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ABSTRACT

We analyze time use studies to describe how people allocate their time as they age, especially among paid work, unpaid work, leisure, and personal care. We emphasize differences in time allocation between older (i.e., those aged 65+) and younger people; between developed and developing countries; and by other demographic characteristics such as gender, marital status, health status, and educational attainment. We summarize related economic literature and crystallize a framework for thinking about key conceptual issues involving time allocation over the life cycle. We conclude by assessing the adequacy of global data resources in this area and by discussing some promising opportunities to fill salient gaps in the literature.

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1. Introduction

Growing life expectancy implies that older people (i.e., those aged 65+) will live for many years after retirement. Globally, life expectancy at age 65 grew from 11 years in 1950–1955 to 17 years in 2015–2020. In high-income countries, which have relatively older populations than lower-income countries, life expectancy at age 65 was 20 years in 2015–2020 (UN DESA, 2019). Given rapid global population aging, rising costs to households and governments of older people’s dependent support, and the importance of time use for well-being, a crucial research question is how older people spend their time. To what extent do older people participate in market activities? How much do they replace paid work with, respectively, leisure and nonmarket productive activities such as childcare?

This paper describes age variations in time use patterns across countries at different stages of development. Using time use diaries from a set of countries included in the Multinational Time Use Study (MTUS: Austria, Canada, France, Hungary, Italy, Netherlands, Republic of Korea, Spain, United Kingdom, and United States), in addition to China and India, we show that the age profile of time use activities is similar across countries. Time spent on paid work decreases with age, while time spent on leisure and personal care (and to a lesser extent unpaid work) increases with age. The main differences between China and India on one hand, and the MTUS countries on the other, concern the amount of time spent on various activities. Across all ages, people in China and India devote more time to paid work than people in the MTUS countries and less time to leisure and unpaid work. While most of the empirical literature on time use focuses on high-income countries (a notable exception is Kan et al., 2021), the paper compares countries at different levels of development.

The paper is organized as follows. Section 2 reviews the economic literature on how people allocate time as they age. Section 3 describes time use diaries, the main mode of time use data collection. Based on time use diaries from the countries previously listed, in Sections 4 and 5 we derive some stylized facts about time use patterns across age groups and across other sociodemographic characteristics. We end by discussing research needs and promising venues of research related to time use among older people (Section 6).

2. Literature Review

This section reviews the economic literature on time allocation, with a special focus on theoretical work on how time use evolves as individuals reach old age.

The modern economic theory of time allocation traces back to the seminal work by Becker (1965), “A Theory of the Allocation of Time.” The theory assumes that household utility depends on the consumption of market- and home-produced goods and services and leisure time (collectively, full consumption). In this framework, the optimal time allocation between work and nonwork activities depends on households’ preferences, the cost of each activity, and time and income constraints. Economists have used the theory to explain work choices, retirement patterns, and the impact of public policies (e.g., increase in legal age of retirement, level of pension benefits, incentives to retire early) on retirement decisions (Blundell et al., 2016).

As individuals reach old age, they cut back on paid work (Hamermesh, 2019). This partly reflects declining health (French, 2005; Capatina, 2015; Bloom et al., 2014) and retirement incentives from private pensions and public policies (e.g., Gruber and Wise, 1999; Brown, 2013; Fetter and Lockwood, 2018; Giesecke and Jäger, 2021). The human capital formation literature sees paid work as a form of investment in skills and experience (Ben-Porath, 1967; Mincer, 1974). Concentrating paid work in youth and middle age allows individuals to enjoy the returns of this investment for longer time horizons. In contrast, the human capital of older people (and thus their wages) declines more rapidly than for younger individuals because spending time on paid work in old age has fewer long-term returns. Cutting back on paid work may also result from life-cycle optimization behaviors (French, 2005; French and Jones, 2011). Young people have liquidity constraints and work to build up a buffer stock of savings. As people grow older, their wealth increases, their health worsens, and their wages tend to decrease. Thus, the overall benefits of supplying labor fall, and people devote more time to nonmarket activities. Within-family spillovers likely play an important role in retirement decisions. Couples tend to retire together if they share similar preferences for leisure (e.g., Blau and Riphahn, 1999; Gustman and Steinmeier, 2000; Baker, 2002). Although the most common retirement pattern (at least in developed countries) is an abrupt transition from work to full retirement, a significant share of older individuals works beyond the official retirement age and gradually moves from a full-time job to full retirement through part-time “bridge jobs” (e.g., Gustman and Steinmeier, 1986; Ameriks et al., 2020).

The economic literature on household production holds that the division of tasks within a household reflects comparative advantage, with women devoting relatively more time to unpaid work than men because of social norms or fewer labor market opportunities (see Chiappori and Mazzocco, 2017, for a recent review). The gender gap in household production seems to persist to some extent to older ages. When one or more individuals in the household retire, the share of nonmarket discretionary time devoted to home production does not change significantly (Rogerson and Wallenius, 2019), although the absolute gender gap tends to decline due to the increase in nonmarket discretionary time (Leopold and Skopek, 2015).

