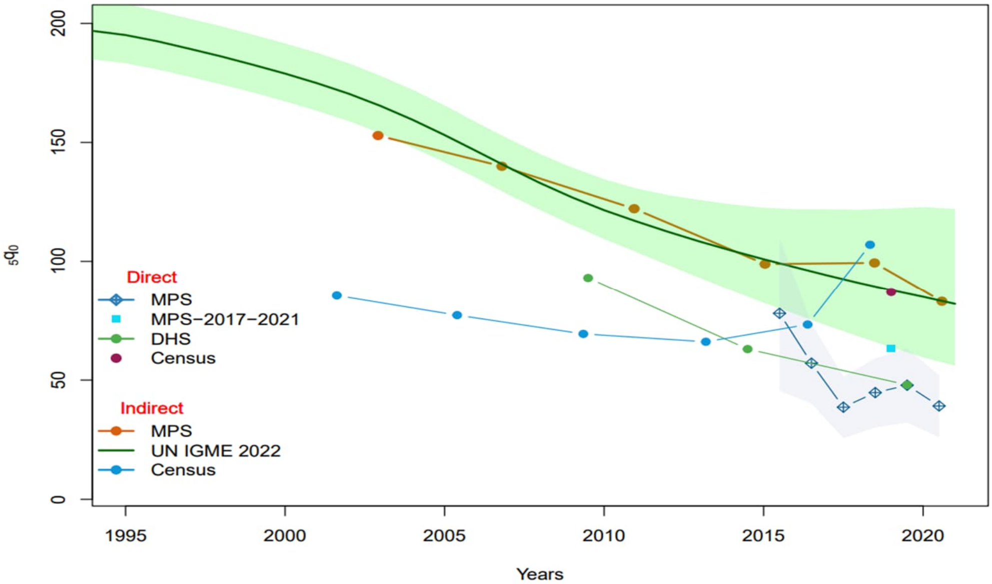


Table A-2: Mean number of siblings ever born by age group of respondent and study arm, compared to the 2010 DHS

Age group	EHCVM	RDD	Both arms combined	DHS
18–20 yrs	6.0	5.8	5.9	6.5
20–24 yrs	5.8	5.8	5.8	6.7
25–29 yrs	6.1	6.1	6.1	6.9
30–34 yrs	6.3	6.4	6.4	6.8
35–39 yrs	6.7	6.5	6.6	6.8
40–44 yrs	7.0	6.5	6.8	6.6
45–49 yrs	6.9	6.6	6.7	6.4
Total	6.4	6.2	6.3	6.7

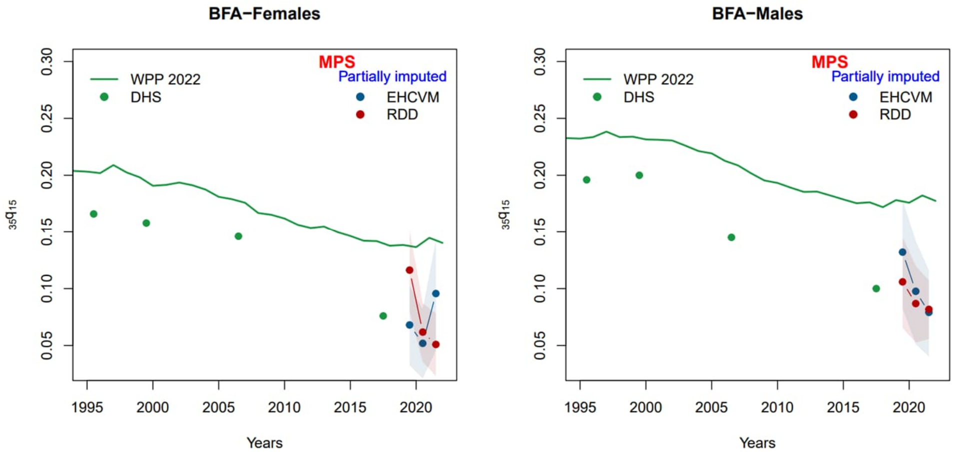
Note: EHCVM: Enquête harmonisée sur les conditions de vie des ménages; RDD: random digit dialing; MPS: mobile phone survey; DHS: Demographic and Health Survey.

