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Pictorial approaches for measuring time use in rural Ethiopia

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Abstract

Time use researchers working in least developed countries (LDCs) face difficulties collecting data from illiterate populations who may conceptualize time differently than those in industrialized countries. We identify existing gaps in time use data collection methods and discuss two novel, pictorial methods to collect time use data from these populations. The first method is a modified recall interview modeled on participatory rural appraisal (PRA) methods that asks respondents to place macaroni on pictures of activity categories in proportion to the amount of time spent on that activity during the previous day. The second is a simplified pictorial time diary that uses a timer and sequentially-numbered stickers to re-create the temporal order of activities in 30-minute increments. The latter method also avoids recall bias problems. We present time use data collected in 2009 using these methods in a study examining the impacts of water infrastructure on women and children's time use in rural Ethiopia. In total, we collected information using the first method from 263 household members over age 10, including 167 water collectors, and pilot-tested the pictorial diary approach with 10 adult respondents.

Keywords

time use; least developed countries; previous day recall; time diaries; methodology

Section 1. Introduction¹

Data on how individuals and households spend their time are used to measure a number of phenomena in social science, such as division of labor, gender inequality, and measuring nonmarket labor (Bhat and Koppelman 1999; Sayer 2005; Shelton and Daphne 1996; United Nations Statistical Division 2005; Wodon and Beegle 2006). Time use data also provide

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important insights into labor supply in informal, non-cash economies, especially rural subsistence agriculture. Time use indicators illustrate how policies or programs impact people's leisure, productivity, and well-being in ways that more widely collected demographic or economic statistics may miss (United Nations 1978). For example, studies in least developed countries (LDCs) have used time use data to estimate the impacts of crop failures on child school attendance hours (Beegle et al. 2006), the effects of price and income on the allocation of time within the household (Mueller 1984), and the effects of ethnic social norms on time use among women (Kevane and Wydick 2001). Despite this, there have been relatively few time use studies in LDCs, and few attempts to adapt time use methods to these populations. The United Nations Statistics Division (2005) reports that only five countries in Sub-Saharan Africa (SSA) have conducted national time use studies, and Kes and Swaminathan (2006) report only five smaller scale academic studies in SSA have been conducted since 2000.

In addition to institutional and logistical constraints in collecting time use data, there are two primary measurement challenges in LDC settings: low literacy rates and unfamiliarity with "clock" time (Hawes et al. 1974; Robinson and Godbey 1999; Verbrugge and Gruber-Baldine 1993). Both Kes and Swaminathan (2006) and Harvey and Taylor (2000) argue that special considerations must be made for regional challenges such as illiteracy and different cultural conceptions of time. Low literacy rates make self-completed contemporaneous diaries impossible, thus forcing researchers to rely on recall-based methods. In addition, rural and poor populations may not commonly use watches and clocks, casting doubt on the accuracy of simple (and widely-used) questions like, "How many minutes did you spend on that activity?" (Paolisso and Hame 2010; Chenu and Lesnard 2006; Reynolds 1991).

Cardenas and Carpenter (2008) note that challenges associated with illiteracy and innumeracy among survey populations extend to other areas of data collection, and argue that using pictures or diagrams may be a better method of data collection among these populations. We take up this suggestion, and extend time use data collection methodologies by proposing two pictorial methods. We report here on a field test of both methods in two rural villages in the Oromiya region of Ethiopia in the summer of 2009. Before describing our approach and data, however, we begin with a brief survey of time use elicitation approaches with a particular focus on LDC settings.

Section 2. Literature

There are four dominant methods that researchers have used to elicit time use data: (1) direct observation by the researcher, (2) time diaries, (3) self-reported recall during an interview, and (4) the experience sampling method (ESM). These methods have distinct advantages and disadvantages with respect to relative reliability, response rates, and cost of data collection.

Direct observation is considered the gold standard when it comes to validity and reliability for time use data collection (Mcsweeney and Freedman 1980; Hames 2010). Direct observation can be done either through continuous (shadowing) or instantaneous (random) sampling over a period of time.² Using this method, observers record respondent time use

on activities over a specified period of time. Recall interviews can be used to supplement direct observation when it is not possible to always follow a respondent, or to supplement instantaneous observations (Betzig and Turkey 1985; Paolisso and Hames 2010). The most important limitation of direct observation is the potential for a “Hawthorne effect”: individuals may alter their behavior in response to being observed, especially for time spent on sensitive activities. They may also direct attention to activities that would otherwise not be conducted in the presence of an observer (Floro 1995; Floro and Miles 2003). The method is also costly and burdensome for the enumerator and the respondent, making it difficult to obtain a large, representative sample.

