Subjective Expectations about Mortality in the Context of HIV/AIDS in Malawi

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September 21, 2007

Abstract

Measuring and analyzing how individuals assess their subjective mortality risks, and how mortality risks differ by socioeconomic groups, health-statuses and health-related behaviors, is essential for understanding the determinants of adopting healthy behaviors. This is particularly the case in sub-Saharan contexts with high HIV prevalence where mortality levels have changes substantially in the recent decade, and individuals are confronted with re-evaluating many behaviors that may affect their HIV infection risks and subsequent mortality. We base our analyses on a newly-developed interactive elicitation methodology to collect probabilistic expectations in developing country contexts with low levels of literacy and numeracy, and use data collected rural Malawi. The mortality expectations elicited from respondents in rural Malawi substantially over-estimate the mortality risks compared to life table mortality rates. Despite this overestimation, however, respondents seem to be aware of important differentials in mortality levels: subjective mortality risks over a 5-year horizon (and similarly also for the 1-year and 10-year horizon) are highest for respondents who (*i*) have low education, (*ii*) are divorced, separated or widowed, (*iii*) have had a relatively large number of sexual partners, and (*iv*) are infected with HIV. Our analyses also show that respondents are clearly aware of the effect of HIV on survival. For example, The mean elicited mortality risk for someone who is healthy is about 30% points lower than the mortality risk of someone who is infected with HIV for the three time horizons. On average, respondents believe that there is a 92% chance for someone who is infected with HIV to be dead in 10 years. In addition, respondents expect ART to increase life expectancy of individuals sick with AIDS. The average mortality risk for someone on ART is about 25% points smaller for the one year horizon than for someone sick with AIDS and 10% points smaller for the 10-year horizon.

1 Introduction

Sub-Saharan Africa is at the epicenter of the HIV/AIDS epidemic, and estimated adult HIV prevalence ranges from less than 0.1% in Comoros to 32.4% in Swaziland (UNAIDS 2006). Because the epidemic has become generalized, heterosexual sexual intercourse among low-risk individuals is the most common pathway of infection for rural populations (Gouws et al. 2005). Behavioral change with respect to sexual relationships, marriage/divorce, condom use and partner selection is therefore crucial for all efforts targeted at curtailing the disease (Aggleton et al. 1994; Cerwonka et al. 2000; UNAIDS 1999). The adaptation of behavioral change in AIDS-related behaviors, however, depends critically on individuals' subjective expectations about their own HIV-infection status, the prevalence of HIV in the local population, the availability of antiretroviral treatments for AIDS, and mortality. The latter—mortality, and related, also life expectancy—deserve particular attention. For example, Oster (2007) has recently argued that there is is no reason per se to expect

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a behavioral response to increased in HIV infection rates in sub-Saharan Africa; especially as becoming infected with HIV means premature death, the "utility lost" depends on how many years people expect to live without HIV (see also Philipson and Posner 1993). Current life expectancy estimates for Malawi are indeed striking: males can expect to live 44.4 years, and females 45.7 years (based on period life-table for 2000-05, United Nations 2007). Given these low levels of life-expectancy and high levels of poverty, Oster then argues that individuals have little motivation to adopt risk-prevention strategies, as these strategies are "costly" in terms of financial expenses (e.g., purchasing condoms) or foregone pleasures (e.g., reduced joy from sex as a result of condom use, lower levels of satisfaction as a result of giving up extra-marital partners, etc.), but, as a result of the generally high levels of mortality, provide only limited gains in terms of longer life expectancy. Similarly "fatalistic" explanations for the HIV/AIDS epidemic in Africa have also been provided by Kremer (1996) or Auld (2003).

Very little, however, is known about the individuals' expectations about mortality in sub-Saharan Africa, how these expectations vary by age or socioeconomic characteristics, and how they compare to lifetable estimates of mortality risks. For instance, are rural Malawians indeed pessimistic about their own survival, and do they overestimate their risk of dying? Do men and women differ in their mortality expectations? In cases where subjective expectations regarding mortality and survival have been investigated, researchers often make non-verifiable assumptions such as regarding the interpretation of verbal scales measuring degrees of subjective likelihood (very likely vs. not very likely) or the interpersonal comparability of subjective risk assessments (e.g., Akwara et al. 2003; Anglewicz and Kohler 2007; Prata et al. 2006).

To resolve the limitations of existing approaches and to investigate the relevance of subjective expectations about mortality in a high HIV-prevalence context in sub-Saharan Africa (SSA), we have developed an innovative interactive elicitation technique to elicit probabilistic expectations, and have implemented this technique as part of the 2006 survey of the Malawi Diffusion and Ideational Change Project (MDICP) covering more than 3,000 adult respondents in rural Malawi (Delavande and Kohler 2007). In this paper, we utilize this approach to investigate subjective expectations about mortality, and expectations of how mortality depends on HIV infection status as well as the adoption of risk reduction strategies, as well as questions about the effect of HIV status and the adoption of risk-reduction strategies on mortality risks, as well as the effect of anti-retroviral therapy (ART) on the survival probabilities of HIV-positive persons.

2 Data & Context

The analyses in this paper are based on the 2006 wave of the *Malawi Diffusion and Ideational Change Project* (MDICP). The general goal of this project is to investigate the multiple processes and influences that contribute to varying degrees of HIV risks in sexual partnerships in a sub-Saharan African context, the variety of ways in which people manage risk through prevention strategies within marriage and other sexual relationships, and the potential effect of HIV risk reduction programs on infection risks and disease dynamics. For this purpose, the MDICP has collected, and continues to collect an unusually rich combination of panel survey data (1998, 2001, 2004, 2006, with ongoing data collection until 2007), qualitative data, and biomarkers for HIV and other sexually transmitted infections. Detailed descriptions of the MDICP sample selection, data collection and data quality are provided on the project website at http://www.malawi.pop.upenn.edu, in a Special Collection of the online journal *Demographic Research* that is devoted to the MDICP (Watkins et al. 2003), and in a recent working paper that incorporates the 2004 and 2006 MDICP data (Anglewicz et al. 2007). Mortality and migration are the primary sources of attrition in the

MDICP, and verbal autopsies (VAs) conducted as part of the MDICP suggest that approximately two-thirds of respondents who died between the 1998–2001 surveys had AIDS-related symptoms (Doctor and Weinreb 2003).

In 2006, the MDICP included more than 3,000 male and female respondents aged between 17 and 60 years old who participated in a household survey and biomarker collection for HIV. Comparisons with the Malawi DHS showed that the MDICP sample population is reasonably representative of the rural Malawi population (Anglewicz et al. 2007). The 2006 MDICP collected information, among other aspects, on (*a*) sexual relations, including the number of sexual partners, the frequency of sexual interactions, the characteristics of the last two sexual partners, and attitudes toward and reported use of condoms; (*b*) marriage and partnership histories; (*c*) household rosters and intergenerational transfers; (*d*) attitudes and behaviors in relation to HIV/AIDS and other STIs, including the acceptability of various risk reduction strategies, perceived HIV/AIDS risks, frequency of attendance at community activities such as funerals and funerals and other community activities, and number of people known to have died of AIDS; and (*e*) respondent's HIV status using HIV rapid tests that were administered to all consenting respondents after the household survey. In addition to various questions about subjective risk assessments that have been asked in the MDICP since 1998, including for instance respondent's assessment of his/her own and partner's current HIV status and expected lifetime HIV risk, the 2006 wave of the MDCIP also included a newly developed ***expectations module*** that was designed to elicit probabilistic expectations on HIV/AIDS related behaviors and outcomes. This expectation module was administered to more than 3,200 respondents (see Table 1 for summary statistics), and this paper provides the first detailed set of analyses of the probabilistic expectation collected as part of the 2006 MDICP.

