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## Men's migration and women's mortality in rural Mozambique

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### Introduction

International labor migration is widespread and growing throughout the world, including sub-Saharan Africa (Agadjanian 2008). A substantial body of research has examined the association of migration with mortality levels and patterns among international migrants (see Aldridge et al. 2018 for a comprehensive review). Studies have also looked at the connection between migration and the physical and mental health of non-migrating ('left-behind') household members, typically contrasting the positive effects of migrant transfers with negative effects of their physical and social absence (e.g., Agadjanian et al. 2011; Adams & Cuecuecha 2013; Adhikari et al. 2011; Kanaiaupuni & Donato 1999; Ponce et al. 2011; Chen et al. 2015; Huang et al. 2016; Lu 2012; Lu et al. 2012; Nobles et al. 2015). Yet, due to understandable data constraints, very little research has extended the examination of these countervailing factors to mortality risks of migrants' non-migrating household members, especially of migrants' left-behind marital partners. Our study begins to fill this important void in our knowledge of the impact of migration on health and well-being of sending households and communities. Using unique longitudinal survey data from a typical sub-Saharan rural setting with high levels of male out-migration, we examine the association of that migration with mortality risks of migrants' wives over a period of twelve years.

### Background

The scholarship connecting migration and mortality has focused almost entirely on mortality levels and patterns among migrants. In general, this scholarship points to a mortality advantage of international migrants, which is typically explained by the selectivity of migrants on health (Aldridge et al. 2018), and has also examined migrants' experiences and behaviors during and after migration as determinants of their mortality risks (e.g., Ginsburg et al. 2016; Wallace et al. 2019). In contrast, little research has sought to connect migration to mortality risks of non-migrating household members. The few existing studies have focused on infant and child mortality. Thus, research in Mexico typically finds beneficial

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effects of parental migration for left-behind children's survival, at least in rural areas (Hamilton et al. 2009; Hildebrant & McKenzie 2005; Kanaiaupuni & Donato 1999). Yabiku et al. (2012) study of rural Mozambique found no differences in mortality rates between migrants' and non-migrants' children overall but detected a significant disadvantage of children of less economically successful migrants. However, no research has examined the impact of migration on mortality of migrants' non-migrating marital partners, probably reflecting data constraints: while infant and child mortality rates remain relatively high in many low-income settings, these rates are much lower in 'prime age' and can be reliably estimated only with data collected over a long period of time.

Although research on migration and mortality of non-migrating household members is extremely scarce, the migration-mortality link is a natural, even if extreme, manifestation of the broader effects of migration on health. Our conceptual reasoning is therefore guided by the scholarship on migration and non-migrants' health outcomes. This scholarship points to diverse, and even countervailing, effects of migration. Thus, labor migration has been shown to improve non-migrating household members' health by generating remittances that reduce economic deprivation, enhance household food security, and increase utilization of health care (Adams & Cuecuecha 2013; Böhme et al. 2015; Frank 2005; Frank & Hummer 2002; Green et al. 2019; Gupta et al. 2009; Hamilton et al. 2009; Kanaiaupuni & Donato 1999; Kuhn 2006; Lopez-Cevallos & Chi 2012; Ponce et al. 2011), even though some positive effects of migration may be attributable to selection into migration (Kuhn et al. 2011). At the same time, migrants' absence from the household and reduced contact with those left-behind may also increase psychological strain, distress, loneliness, depressive symptoms, and other mental and physical health impairments among non-migrating household members (Antman 2010; Chen et al. 2015; Ghimire et al. 2018; Graham et al. 2015, Huang et al. 2016; Lu 2012; Lu et al. 2019; Nobles et al. 2015; Thapa et al. 2018; Xiang et al. 2016) and may even constrain access to health care among non-migrating adults (Adhikari et al. 2011). Yet, as Lu et al. (2012) argued in their study of rural China, migrant remittances may partly offset the negative effects of migration on non-migrant household members' health. Similarly, as Frank (2005) found in Mexico, economic remittances from migrant fathers, coupled with social remittances in the form of positive health behaviors, help to improve infant health, compensating for the negative effects of paternal absence and related maternal stress and anxiety.

While most of the above studies have focused on the effects of migration on physical and mental health of migrants' left-behind elderly parents and children, the scholarship addressing possible health consequences of migration for migrants' non-migrating partners has paid considerable attention to migration-related increase in risks of sexually transmitted infections, including HIV, especially in settings of high HIV prevalence due to (usually male) migrants' propensity to engage in risky extramarital partnerships in destination settings (Agadjanian et al. 2011; Agadjanian & Markosyan 2017; Agadjanian et al. 2013; Crush et al. 2010; Hirsch et al. 2007; Sevoyan & Agadjanian 2010; Weine & Kashuba 2012). Prolonged marital separation due to migration may also expose non-migrating spouses to HIV risks through their own extramarital partnerships (e.g., Crush et al. 2010; Lurie 2006; Lurie et al. 2003).

Importantly, because labor migration is typically a long-lasting state, and because improved material well-being and nutrition and better access to medical care, but also prolonged family separation, may have long-term impacts, the influence of migration on health of non-migrants may accumulate over time. However, the cumulative effects of migration on health of non-migrating household members are not well understood largely because of the lack of adequate longitudinal data. Arguably, this knowledge gap is especially critical for the understanding of health and mortality implications of migration for migrants' left-behind marital partners, who typically experience the most direct impact both of the economic returns to migration and of the social and emotional disruptions and strains caused by migrants' departure and prolonged absence.

While focusing on the link between men's migration and their wives' mortality, our study also dialogues with and contributes to the literature on gendered trends and patterns of adult mortality in low-income settings. Thus, an analysis of the Demographic and Health Survey (DHS) data collected in 25 sub-Saharan countries in 1990–2014 found a rise in mortality in ages 15–50 during that period, with a particular large increase among women (Doctor & Udo 2017). As Anderson & Ray (2010) showed, the excess of female mortality in the 14–44 age group in the sub-continent is primarily caused by HIV/AIDS. These patterns are rooted in profound and persistent gender inequalities that are highly consequential for health outcomes in general (Heise et al. 2019), and, specifically, disproportionately expose women to HIV infection risks (Richardson et al. 2014). Following this evidence, we examine the place of HIV/AIDS in the link between men's migration and women's mortality.