The empirical literature on time allocation of older adults is growing. The main findings are that older people tend to devote less time to physically demanding leisure activities and more time to home-based and family-related activities (Gauthier and Smeeding, 2003); they are also more likely to spend time on passive leisure activities (e.g., watching TV) and on religious activities (Hamermesh, 2019). In addition, social leisure activities and exercise appear positively correlated with cognitive and physical functioning and with subjective well-being (Sala et al., 2019; Steptoe and Fancourt, 2019).

3. Data Resources

The main mode of time use data collection is a time use diary, and all our analyses in this paper are based on this type of data (Frazis and Stewart 2012). A diary is a sequential record of all activities respondents carry out during a specific 24-hour period. Additional information collected in diaries include activity locations, co-participants, any information technologies or modes of transportation used, and demographic information about diarists (e.g., age, sex, educational achievement, health status). Diaries may also report secondary activities, if any, performed with the primary activity (e.g., eating while watching TV). Diaries can be either self-administered (e.g., as recommended by the Harmonized European Time Use Survey guidelines), or collected through personal or phone interviews (e.g., as typically done in developing countries). Interview-based time use surveys ask respondents to recount what they did on the prior day. In contrast, self-administered diaries are typically filled out in real time.² Time use surveys often differ in the

² That is, whenever a respondent stops performing one activity and starts performing another during an appointed diary day, she writes in her diary the new activity and the time she began doing it.

number of diaries that each respondent is asked to complete (e.g., in the Netherlands respondents keep a seven-day diary, while the American Time Use Survey gathers one single diary per respondent). In addition, large-scale surveys typically sample their populations' time use at all points in the survey's reference year, while smaller surveys may be unable to undertake data collection outside of a specific season.

Table 1 lists some main sources of publicly available time use data. With few exceptions (e.g., the Feed the Future project), time use surveys represent a country's population, although information on older people can be sparse (e.g., due to small sample sizes among older people and top coding of individuals' ages). Time use surveys typically include only noninstitutionalized individuals, which prevents a complete picture of time use patterns among older people. In addition, most time use data come from developed countries, while less is known about how people (especially older people) spend their time in less developed settings.

Most sources cited in Table 1 refer to microdata. Additionally, many countries provide aggregate statistics on time allocation, with various degrees of granularity in terms of, e.g., size of the age groups or disaggregation by sociodemographic characteristics (Charmes, 2019). For example, China's National Bureau of Statistics provides aggregate statistics on time use by five-year age groups, while other countries only provide information by broader age groups.

Table 1. Main sources for time use data

Source	Country-Years	Data Type
American Time Use Survey https://www.bls.gov/tus/	United States (2003–present)	Microdata
Counting Women’s Work https://www.countingwomenswork.org/	Colombia (2012), Ghana (2009), India (1999), Mauritius (2003), Mexico (2014), Senegal (2011), South Africa (2010), United States (2009), Uruguay (2013), Vietnam (2015)	Integer-age aggregates
Harmonized European Time Use Survey https://ec.europa.eu/eurostat/web/time-use-surveys	Austria (2008–2009), Belgium (2012–2013), Estonia (2009–2010), Finland (2009–2010), France (2009–2010), Germany (2012–2013), Greece (2013–2014), Hungary (2009–2010), Italy (2008–2009), Luxembourg (2014–2015), Netherlands (2011–2012), Norway (2010–2011), Poland (2012–2013), Romania (2010–2011), Serbia (2010–2011), Spain (2009–2010), United Kingdom (2014–2015)	Microdata
Multinational Time Use Study https://www.mtusdata.org/mtus/	Austria (1992, 2008), Bulgaria (2001), Canada (2005, 2010, 2015), France (1985, 2009), Hungary (1999, 2009), Israel (1991), Italy (2002, 2008), Netherlands (1975, 1980, 1985, 1990, 1995, 2000, 2005), Republic of Korea (2004, 2009), Spain (2002, 2009), United Kingdom (1974, 1983, 1987, 1995, 2000, 2005, 2014), United States (1965, 1975, 1985, 1993, 1995, 1998, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019)	Microdata
Feed the Future https://data.usaid.gov/browse	Malawi (2015), Mozambique (2015), Nepal (2015), Rwanda (2014–2015), Uganda (2015)	Microdata

The MTUS list of country-years contains only datasets freely accessible through MTUS-X (<https://www.mtusdata.org/mtus/>).