Many researchers have found self-completed time diaries to be the next most reliable method. To use standard time diaries, however, respondents must be literate and have a sense of “clock” time. The interval of time between each reported activity must also be relatively short. Time diaries that cover a day’s worth of activities have been found to be a robust source of information on aggregate time use if the sample is large and representative. Therefore, even if an atypical day is reported by a respondent it will be statistically balanced by other observations (Robinson and Godbey 1999). The United Nations (2005) notes two variants of time diaries: light and full diaries. Light diaries involve pre-coded activities, while full diaries require the respondent to write in their own words the activities they are conducting. Light diaries may be a simpler, self-instructing instrument, and are a sufficient alternative method for respondents that are able to read but not write. Time diaries have their critics as well: Chenu and Lesnard (2006) argue that time diaries are also exposed to normative bias by the underreporting of “extra-occupational” activities like flirting or drinking.

The recall method is commonly used in surveys (Michelson 2005). These exercises typically ask a respondent to recall how they spent their previous day using either pre-coded activities or open-ended descriptions. The recall method also allows interviewers to ask about simultaneous activities, although some research has shown that there are some reporting bias issues with simultaneous activities (Kitterod 2001; Michelson 2005). Two variations can be employed with this method. One variation asks respondents to recall in fixed increments of time (e.g., 10 minutes) the activities they conducted the previous day. Another variation relies on open-ended recall of time spent on activities. Activities may be recalled in sequential order, or participants may recall the total amount of time spent on an activity during the previous day.

The recall method is subject to error due to a number of factors. The period of recall can influence the accuracy of the recall, as longer periods of time place a greater cognitive burden on the respondent’s memory. The general consensus among time use researchers is that recall of no more than two days should be asked (Juster and Stafford 1985; Keller et al. 1982; Klevmarken 1982), preferably a recall of yesterday (Robinson and Godbey 1999). Many studies, however, ask about time use on an “average” day or during the previous week, month, or even year. Like observation and diaries, recall exercises may also lead to an

²For an extensive discussion on anthropological perspectives of time use data collection see Grossman (1984), Hames (2010), and Paolisso and Hames (2010).

exaggeration of socially acceptable behaviors and an under-reporting of others.³ In addition, researchers have found that open-ended recall methods that do not cap hours tend to overestimate time use. Hawes et al. (1974), Verbrugge and Gruber-Baldine (1993) and Robinson and Godbey (1999) all find that the average daily (or weekly) activity times summed to greater than 24 (or 168) hours, although Chenu and Lesnard (2006) find evidence of underreporting of hours using the recall method.

In the Experience Sampling Method (ESM) respondents record their activity at random points during the day, usually when an electronic beeper goes off (Larson and Csikszentmihalyi 1983; Csikszentmihalyi and Larson 1987; Michelson 2009). The main purpose of the ESM is to collect affective data (i.e., mental state or happiness) from individuals during their normal days without the respondent being aware of exactly when he or she might be prompted. It does not produce full time budgets. The ESM, however, has been found to suffer from non-random nonresponse, and requires more time and makes more cognitive demands on respondents than most other survey methods (Jeong 2005). The use of advanced technologies could be an implementation challenge in some locations where familiarity and exposure with electronic devices is limited, although the use of mobile phones has increased dramatically in recent years. The instrument has since been extended by Kahneman et al. (2004) in a method called the Daily Reconstruction Method (DRM), which combines the recall method with components of the ESM. They argue that this method is superior to the ESM in that it is less burdensome, while also providing full time budgets. We are unaware of a test of this approach in a rural LDC setting.

Despite extensive testing and refinement in methods for collecting time use data in industrialized, mostly literate countries, existing methods to collect time use data from rural populations in LDC still need improvement. Because there have been so few time use studies in these settings, it is difficult to assess the level of measurement error for existing tools. Some researchers recommend using only free-form recall methods for illiterate populations, while others recommend enumerator assisted recall exercises (Hames 2010; United Nations 2005). Kes and Swaminathan (2006) provide a review of small- and large-scale time use studies conducted in Sub-Saharan Africa. They find that in LDCs direct observation methods are preferable due to issues of illiteracy and familiarity with a Western concept of time, but that interviewer-driven recall exercises are also common. Like Cardenas and Carpenter (2008), they also suggest that illustrated survey materials, or pictorial depictions of activities, may be needed to elicit time use data from these populations. We are unaware, however, of any academic studies that have taken up these suggestions by fielding pictorial approaches for measuring time use.⁴ We now turn to describing the methods used in our field study in Ethiopia.