Table A-3: Distribution of sibling survival status by sibling sex and time since death, per survey

Respondent age group	Proportion of surviving brothers	Proportion of deceased brothers	Proportion of deceased brothers < 3 years	Proportion of surviving sisters	Proportion of deceased sisters	Proportion of deceased sisters < 3 years
EHCVM						
18–20 yrs	84.7	15.3	1.0	88.8	11.2	0.3
20–24 yrs	83.1	16.9	0.4	85.4	14.7	0.2
25–29 yrs	82.5	17.5	0.5	84.7	15.3	0.5
30–34 yrs	82.9	17.1	0.8	84.5	15.5	0.6
35–39 yrs	78.5	21.6	0.8	81.3	18.7	0.6
40–44 yrs	73.9	26.1	1.9	78.5	21.5	0.4
45–49 yrs	74.8	25.2	1.0	79.6	20.4	0.3
Total	80.1	19.9	0.8	82.8	17.2	0.5
RDD						
18–20 yrs	85.4	14.6	0.8	86.4	13.6	1.1
20–24 yrs	86.9	13.2	0.8	87.7	12.3	0.7
25–29 yrs	84.8	15.2	0.8	88.3	11.7	0.7
30–34 yrs	83.4	16.6	0.9	84.4	15.6	0.3
35–39 yrs	78.7	21.3	1.1	80.1	19.9	0.8
40–44 yrs	76.5	23.5	0.6	83.3	16.7	0.7
45–49 yrs	76.2	23.8	1.1	74.4	25.6	1.2
Total	82.0	18.1	0.9	84.5	15.5	0.6
DHS						
18–20 yrs	83.4	16.6	1.3	84.5	15.4	1.2
20–24 yrs	82.8	17.2	0.9	84.4	15.6	0.9
25–29 yrs	80.4	19.6	0.8	84.0	15.9	0.8
30–34 yrs	78.1	21.9	0.9	81.0	19.0	0.8
35–39 yrs	74.6	25.4	1.2	78.2	21.8	0.8
40–44 yrs	71.6	28.5	1.3	74.6	25.4	0.9
45–49 yrs	66.2	33.7	1.6	72.3	27.6	1.0
Total	78.5	21.5	1.1	81.3	18.7	0.9

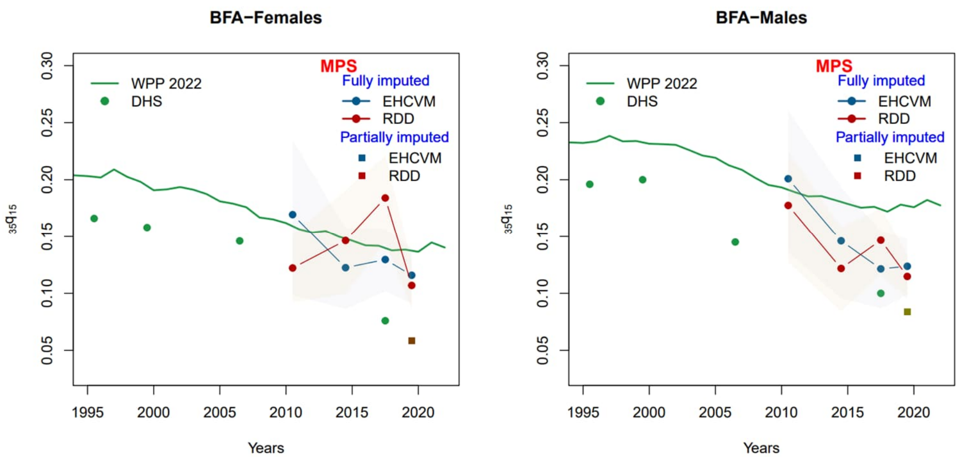
Note: EHCVM: Enquête harmonisée sur les conditions de vie des ménages; RDD: random digit dialing; DHS: Demographic and Health Survey.

Figure A-3: Trends in adult mortality ($_{35}q_{15}$) according to sibling survival histories in the RaMMPS survey per year or DHS and in the World Population Prospects



Note: Imputation based on the 2021 DHS.

Figure A-4: Trends in adult mortality ($_{35}q_{15}$) according to sibling survival histories in the RaMMPS survey or DHS and in the WPP



Note: The imputation in this graph is performed using data on full sibling survival histories from the DHS 2010.