## Setting

Our data come from a survey conducted in the Republic of Mozambique, a nation in Southeast Africa with a population of some 30 million and a GNI per capita of \$480 (World Bank 2019). The data were collected in rural areas of Gaza province. The study site is characterized by patrilineal kinship system and is largely monoethnic, Changana-speaking, and predominantly Christian. Marriage is nearly universal and, at least nominally, bridewealth-based, although these days bridewealth payments are increasingly postponed and even forgone altogether (Chae, Agadjanian, & Hayford 2021). As bridewealth marriage is not replaced by civil marriage, the increased informalization of marriage has led to greater marital instability. Polygyny is common despite the Christian churches' supposed opposition to it (Agadjanian 2020). As in most patrilineal societies, marriage is virilocal as women move to their husbands' households upon marriage. Extended family arrangements, typically including husband's parents and/or other relatives or co-wives, are traditionally normative, but nuclear households are also common.

An important epidemiological feature of the study site, and of the part of the African continent where it is located, is a high level of HIV infection. HIV prevalence in Gaza province during the period we examine was around 25% of the adult population, and as high as 30% among women of reproductive age (Instituto Nacional de Saúde, 2010:163). As in other sub-Saharan settings greatly impacted by the HIV pandemic (Anderson & Ray 2010), high HIV prevalence has undoubtedly contributed to adult mortality in Mozambique. According to Doctor & Udo (2017), Mozambique experienced among the highest increases

in 'prime-age' (15–50) mortality between the late 1990s-early 2010s. Notably, while male mortality has been consistently higher than female mortality, the latter saw a greater increase: between the 1997 and 2011 DHS, the probability of dying at ages 15–50 rose from 177 to 241 per 1000 for men and from 119 to 199 per 1000 for women (Doctor & Udo 2017:379). Although no subnational adult mortality estimates are available, Gaza is likely to have seen a particularly large adult mortality increase given its very high HIV prevalence and pronounced and pervasive gender inequalities in that patriarchal context (Loforte 2000).

The economy of rural Gaza is dominated by subsistence agriculture, which relies primarily on women's labor. Since the colonial times, Gaza has been a major source of male labor migration to neighboring Republic of South Africa (RSA), and this migration continues today. Labor migration is typically a continuous, multi-year livelihood strategy, with migrant men returning home for relatively brief visits. Male labor migration is deeply engrained in local society and is organically integrated into household productive activities (Mercandalli 2018). In recent times it has increasingly shifted from highly regulated employment, mainly in the South African mining industry, to less formal work with varied and often unstable earnings (de Vletter 2007; Crush & Frayne, 2010). Accordingly, the economic outcomes of migration for sending households, which is largely shaped by financial remittances, have also become more diverse. Labor migration and its growing diversity may also affect levels and patterns of HIV infection in the study site (Crush et al. 2010). Our analyses of mortality of migrants' non-migrating partners account for this diversity of migration outcomes.

## Approach and Hypotheses

Our approach adapts the scholarship on migration and non-migrants' health to the socio-economic, migration, and epidemiological context of rural Mozambique. Given that migration-generated resources are critical for food and health care needs and enhance the household's overall economic security and social safety, compensating for migrant's physical absence and withdrawal from subsistence farming and other productive and maintenance activities, we should expect the effect of husbands' migration on wives' mortality to vary depending on resources that the household receives through migrant remittances.

Following previous research that highlights the importance of diverging economic fortunes of migrants' households, rather than a simple migrant vs. non-migrant dichotomy, we contrast mortality of women whose husbands have been economically more successful migrants with that of women married to economically less successful migrants. Importantly, migration success is defined here from the standpoint of the migrant's household in the community of origin, i.e., the actual or perceived effect of migration on the household, rather than migrant's labor market trajectories or the absolute amount of his earnings. Guided by previous work (e.g., Agadjanian, et al. 2011; Yabiku et al. 2012; Agadjanian & Hayford 2018), we also test two alternative definitions of migration success – one based on reported financial transfers to the left-behind household and the other based on the wife's perception of the impact of her husband's migration on household material well-being (see Data and Method for specific operationalization). Although the two definitions are interrelated, we see potential differences in how they may connect with non-migrants' health and, by extension,

their mortality risks. Thus, the remittances-based success of migration may directly benefit non-migrants' physical health through improved nutrition or resources to access health care. In comparison, the perception-based migration success, even if also shaped by improvements in the household material conditions, may reflect more on left-behind wives' psychosocial well-being, including optimism and life satisfaction, which may, in turn, have implications for physical health. Under either definition of migration success, we hypothesize that women married to more successful migrants will have lower mortality risks compared to wives of less successful migrants. At the same time, we also expect that wives of more successful migrants will have lower mortality than wives of non-migrants, because migrant success implies improvements in migrants' households relative to non-migrants' households that may lead to better health and mortality outcomes. We also compare all women married to migrants and women married to non-migrants. However, considering the heterogeneity of the migrant wives' sub-sample in terms of migration success and the hypothesized countervailing impacts of more successful vs. less successful migration, we do not anticipate a significant difference in mortality between migrants' wives as a whole and non-migrants' wives.

Given the noted prominence of the HIV/AIDS epidemic in the study setting and its impact on mortality, and guided by the scholarship that connects migration to HIV risks, we explore the possible role of HIV/AIDS in the connection of women's mortality with their husbands' migration status and with the success of that migration. Here, we use verbal autopsies from proxy interviews for deceased women to compare the distribution of deaths that can be attributed to HIV/AIDS and of those that are unlikely to be HIV/AIDS-related across the husband migration status and migration success categories. We also estimate multivariate models predicting the net effects of husband's migration characteristics on the probabilities of the two types of deaths.