³For example, Hofferth (2000) found that parents over-reported time spent reading to their children while underreporting the amount of time kids spent watching television. Robinson (1985) found that respondents over-reported socially desirable activities and under-reported activities of short duration. Chenu and Lesnard (2006) reported that people overestimated time spent on paid employment by understating interruptions. Several other authors, however, have found this problem to be minimal and unsystematic (Juster and Stafford 1985; Robinson 1977; Robinson 1985; Szalai 1973; Bonke 2005; Robinson and Godbey 1999).

⁴Wiseman et al. (2005) used a pictorial diary to record household consumption and expenditure data, though not time use, over a 12 month period in Tanzania and the Gambia. Haraldsen et al (2000) proposed a modified form of time diaries using pictures in a paper presented at the 2000 International Association of Time Use Research Conference in Belo Horizonte, Brazil, though, to our knowledge the instrument was never implemented.

Section 3. New methods for time-use data collection

The PRA-Based Method

The first method we test is an adaptation of the participatory rural appraisal (PRA) method (Narayan-Parker 1993a; 1993b). The PRA method is a modified recall exercise that asks respondents to recall time spent yesterday on activities using pasta pieces as a physical representation of time. We grouped typical daily activities into 15 categories after careful pre-testing and consultation with local colleagues (see Table 2). Although these categories could not capture every possible activity, we are reasonably confident they captured all of the most important activities. We also trained enumerators to deal with activities which were difficult to categorize. For each of these 15 categories, we constructed a card with color pictures and drawings to represent the activities pictorially. [These are included in the supplementary appendix].

Enumerators began by showing the respondent the macaroni pieces and by explaining that they represented all the time the respondent spent awake the previous day. She explained that each macaroni piece represented 20 minutes, and that three macaroni pieces therefore equaled one hour. The enumerator then displayed each activity card in front of the respondent and read the descriptions from Table 2. After reading through all cards, the enumerator showed each card again and asked the respondent whether she engaged in that activity during the previous day. Cards for activities which the respondent did not do the previous day were discarded. The remaining cards were placed on a mat in front of the respondent to physically display every activity that the respondent stated she conducted during the previous day. [Pictures of the process are also included in the supplementary appendix]. The enumerator then asked the respondent if she participated in any activity the previous day that was not included among the activity cards displayed in front of her. If the respondent felt that an activity did not clearly fit within one of the fifteen categories, the enumerator helped identify the most appropriate card. Although this rarely happened in our study, this is a potential limitation of our approach compared to an open-ended recall exercise that relies on grouping types of activities *ex post*. Again, though, we worked extensively to identify groupings that were salient to respondents and which incorporated the most common daily activities.

The enumerator then asked the respondent what time she woke up and what time she went to bed the previous day, and gave her the corresponding number of macaroni pieces (again 3 pieces = 1 hour).⁵ The enumerator explained that the number of macaroni pieces on an activity card represented the amount of time spent engaged in the activity the previous day and asked the respondent to allocate the appropriate number of macaroni pieces to each activity card. To document the potential influence of other people on the respondent's reported allocation of time, the enumerator noted the number of people present for each PRA exercise. Once the respondent allocated all macaroni pieces to the activity cards, the

⁵In our study region in central Ethiopia, Western clock time is not typically used, although people use a similar system where zero o'clock is 6:00am on the Western clock and corresponds to sunrise, and twelve o'clock is 6:00pm and corresponds to sunset. Because of this and because there is not a lot of variation in daylight because of proximity to the equator, we think asking the respondent what time she woke up and what time she went to bed was reasonably reliable. The *percentages* of time spent in various activities would, of course, be unaffected by error in the wake-up and sleep times.

enumerator repeated the number of macaroni pieces allocated to each activity card back to the respondent by converting macaroni pieces into minutes. This was to ensure that the respondent understood the exercise, and also to allow the respondent to correct any allocation that sounded incorrect. The respondent was then allowed to reallocate macaroni pieces, although the enumerator recorded both the original and revised allocation.