3 Interactive elicitation of probabilistic expectations

Attitudional researchers have used verbal questions to measure "qualitative" expectations, such as whether an event is "very likely," or "unlikely" to occur. A main difficulty with the interpretation of these verbal scales is that answers may not be comparable across respondents (King et al. 2004), and individuals may have very different perceptions about what "very likely" is. Cognitive psychologists and economists have therefore started to elicit *probabilistic expectations* that have the advantage of being measured on a numeric scales on which answers can be consistently interpreted as probabilities across different domains (Manski 2004). Several large-scale surveys—including the Survey of Economic Expectations (SEE), the Health and Retirement Study (HRS), the National Longitudinal Survey of Youth (NLSY) or the Michigan Survey of Consumers—have included questions eliciting respondents' expectations in a probabilistic form. Respondents' answers to these questions about subjective expectations have been shown to vary in a systematic manner with covariates affecting the underlying events, and the elicited expectations have also been found to have strong predictive power for subsequent outcomes (e.g., Dominitz and Manski 1996, 1997; Lillard and Willis 2001). For example, the subjective probabilities about survival in the HRS have been found to vary systematically with other variables such as smoking (Hurd and McGarry 1995), to evolve coherently in panel in response to new information such as the onset of a disease or the death of a parent at an early age (Hurd and McGarry 2002), and to be predictive of actual mortality (Delavande and Rohwedder 2006; Hurd and McGarry 2002).

The low levels of literacy and numeracy in rural sub-Saharan Africa, however, renders the direct application of the above techniques infeasible. To elicit probabilistic expectations in a rural sub-Saharan African context, we have therefore developed an innovative *interactive elicitation*

Table 1: Summary statistics for respondents participating in the 2006 MDICP expectations module

	Percentage of Respondents		
	Males	Females	Total
N	1,498	1,740	3,238
Age			
< 20	11.82	11.18	11.45
20–29	25.48	28.97	27.45
30–39	22.38	26.65	24.80
40–49	18.52	20.55	19.67
50+	21.79	12.65	16.62
Education			
low (no schooling)	12.91	26.37	20.14
medium (primary schooling)	67.02	63.96	65.38
high (secondary schooling or higher)	20.07	9.67	14.48
Marital status			
married	79.56	82.05	80.90
divorced/separated/widowed	2.40	11.74	7.42
never married	18.04	6.21	11.68
Land ownership			
≤ 2 acres	36.88	47.14	42.40
2–4 acres	32.10	32.26	32.18
> 4 acres	31.02	20.60	25.41
Lifetime number of sexual partners			
0	4.28	3.22	3.71
1	17.71	42.54	31.05
2	22.26	31.15	27.03
3	17.51	13.82	15.53
4+	38.24	9.27	22.67
Ever tested for HIV (prior to 2006 MDICP survey)			
no	38.17	37.90	38.02
yes, learned result	58.20	55.75	56.88
yes, did not learn result	3.63	6.35	5.09
2006 HIV status (determined after 2006 MDICP survey)			
negative	88.41	86.34	87.26
positive	3.59	6.14	5.01
no test	8.00	7.52	7.73
Region			
North (Rumphi)	31.87	31.68	31.77
Center (Mchinji)	33.47	34.22	33.88
South (Balaka)	34.65	34.10	34.35

technique based on asking respondents to allocate up to ten beans on a plate to express the likelihood that an event will be (Delavande and Kohler 2007). Interviewers during the 2006 MDICP introduced this technique by reading the following text to the respondents:

> *"I will ask you several questions about the chance or likelihood that certain events are going to happen. There are 10 beans in the cup. I would like you to choose some beans out of these 10 beans and put them in the plate to express what you think the likelihood or chance is of a specific event happening. One bean represents one chance out of 10. If you do not put any beans in the*

plate, it means you are sure that the event will NOT happen. As you add beans, it means that you think the likelihood that the event happens increases. For example, if you put one or two beans, it means you think the event is not likely to happen but it is still possible. If you pick 5 beans, it means that it is just as likely it happens as it does not happen (fifty-fifty). If you pick 6 bins, it means the event is slightly more likely to happen than not to happen. If you put 10 beans in the plate, it means you are sure the event will happen. There is not right or wrong answer, I just want to know what you think. Let me give you an example. Imagine that we are playing Bawo. Say, when asked about the chance that you will win, you put 7 beans in the plate. This means that you believe you would win 7 out of 10 games on average if we play for a long time."

The bean format outlined in this introductory text has the advantage of being visual, relatively intuitive and fairly engaging for respondents, it the question format can be designed to improve the consistency of answers. After the above introduction and any clarifying questions, respondents were first asked a training questions about the probability of winning in a local board game (Bawo), followed by a question about the likelihood of a newborn baby dying before his first birthday. To evaluate whether respondents understand the concept of probability, respondents were then asked about two *nested* events: going to the market within (*a*) *two days*, and (*b*) *two weeks*. If respondents understand the concept of probability, they should provide an answer for the two-week period that is larger than or equal to the one of the two-day period. Interviewers were instructed to leave the number of beans on the plate after the respondents had responded to the likelihood of going to the market within two days, thereby ensuring that s/he remembers the answer when answering about the two-week period in the next question. If the respondent violated the monotonicity property, the interviewer was instructed to explain the incoherency of the answers by stating that: "*as time goes by, you may find more time to go to the market. Therefore, you should have added beans to the plate.*" And the respondent was invited to reformulate the answer. For this first set of training questions, the interviewers were also instructed to prompt the respondent if s/he allocated 0 or 10 beans in the plate.

Respondents were then asked a series of questions related to economic outcomes, health outcomes, and risk-prevention strategies (see Appendix A for the expectations module included in the 2006 MDICP questionnaire). For the analyses in this paper, we focus on the following events: (*a*) going to market within the next *2 days*; (*b*) going to the market within the next *2 weeks*; (*c*) experiencing a food shortage within the next 12 months; (*d*) having to rely on family members for financial assistance in the next 12 months; (*e*) being infected with HIV now; (*f*) using condom at the next sexual encounter with spouse; (*g*) using condom at the next sexual encounter with someone other than spouse (not asked if respondent reports sex only with spouse); and (*h*) the respondent dying within (*i*) *1 year*; (*i*) *5 years*; and (*ii*) *10 years*. The mortality questions were designed to ensure that respondents provided answers that would allow us to construct well-defined survival curves. In particular, respondents were first asked to pick the number of beans that reflects how likely it is that they will die within a one-year period beginning today. Then, with the beans of the previous question still on the plate, they were asked to *add* more beans to reflect how likely it is that they would die within a five-year period. The same procedure was followed for the ten-year period mortality question. This ensured that respondents provided weakly increasing answers when the time horizon increased.

In addition to these questions about respondent's subjective expectation about their own mortality, the questionnaire also included a several questions about the one-year, 5-year and 10-year survival of the following hypothetical individuals (see also questionnaire in Appendix A): (*i*) a

woman/man your age who is healthy and does not have HIV; (*ii*) a woman/man your age who is infected with HIV; (*iii*) a woman/man your age who is sick with AIDS; (*iv*) a woman/man your age who is sick with AIDS and is treated with Antiretroviral Therapy. The gender used in the scenarios was the same as the one of the respondent.

In our subsequent analyses, we use two related scales to represent respondents' answers to the subjective expectation questions. *First*, the direct response to the expectation questions in terms of the number of beans that the respondent put on the plate (ranging from zero to ten). *Second*, we interpret the reported number of beans as *implied subjective probabilities* by assuming that each number of beans between zero and ten corresponds to a specific probability interval between zero and one. This approach assumes that respondents choose the number of beans that best represents their subjective probability, and it reflects our beliefs that all respondents who place zero (ten) beans on the plate do not believe literally that this event has a probability of zero (one). While the correspondence between the number of beans and the implied probabilities was not explicitly stated in the preamble that was read to respondents prior to the expectation questions, a linear relationship covering the range from zero (very unlikely) to one (very likely) was strongly suggested by the statement. We therefore calculate the *implied subjective probability* by assuming that respondents allocate the number of beans as a function of their underlying subjective probability P_i as follows:

$$\begin{array}{rcl} \textit{zero} \text{ beans} & \text{if} & P_i < 0.05 \\ \textit{one} \text{ bean} & \text{if} & 0.05 \leq P_i < 0.15 \\ \vdots & & \vdots \\ X_i \text{ beans} & \text{if} & \frac{X}{10} - 0.05 \leq P_i < \frac{X}{10} + 0.05 \\ \vdots & & \vdots \\ \textit{nine} \text{ beans} & \text{if} & 0.85 \leq P_i < 0.95 \\ \textit{ten} \text{ beans} & \text{if} & P_i \geq 0.95, \end{array} \tag{1}$$

where X_i is the number of beans allocated by respondent i given his/her underlying subjective probability P_i.