## Data and Method

### Data

Our data come from a longitudinal panel "Men's Migrations and Women's Lives" (MMWL) carried out in four districts of Gaza province starting in 2006. The initial wave of the panel was carried out in 2006 and interviewed a sample of women in marital unions (either formalized or not) drawn in 56 villages, which were selected with probability proportional to population size. In each village, all households containing at least one married couple were enumerated and separated into households with a married male migrant and households without one. Then, fifteen households were randomly selected from each list and one married woman aged 18–40 from each household was interviewed. The procedure yielded a total sample of 1678 women, of whom just under one-half were married to labor migrants.<sup>1</sup> Face-to-face standardized interviews covering a wide range of socio-demographic and health issues were carried out. Additional four rounds of interviews were carried out in 2009–10 (Wave 2), 2011–2 (Wave 3), 2014 (Wave 4), and 2017–8 (Wave 5). As in any longitudinal

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<sup>1</sup>In some villages, this stratification resulted in an overrepresentation of women married to migrants, while in other villages the migrants' wives subsample was similar to the population share of migrants' wives or even underrepresented this group. Sample weights are available to make the sample generalizable to the population.

study, the sample became more geographically dispersed over time: some 14% of Wave 1 respondents whose survival status by Wave 5 can be fully ascertained moved out of the original villages since the panel's start. Of those who moved, c. 62% did so following marital dissolution (separation or widowhood) and the remained relocated jointly with their husbands. Yet, despite the sample dispersion, the survey had a high retention rate: 84% of the Wave 1 respondents who had not been confirmed dead were found and interviewed in Wave 5, either in the original villages or in new communities of residence. The loss-to-follow-up was almost entirely due to respondents' moves to unknown locations. The respondents who could be located, either at their original residences or elsewhere, had a participation rate of almost 100%.

At all waves after the first, for respondents who could not be located or who were reported as deceased, a proxy interview was conducted with someone who knew the respondent well (typically another member of the household or a close relative or neighbor). The information from proxy interviews was used for locating respondents who had moved out of the original villages. For deceased respondents, proxy interviews included verbal autopsies seeking to determine the year, possible causes, place, and social circumstances of death. The verbal autopsies also contained questions on whether, to the proxy respondent's best knowledge, the deceased person had AIDS. Verbal autopsies have proven effective in producing credible estimates of HIV/AIDS-related mortality elsewhere in the sub-Saharan (e.g., Doctor & Weinreb 2003; Kahn et al. 2000).

## Method

We analyze respondents' deaths between Wave 1 and Wave 5. We limit the analytic sample to the Wave 1 respondents (i.e., excluding the Waves 2 and 3 refresher samples) to ensure the comparable length of exposure to the risk of death of all women included in the analysis. In some proxy interviews, especially those for women who died after moving from the original survey communities, exact years of death could not be ascertained. Likewise, yearly information for other covariates (see below) is not available for all deceased respondents. These limitations make the application of survival analyses techniques problematic. We therefore opt for modeling the likelihood of death regardless of its timing within the W1-W5 window. Accordingly, we fit logistic regression models predicting whether respondents interviewed in Wave 1 were dead at Wave 5, i.e., some eleven or twelve years later. These analyses are limited to Wave 1 respondents for whom the survival status could be reliably ascertained, i.e., mainly respondents who were contacted in-person or by phone in Wave 5 (including a few women who for various reasons could not be interviewed) and those whose death was convincingly confirmed through a proxy interview. However, we also conduct supplementary sensitivity analyses that include respondents whose survival status could not be confirmed, i.e., overwhelmingly those who had moved from the original villages and could not be located and contacted based on proxy interview information.

The main predictor is husband's migration status at Wave 1. In line with our conceptual arguments and hypotheses, we define it as a set of dummy variables that separate migrants from non-migrants but also distinguish more successful migration from less successful migration. As explained in the Approach section, we use two alternative ways to measure



husband's migration success from the perspective of migrant's left-behind household. The first measure is constructed from information on the frequency of remittances received from migrants in the twelve months preceding the survey. While we acknowledge that the number of remittances may involve some inaccuracy of reporting, we believe that reports of actual amounts of remittances (which are not available in the MMWL data) would be much more biased due to both recall failure and deliberate misreporting (cf. Mohapatra & Ratha 2011). Importantly, although the frequency of remittances may not accurately reflect the volume of financial input from the migrant (not to mention the value of material items, such as furniture, appliances, or building materials that migrants might send or bring home) it is a reasonable proxy for stability of support that the left-behind household receives from the migrant. And as Green et al. (2019) found in India, regularity of financial transfers from migrants to their left-behind wives is more consequential for the wives' health behavior and outcomes than the amount of those transfers. Our measure includes three levels, separating women who reported that they received money from their husbands at least four times, those who received money between one and three times, and those who did not receive any money from their migrant husbands during that period (in exploratory analyses, we also tested alternative groupings of remittance frequencies, but the results did not differ in essence from the ones we present here). The second measure is derived from wife's perception of improvement of the household's economic conditions following husband's migration. This measure is dichotomous, contrasting women who thought that their household conditions had improved since the beginning of their husbands' migration to those who saw no such improvement. The latter category includes the women who said that the conditions of their household had worsened. We include them in the "conditions have not improved" category because any labor migration is undertaken with the primary purpose of improving family life, and therefore the lack of improvement already connotes a failure of the migration project. Besides, only a small fraction of migrants' wives, 10%, chose the 'worsened' option, which may also reflect some women's reluctance to admit the worsening of their household's conditions to a stranger. In general, we argue that compared to the first measure, the second measure reflects a more holistic assessment of the effect of migration on the household. Importantly, both measures of migration success have been validated in previous research (e.g., Agadjanian, Arnaldo, & Cau 2011; Yabiku, Agadjanian, & Cau 2012; Agadjanian & Hayford 2018). Following that research, in the remainder of the paper, we label the remittance-based measure of migration success as 'objective' (in the sense that it reflects observable and countable facts) and the perception-based measure as 'subjective' (i.e., reflecting individual judgment), while acknowledging the obvious semantic and practical overlap between them.