This method has several advantages. By giving the respondent a physical representation of time to allocate to each activity, this method allows for a respondent to think about how much time she spent on certain activities while being aware of her time allocation to other activities. For respondents who may be innumerate this method helps them visualize time in terms of piles of macaroni. Finally, having a respondent allocate a specific amount of time to activities prevents overestimation of time spent on activities often found in open-ended recall exercises (Hawes et al. 1974; Verbrugge and Gruber-Baldine 1993; Robinson and Godbey 1999).

The Melina method: Pictorial diaries

The Melina method combines elements of the PRA method and the fixed interval time diary method, adapted to be appropriate for illiterate populations without access to timepieces. The method involved three components: a pictorial diary (a booklet consisting of the same 15 cards as above but bound together);⁶ a roll of numbered stickers; and a timer. Respondents were given aprons in which to carry the materials with them throughout the day. Respondents were instructed to start the timer when they woke up and carry it with them until they went to sleep. The timer was a basic device with three buttons,⁷ and was set to go off at 30 minute intervals. Red tape was put over the minute and second buttons to discourage the respondents from touching them and resetting the timer. A roll of stickers numbered 1 to 32 was used to document the temporal order of activities and to approximate the time of day respondents conducted the activities based on when the respondent stated they woke up that day. Each sticker represented 30 minutes. Each time the timer beeped, the respondent was instructed to place the next numbered sticker on the picture of the primary activity that she had been engaged in for the previous 30 minutes (since the timer last beeped).

Because the diary method occurred without supervision, enumerators first conducted the PRA exercise to help familiarize the respondent with the cards and the activities they represented. After completing the PRA exercise, the enumerator explained the diary, stickers, and timer. The enumerator demonstrated the method by starting the timer (it was set for only one minute), waiting for it to beep, turning it off, placing a sticker on a picture, and restarting the timer. The respondent was then encouraged to practice using the timer and placing practice stickers on activity pictures in the diary. The enumerator also asked the respondent what activities she was planning on doing the next day, and whether she had any questions about identifying the appropriate activity card for the planned activities.

⁶Because we tested this method only on individuals over 15 years of age, we excluded the activity card representing children playing from the diary.

⁷The timer we used was a basic digital kitchen timer that can be purchased at any grocery or department store in the US for approximately US\$6–10. A picture of it is included in the supplementary appendix.

Once the respondent was comfortable with the different components of the activity, she was given the 32 stickers representing 16 hours in the day. The enumerator instructed the respondent that it was not necessary to allocate all the stickers over the course of the day (if she was awake less than 16 hours). If the diary method was interrupted for any reason – for instance, if the respondent forgot to put a sticker on an activity card or the timer stopped and was never restarted – the enumerator encouraged the respondent to resume the diary and continue until she went to bed.

The enumerator returned to pick up the diary and debrief the respondent two days later. Respondents were asked a series of questions about conducting the diary activity the previous day to determine if they had any problems. The enumerator reconstructed the day based on the pattern of stickers in the activity book and asked the respondent if it seemed generally accurate.

Section 4. Study Site and Sampling

We collected data as part of a larger study evaluating the impacts of a rural water supply project being implemented jointly by two NGOs, Water Action (based in Ethiopia) and Water 1st International (based in the US). We interviewed households in project villages before and after implementation of the water project in order to measure the impact on household time use.

This paper reports data from the baseline survey collected in the summer of 2009 from two villages (Bishikiltu and Tutekunche) in the Oromiya region of Ethiopia. Both villages are largely agrarian. The main crops in this area consist of teff, chickpeas, wheat, maize, and beans. The region is widely known in Ethiopia for providing teff, the country's main cereal crop. There are distinct dry and rainy seasons, and the rainy season is seen as the time for plowing, sowing, and harvesting. Furthermore, school is not in session during the rainy season, and children often work on agricultural or household labor. Our data indicate that 32 percent of children 5 to 15 years of age work on the farm during this season. Since our data were collected during the rainy season, the results may not be generalizable to the drier seasons where water is far less available and agricultural activities more limited.

We selected households using a two-stage randomized sampling method. In the first stage, we constructed a list of sub-villages (each containing approximately 30 households) in the two areas that would be beneficiaries of the new project; that is, the areas where a new public water tap would be close enough that most residents were expected to switch from their current water source to the new tap. We used a random number generator to decide the order in which sub-villages would be interviewed.⁸ In the second stage, we randomly selected households for interviews from household rosters.⁹ In each sub-village we randomly selected 30 percent of households to be interviewed. Once 30 percent of households in the first selected sub-village were completed,¹⁰ interviewers moved to the

⁸We chose this approach rather than deciding a set of number of interviews per sub-village because we were initially unclear how rapidly field staff could conduct interviews.