Activities can be classified in four main broad categories: paid work, unpaid work, personal care, and leisure (Table 2).³ Paid work includes all time spent working on a main job, second jobs, and overtime and the time spent on ancillary activities to paid work (e.g., commuting time and work-related meals). Two criteria define unpaid work. First, it must not generate personal or household income. Second, it must satisfy the third-party principle: It is an activity someone else (a “third party”) could be paid to do.⁴ Unpaid work includes, for instance, child and elderly care, cooking, shopping, and volunteering. Personal care includes all biological necessities, such as eating, sleeping, bathing, receiving medical care, and engaging in sexual activity. Finally, leisure includes all those activities that are not biological necessities and do not satisfy the third-party principle. Examples are reading, running, and going to a concert.⁵

One of the main challenges in analyzing time use data is the lack of a complete harmonized definition and classification of activities across countries. This creates uncertainty in international comparisons of time use patterns. For example, in many countries adult care is classified under general household chores instead of having its own category (Charmes, 2019). Resting/relaxing is not disaggregated from sleeping in some cases (e.g., in the Feed the Future surveys or the 2008 China Time Use Survey), while other surveys record it separately. Although travel time should in principle be added to the time spent in a specific activity, some surveys report it as a single separate category that cannot be easily associated with any activity (e.g., in the Feed the Future surveys). In addition, some surveys include country-specific activities that highlight national social norms or specific objectives of the study. For example, Finland’s Harmonized European Time Use Survey data contain a code for sauna bathing that other European countries do not replicate.

³ An additional category not included here is time spent on education.

⁴ For simplicity, in the analysis we categorize time spent accessing government services and performing civic duties as time spent on unpaid work, even though certain aspects of these activities may not satisfy the third-party principle—for instance, one cannot pay someone else to testify under oath or attend a passport renewal interview in one’s place.

⁵ In the analysis, we categorize religious activities as leisure, notwithstanding the opportunities to pay someone to pray on one’s behalf.

Table 2. Definition of main time use categories

Category	Principle	Examples
Paid work	Labor market activities and ancillary activities to paid work	Primary/secondary employment Unpaid work generating household income Business travel Searching for paid work Commuting to/from work
Unpaid work	Activities that (i) do not generate income and (ii) others could be paid to do	Domestic housework (e.g., cooking, washing up) Gardening Shopping Child/elderly care Volunteering Accessing government services Related travel
Personal care	Biologically necessary activities	Sleep Eating and drinking Bathing Receiving medical care Sexual activity Related travel
Leisure	Activities that (i) are not biologically necessary and (ii) others cannot be paid to do	Active leisure (e.g., exercise, attending a concert, religious activities, reading, conversation) Passive leisure (e.g., watching TV, relaxing) Related travel

The aforementioned broad time use categories can overlap to a considerable extent. For example, parents engage in recreational activities with their children while also exercising supervisory care responsibilities. Individuals who work in the informal sector might simultaneously engage in household production activities and supervising children and elderly. Generally speaking, people may fulfill multiple responsibilities simultaneously, and often caring for others is not reported as the main activity performed. This complicates estimating time devoted to unpaid work.

Access to time use microdata mitigates the harmonization problem because the granularity of activities allows researchers to create custom time use categories that are to some extent comparable across countries, years, and survey designs. If the microdata provide information on

secondary activities or on co-participants, getting a better picture of the overall time spent on unpaid work would also be possible (UN Women, 2021). But many countries (especially less developed countries) provide only aggregated time use data, and these tabulations differ in terms of aggregation of time use categories, treatment of missing values or outliers, and descriptive detail about the methodologies used to compute the statistics.

Time use surveys based on diaries are, to our knowledge, exclusively cross-sectional: respondents' time use is observed only once. The impact of aging on time use can only be inferred by comparing time allocation across various age groups at one point in time. This is suboptimal because cohort effects may confound the impact of aging on time use.

Instead of employing time use diaries, some countries (e.g., most Latin American countries) adopt activity-list surveys, where respondents face a list of activities and have to report whether they spent any time on them in the past. Activity-list surveys are considered less reliable and accurate than diary-based surveys (Bonke, 2005), although they tend to give more prominence to recording of time spent on care (typically a secondary activity) because there is no time constraint (UN Women, 2021). Other sources of time use data are labor force and household surveys. These shed useful light on patterns of labor supply and retirement, but are typically uninformative on time allocation to nonmarket activities and do not take the form of a complete diary. The family of health and retirement surveys (<https://g2aging.org/>) also includes information on activities performed by older individuals, e.g., whether they engage in paid work or in nonmarket productive activities. For example, the Consumption and Activity Mail Survey Module of the U.S. Health and Retirement Study collects data based on recalling the amount of time that respondents spent on a predefined set of activities in the last week/month.