In addition to providing various summary statistics of these implied probabilities, we will also use a standardized boxplot-like diagram to display the *distribution* of subjective probabilities. Figure 1 indicates how this boxplot-like graph displays the mean and median of the reported expectations, as well as the 10^{th}, 25^{th}, 75^{th}, and 90^{th} percentiles of the distribution. The median and percentiles of the distribution of subjective probabilities are calculated assuming an uniform distribution of the underlying subjective probabilities P_i within each interval in Eq. (1). The mid-point of each interval in Eq. (1) is used in calculations of the average (implied) subjective probability.[1]

The expectation module included in the 2006 wave of the MDICP was administered to 3,252 respondents in three regions of rural Malawi. Table 2 reports the responses in terms of number of beans to the questions about going to the market, experiencing a food shortage, having to rely on family members, infant mortality, being infected with HIV, condom use and mortality. The analyses in Delavande and Kohler (2007) show that, remarkably, the above approach elicited—for almost all respondents—subjective expectations that are consistent with basic properties of probability theory. Moreover, for basically all the domains we have considered, we find that the central tendencies and percentiles of the distributions of elicited subjective probabilities vary with observ-

Table 2: Subjective probabilities of various common events

# beans	implied subjective probability	Going to the market within		Experi-encing food shortage in the next 12 months	Rely on family for financial assistance in the next 12 months	Baby dying before 1st birthday	Being infected with HIV now	Using condom at next sexual encounter with		Own Mortality: Probability of dying within		
		2 days	2 weeks					spouse	someone other than spouse	1-year	5-years	10-years
0	0 to .05	6.0	1.1	11.2	22.1	18.4	66.6	64.4	10.0	29.1	6.0	2.0
1	.05 to .15	9.6	1.3	7.7	11.7	22.2	9.5	7.6	1.5	24.1	8.5	1.9
2	.15 to .25	17.7	2.5	10.2	11.9	17.8	7.6	6.6	3.7	16.3	16.1	4.9
3	.25 to .35	14.9	6.2	8.8	8.6	10.8	4.7	4.4	3.9	9.0	16.7	7.9
4	.35 to .45	14.5	7.0	9.1	6.8	7.3	2.4	3.0	3.5	5.6	12.2	10.1
5	.45 to .55	14.7	12.3	17.4	13.1	17.4	5.6	6.1	11.4	13.1	20.4	24.9
6	.55 to .65	8.0	14.0	8.1	6.7	2.8	0.5	2.7	8.2	0.9	7.0	10.2
7	.65 to .75	4.9	15.3	7.4	5.0	1.3	0.5	0.9	5.5	0.4	5.8	11.3
8	.75 to .85	3.5	13.4	7.1	4.8	0.9	0.9	1.3	8.7	0.5	3.3	9.8
9	.85 to .95	1.8	6.8	3.0	2.4	0.4	0.7	0.5	7.2	0.3	0.9	4.8
10	.95 to 1	4.6	20.1	9.9	6.9	0.7	1.0	2.7	36.5	0.9	3.2	12.1
Implied subjective probability												
Mean		0.39	0.67	0.46	0.36	0.25	0.12	0.16	0.67	0.20	0.39	0.58
10th percentile		0.09	0.33	0.04	0.02	0.03	0.01	0.01	0.05	0.02	0.10	0.26
25th percentile		0.20	0.51	0.21	0.08	0.08	0.02	0.02	0.47	0.04	0.22	0.43
Median		0.36	0.69	0.47	0.30	0.20	0.04	0.04	0.78	0.14	0.37	0.54
75th percentile		0.53	0.88	0.68	0.56	0.43	0.14	0.20	0.97	0.31	0.53	0.77
90th percentile		0.75	0.98	0.95	0.83	0.53	0.41	0.52	0.99	0.50	0.71	0.96
N		3,236	3,223	3,209	3,229	3,237	3,228	2,643	598	3,191	3,191	3,189

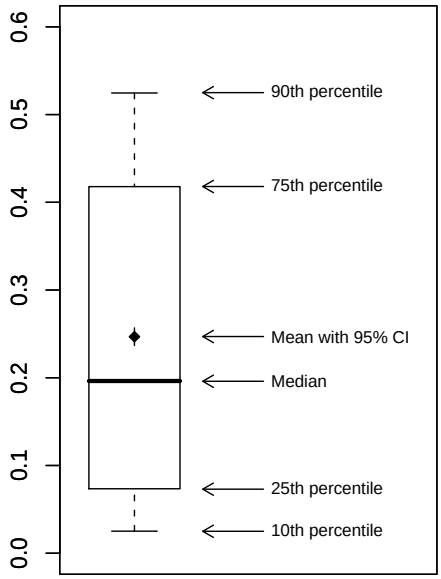


Figure 1: Standardized boxplot-like graph to display distribution of subjective probabilities

able characteristics, such as gender, age, education or risk behavior, in the same way that actual outcomes vary with these variables. For example, expectations about infant and adult mortality and economic outcomes exhibit regional differences that are similar to actual outcomes. Beliefs about HIV infection increase with the number of sexual partners a respondent has had, and decrease with education level, as do actual levels of prevalence. Moreover, we find that beliefs about future events vary across individuals in the same way past experience does: people who have been to the market more frequently in the previous month report a higher belief of going to the market in the coming days. These systematic relationships between elicited expectations and characteristics provide strong evidence that individuals in a developing country are able to provide meaningful answers when asked about their beliefs in a probabilistic manner.

4 Subjective expectations about mortality

4.1 Infant mortality

Respondents were asked the likelihood that a baby born in their community this month will die within one year.[2] Infant mortality, unfortunately, continues to be a fairly common event in rural Malawi. The Malawi DHS, for instance, estimated an infant mortality, i.e., the probability of dying before the first birthday, of 98 per 1,000 for rural areas during 1994–2004 (Malawi DHS 2004). Respondents subjective expectations about infant mortality are in close correspondence to these DHS-estimated probabilities (Table 2): 1 bean—corresponding, on average, to an implied infant mortality of 100 per 1,000 births (10% mortality risk)—is the most common answer, with the two next commons answers being 0 and 2 beans. Overall, 58% of the respondents placed two or fewer beans in the plate, thus estimating a infant mortality of less than 250 per 1,000, which corresponds well with the DHS estimates as infant mortality varies considerably across regions and can be as high as 145 per 1,000 in some districts. Respondents are aware of these regional differences: the central tendencies and percentiles of the distribution of implied probabilities by region match remarkably well the regional differences reported in the Malawi DHS (graphs not shown). Respondents are also clearly aware that the death of an infant is not a very likely event as 77% of them have placed 4 beans or less in the plate, and the median of subjective probabilities about

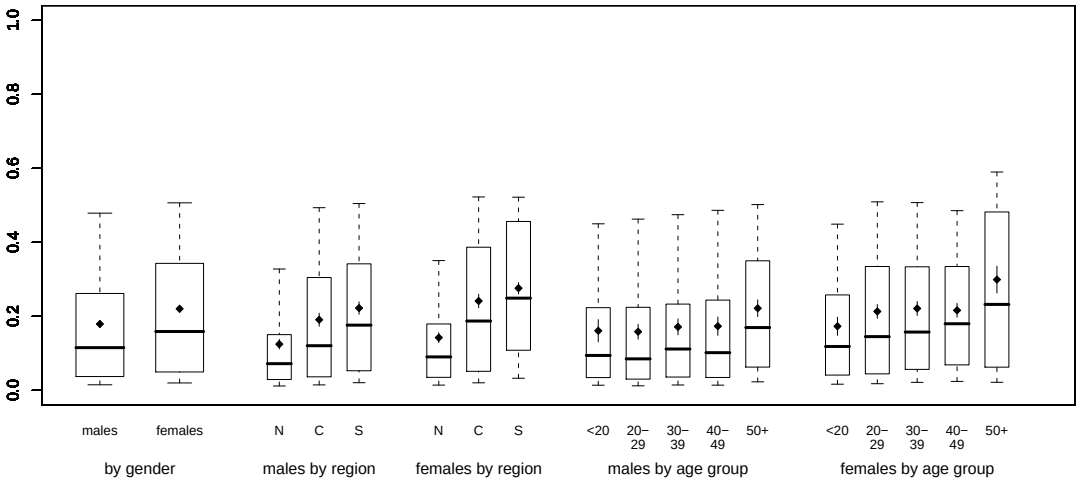
infant mortality is 20%. Nevertheless, about 25% of respondents—both male and female—have subjective probabilities about infant mortality in excess of 43%. The HIV/AIDS epidemic might explain some of the high answers. During the pilot phase, a respondent explained that he allocated 9 beans because nowadays babies were dying more often than in the past due to HIV/AIDS. This is somewhat in contrast to actual mortality trends for Malawi overall, which show declines in infant mortality in the last decade despite HIV/AIDS, but strong increases in adult mortality as a result of HIV/AIDS (Malawi DHS 2000, 2004).[3] A possible explanation for this overestimation of infant mortality in a subset of the population may be the related to the problem of inferring mortality risks by observing trends in infant deaths. In particular, when the population is growing, infant mortality rates can decrease while the total number of infant deaths increases (Montgomery 1998). Thus, some respondents might have noticed an increase of child funerals, without taking into account that more children were born.