⁹In Tutekunche, our sampling frame was a comprehensive list of households (by sub-village) that was prepared by the local school principal and sub-village leaders. In Bishikiltu we used a household list prepared by sub-village leaders and the village association chairman.

second selected sub-village, and this process continued until the end of the data collection period.

The final sample size consisted of 149 households. In all households, we collected time use data from the “main person responsible for collecting water in your household.” Some households reported sharing the responsibility, and we conducted the exercise with all water collectors who shared the responsibility. In a randomly-chosen subset of households we also attempted to collect time use information on all household members. During pre-testing, it became clear that individuals younger than 10 were uncomfortable, unconfident, or too shy to participate in the time use exercise.¹¹ Four households refused to complete the main survey. Eight households had no family members conduct time use exercises due to outright refusal or to physical or mental disabilities that rendered the participant unable to complete the time use exercise. In addition, 16 water collectors either refused or were not eligible to conduct time use exercises because they were too nervous, too young, or physically or mentally incapable of conducting the time use exercise. In total, 167 water carriers completed time use exercises. In addition, we pilot- tested 10 pictorial diaries with water carriers, though these participants were not randomly selected from the larger group.

Section 5. Results from field tests

Table 3 below presents summary statistics for the study site for both villages. The average household size across villages is 5.8 persons. Approximately half of the household members were under 16 years of age. Females received less education than males at 1.9 years compared to 2.3 years, and among household heads the average highest educational attainment is 2.8 years across villages. In our sample, 45 percent of homes owned at least some kind of timekeeping device such as a clock, mobile phone, or wristwatch. Only one household reported owning a clock, and approximately 6 percent reported owning a mobile phone. Nearly half the households reported owning a watch. It should be noted, however, that the household head primarily wears the watch, and in some cases the watches themselves were no longer functioning. Clocks are the only time keeping device that all household members can use, and because clocks are nearly nonexistent in our sample it is likely that many household members did not regularly keep track of “clock” time.

The literacy rate is 32 percent across villages for all ages, but rates vary by gender. For adult women above 16 years of age the literacy rate is 22 percent, less than half of that of adult men at 52 percent. For school-age household members (those above 7 but below 16 years of age) the literacy rates are nearly identical across genders at 45 percent and 44 percent for females and males, respectively. This suggests that in our random sample nearly 80 percent of the adult females would be unable to complete a traditional time diary, and approximately half of school-age children would be unable to do so.

¹⁰If either the head of household or spouse were not present, the survey team attempted to find individuals in the fields or other places of work. The survey team attempted to contact the household a second time before drawing the next household from the sample to count towards the 30 percent goal. Non-response rates in the 2009 survey were 3 percent in Tutekunche and 4 percent in Bishikiltu.

¹¹One study in rural Sub-Saharan Africa elicited time use data from children as young as 6 years of age, but this study relied on open-ended or freeform recall of previous day activities or used parent-assisted recall (Mueller 1984).

Table 4 below presents summary statistics for the water collectors who conducted the PRA exercise. Eighty-nine percent are female. The average age is 26 years old, and nearly a quarter were under 16. The highest school grade attained is 2.67 years, and only 13 percent report being literate. Reported literacy rates for primary water carriers were 7 percent lower than the average adult female literacy rate, and 4 times lower than the average adult male literacy rate, suggesting that water carriers may be an especially difficult population with which to capture time use data using standard time use methods.

The majority of participants report also collecting water during the dry season. In addition, approximately 75 percent of participants report working on the family farm and 7 percent report working outside the household. Finally, participants spend, on average, 15 hours awake.

Table 5 below presents the average amount of time spent on each activity for water carriers for the PRA exercise. For simplicity we also report five broader categories that collapse the 15 activities: household labor, income labor, personal care, social activities, going to the market, and water collection. For instance, we summed the proportion of time spent on food preparation, wood collection, household chores, and childcare to create the household labor category. Water collection takes, on average, 9.7 percent of reported time, while household labor takes 37 percent of their time. Time spent farming occupies, on average, approximately 9 percent of a participant's time spent awake, while social activities take an average of 21 percent their time. Reported time allocations are representative of what has been found in other studies of time allocation (Kes and Swaminathan 2006), suggesting that the method is reasonably reliable.