Reflecting the earlier described generations-long migratory connections of the study area with the neighboring RSA, the continuing attractiveness of that country's labor market, and the relative ease of crossing the international border, the vast majority of migrant husbands, 84%, worked in that country. The rest worked mainly in Mozambique's capital Maputo (10%) and in other cities across the country (husbands who commuted between the community of permanent residence and another community where they worked are not considered migrants in this analysis). Also, it is important to remind that in this setting male labor migration is typically a long-term, continuous practice. Thus, husbands who were in



migration at the time of the Wave 1 survey and whose marital union started before 2000 spent on average 5.3 years in migration in the six years preceding the survey year (2000–2005). Among Wave 1 respondents with migrant husbands who were also interviewed in Wave 5 (i.e., some 11–12 years later) and were in marital union at that time, 78% were still married to a migrant. Although the success of migration may change over time, we assume that the reports on which our measures are based are generally reflective of the dynamics and impact of migration over a long span.

Using our definitions of migration and migration success, we test three multivariable models: a model in which all women with migrant husbands are compared to women with non-migrant husbands; a model in which women married to migrants who sent no remittances are compared to those whose migrant husbands sent occasional remittances, those whose migrant husbands sent frequent remittances, and women married to non-migrants; and a model that compares women married to ‘subjectively’ more successful migrants, to those married to ‘subjectively’ less successful migrants, and to non-migrants.

The models include several individual and household characteristics as controls. Respondent’s age, by the survey design, ranges from 18 to 40. The models also control for the number of respondents’ living biological children. Reflecting the sample’s age, the overwhelming majority of children, 97%, were under eighteen years of age and almost all of them co-resided with their mothers. Importantly, in this rural sub-Saharan context with little fertility regulation, the number of children is both a measure of household’s financial needs and a proxy for mother’s reproductive health.<sup>2</sup> Respondent’s educational level is operationalized as a trichotomy: no education, 1–5 years, 6 or more years of schooling. By design, all respondents were in a marital union, broadly defined. We distinguish unions that are formalized through complete or partial payment of bridewealth from those that did not involve any bridewealth payment (civil marriage is not considered as it is extremely rare in the study site). The models also control for whether the current union is polygynous or monogamous. The models include a control for the status of the Wave 1 marriage: whether it remained intact, dissolved through divorce, or ended due to husband’s death at any time prior to respondent’s death/censoring.

Several other respondent characteristics are included. Remunerated work outside subsistence agriculture (e.g., petty trade, charcoal making, regular or occasional craftsmanship, etc.) during the month preceding the survey is operationalized as a dichotomy – worked vs. did not work. Importantly, such employment rarely means complete withdrawal from subsistence farming: fewer than 4% of respondents were not involved in subsistence agriculture. The models include a decision-making autonomy score (derived from questions on whether the woman needs her husband’s or his family’s permission to make decisions in seven aspects of everyday life). They also control for respondent’s affiliation with a formal religion, overwhelmingly a Christian church (affiliated vs. not). As a proxy for respondent’s health status at Wave 1, the models control for respondent’s report of having been told by a

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<sup>2</sup>Because the burden of childcare may vary depending on children’s age, we also estimated models in which younger children (0–5 years) are disaggregated from their older siblings. This disaggregation did affect the association of primary interest. We therefore chose to present the more parsimonious models.

health professional that she had at least one of the following health conditions: tuberculosis, hypertension, hypotension, diabetes, cancer, asthma, or a sexually transmitted infection. For the last condition, the questionnaire listed such examples as syphilis, gonorrhea, and herpes (HIV diagnosis was not explicitly asked about because of the relatively low level of HIV testing at the time of Wave 1). Of course, in this low-income setting, many of these conditions remain under-diagnosed. However, given the very low health care costs in the area (in fact, Mozambique has the lowest out-of-pocket health care expenditures per capita in the world, see World Bank 2020), we do not believe that underreporting is biased by household socio-economic status. The models also control for whether the respondent ever experienced physical violence by her marital partner; while in some surveys the corresponding questions define an exposure period (typically last twelve months), considering prolonged absence of migrant husbands, no such time limit was used in the MMWL. Two household characteristics are also controlled for. First, we distinguish between nuclear family households (the respondent, her husband, and their children only) and extended family households (which typically include husband's parents and/or other relatives and his other wives and their offspring). Women's position, options, and obligations may differ between the two types of households, with potential implications for women's long-term health. Second, the models include a household material assets scale, which is based on the household possession of such items as a bed, radio, tv set, bicycle, automobile, etc.<sup>3</sup> All the covariates, except the status of the Wave 1 marriage, are measured at Wave 1. Table 1 presents the distributions of the covariates.

For the second part of the analysis we look at whether the association of husband's migration status, and of his migration's success, with the risks of wife's death, may vary by HIV/AIDS status. This analysis uses the same sample as the main analysis described above and draws from verbal autopsies to classify the deceased respondents into two categories: 1) certainly or likely having HIV/AIDS at the time of death; and 2) likely not having HIV/AIDS at the time of death. We assume that women in the former category died of HIV/AIDS-related causes, while the deaths of women in the latter category were not related to HIV/AIDS (regardless of their HIV status at the time of death). We first compare this distribution among non-migrants' wives, wives of all migrants, and wives of migrants grouped by migration success (using both definitions of migration success). We then fit multinomial logit models with a trichotomous outcome: did not die between Waves 1 and 5; died of HIV/AIDS; and died of HIV/AIDS-unrelated causes. The models use the same covariates as the main models described above. Recognizing the limitations of proxy reports by lay informants as well as possible limitation of the statistical power due to further disaggregation of a relatively small number of deaths, we treat this part of our analysis as exploratory.