4.2 Own Mortality

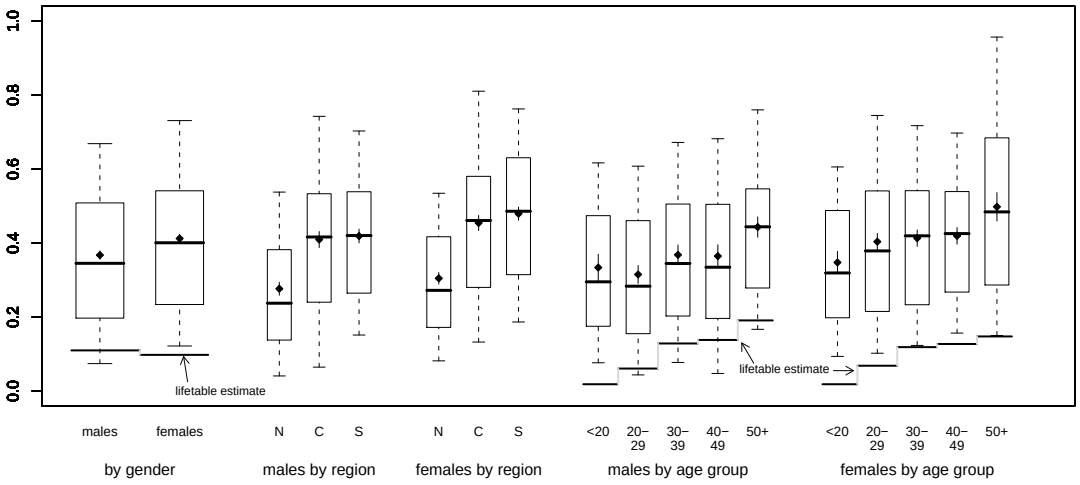
To provide a first indication about perceptions about respondent's own mortality risks in a sub-Saharan African context with high HIV prevalence, Figure 2 depicts the distribution of MDICP respondents' subjective expectations about their own mortality. In particular, respondents were asked about their subjective probability of dying within one year (Figure 2a), five years (Figure 2b), and ten years (Figure 2c; see Table 2 for actual responses to these questions in terms of number of beans). For the five and ten year periods, the figures also include the corresponding lifetable estimates by gender and age group (see also Table A.4).[4]

An important characteristic of the reported subjective expectations about mortality is that respondents' expectations agree in broad terms with the actual variation in mortality: the probability of dying increases the longer the time horizon, and the older the respondent. For example, the mean implied probability of dying is 17.9% (men) and 22.0% (women) over a 1-year horizon, and it increases to 36.7% (men) and 41.2% (women) for the five year, and to 55.2% (men) and 60.6% (women) for the ten year horizon. The mean reported probability of dying during, for example, the next five years increases for women from 40.4% at ages 20–29 to 49.8% at ages 50 and older, and for men the increase is from 31.5% (ages 20–29) to 44.3% (ages 50+). The reported subjective mortality risks are also substantially lower in the northern region (Rumphi), consistent with the actual variation in mortality across these regions (Bicego 1997). There is also a gender difference, with women being somewhat more pessimistic about their own survival than men. A similar gender difference in mortality expectations has also been found in developed countries among older adults: in HRS and SHARE, women provide higher expectations of dying than men, while they have actually greater life expectancies.

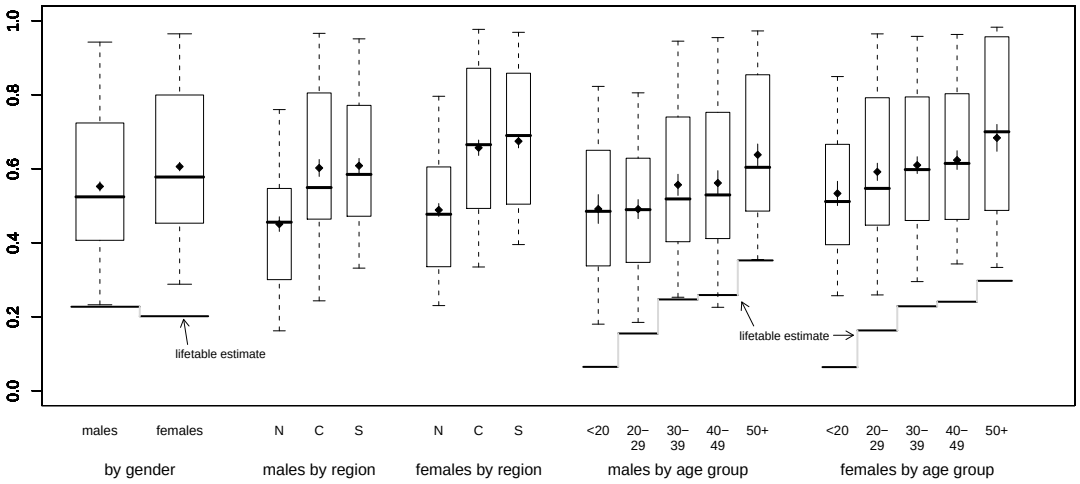
The subjective probabilities of dying within one, five and ten years, however, deviate from the observed mortality pattern in an important dimension: both men and women in rural Malawi substantially *overestimate* their mortality risk, and they are much more pessimistic regarding their own survival as is warranted given current estimates of actual mortality rates. Across all ages in the sample, the median perceived 5-year mortality risk exceeds the corresponding lifetable estimate by a factor of 3.2 for males and 4.1 for females, and the median perceived 10-year mortality risk exceeds the lifetable estimate by a factor of 2.3 (males) to 2.9 (females). This overestimation of mortality risks varies considerably by age. The "bias" is the most severe for younger respondents, where the median five-year mortality probability reported by 15–19 year old which is 16–17 times greater than the lifetable estimate; for the ten year period, young respondents overestimate the probability of dying by a factor of 7.6–8 (for additional details, see Table A.4). A similar phe-



(a) Probability of dying within a 1-year period



(b) Probability of dying within a 5-year period



(c) Probability of dying within a 10-year period

Figure 2: Respondent's subjective probability of dying within a 1-year, 5-year and 10-year time period, by gender, region and age group

Notes: Region is coded as: N = North (Rumphi), C = Center (Mchinji), S = South (Balaka); lifetable estimates are obtained from United Nations (2007); see Tables A.1– A.4 for data in tabulated form.

nomenon has been reported among teens in the US: teens of the NLSY97 have relatively well-calibrated expectations about various life events, but greatly overestimated their chance of death (Fischhoff et al. 2000). The average answer in the NLSY97 for a time-period of 4 to 5 years was 50 times greater than the statistical estimate.[5] The discrepancy between life table estimates and subjective mortality expectations, however, decreases with age: above age 30, the median subjective probability of dying for men exceeds the corresponding lifetable estimate by a factor of 2.5–2.7 (5 year period) and 1.7–2.1 (10 year period); for women, the overestimation of mortality risk above age 30 is by a factor of 3.2–3.5 (5 year period) and 2.4–2.6 (10 year period). This subjective overestimation of mortality risks at older ages contrasts with findings in developed countries for persons aged 50 and over: for example, while the survival expectations in the HRS exhibit a lot of heterogeneity, they aggregate remarkably well to population probabilities (Hurd and McGarry 1995). Yet, some small age variation in discrepancies between expectations and life table has been reported in the HRS and SHARE. However, in those surveys younger respondents tend to provide expectations that are lower than the life table mortality rates, while older are more optimistic than the life tables (Hurd et al. 2005).