The data collected in the field suggest that respondents took the exercise seriously and made a good faith effort to report their time use accurately. Forty-seven percent of respondents chose to reallocate pasta after their initial allocation. Based on the enumerator's rating of the interview, only 5 percent of respondents did not take the exercise seriously, and 10 percent did not understand the exercise. Those who did not take the exercise seriously were, on average, younger (23 years old vs. 26), had lower levels of school attainment (0 years versus 2.69), and were less likely to be literate (0 percent literate versus 33 percent). Respondents whom the enumerators felt did not understand the exercise also tended to have lower levels of education and literacy (though there was no difference in ages). This similarity is not surprising since respondents who were confused by the exercise may have also appeared to the enumerator to be unserious about it; the correlation between the two measures was 0.72. Even with a simplified, pictorial approach, illiterate respondents may need more practice and debriefing with the macaroni exercise to ensure their understanding.

Melina method results

Table 6 below presents the sequential time use data from the ten respondents who completed the pictorial diary. Each row represents one respondent, and the numbers refer to the activity category given in the legend. For example, respondent 1 woke at 6:30, spent most of the first 30 minutes preparing food, spent the next hour on "coffee ceremony, social or religious," the following 90 minutes again preparing food, and then the next seven hours doing farm work. She collected water two and a half hours in the afternoon. We include the table not to imply

that it is representative of women's time use in our study site, but to illustrate the type of temporal data – elicited without recall bias – that is possible with this method.

Blank cells indicate missing data; although all ten respondents completed at least part of the diary, some parts of the day were missing for six of the ten respondents. One of these respondents reported that conducting the diary was overly burdensome, and expressed concern about ruining or destroying the time diary itself during the day and thus stopped midday. Our incompleteness rate may seem high; however, other research has shown that attrition using time diaries is much higher than previous day recall due to the burden of the survey instrument. For instance, attrition was approximately 60 percent in the Multinational Time Use Study (Gershuny 2000). Researchers here face a tradeoff between avoiding recall bias and jeopardizing the external validity of their findings with high attrition rates. Increasing the size of participation gifts or payments may compensate respondents for the additional burden and decrease attrition.

The enumerators conducted random checks during the day to confirm that respondents were in fact conducting the exercise and not filling out diaries at the end of the day. During the debrief, enumerators asked respondents what time they woke up and went to bed in order to roughly recreate the day. Some respondents reported being awake more hours than shown in their time diaries. Despite these discrepancies, most respondents reported that their completed diaries seemed accurate.

Section 6. Discussion

There is increasing interest in time use data from LDC populations, and we argue that there is a need for methodological improvements. In this paper we propose two pictorial methods that we feel have promise for time use researchers. They are simple to implement and do not rely on respondents' literacy or familiarity with clocks or watches. Our diary approach suggests a way to minimize recall bias in illiterate populations, though clearly it will need more widespread testing. Though these approaches will be more expensive to conduct than simple activity-based recall questions, they provide much richer data and are less costly in time and money than direct observation approaches.

We acknowledge limitations with both methods. The PRA method does not collect the temporal order of activities and contextual factors, although these data could be collected through a qualitative interview after the respondent has finished the PRA exercise. One limitation of the diary is that we observe only 30-minute time increments. Although shorter time intervals may be preferred and most national time diary studies use 10–15 minute increments, this clearly imposes an additional burden on respondents. Thirty-minute increments have also been used in South Africa and Nicaragua (Apps 2002).

The pictorial diary used in this pilot was relatively simple, and as a result it does not capture other data, particularly simultaneous activities. A more complex diary instrument could be developed to capture some of these missing elements. For instance, a diary might have another set of stickers for secondary activities (perhaps with a different color), or stickers representing what friends or household members were present, or where the activity took

place. The diary might also be administered via a preprogrammed smart-phone, which could allow for simple menu options to capture some of these other elements.

The drawback, however, is that each additional component increases the complexity of the survey instrument and the required learning curve. Research has shown that there is a tradeoff with respect to the resolution and specificity of data and respondent burden and potential attrition (Gershuny 2000). The burden here is the cognitive complexity of the instrument rather than the length of time that a respondent is asked to keep a diary. If an instrument is too complex it may discourage participation disproportionately among a subset of respondents that may be systematically different from the intended target population.

A final limitation results from the use of pre-coded activities. Some categories such as socializing are broad and essentially contain all other activities that are not covered in the 14 other activity cards. This can create problems if certain activities are distinct and have more weight than others in the grouped category. For instance, an individual may attend church regularly – perhaps 1 to 2 hours per day – and it is assumed that church has equal social importance and is a substitute for 1 to 2 hours spent on other social activities. Using pre-coded activities also may make cross-country comparisons more challenging, or even comparisons within a country where distinct ethnic groups exist with differing cultural and social norms that shape the way an activity is defined or perceived.