Table 3. Characteristics of the countries included in the analyses

Country	Source	Reference Year	GDP per Capita (2015 USD)	Life Expectancy	Retirement Age (Men)	Retirement Age (Women)	Sample Size (% 60+)
Austria	MTUS	2008	44,422	80.1	65	60	8,234 (26.6%)
Canada	MTUS	2005	38,573	80.8	65	65	19,597 (25.5%)
Canada	MTUS	2010	41,155	81.8	65	65	15,390 (33.5%)
China	NSA	2008	4,712	73.7	60	60/55/50*	37,142 (N/A)
France	MTUS	2009	35,117	81.0	60	60	16,239 (30.3%)
Hungary	MTUS	1999	8,564	70.9	61	55	11,404 (29.8%)
Hungary	MTUS	2009	11,167	73.7	62	62	8,390 (28.8%)
India	NSA	1998–1999	695	61.5	55**	55**	63,265 (8.2%)
Italy	MTUS	2002	32,985	80.3	65	60	51,206 (23.9%)
Italy	MTUS	2008	33,517	81.5	65	60	40,944 (28.2%)
Korea, Rep. of	MTUS	2004	20,361	77.2	60	60	31,634 (17.2%)
Korea, Rep. of	MTUS	2009	23,948	79.5	60	60	20,263 (18.4%)
Netherlands	MTUS	2000	40,441	78.7	65	65	1,813 (20.8%)
Netherlands	MTUS	2005	42,185	80.2	65	65	2,204 (17.6%)
Spain	MTUS	2002	25,016	79.9	65	65	46,774 (26.9%)
Spain	MTUS	2009	25,769	81.2	65	65	19,295 (28.3%)
United Kingdom	MTUS	2000	39,229	78.4	65	60	10,573 (19.8%)
United States	MTUS	2003	50,054	77.2	65 and 2 mos.	65 and 2 mos.	20,720 (22.6%)
United States	MTUS	2009	51,870	78.2	66	66	13,133 (25.6%)

NSA = National Statistical Agency.

Sources of data: World Development Indicators for GDP per capita, <https://databank.worldbank.org/source/world-development-indicators>; 2019 World Population Prospects for life expectancy, <https://population.un.org/wpp/>; “Social Security Programs Throughout the World” by the U.S. Social Security Administration for retirement age, <https://www.ssa.gov/policy/docs/progdesc/ssptw/>. The retirement age denotes the age at which someone meeting contribution requirements may access a full old-age pension. Retirees from arduous or hazardous work, especially miners, may be eligible for full pensions at lower ages.

* Professional women retire at 60; nonprofessional salaried women retire at 55; other women retire at 50.

** Retirement age data from 2002.

4. Patterns of Time Use by Age

This section reviews evidence on how older people spend their time and how this varies with age and gender. For harmonization purposes, most of the analyses are based on microdata from the MTUS project from Austria (2008), Canada (2005, 2010), France (2009), Hungary (1999, 2009), Italy (2002, 2008), Netherlands (2005), Republic of Korea (2004, 2009), Spain (2002, 2009), United Kingdom (2000), and United States (2003, 2009).⁶ Because these are all high-income countries, we supplement the analysis with microdata from the Indian Time Use Survey (1998–1999 wave) and aggregate statistics on time use from the 2008 Time Use Survey in China.⁷ Table 3 summarizes the data used in the analyses and provides country-specific sociodemographic information.

We focus on the four broad time use categories defined in the previous section: paid work, unpaid work, personal care, and leisure. The analysis includes only primary activities (i.e., activities that were the main focus of the respondents).⁸ Figure 1 plots the average time (in hours per day) spent on paid work, unpaid work, leisure, and personal care by people living in countries surveyed in the MTUS project and by people living in India and in China. For each time use category and country/region, we plot the distribution of time by age including only individuals between the ages of 25 and 75.⁹ In the case of China, we plot the age profile of time use by five-year age groups because of data availability. For India and the MTUS countries, we construct the age profile of time use starting from the microdata. Because the MTUS countries share similar age profiles of time use, instead of showing country-specific age profiles we construct an average age profile

⁶ MTUS is an ex post harmonized, cross-time, cross-national time use database with a common series of time use activities. Information on the harmonization procedures applied by the MTUS research team can be found here: https://www.timeuse.org/sites/default/files/2021-02/User%20Guide_2021.pdf.

⁷ The authors are grateful to Dr. Shen Ke of Fudan University for sharing the statistical summary of the 2008 Time Use Survey in China.

⁸ Compared with the classification provided by the original datasets, we made a few small adjustments to enhance harmonization across surveys. In the MTUS dataset, we categorized “gardening/picking mushrooms” as unpaid work instead of leisure, participation in religious activities as leisure instead of unpaid work, and consuming personal care services as personal care instead of unpaid work. In the Indian Time Use dataset, we reclassified “travel for job searching” as paid work instead of leisure, and we moved the following activities from personal care to leisure: light exercise; talking, gossiping, and quarrelling; rest and relaxation; and individual religious practices.

⁹ In the MTUS countries, data on time use are typically available from the age of 15 to the age of 80 (although 80 is often top-coded). The Time Use Survey in China includes people in the age group 15–74, and the India Time Use dataset includes individuals from the age of 6 to the age of 99. The age limits in Figure 1 are due to the fact that we adopted cubic splines regression methods to construct the age profile of time uses in India and in the MTUS countries. To prevent misbehavior of the splines near the extreme values of the age interval, we cut off the outer tips of the splines we present.

across all the MTUS countries considered in the analysis. The MTUS age profile can be interpreted as the typical allocation of time by age for people living in developed countries. The MTUS and India age profiles have been constructed through cubic spline regression methods (Dupont and Plummer, 2005).¹⁰ Average time spent on various activities reflect the zeros of individuals not spending any time on those activities.