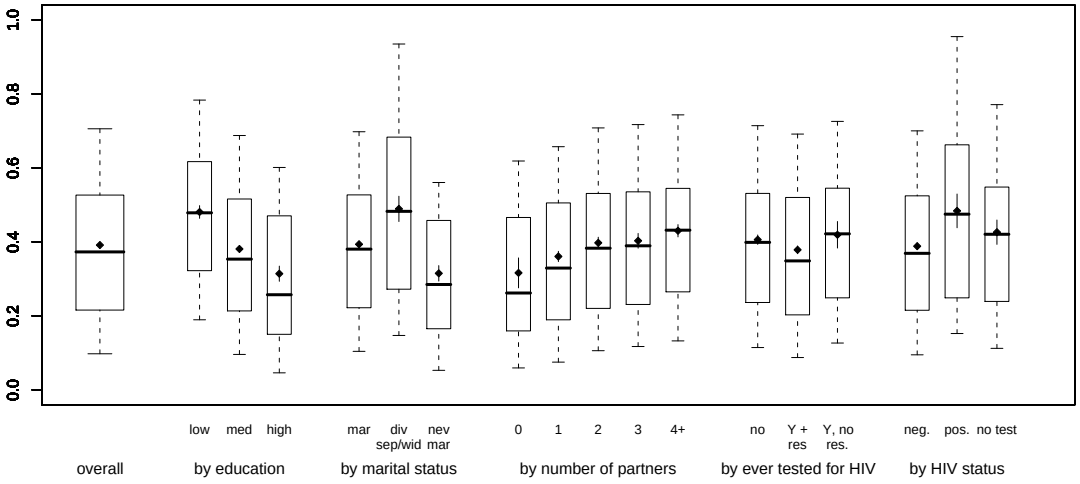
The overestimation of mortality might be an overreaction to the substantial increases in adult mortality that has occurred as a result of the HIV/AIDS epidemic in the last decade in sub-Saharan Africa in general (e.g., Blacker 2004; Urassa et al. 2001; Zaba et al. 2004) and in Malawi in particular (Blacker 2004; Doctor 2001). Zaba et al. (2004), for example, report that in the worst affected countries of Africa, the probability of dying between 15-year old and 60 has risen from a range of 10 to 30% in the mid-1980s, to a range of 30–60% at end of the 1990s. For Malawi, Blacker (2004) report a change of this probability from 24.8% for men in the 1977-1987 period to 48.7% in the 1987-1998 period. A similar increase is reported for women (from 29.0% to 42.9%). While longitudinal data on subjective mortality risks do not exist, it is possible that individuals in rural Malawi have "overreacted" in their subjective expectations to the rapid mortality increase resulting from the AIDS epidemic (Grether 1980; Kahneman and Tversky 1982).

[Note: the following parts of this paper are still very preliminary and will be much expanded for the PAA presentation and paper]

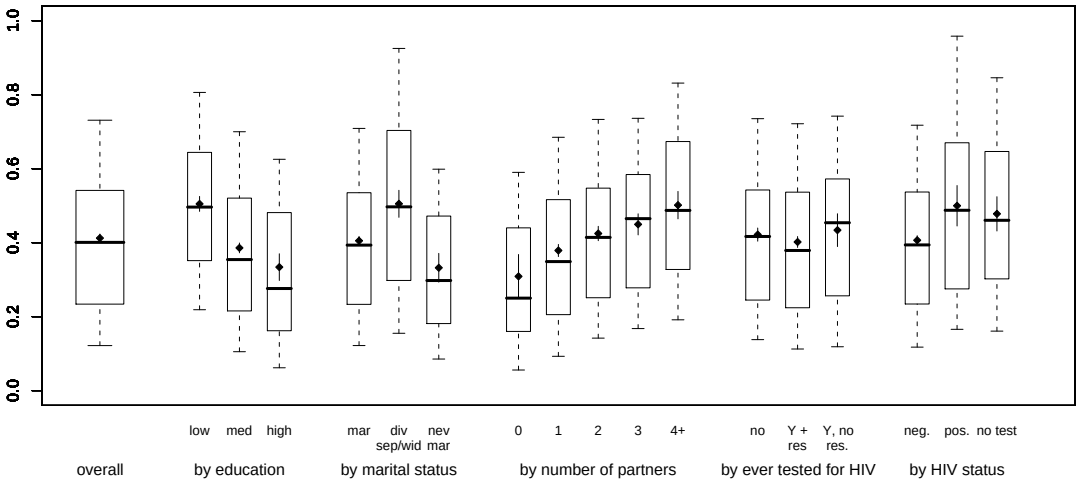
Figure 3 disaggregates respondents subjective mortality expectations over the 5-year horizon by several important socioeconomic and health characteristics: education, marital status, number of sexual partners, having ever been tested for HIV, and the HIV status (as of 2006, obtained after the survey). The results in Figure 3 are shown first for both males and females combined, and then for each gender separately. The key finding of this figure is that mortality expectations are highly consistent with the scientific knowledge about the determinants and covariates of mortality differentials in sub-Saharan Africa. In particular, subjective mortality risks over a 5-year horizon (and similarly also for the 1-year and 10-year horizon) are highest for respondents who (*i*) have low education, (*ii*) are divorced, separated or widowed, (*iii*) have had a relatively large number of sexual partners, and (*iv*) are infected with HIV. The gradient in mortality expectations by education, number of sexual partners is more pronounced for females than for males, while for males the gradient by respondent's own HIV status is lightly more pronounced.

4.3 Mortality for hypothetical individuals

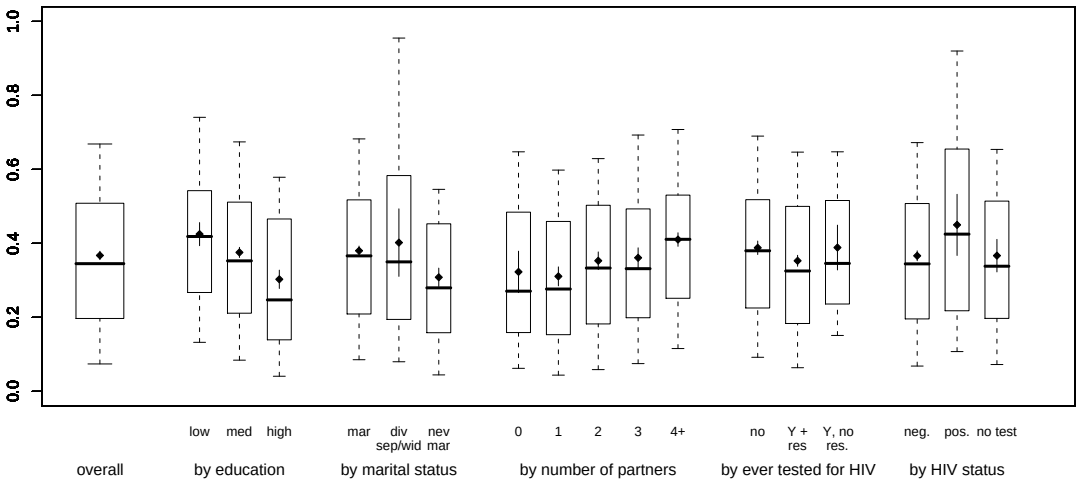
We have asked respondents about the one-year, 5-year and 10-year survival of the following hypothetical individuals (see also questionnaire in Appendix A): (*i*) a woman/man your age who is healthy and does not have HIV; (*ii*) a woman/man your age who is infected with HIV; (*iii*) a woman/man your age who is sick with AIDS; (*iv*) a woman/man your age who is sick with AIDS



(a) Males and females combined



(b) Females



(c) Males

Figure 3: Respondent's subjective probability of dying within a 5-year period: by education, marital status and number of partners and HIV status/knowledge
Notes: Region is coded as: N = North (Rumphi), C = Center (Mchinji), S = South (Balaka)

Table 3: Mean answers for questions about mortality of hypothetical persons

	1-year	5-year	10-year
Someone your age who is healthy and does not have HIV	1.83	4.06	6.16
Someone your age who is infected with HIV	4.54	7.34	9.16
Someone woman your age who is sick with AIDS	6.88	9.26	9.93
Someone your age who is sick with AIDS and is treated with ARV	4.35	6.83	8.96
own	1.95	4.05	6.05
"imputed" own (weighted average of healthy & HIV)	2.15	4.42	6.49

and is treated with Antiretroviral Therapy. The gender used in the scenarios was the same as the one of the respondent.