Supplementary appendix (for “Pictorial approaches for measuring time use in rural Ethiopia”)

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Table 1

Existing methods for time use data collection

Methodology	Strength	Weakness
Direct observation	<ul style="list-style-type: none"> No recall bias issues “Gold standard” No requirement for literacy or a Western concept of time 	<ul style="list-style-type: none"> Hawthorne effect Difficult to get large sample High cost and time intensive
Diary method	<ul style="list-style-type: none"> Minimizes recall bias Can measure primary and secondary activities Can measure present company Can measure temporal order 	<ul style="list-style-type: none"> Literacy requirement Survey instrument is complicated and can be overly burdensome May require familiarity with a western concept of time
Recall method	<ul style="list-style-type: none"> Standard survey question and has been used widely in literature (lots of validity testing) Can measure temporal order of activities 	<ul style="list-style-type: none"> Room for “major” recall bias depending on length of recall period Mainly for primary activity Assumes participant can conduct necessary mental calculus Assumes participant is familiar with a Western concept of time
Experience Sampling Method (ESM)	<ul style="list-style-type: none"> Measures quality of time Measures degree to which one’s activity/attention are divided Measures affective data 	<ul style="list-style-type: none"> Temporal order lost “Advanced” technology used Can be overly burdensome

Table 2

Activity card titles and descriptions

Activities	Description
Eating	Time spent eating meals, including breakfast, lunch, and dinner. Do not include time spent preparing food.
Preparing food or coffee	Time spent preparing food, including baking injera and bread, roasting cereals, and preparing coffee ceremonies.
Collecting water	Time spent collecting water, including the time spent walking from the house to the water source, the time spent waiting to fill the container, and the time spent walking home.
Collecting firewood	Time spent collecting firewood. This includes the time spent walking from the house to the area where you collect and back.
Household chores	Time spent on chores you do at home, like sweeping, washing dishes and utensils, tidying, collecting dung, and working with animal dung. Do not include time spent cooking or preparing food.
Caring for children	Time spent caring for children, including breastfeeding, bathing children, dressing children, but does not include time spent caring for sick children
Going to the market	Time spent traveling to the market and back, as well as time spent at the market.
Agricultural work and farming	Time spent for farming work including plowing, sowing, weeding, harvesting, and hoeing.
Caring for animals	Time spent taking animals to graze or drink.
Other work	Time spent on other physical work like repairing houses, fences, or building shelters.
Coffee, social, or religious gatherings	Time spent socializing, attending coffee ceremonies, attending Idur ^a and Ikub ^b meetings, going to church, attending funerals, and relaxing by yourself.
Washing and bathing	Time spent bathing and washing your own clothes or body. If you wash at the river or spring, include the time spent walking there and back.
Sanitation, including time spent defecating	Time spent defecating. This includes time spent walking to find a suitable spot and walking home for open defecation. Do not include if it was part of another trip (i.e., collecting firewood or water, working in the fields).
Visiting or caring for the sick, including individuals that may have been ill	Time spent caring for people in your household who are sick, or any time spent visiting a health clinic, including the time traveling to the clinic and back home.
Playing (for children <15)	Time spent on games and fun activities, playing with other children.

^a Meetings where community members meet to deposit money for funerals or other life expenses

^b Meetings where community members meet every Sunday to deposit and collect money on a turn-by-turn basis

Table 3

Household summary statistics

	Bishikiltu	Tutekunche	All
<i>n</i> (Households)	76	73	149
<i>n</i> (Individuals)	425	451	876
<i>n</i> (PRA)	145	118	263
<i>n</i> (PRA with water carriers)	92	75	167
Average age	21	20	21
Percent male	53	52	53
Average household size	5.5	6.1	5.8
Average number of household members under 16	2.7	2.9	2.8
Average education (highest grade attained)	2.7	2.7	2.7
Males only	3.3	3.1	3.2
Females only	1.9	2.3	2.1
Household head	3.0	2.7	2.8
Adults (age 16 or older)	3.0	3.6	3.4
Percent literate ^a	35	29*	32
Adult male	55	49	52
Adult Female	19	25	22
School-age (ages 7 to 16)	60	30***	45
Percent owning clocks	0	1.3	0.67
Percent owning watches	46	41	43
Percent owning mobile phones	2.6	9.5	6.0
Percent owning any timekeeping device	47	43	45
Average income from agriculture ^b	241	227	234
Average non-farm income ^{b,c}	36	53	45
Percent rent land to others	18	6.8*	12
Percent rent land from others	31	42	36
Number of kerts owned	7.0	8.3	7.6
Number of kerts farmed	5.9	8.0**	6.9

*
p<0.05,**
p<0.01,***
p<0.001, two-tailed t-test

^aThe household head reported the level of literacy for each household member. Literacy is reported as can read easily, with difficulty, or not at all. Household members are considered literate if they answered that they could read easily.