All the analyses were carried out in Stata 16. Multilevel mixed-effect regressions were fitted to account for clustering of observations and unobserved heterogeneity at the village level.

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<sup>3</sup>We acknowledge a possible association of migration and its success with household material asset possession, but this association may not be unidirectional. To minimize concerns about multicollinearity we also tested models without controlling for household assets; the association of primary theoretical interest did not change as a result.

## Results

Table 2 shows the percentages of Wave 1 respondents who died by Wave 5 overall and across different migrant-husband categories for respondents whose survival status could be firmly ascertained and for whom all covariates have non-missing values (N=1444). Overall, mortality in the sample is remarkably high, especially considering the age range of the sample at Wave 1: 12.3% of the analytic sample (10.6% of the entire Wave 1 sample) were dead twelve years after they were first interviewed. The difference between migrants' wives and non-migrants' wives is rather modest, with only slightly higher mortality among the latter. However, the breakdown of the migrant wives subsample by migrant 'objective' success produces a clear gradient: mortality is lowest among women who were receiving remittances frequently, somewhat higher among those who were receiving them occasionally, and highest among those who were not receiving any remittances at all. The 'subjective' migration success dichotomy yields an even sharper contrast: 15.2% of wives of less successful migrants died, compared to 8.9% of wives of more successful migrants.

### Multivariable results

Table 3 displays the results of three binomial logistic regression models predicting Wave 1 respondents' death by Wave 5. Model 3.A, which compares wives of non-migrants to all wives of migrants, shows no difference in mortality risk between the two groups. In Model 3.B, the migrant wives subsample is broken down by frequency of remittances ('objective' success), with women receiving no remittances as the reference category. The results generally conform to the bivariate pattern, although the difference between women receiving frequent remittances and women receiving no remittances is short of the conventional threshold of statistical significance ( $p=0.07$ ). However, in the last model (3.C), which compares women based on their assessment of the impact of their husbands' migration on their households' well-being ('subjective' success), the contrast between wives of less successful and more successful migrants echoes the bivariate pattern and is strong and statistically significant: other things equal, women who in Wave 1 said that their husbands' migration had improved their household well-being, had almost half the odds of dying within the following twelve years, compared to women who did not report such improvement at Wave 1. In both models, the difference between wives of more successful migrants (i.e., frequent remitters or those whose migration improved the household conditions) and wives of non-migrants also points in the predicted direction even though in both cases this difference is only marginally significant (not shown). These results generally support our hypotheses.

A bias in the sample attrition related to husband's migration characteristics at Wave 1 could potentially influence these results. As stated earlier, we used very rigorous criteria for inclusion in the analytic sample: firmly confirmed deaths through proxy interviews for deceased respondents and direct face-to-face or phone contact (in almost all cases) with survivors. The distribution of husband's Wave 1 migration characteristics in the analytic sample is nearly identical to their distributions in the entire Wave 1 sample, suggesting little migration-related bias due to loss to follow-up. We also conducted sensitivity tests in which we fitted models assuming that all women whose survivorship status could not be fully

ascertained were alive at Wave 5. In these analyses, the effect of migrant's 'objective' success somewhat diminished, but the effect of 'subjective' success barely changed in magnitude and remained statistically significant. Similarly, the effects of migration success were significant (and even larger) in models that assumed that all women with unconfirmed survivorship status were dead by Wave 5 (the results of the sensitivity tests are available from the authors upon request).<sup>4</sup>

Notably, the effects of migration success persist after the inclusion of a wide range of covariates. The effects of some of these covariates merit attention. The number of children (which in this context is, in part, a marker of general health) is strongly and negatively associated with the risk of death. In comparison, the net positive effect of age on the probability of dying is not statistically significant in this relatively young sample. Education, employment, and religious affiliation show no significant associations with mortality. The characteristics describing the nature of marriage and marital relationship – bridewealth, polygyny, decision-making autonomy – do not have any net effects either. However, marital separation is strongly and positively associated with the likelihood of death. Marital separation may raise women's mortality risk by increasing their socioeconomic vulnerabilities; yet, endogeneity of divorce relative to women's health (i.e., women with deteriorating health are more likely to be abandoned by their husbands) cannot be ruled out. Notably, however, additional sensitivity tests showed that the effect of migration success persists in the models that limit the analysis only to women in intact Wave 1 unions at the time of death or censoring (not shown but available upon request). Similarly to marital separation, widowhood has a strong positive association with the probability of death; while husband's death may heighten women's socioeconomic insecurity, HIV infection is also a likely pathway connecting the spouses' deaths. It is, however, impossible with the proxy interview data to identify specific mechanisms linking both types of marital dissolution with mortality. Women who reported having been diagnosed with a health problem were more likely to die within the next twelve years, but the effect is marginally significant. Interestingly, women who reported having been a target of physical violence by their husband in Wave 1 were, *ceteris paribus*, significantly more likely to die by Wave 5. Notably, while in other similar contexts female homicides are common (e.g., Abrahams et al. 2009), almost no MMWL verbal autopsy pointed to husband's violent behavior as a possible direct cause of death. Intimate partner violence may affect women's health and survival gradually and cumulatively; it may also hinder their access to and utilization of health services. Experience of intimate partner violence has also shown an association with increased HIV risks (e.g., Dunkle et al., 2004). While this intriguing – and troubling – result does not shed light on possible mechanisms and pathways, it does call for further investigation.