Figure 1 presents two age profiles for the MTUS countries, corresponding to two different points in time (early versus late 2000s). We plotted two different time periods to improve comparability with the time allocation in India (1998–1999) and China (2008), respectively. In addition, the two MTUS curves allow us to look at temporal variations in time use, notwithstanding that the most recent time period (late 2000s) is close to the Great Recession of 2008.

We first look at time allocation in the MTUS countries. Figure 1 highlights some familiar trends in developed countries. Individuals spend a substantial amount of time doing paid work during their adult life. Paid work time sharply declines as individuals approach old age but remains significantly positive until the late 70s, suggesting that some people continue working even after the official retirement age, as the theory of optimal retirement timing suggests (Gustman and Steinmeier, 1986). Time devoted to paid work seems to dip slightly in the 30s, likely driven by the reduction in paid work among childbearing women.

The age profile of unpaid work has a double-humped shape, with peaks in the 30s and 60s and a trough in the 50s. As people age, part of the time devoted to paid work is reallocated to unpaid work. Compared with the trough in the 50s, time spent on unpaid work increases by about one hour per day among individuals aged 65 and over. Time devoted to leisure systematically increases

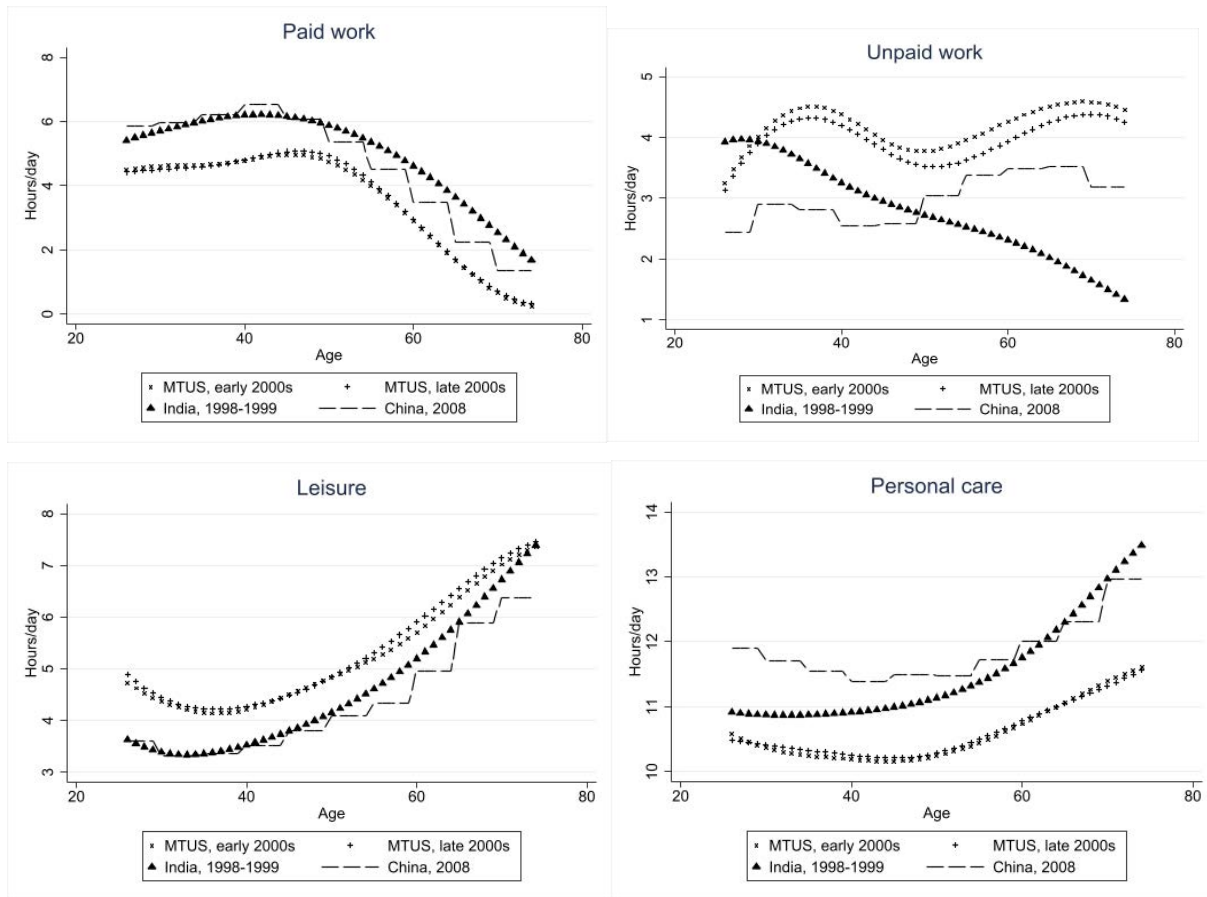
¹⁰ A cubic spline places “knots” of number k over the distribution of a continuous sample variable—in this case, age—and generates k minus 2 nonlinear (cubic) transformations of the age variable. Leveraging the time use diary microdata, we regressed the reported time use on k minus two nonlinear transformations (and the linear age variable and an intercept), thereby effectively fitting a distinct cubic function to the data lying in each “window” between consecutive knots. The result is a set of smooth, nonlinear fitted values that closely resemble the weighted sample average of time use by integer age, albeit with less sensitivity to sampling fluctuation.