^bValues are presented in United States Dollars (USD) with an exchange rate of 1 Ethiopian Birr =0.0881 USD using the July 2009 exchange rate.

^c23 percent of Bishikiltu and 21 percent of Tutekunche households reported nonfarm income.

Table 4

Summary statistics for water collectors who completed PRA exercise

		SE
Percent female	89	2.3
Average Age	26	1.0
Average highest grade attained (years)	2.6	0.26
Percent wood collector	41	3.8
Percent literate	13	2.6
Average number of trips to collect water the previous day	1.4	0.061
Percent that used a donkey to collect water yesterday	11	2.4
Percent who also collect water during the dry season	90	2.2
Percent who also work on family farm	76	3.2
Percent who work outside the home	7.7	2.1
Average hours awake	15	0.87
Percent under 16 years old	23	3.2
<i>n</i>	167	

Table 5Percent distribution of time for household water collectors^a

	Mean	SE
Food prep	14	0.69
Wood collection	6.4	0.75
Household chores	10	0.52
Childcare	6.5	0.75
All HH labor	37	1.3
Farming	9.6	1.28
Animal husbandry	5.1	0.82
Other labor	1.0	0.38
All income labor	15	1.5
Bathing	6.1	0.32
Sanitation	2.8	0.16
All personal care	8.9	0.43
Eating	6.5	0.19
Socializing	12	0.67
Caring for sick	0.31	0.12
Playing (<15)	1.2	0.33
All social activities	21	0.75
Market	6.8	1.1
Water collection	9.7	0.54
<i>n</i>	167	

^aBold sections denote broader categories

Table 6

Pictorial diary data

	6:00am	6:30am	7:00am	7:30am	8:00am	8:30am	9:00am	9:30am	10:00am	10:30am	11:00am	11:30am	12:00pm	12:30pm	1:00pm	1:30pm	2:00pm	2:30pm	3:00pm	3:30pm	4:00pm	4:30pm	5:00pm	5:30pm	6:00pm	6:30pm	7:00pm	7:30pm	8:00pm	8:30pm	9:00pm	9:30pm	
Respondent ID	1		2	11	11	2	2	8	8	8	8	8	8	8	8	8	8	8	8	8	8	3	3	3	3	3	3	5	5	5	5	12	12
	2	2	2	1	11	11	3	4	4	4	4	4	4	4	4	4	4	4	4	4	12	2	2	2	2	2	2	1	2	2	5	10	12
	3			5	2	13	2	5	12	6	9	5	11	11	10	3	1	11	11	11	11	11	11	11	11	11	11	11					
	4			9	13	5	12	2	2	2	2	2	1	4	4	4	4	4	3	5	7	7	7	7	7	7	7						
	5			5	2	2	2	3	4	4	2	5	1																				
	6	13	12	5	3	14	5	2	1	2	6	11	11	9	12	5	5	10	7	3	2	5	6	12	12	13	1	11	10				
	7	13	12	5	3	1	2	11	11	10	10	10	10	10	10	2	2	2	2	9	9	9	9	9	9	13	12	1	10				
	8	13	2	2	2	1	5	11	11	11	12	12	3	3	3	3	3	1	1	4	4	4	9	13	1	14	5	5	5	5	5		
	9	13	6	12	3	11	2	2	5	1	9	3	3	3	3	12	7	7	7	1	7	7	2	2	2	2	5	1	2	2	6	12	
	10	5	12	8	8	8	6	1	11	3	6	13	3	8	8	8	8	8	8	2	2	2	2	1	2	2	2	2	2	2	2	6	

Key

1	Eating
2	Preparing food or coffee
3	Collecting water
4	Collecting firewood
5	Household chores
6	Caring for children
7	Going to the market
8	Agricultural work and farming
9	Caring for animals
10	Other work
11	Coffee, social, or religious gatherings
12	Washing and bathing
13	Sanitation
14	Visiting or caring for the sick