Table 3 presents the mean answers for those questions. Respondents are clearly aware of the effect of HIV on survival. The mean elicited mortality risk for someone who is healthy is about 30% points lower than the mortality risk of someone who is infected with HIV for the three time horizons. On average, respondents believe that there is a 92% chance for someone who is infected with HIV to be dead in 10 years. Respondents are also aware of the difference between HIV and AIDS as they provide, on average, a higher mortality risk for someone who is sick with AIDS than infected with HIV. This difference is higher for the shorter time horizon but vanishes for the 10-year period, which is consistent with the fact that respondents think that both individuals with HIV and AIDS are likely to be dead in 10 years.

Table 3 shows that respondents expect ART to increase life expectancy of individuals sick with AIDS. The average mortality risk for someone on ART is about 25% points smaller for the one year horizon than for someone sick with AIDS and 10% points smaller for the 10-year horizon. Overall, the average mortality expectations for someone treated with ART are a bit lower than those for someone infected with HIV, but still quite higher than those of the healthy individuals.

Table 3 also presents the average expectations for own mortality and an "imputed" own mortality, which is a weighted average of the respondent's expectations for the mortality of a healthy individual and that of someone who is sick with HIV using as weight the respondent's own expectations about being infected. The own and imputed mortality expectations are very similar, both on average and at the individual-level, showing remarkable consistency in the way respondents answered the questions. Note that they are also fairly similar to mortality expectations of the healthy individual since a large proportion of the respondents believe that they are at no risk of being infected with HIV.

In other surveys (such as the HRS or the NLSY), expectations about mortality tend to attract of a lot of 50%, which may reflect the uncertainty faced by respondents regarding their own survival. Table 4 present the proportion of respondents who allocated 5 beans for each of the mortality questions. It ranges from 0% for the 10-year mortality of someone who is infected with AIDS to 25% for own 10-year mortality. This is definitely at the low-end of other surveys eliciting expectations in developing countries. The overall pattern is coherent: for example while about 20% of the respondents provided 5 beans for the one-year mortality of someone who is infected with HIV, only 2% did so for the 10-years mortality. If one is willing to interpret the "50-50" answers as epistemic uncertainty, we can conclude from Table 4 that respondents are quite certain long-term mortality

Table 4: Mean answers for questions about mortality of hypothetical persons

	Proportion of 50%		
	1-year	**5-year**	**10-year**
Someone your age who is healthy and does not have HIV	0.07	0.21	0.23
Someone your age who is infected with HIV	0.21	0.15	0.02
Someone your age who is sick with AIDS	0.19	0.01	0
Someone your age who is sick with AIDS and is treated with ARV	0.21	0.18	0.03
Own	0.13	0.23	0.25

rate of people infected with HIV and AIDS.

5 Conclusions

The elicitation of subjective expectations about HIV/AIDS related behaviors and events are an important, but rarely implemented, tool for understanding the determinants and consequences of HIV-infection risks in sub-Saharan Africa. This lack of data on HIV/AIDS-related expectation is in part due to the fact that existing methods for eliciting subjective probabilities are based on questions about the "percent chance" of various events, and these methods are not applicable to contexts with low literacy and numeracy. In this paper we therefore present and evaluate a new interactive elicitation technique to collect probabilistic beliefs from respondents in a developing country context. This method has been implemented as part of the 2006 Malawi Diffusion and Ideational Change Project involving more than 3,000 individuals in rural Malawi, and the expectation data collected as part of this survey provides the first large-scale data on of probabilistic expectations about important life events and health and economic outcomes in a developing country.

The mortality expectations elicited from respondents in rural Malawi substantially over-estimate the mortality risks compared to life table mortality rates. This overestimation might have important implications for HIV-prevention strategy, since one important cost associated with being infected with HIV is a reduction of life expectancy. This cost may be perceived as smaller than it actually is for individuals whose beliefs about life expectancy are heavily biased downward. Finally, risk-reduction strategies have to be perceived as efficient and acceptable in the population in order to be implemented. The skewed distribution of expectations about condom use with spouse is consistent with the median person being hesitant to use condom within marriage while a small group of innovators are the forerunners in the adoption of this strategy. Despite this overestimation, however, respondents seem to be aware of important differentials in mortality levels: subjective mortality risks over a 5-year horizon (and similarly also for the 1-year and 10-year horizon) are highest for respondents who (*i*) have low education, (*ii*) are divorced, separated or widowed, (*iii*) have had a relatively large number of sexual partners, and (*iv*) are infected with HIV.

The survey also included questions about the one-year, 5-year and 10-year survival of hypothetical individuals: (*i*) a woman/man who is healthy and does not have HIV; (*ii*) a woman/man who is infected with HIV; (*iii*) a woman/man who is sick with AIDS; (*iv*) a woman/man who is sick with AIDS and is treated with Antiretroviral Therapy. Our analyses show that respondents are clearly aware of the effect of HIV on survival. The mean elicited mortality risk for someone who is healthy is about 30% points lower than the mortality risk of someone who is infected with

HIV for the three time horizons. On average, respondents believe that there is a 92% chance for someone who is infected with HIV to be dead in 10 years. Respondents are also aware of the difference between HIV and AIDS as they provide, on average, a higher mortality risk for someone who is sick with AIDS than infected with HIV. This difference is higher for the shorter time horizon but vanishes for the 10-year period, which is consistent with the fact that respondents think that both individuals with HIV and AIDS are likely to be dead in 10 years. In addition, respondents expect ART to increase life expectancy of individuals sick with AIDS. The average mortality risk for someone on ART is about 25% points smaller for the one year horizon than for someone sick with AIDS and 10% points smaller for the 10-year horizon.

Acknowledgments: We gratefully acknowledge the support for this research through the National Institute of Child Health and Development (grant numbers RO1 HD044228 and RO1 HD/MH41713), National Institute on Aging (grant number P30 AG12836), the Boettner Center for Pensions and Retirement Security at the University of Pennsylvania, and the National Institute of Child Health and Development Population Research Infrastructure Program (grant number R24 HD-044964), all at the University of Pennsylvania, and the Norwegian Center for Advanced Studies.

Notes

[1]This midpoint of the interval in Eq. (1) is equal to the number of beans, X, divided by 10, except for 0 beans, where the midpoint is .025, and 10 beans, where the midpoint is .0975.

[2]The question asked about "a baby born in your community," so the interpretation of "community" was left to the respondents.

[3]However, in many countries of sub-Saharan Africa, in particularly those severely affected by AIDS, there is evidence of a reversal of the child mortality decline during the 1990s (Zaba et al. 2004).

[4]The calculations are based on United Nations (2007) lifetable estimates for Malawi for 2000–05. The probability of dying for a person aged x to $x+5$ within a 5-year time period is calculated as $1 - {}_5L_{x+5}/{}_5L_x$; the probability of dying within a 10-year time period is calculated as $1 - {}_5L_{x+10}/{}_5L_x$. Calculations are performed for 5-year age groups, and then combined across all age groups ("overall") or across 10-year age groups using the age structure of the survey respondents.

[5]The NLSY97 asked about the probability of dying from any cause between now and when the respondents turn 20 to a set of respondents aged 15 and 16.

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Appendix A: Expectation module included in the 2006 MDICP questionnaire

Section 6: Expectations Questions

INTERVIEWER: Put the plate and the cup side by side. Recount the number of beans and check that you have 10 beans in the cup [__]. As you provide the explanation below, add the beans into the plate to illustrate what you say.

"I will ask you several questions about the chance or likelihood that certain events are going to happen. There are 10 beans in the cup. I would like you to choose some beans out of these 10 beans and put them in the plate to express what you think the likelihood or chance is of a specific event happening. One bean represents one chance out of 10. If you do not put any beans in the plate, it means you are sure that the event will NOT happen. As you add beans, it means that you think the likelihood that the event happens increases. For example, if you put one or two beans, it means you think the event is not likely to happen but it is still possible. If you pick 5 beans, it means that it is just as likely it happens as it does not happen (fifty-fifty). If you pick 6 bins, it means the event is slightly more likely to happen than not to happen. If you put 10 beans in the plate, it means you are sure the event will happen. There is not right or wrong answer, I just want to know what you think.