The MTUS splines are formed around a core of five countries (Hungary, Italy, Republic of Korea, Spain, and United States) for which microdata are available from the early and late 2000s. The early 2000s sample is broadened by the inclusion of 2005 microdata from Canada and the Netherlands and 2000 microdata from the United Kingdom. Likewise, the late 2000s sample is expanded by the addition of 2008–2010 microdata from Austria, Canada, and France. Splines computed using these expanded samples present no significant differences in shape or level to splines computed using samples from the core five countries.

The graphical representations of time use by age are based on splines with five knots (Harrell, 2001). We tried different numbers of knots. The five-knots splines had the best fit in terms of lower root mean squared errors.

with age after reaching a minimum level in the 30s. On average across the MTUS countries, people age 60 and older spend more than six hours per day in leisure activities, compared with about four hours in the middle age. Time spent on personal care also increases with age. This likely reflects the higher incidence among older people of health conditions that restrict daily activity and mobility.

Figure 1. Patterns of time use by age in MTUS countries and India and China



The allocation of time by age has not substantially changed over time in the MTUS countries. The “early 2000s” and “late 2000s” age profiles have similar shapes for all time use categories. The main difference is a reduction in unpaid work time in the “late 2000s.” An increase in time spent on paid work and leisure mostly compensates for this reduction. The reduction in unpaid work is consistent with the results that (i) over time, women have on average devoted less time to unpaid

work activities, and (ii) both men and women devote more time to leisure activities than previous cohorts (Aguiar and Hurst, 2007). The increase in time spent on paid work is mostly due to increments among women, while men spend fewer hours on paid work activities in the late 2000s compared with the early 2000s (not shown here).¹¹ The reduction in male paid work is likely a consequence of the Great Recession in the late 2000s. The analysis cannot shed light on the causes of the change in time use patterns over time, in particular the relative contribution of social changes and of the Great Recession (Aguiar et al., 2013).

The results presented so far refer to developed countries. An open question is whether patterns of time use across age groups depend on the level of economic development. If we look at the age profiles of time use in India and China, we can see that, for most time use categories, the variation in time use by age does not differ significantly from the developed MTUS world. Indeed, the age profiles of time devoted to paid work, leisure, personal care, and to some extent unpaid work have similar shapes as those in the MTUS countries. The main difference concerns the average amount devoted to the various time use categories rather than the variations in this amount by age.

For example, although paid work declines with age, on average Chinese and Indian people spend more time on paid work activities than their MTUS counterparts over the entire life cycle; at old ages, the difference is almost two hours per day. Leisure seems to be a normal good: the greater the level of economic development, the larger the share of time devoted to leisure, especially among the younger age groups. In contrast, more time is devoted to personal care in India and in China than in the MTUS countries, suggesting that personal care technology constraints may increase the time required to perform some daily activities. This is especially true for individuals at older ages.

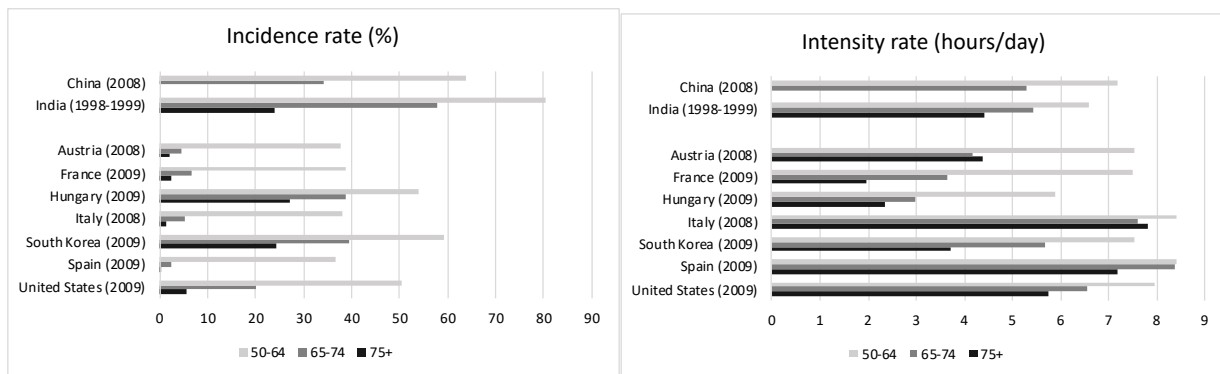
Individuals in China and India spend less time on unpaid work activities than their MTUS counterparts. This reflects men in China and India doing less unpaid work than their MTUS counterparts, while women's unpaid work is comparable across countries, at least at young ages. In addition, while the age profile of unpaid work in China resembles the double-humped shape in the MTUS countries, time devoted to unpaid work steadily decreases with age in India. This

¹¹ See also Figure 3, which shows that the gender paid work gap (i.e., the difference in the time spent on paid work between men and women) reduces in the MTUS countries over time.

reflects very low unpaid work among men and decreasing unpaid work among women as they age, perhaps due to social norms and intergenerational households.