### Exploring the role of HIV/AIDS

Next, we explore whether variations in mortality risks between wives of more and less successful migrants may be related to HIV/AIDS. Table 4 shows the distribution of deaths

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<sup>4</sup>One limitation of these sensitivity tests is that they could not account for the status of Wave 1 marriage of the women whose survival could not be fully ascertained by Wave 5. However, even the tests that were limited to women whose Wave 1 marriage status is known yielded similar results for the effects of migration success (the results of these additional tests are available upon request).

by these two categories and by husband's migration status. Section 4.A displays the percentage breakdown of HIV/AIDS-related and unrelated deaths. Overall, 42.1% of the deaths were certainly/likely related to HIV/AIDS infection. This share is nearly identical for migrants' wives and non-migrants' wives. However, variations by husband's migration success are quite noticeable. Thus, among wives of more successful migrants, regardless of how migration success is defined, a higher proportion of deaths is attributable to HIV/AIDS. Section 4.B shows this variation in terms of probabilities of HIV/AIDS-related and unrelated deaths (for convenience, it also re-displays the overall probabilities of death from Table 2). It suggests that the overall mortality advantage of wives of more successful migrants, compared to wives of less successful migrants, is due to much lower probability of HIV/AIDS-unrelated deaths among the former. At the same time, conditional on dying, more successful migrants' wives seem more likely to have died of illnesses attributable to HIV/AIDS.

To further explore possible connections between HIV/AIDS and husband's migration status and success, we fit a series of multinomial logistic regression models predicting the likelihood of HIV/AIDS-related vs. HIV/AIDS-unrelated deaths. These models use the same covariates as the multivariable models shown in Table 3, but the outcome now has three categories: did not die (base), died certainly/likely of HIV/AIDS, and died of HIV/AIDS-unrelated causes. As the models included in Table 3, these models control for village-level unobserved characteristics. The results of these models are presented in Table 5. In the first model (5.A), which compares all migrants' wives to non-migrants' wives, we see no difference in the effect of husband's migration status on the risk of dying from HIV/AIDS-related or HIV/AIDS-unrelated causes, relative to not dying. However, in the second model (5.B), where the migrants' wives subsample is broken down by migration's 'objective' success, while we find no significant variation by that success in the likelihood of HIV/AIDS-related death, relative to not dying, we detect a significantly lower probability of HIV/AIDS-unrelated death of wives of most successful migrants compared to wives of least successful ones. Similarly, in Model 5.C, where migrants' wives are split on the basis of migration 'subjective' success, the difference between more and less successful migrants in the probability of HIV/AIDS-related death, relative to not dying, is not significant, but for HIV/AIDS-unrelated deaths, wives of more successful migrants hold a significant advantage over women married to less successful migrants. Notably, the adjusted probability of dying from HIV/AIDS-unrelated causes among wives of 'objectively' most successful migrants and wives of 'subjectively' successful migrants alike is also significantly lower than that among non-migrants' wives. In sum, these analyses, with understandable caveats about the reliability of the verbal autopsy data and the statistical power, generally reproduce the patterns displayed in Table 4 but also suggest an important nuance to our conceptual models: the hypothesized mortality advantage of women married to more successful migrants may be explained by lower risks of deaths that are likely unrelated to HIV/AIDS.

## Discussion and Conclusion

Our findings resonate with the previous research showing that the effects of migration on health and general well-being of non-migrating household members vary according to the economic returns of migration to the household (e.g., Agadjanian et al. 2011a; Agadjanian &

Hayford 2018; Agadjanian, et al. 2011b; Green et al., 2019; Yabiku & Agadjanian 2017; Yabiku, Agadjanian, & Cau 2012). Our analyses extend this evidence by offering important novel insights into the understudied association of migration with mortality of migrants' left-behind marital partners. In particular, the findings illustrate the diversity of economic outcomes of contemporary labor migration in rural Mozambique and similar settings of rapid social change, and the implications of this diversity for mortality.

Adapting the cross-national scholarship on migration and health and following previous research, we employed two approaches in defining migration success – one based on the frequency of financial transfers from migrants to their left-behind households ('objective' success) and another based on the assessments by migrants' wives of the impact of migration on their household's material well-being ('subjective' success). The results suggest the existence of the predicted variation in mortality risks across both the 'objective' scale and the 'subjective' migration-quality dichotomy, even though the latter yielded a slightly more salient statistical distinction. Although 'subjective' assessments may seem less precise than 'objective' measures such as remittances, we argue that they are more inclusive and multilayered, and in this sense, are no less real, as they encompass and reflect various dimensions of individual and household life that reported frequency of financial remittances may not fully capture. Given the practical difficulties in generating precise survey measures of the multiple dimensions of migrant transfers, subjective measures may be more feasible for capturing holistic assessments of the returns to migration for left-behind households.

The link between husband's migration success and wife's mortality risk is evident even accounting for multiple controls. Of particular note, this link persisted after controlling for marital dissolution through either divorce or widowhood which had a powerful net impact on mortality. Although we cannot directly identify and measure the pathways through which the quality of men's labor migration may affect their wives' health and mortality based on this analysis, several possibilities may be suggested based on existing cross-national evidence on the association between migration and health. For example, migrant's financial support may enhance women's nutrition and improve their access to health care (e.g., López-Cevallos & Chi 2012; Thow, Fanzo, & Negin 2016). Although in a typical rural sub-Saharan setting like the one examined in this study most women are continuously engaged in subsistence agriculture, food and general economic security resulting from successful migration may reduce the time women are required to spend in physically demanding farming activities (Mercandalli 2018). Husband's migration success may also positively affect women's mental health by reducing stress, anxiety, and depression, and by increasing self-efficacy (e.g., Green et al. 2019). Importantly, although the scholarship on migration and health often tends to contrast the financial premiums of migration with the relational and psychosocial penalties resulting from migrants' physical absence, in settings where male labor migration is an established and expected way of life, the physical separation of spouses per se may not have a strong negative effect on their respective well-being (cf. Nobles et al. 2015). In fact, satisfaction with how husband's migration impacts the household, i.e., what we defined as 'subjective' success, may connote and instill overall greater confidence and optimism. Extensive research in western settings has documented a negative association of optimism, happiness, and life satisfaction with all-cause mortality (e.g., Chida & Steptoe 2008; Collins, Gleib & Goldman 2009; Diener & Chan 2011; Kim et al. 2017; Rozanski et al.



2019; Steptoe 2019), and we suggest that this association may contribute to our findings as well.