Let me give you an example. Imagine that we are playing Bawo. Say, when asked about the chance that you will win, you put 7 beans in the plate. This means that you believe you would win 7 out of 10 games on average if we play for a long time.

INTERVIEWER: Report for each question the NUMBER OF BEANS put in the PLATE. After each question, replace the beans in the cup (unless otherwise noted).

For questions X1a to X1f: If respondent puts 10 (or 0) beans, prompt "Are you sure that this event will almost surely (not) happen?" CIRCLE 1 in column P if you prompted the respondent, and report the final answer only.

X1 Pick the number of beans that reflects how likely you think it is that…	# of beans in plate	Prompt for 0 or 10?
a) *you will win if we play a game of Bawo after this interview*	[____]	1
b) *a baby born in your community this month will die within one year*	[____]	1
c) *you will go to the market at least once within the next 2 days* (LEAVE BEANS IN PLATE)	[____]	1
d) *you will go to the market at least once within the next 2 weeks?*	[____]	1
INTERVIEWER: Did Respondent add any beans between X1c and X1d?	**If yes → X1f**	
e) *Remember, as time goes by, you may find more time to go to the market. Therefore, you should have added beans to the plate. Let me ask you again. Now, add beans in the plate so that the number of beans in the plate reflects how likely you think it is that you will go the market at least once within 2 weeks?*	[____]	1
f) *you will experience shortage of food in the next 12 months?*	[____]	1

For the subsequent questions, no longer prompt for "0" and "10" answers

X2 Pick the number of beans that reflects how likely you think it is that…	# of beans in plate
a) *you will have to rely on family members for financial assistance in the next 12 months*	[____]
b) *you are infected with HIV/AIDS now*	[____]
FOR MARRIED RESPONDENTS (INTERVIEWER: If respondent is not married → X2f)	
c) *your spouse is infected with HIV/AIDS now*	[____]
d) *you will use condom the next time you have sex with your spouse*	[____]
e) *you will use condom the next time you have sex with someone else other than your spouse* **(INTERVIEWER: If sex only with spouse, write 99)**	[____] **→ X3**
FOR UNMARRIED RESPONDENTS	
f) *your romantic partner is infected with HIV/AIDS now* **(INTERVIEWER: If no romantic partner, write 99 and → X2h)**	[____]
g) *you will use condom the next time you have sex with your romantic partner* **(INTERVIEWER: if no romantic partner, write 99)**	[____]

X2	Pick the number of beans that reflects how likely you think it is that…	# of beans in plate
	h) *you will use condom the next time you have sex with someone you just met* **(INTERVIEWER: If no sex with someone just met, write 99)**	[_____]
	i) *you will be married one year from now*	[_____]

FOR BOTH MARRIED AND UNMARRIED RESPONDENTS		
X3	***Consider a healthy woman in your village who currently does not have HIV. Pick the number of beans that reflects how likely you think it is that she will become infected with HIV …***	**# of beans in plate**
	a) during a single intercourse without a condom with someone who has HIV/AIDS	[_____]
	b) *within the next 12 months (with normal sexual behavior)*	[_____]
	c) within the next 12 months if she is married to someone who is infected with HIV/AIDS	[_____]
	d) within the next 12 months if she has several sexual partners in addition to her spouse	[_____]
	e) *what about if this woman we just spoke about [in X3d] uses a condom with all extra-marital partners? How many beans would you leave on the plate?*	[_____]

Next, I would like you to consider the likelihood that somebody dies as time goes by. This is an imaginary person, and I am going to describe her to you. The beans in the plate represent the chances out of 10 that the person dies within a certain time period. The person is alive today so we start with an empty plate. As time goes by, more unfortunate things can happen and the person has more chances of dying, so more beans will be added to the plate"

INTERVIEWER:

1. **Ask questions X4 to X5b for the INDIVIDUAL described in Column A. After X4 and X5a, LEAVE beans in plate. After X5b, put beans back in the cup. RECORD the number of beans in the plate after each question.**
2. **COLUMN by COLUMN, REPEAT questions X4 to X5b for the INDIVIDUALS described in Columns B, C and D. For each individual, LEAVE the beans in the plate after X4 and X5a, and put beans back in the cup after X5b. RECORD the number of beans in the plate after each question.**
3. **If respondent says "I Don't Know", probe with examples: "someone might die because of old age, disease, car accident. How likely do you think it is any of those things happen within [*for X4*: 1 year; *for X5a:* 5 years; *for X5b:* 10 years]?**

	RECORD the number of beans in the plate for each question.	**DESCRIPTION OF INDIVIDUAL**	
		A *A woman your age who is healthy and does not have HIV*	**B** *A woman your age who is infected with HIV*
X4	*Pick the number of beans that reflects how likely you think it is that [INDIVIDUAL] will die within a <u>one-year</u> period beginning today* . **(LEAVE BEANS ON PLATE)**	[_____] Beans in plate **If 10, → X4 for individual B**	[_____] Beans in plate **If 10, →X4 for individual C**
X5	**Add additional beans so that the number of beans in the plate reflects how likely you think it is that [INDIVIDUAL]** a) *will die within a <u>five-year</u> period beginning today* **(LEAVE BEANS ON PLATE; IT IS POSSIBLE TO ADD ZERO ADDITIONAL BEANS)**	[_____] Beans in plate **If 10, → X4 for individual B**	[_____] Beans in plate **If 10, →X4 for individual C**
	b) *will die within a <u>ten-year</u> period beginning today* **(IT IS POSSIBLE TO ADD ZERO ADDITIONAL BEANS. PUT BEANS BACK IN CUP AFTER RECORDING THE ANSWER)**	[_____] Beans in plate **→ X4 for individual B**	[_____] Beans in plate **→ X4 for individual C**

		C *A woman your age who is sick with AIDS*	D *A woman your age who is sick with AIDS and is treated with ARV* **If R does not know about ARV, skip and go to X6**
X4	*Pick the number of beans that reflects how likely you think it is that [INDIVIDUAL] will die within a <u>one-year</u> period beginning today.* **(LEAVE BEANS ON PLATE)**	[_____] Beans in plate **If 10, → X4 for individual D**	[_____] Beans in plate **If 10, → X6**
X5	**Add additional beans so that the number of beans in the plate reflects how likely you think it is that [INDIVIDUAL]** **a)** *will die within a <u>five-year</u> period beginning today* **(LEAVE BEANS ON PLATE; IT IS POSSIBLE TO ADD ZERO ADDITIONAL BEANS)**	[_____] Beans in plate **If 10, → X4 for individual D**	[_____] Beans in plate **If 10, → X6**
	b) *will die within a <u>ten-year</u> period beginning today* **(IT IS POSSIBLE TO ADD ZERO ADDITIONAL BEANS. PUT BEANS BACK IN CUP AFTER RECORDING THE ANSWER)**	[_____] Beans in plate **→ X4 for individual D**	[_____] Beans in plate **→ X6**

Finally, I would like to ask you to consider the likelihood that <u>you</u> may not be alive as time goes by. We hope that nothing bad will happen to you, but nevertheless, something unfortunate may occur over the next years despite all precautions that you may take. If you don't want to, you do not need to answer this question.