A general finding from the previous analysis is the substitution of paid work with leisure and personal care as people age. Considering both the incidence and intensity of paid work can illuminate retirement patterns. Incidence is the percentage within a group of individuals doing some positive amount of paid work, while intensity is the average time spent on paid work by such individuals. Figure 2 depicts the incidence and intensity of paid work in China, India, and a subset of the MTUS countries. In most countries, incidence drastically drops after age 65, but intensity remains high though declining with age. As the literature stresses (e.g., Ameriks et al., 2020), two patterns of time use seem to emerge. Most individuals abruptly transition from full-time paid work to retirement (as shown by the abrupt decline in incidence with age), although a significant proportion seem to gradually move from full-time jobs to part-time jobs (as shown by the slow decline in intensity with age). Retirement patterns differ across countries, reflecting differences in norms and social security systems. For example, incidence in the 65–74 age group is 40 percent in Republic of Korea (2009) compared with 2.5 percent in Spain (2009). However, the intensity for the same age group in Spain is larger than that in Republic of Korea (eight and a half hours versus less than six hours), perhaps because flexible job arrangements among older people are more prevalent in Republic of Korea than in Spain.

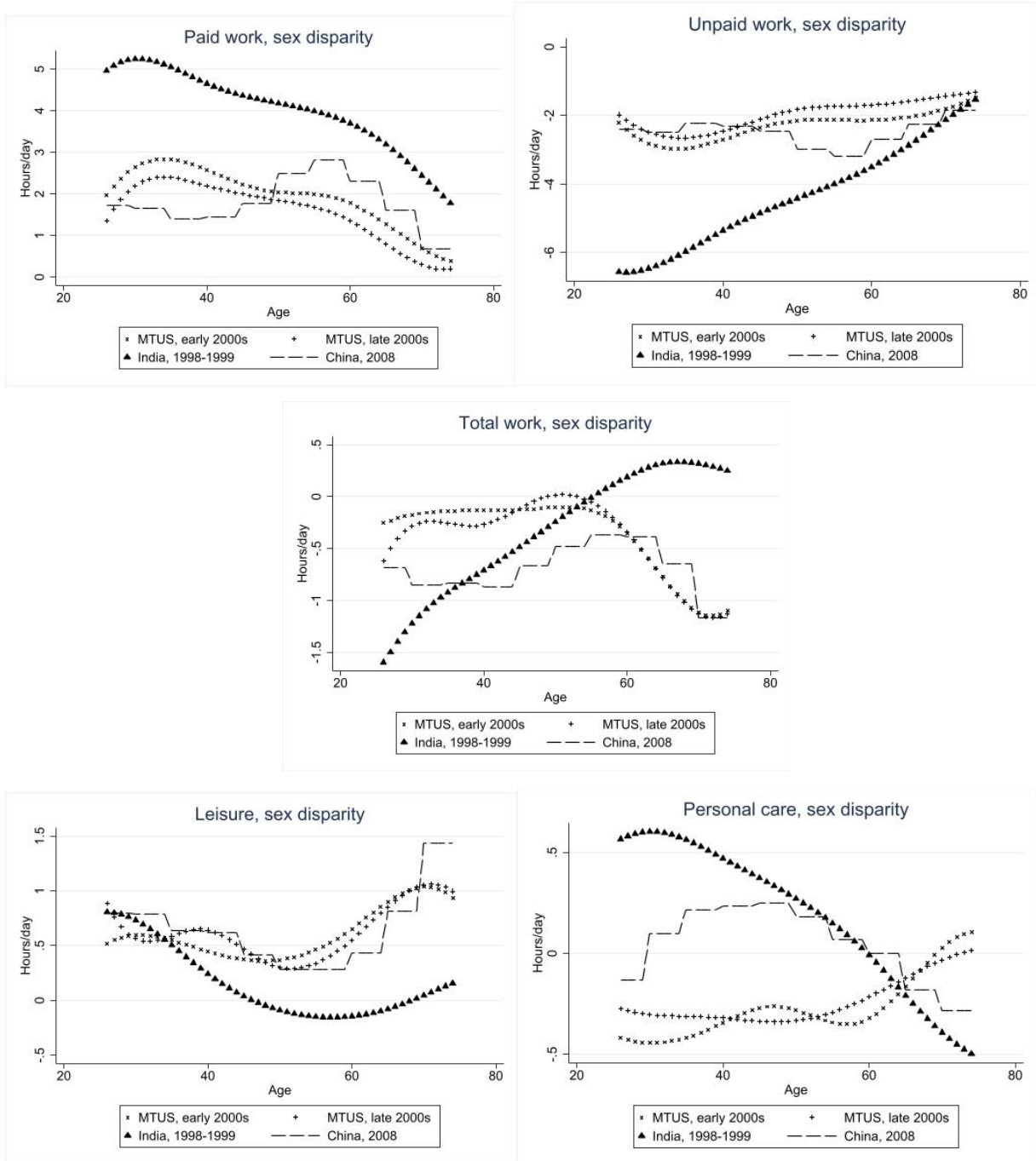
Figure 2. Incidence rate and intensity rate of paid work, selected countries