It has been argued that physical separation of spouses due to migration may increase their STI/HIV risks (e.g., Crush et al. 2010; Lurie et al. 2003). Undoubtedly, HIV/AIDS is a major factor in mortality risks in the study setting: more than forty percent of deceased respondents certainly or likely had AIDS at the time of their deaths, according to verbal autopsies. In a cross-sectional analysis of MMWL Wave 1 data, Agadjanian et al. (2011) found that wives of more successful migrants expressed greater concern about the risk of contracting HIV than did wives of less successful ones. However, our explorations of the HIV/AIDS status at the time of death do not allow for extending their findings to HIV/AIDS-related mortality: the higher share of deaths attributable to HIV/AIDS among more successful migrants' wives that was apparent in descriptive comparisons did not translate into a statistically significant association between husband's migration success and the risks of HIV/AIDS-related deaths. In fact, migration success statistically mattered only for the risks of what we assumed to be HIV/AIDS-unrelated deaths, relative to not dying. The imprecisions of verbal autopsies and the limited statistical power invite caution in the interpretation of the results. Also, a fuller analysis of HIV risks and related mortality would need to account for the growing intensity and effectiveness of HIV prevention campaigns and rapid expansion of access to antiretroviral therapy during our study's observation span.

Several other limitations of our study must be acknowledged. As with any observational data, causality in the association of migration with health and mortality of non-migrating household members cannot be fully ascertained. Specifically, the association of migration and its characteristics with health outcomes of non-migrating household members may reflect some endogeneity of migration with respect to these outcomes (e.g., Lurie & Williams 2014). For example, expanding on the health selectivity of migration argument (Lu et al. 2008), it is conceivable that a man's decision to migrate or (especially) his commitment to his left-behind marital partner, and therefore the amount of support that he provides to her, may be influenced by the state of her health. Although our multivariable models partially assuage this concern with a control for reported diagnosis of major health problems at Wave 1, endogeneity cannot be fully ruled out. Another limitation is attrition from the sample. Despite substantial and largely successful efforts to locate and interview the respondents who have moved from the original villages, some of those women could not be located and their survival status could not be fully ascertained. Proxy interviews with other community members to determine the causes, circumstances, and destination of such relocations point to a large share of divorced women among those who moved. Because in this patrilineal and virilocal setting women usually move to their husbands' communities and households upon marriage, when they divorce, they are typically ejected from those communities and are often effectively effaced from the household's and community's memory and therefore are very hard to locate. Yet, reassuringly, our results for the effects of migration success held even when we restricted the analyses to women who remained in their Wave 1 unions until death or censoring.

Our analyses included women who were directly contacted by the MMWL staff (in person or by phone) as well as a few other women whose survival status could be unequivocally



confirmed otherwise. These analyses assume that the ‘missing’ women do not have health profiles and mortality risks that are systematically distinct from those of the women that were interviewed or for whom survival status is known. While any attrition bias with respect to health cannot be formally ascertained, it is reassuring that the loss to the follow-up did not vary by husband’s migration status and across the categories of migration success. Also, for women who died or were lost to follow-up, the proxy interviews in this low-literacy and low-numeracy context do not allow us to reliably reconstruct husbands’ migration history or the timing of marital dissolution (if such occurred) after our last direct contact with those women; we therefore cannot capture changes in these characteristics over the observation span for this part of the sample. Finally, we also acknowledge the statistical power of the analysis as a possible limitation.

These limitations notwithstanding, our findings provide uniquely important insights into our understanding of the connection of labor migration with health and mortality. As migration grows worldwide, it also becomes increasingly diversified in its forms and outcomes. This variation is an important ingredient of the rapidly changing gender and family landscapes in low- and middle-income countries, and as such it is highly consequential for health and well-being. Also importantly, while it may be tempting to see these consequences through a singular dominant epidemiological prism, such as that of the HIV/AIDS pandemic, our study suggests that a more comprehensive vision is necessary to fully capture them. Future research should focus on identifying specific gendered pathways and cumulative mechanisms connecting migration with health and mortality of left-behind household members so as to inform related health and social policy interventions in origin communities.

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**Table 1.**

## Predictor and control variables

Variable	Mean
Husband is a current migrant	0.40
<i>Husband's migration success – based on frequency of remittances</i>	
No remittances in past 12 months	0.10
Occasional remittances in past 12 months	0.16
Frequent remittances in past 12 months	0.14
<i>Husband's migration success – based on wife's assessment</i>	
Household conditions have not improved since migration	0.19
Household conditions have improved since migration	0.21
Age	27.48
Number of living children	2.35
No schooling	0.26
1–5 years of schooling	0.60
6 or more years of schooling	0.14
Bridewealth paid fully or partially	0.42
In polygynous union	0.22
Affiliated with organized religion	0.86
Works outside subsistence agriculture	0.22
Decision-making autonomy (scale 0–7)	4.59
Lives in a nuclear family household	0.38
Household material assets scale (1–20)	3.40
Husband has beaten her	0.36
Diagnosed with a health condition	0.30
Wave 1 marriage ended in divorce	0.14
Wave 1 marriage ended in husband's death	0.15

Notes: Wave 1 respondents with confirmed survival status by Wave 5 and non-missing values on all covariates (N=1444); all variables, except for divorce and widowhood, measured at Wave 1.

**Table 2.**

Deaths between Wave 1 and Wave 5, by husband's migration status and by success of his migration

Husband's migration status at Wave 1	Percent died between W1 and W5
Non-migrant	12.6
Any migrant	11.8
<i>Husband's migration success – frequency of remittances</i>	
No remittances in past 12 months	14.2
Occasional remittances in past 12 months	12.8
Frequent remittances in past 12 months	8.6
<i>Husband's migration success – wife's assessment</i>	
Household conditions have not improved or have worsened since migration started	15.2
Household conditions have improved since migration started	8.8
All	12.3

Note: Wave 1 respondents with fully confirmed survival status by Wave 5 and non-missing values on all covariates (N=1444).