INTERVIEWER: If respondent refuses to answer, skip to **X8: Time and Risk Preferences.**

		# OF BEANS in plate
X6	*Pick the number of beans that reflects how likely you think it is that you will die within a <u>one-year</u> period beginning today.* **(LEAVE BEANS ON PLATE)**	[_____] **if 10 →X8**
X7	**Put additional beans so that the number of beans in the plate reflects how likely you think it is that <u>you</u>…** **a)** *will die within a <u>five-year</u> period beginning today* **(LEAVE BEANS ON PLATE; IT IS POSSIBLE TO ADD ZERO ADDITIONAL BEANS)**	[_____] **if 10 → X8**
	b) *will die within a <u>ten-year</u> period beginning today* **(IT IS POSSIBLE TO ADD ZERO ADDITIONAL BEANS. PUT BEANS BACK IN CUP AFTER RECORDING THE ANSWER)**	[_____]

X8 *Next, I would like to ask you a few questions about what you expect in the future. I know that nobody knows for sure what the future may bring, but lets just talk about your best guess*

In the next 2 years do you plan on:

		Yes	No
a)	*making large repairs or addition on your home*?	1	0
b)	*starting a new business*	1	0
c)	opening *a bank account*	1	0
d)	*purchasing (more) land?*	1	0
e)	*sending a child or grandchild to secondary school or university*	1	0
f)	*saving money*	1	0

Appendix B: Additional Tables

Table A.1: Respondent's subjective probability of dying within a 1-year time period, by gender, region and age group

		# of beans		implied subjective probability						
						Percentiles				
	N	mean	SE	mean	SE	10^{th}	25^{th}	50^{th}	75^{th}	90^{th}
Males	1,479	1.71	0.05	0.18	0.005	0.01	0.04	0.12	0.26	0.48
Females	1,712	2.14	0.05	0.22	0.005	0.02	0.05	0.16	0.34	0.51
Males, by region										
North	491	1.14	0.07	0.12	0.007	0.01	0.03	0.07	0.15	0.33
Center	451	1.82	0.09	0.19	0.009	0.01	0.04	0.12	0.30	0.49
South	479	2.16	0.09	0.22	0.009	0.02	0.05	0.18	0.34	0.50
Females, by region										
North	579	1.34	0.07	0.14	0.007	0.01	0.04	0.09	0.18	0.35
Center	537	2.36	0.10	0.24	0.009	0.02	0.05	0.19	0.39	0.52
South	586	2.72	0.08	0.28	0.008	0.03	0.11	0.25	0.46	0.52
Males, by age group										
< 20	140	1.52	0.16	0.16	0.015	0.01	0.03	0.09	0.22	0.45
20–29	297	1.48	0.11	0.16	0.010	0.01	0.03	0.08	0.22	0.46
30–39	266	1.63	0.12	0.17	0.011	0.01	0.04	0.11	0.23	0.47
40–49	219	1.64	0.13	0.17	0.013	0.01	0.03	0.10	0.24	0.49
50+	256	2.16	0.12	0.22	0.012	0.02	0.06	0.17	0.35	0.50
Females, by age group										
< 20	171	1.65	0.13	0.17	0.013	0.02	0.04	0.12	0.26	0.45
20–29	444	2.06	0.10	0.21	0.010	0.02	0.04	0.15	0.33	0.51
30–39	407	2.15	0.10	0.22	0.010	0.02	0.06	0.16	0.33	0.51
40–49	317	2.11	0.10	0.22	0.010	0.02	0.07	0.18	0.33	0.49
50+	190	2.94	0.19	0.30	0.019	0.02	0.06	0.23	0.48	0.59

Table A.2: Respondent's subjective probability of dying within a 5-year time period, by gender, region and age group

		# of beans		implied subjective probability						
						Percentiles				
	N	mean	SE	mean	SE	10^{th}	25^{th}	50^{th}	75^{th}	90^{th}
Males	1,480	3.66	0.06	0.37	0.006	0.07	0.20	0.35	0.51	0.67
Females	1,711	4.12	0.06	0.41	0.006	0.12	0.23	0.40	0.54	0.73
Males, by region										
North	489	2.74	0.09	0.28	0.009	0.04	0.14	0.24	0.38	0.54
Center	455	4.08	0.11	0.41	0.011	0.06	0.24	0.42	0.53	0.74
South	478	4.19	0.10	0.42	0.009	0.15	0.26	0.42	0.54	0.70
Females, by region										
North	579	3.04	0.08	0.31	0.008	0.08	0.17	0.27	0.42	0.54
Center	537	4.55	0.11	0.45	0.011	0.13	0.28	0.46	0.58	0.81
South	585	4.79	0.09	0.48	0.009	0.19	0.32	0.49	0.63	0.76
Males, by age group										
< 20	140	3.33	0.19	0.33	0.018	0.08	0.18	0.30	0.47	0.62
20–29	296	3.12	0.13	0.32	0.012	0.04	0.16	0.28	0.46	0.61
30–39	267	3.67	0.14	0.37	0.014	0.08	0.20	0.34	0.51	0.67
40–49	218	3.63	0.16	0.36	0.016	0.05	0.20	0.33	0.50	0.68
50+	257	4.44	0.14	0.44	0.014	0.17	0.28	0.44	0.55	0.76
Females, by age group										
< 20	171	3.46	0.16	0.35	0.015	0.09	0.20	0.32	0.49	0.61
20–29	445	4.04	0.12	0.40	0.011	0.10	0.22	0.38	0.54	0.74
30–39	405	4.13	0.12	0.41	0.011	0.12	0.23	0.42	0.54	0.72
40–49	317	4.19	0.12	0.42	0.011	0.16	0.27	0.43	0.54	0.70
50+	190	5.00	0.20	0.50	0.020	0.15	0.29	0.48	0.68	0.96

Table A.3: Respondent's subjective probability of dying within a 10-year time period, by gender, region and age group

		# of beans		implied subjective probability						
						Percentiles				
	N	mean	SE	mean	SE	10^{th}	25^{th}	50^{th}	75^{th}	90^{th}
Males	1,479	5.54	0.06	0.55	0.006	0.23	0.41	0.52	0.72	0.94
Females	1,710	6.09	0.06	0.61	0.006	0.29	0.45	0.58	0.80	0.96
Males, by region										
North	489	4.51	0.10	0.45	0.010	0.16	0.30	0.46	0.55	0.76
Center	454	6.06	0.12	0.60	0.012	0.24	0.46	0.55	0.81	0.97
South	478	6.10	0.10	0.61	0.010	0.33	0.47	0.58	0.77	0.95
Females, by region										
North	579	4.90	0.09	0.49	0.009	0.23	0.34	0.48	0.61	0.80
Center	536	6.62	0.11	0.66	0.011	0.34	0.49	0.67	0.87	0.98
South	585	6.78	0.09	0.67	0.009	0.40	0.50	0.69	0.86	0.97
Males, by age group										
< 20	140	4.91	0.20	0.49	0.020	0.18	0.34	0.49	0.65	0.82
20–29	296	4.91	0.13	0.49	0.013	0.18	0.35	0.49	0.63	0.81
30–39	266	5.59	0.15	0.56	0.015	0.25	0.40	0.52	0.74	0.95
40–49	218	5.64	0.17	0.56	0.017	0.23	0.41	0.53	0.75	0.95
50+	257	6.42	0.15	0.64	0.015	0.35	0.49	0.60	0.85	0.97
Females, by age group										
< 20	171	5.35	0.17	0.53	0.017	0.26	0.39	0.51	0.67	0.85
20–29	445	5.95	0.12	0.59	0.012	0.26	0.45	0.55	0.79	0.96
30–39	404	6.13	0.12	0.61	0.012	0.29	0.46	0.60	0.79	0.96
40–49	317	6.26	0.13	0.62	0.013	0.34	0.46	0.61	0.80	0.96
50+	190	6.91	0.19	0.68	0.019	0.33	0.49	0.70	0.96	0.98

Table A.4: Lifetable estimates of probability of dying within 5 and 10 years

	Lifetable estimates for probabiltiy of dying				Ratio of median subjective probability to lifetable estimate			
	Males		Females		Males		Females	
Time period:	5 yrs	10 yrs	5 yrs	10 yrs	5 yrs	10 yrs	5 yrs	10 yrs
Overall	0.110	0.227	0.098	0.201	3.2	2.3	4.1	2.9
Age group:								
< 20	0.018	0.065	0.018	0.064	16.4	7.6	17.4	8.0
20–29	0.061	0.155	0.068	0.163	4.6	3.2	5.6	3.4
30–39	0.128	0.247	0.119	0.228	2.6	2.1	3.5	2.6
40–49	0.138	0.259	0.127	0.241	2.4	2.0	3.4	2.5
50+	0.173	0.352	0.148	0.297	2.5	1.7	3.3	2.4

Notes: Lifetable estimates are based on the United Nations (2007) lifetable for Malawi for 2000–05. The probability of dying for a person aged x to $x+5$ within a 5-year time period is calculated as $1 - {}_5L_{x+5}/{}_5L_x$; the probability of dying within a 10-year time period is calculated as $1 - {}_5L_{x+10}/{}_5L_x$. Calculations are performed for 5-year age groups, and then combined across all age groups ("overall") or across 10-year age groups using the age structure of the survey respondents. The median subjective probabilities of dying within a five and ten year period are obtained from Tables A.2–A.3.