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**Table 3.**

Death by Wave 5 predicted from husband's migration status and migration success at Wave 1, multilevel binomial logistic regression, odds ratios and standard errors

<i>Predictors and controls</i>	<b>A</b>	<b>B</b>	<b>C</b>
Non-migrant husband	1.11(0.20)	0.88(0.24)	0.85(0.18)
Migrant husband, any	[Ref]		
Migrant husband, no remittances		[Ref]	
Migrant husband, occasional remittances		0.93(0.30)	
Migrant husband, frequent remittances		0.51(0.19) <sup>+</sup>	
Migrant husband, hh conditions have not improved			[Ref]
Migrant husband, hh conditions have improved			0.55(0.15) <sup>*</sup>
Age	1.03(0.02)	1.03(0.02)	1.03(0.02)
Number of children	0.77(0.05) <sup>**</sup>	0.76(0.05) <sup>**</sup>	0.77(0.05) <sup>**</sup>
1–5 years education [No education]	1.05(0.21)	1.06(0.21)	1.07(0.22)
6 <sup>+</sup> years education	0.18(0.34)	1.18(0.34)	1.22(0.35)
Bridewealth paid fully or partially [None paid]	0.92(0.17)	0.93(0.17)	0.96(0.18)
In polygynous union [In monogamous union]	0.89(0.19)	0.87(0.18)	0.86(0.18)
Affiliated with organized religion [Not affiliated]	0.79(0.19)	0.79(0.19)	0.78(0.19)
Works outside subsistence agriculture [Does not work]	1.07(0.21)	1.05(0.21)	1.05(0.21)
Decision-making autonomy score	1.04(0.05)	1.04(0.05)	1.04(0.05)
Nuclear family household [extended family household]	1.19(0.22)	1.16(0.21)	1.16(0.21)
Household assets scale	1.00(0.03)	1.01(0.03)	1.01(0.03)
Husband has beaten her [has not beaten]	1.51(0.26) <sup>*</sup>	1.51(0.26) <sup>*</sup>	1.52(0.27) <sup>*</sup>
Reported a chronic health problem [did not report]	1.36(0.24) <sup>+</sup>	1.38(0.25) <sup>+</sup>	1.36(0.24) <sup>+</sup>
W1 marriage ended in divorce [W1 marriage intact]	2.10(0.46) <sup>**</sup>	2.11(0.47) <sup>**</sup>	2.10(0.47) <sup>**</sup>
W1 marriage ended in husband's death	2.04(0.44) <sup>**</sup>	2.10(0.46) <sup>**</sup>	2.04(0.45) <sup>*</sup>
Constant	0.61(0.03) <sup>**</sup>	0.06(0.04) <sup>**</sup>	0.08(0.04) <sup>**</sup>
Constant, level 2 (village)	0.14(0.10)	0.15(0.11)	0.15(0.11)
Log-likelihood	–510.70	–508.52	–508.37
N	1444	1444	1444

Notes: Reference categories in brackets; significance level:

<sup>+</sup>  $p < 0.1$

<sup>\*</sup>  $p < 0.05$

<sup>\*\*</sup>  $p < 0.01$ .



**Table 4.**

HIV/AIDS-related vs HIV/AIDS-unrelated deaths between Waves 1–5, by migration status and success

Husband migration status at Wave 1	A. Share of deaths by HIV/AIDS status		B. Probability of dying by HIV/AIDS status		
	Likely HIV related	Likely HIV unrelated	Total	Likely HIV related	Likely HIV unrelated
All	42.1%	57.9%	0.12	0.05	0.07
Non-migrant	42.1%	57.9%	0.12	0.05	0.07
Any migrant	42.3%	57.7%	0.12	0.05	0.07
<i>Migration success – frequency of remittances</i>					
No remittances in past 12 months	23.8%	76.2%	0.14	0.03	0.11
Occasional remittances in past 12 months	41.4%	58.6%	0.12	0.05	0.7
Frequent remittances in past 12 months	68.4%	31.6%	0.9	0.07	0.3
<i>Migration success – wife's assessment</i>					
Household conditions have not improved since migration	27.3%	72.7%	0.15	0.04	0.11
Household conditions have improved since migration	66.7%	33.3%	0.09	0.06	0.03

**Table 5.**

HIV/AIDS-related vs. HIV/AIDS-unrelated deaths by Wave 5 predicted from husband’s migration status and migration success at Wave 1, multilevel multinomial logistic regression, odd ratios (standard errors in parentheses)

<i>Predictors</i>	<b>A</b>	<b>B</b>	<b>C</b>
<i>Died, certainly/probably HIV/AIDS-related causes</i>			
Non-migrant husband	1.00(0.26)	1.42(0.71)	1.21(0.42)
Migrant husband, any	[Ref]		
Migrant husband, no remittances		[Ref]	
Migrant husband, occasional remittances		1.65(0.91)	
Migrant husband, frequent remittances		1.46(0.83)	
[Migrant husband, hh well-being has not improved]			[Ref]
Migrant husband, hh well-being has improved			1.43(0.57)
<i>Died, certainly/probably HIV/AIDS unrelated causes</i>			
Non-migrant husband	1.18(0.27)	0.70(0.22)	0.69(0.17)
Migrant husband, any	[Ref]		
[Migrant husband, no remittances]		[Ref]	
Migrant husband, occasional remittances		0.68(0.27)	
Migrant husband, frequent remittances		0.24(0.12) **	
[Migrant husband, hh conditions have not improved]			[Ref]
Migrant husband, hh conditions have improved			0.25(0.10) **
Log-likelihood	-623.29	-618.12	-616.35
N	1444	1444	1444

Notes: Base outcome: Did not die. Controls are the same as in Table 4 (not shown). Reference categories in brackets; significance level:

- <sup>+</sup>  $p < 0.1$
- \*  $p < 0.05$
- \*\*  $p < 0.01$ .