The literature on time allocation focuses mostly on differences in time use by gender. Figure 3 highlights gender-specific variations in market and nonmarket activities by age. For each

country/region, time use category, and age, the gender gap is defined as the difference between men and women in the average time (in hours per day) spent on a given activity.

Figure 3. Gender gap in time use by age in the MTUS countries and in China and India



In line with the intrahousehold specialization literature, men spend more time on paid work than women at all ages and in all countries/regions. In the MTUS countries, the gender gap in paid work declines with age until it almost disappears. Although decreasing with age, the gender paid work gap in India persists among older people: At age 70, Indian men report almost two hours per day of paid work more than women at the same age. In China, the gender paid work gap is largest around the retirement age, likely due to differences in retirement age between genders.

Throughout their lives, women spend more time on unpaid work than men (about two to three hours more per day) in China and in the MTUS countries, although the difference slightly declines with age. When considering both paid and unpaid work together (“total work”), women spend more time on work than men throughout their lives. In particular, women in old age spend almost one hour per day more on total work than men, roughly reflecting differences in unpaid work. India is the outlier, with the gender gap in unpaid work decreasing with age, and older men spending more time on total work than women. Once again, this is due to the fact that Indian women report a substantial reduction in time devoted to unpaid work as they age.

In China and the MTUS countries, men spend more time on leisure than women across the entire life cycle (about 30–60 minutes per day), and the increase in leisure time with age is steeper for men than for women, thereby explaining why the gender gap in leisure increases with age. Thus, men reallocate paid work time mostly to leisure activities. In contrast, in India the gender gap in leisure decreases with age. While women in the MTUS countries report more time devoted to personal care when young, there is no significant gender difference in personal care among the older populations. In contrast, in both China and India, younger men tend to report more personal care time than women, while the opposite occurs at older ages.

5. Patterns of Time Use among Older People by Sociodemographic Characteristics

The previous section discussed patterns of time use by age and gender. This section focuses on variations in time use among older people by sociodemographic groups. To enhance comparability, we focus only on pooled observations from the MTUS countries previously analyzed. Due to missing observations concerning some of the sociodemographic variables, the sample includes the following list of countries: Canada (2005, 2010), Spain (2002, 2009), Hungary

(2009), Italy (2002, 2008), Netherlands (2000, 2005), and United Kingdom (2000). Table 4 provides descriptive statistics. We consider individuals aged 60–79.¹²

Table 4. Demographic characteristics of the sample

Statistic	Mean/percentage	Standard deviation
Age	68.4	5.54
Weekday diary	54.3%	0.50
Incomplete secondary education	60.8%	0.49
Complete secondary education	22.0%	0.41
Postsecondary education	17.1%	0.38
Urban or suburban	66.6%	0.47
Female	54.0%	0.50
Married/partnered/cohabitating	69.4%	0.46
In good health	48.3%	0.50
Anglo-Saxon	22.0%	0.41
Southern European	66.2%	0.47
Western-Central European	11.9%	0.32

Complete diaries used in regression analysis count 51,540. To adjust for the presence of outliers in the reported time devoted to personal care (with some reporting 0 minutes), we dropped the first percentile of its distribution.

To investigate the sociodemographic determinants of time use, we regress time devoted to paid work, unpaid work, leisure, and personal care on age and age squared, gender, educational attainment (less than higher secondary education, higher secondary education, or more than higher secondary education), urban or rural residence, health status (good perceived health versus poor perceived health), and civil status (married/partnered versus single). We include survey year dummies and regional dummies to capture differences in social norms: Southern Europe (Italy and Spain), English-speaking countries (Canada and United Kingdom), and Western-Central Europe

¹² We exclude individuals aged 80 because 80 is top-coded (i.e., it stands for individuals aged 80 and older), and there may be a lot of indiscernible heterogeneity in that age group.

(Hungary and Netherlands). We include weights to adjust for sampling differences across and within countries, i.e., so that the 60–79 sample in each country represents the national age and sex distribution of the 60–79 population and the distribution of days in a week (five weekdays versus two weekend days), and so that each country-year sample is proportional to the 60–79 population of that country.

Figure 4. Differences in time use among older people (60+) by sociodemographic characteristics, MTUS countries (minutes per day)

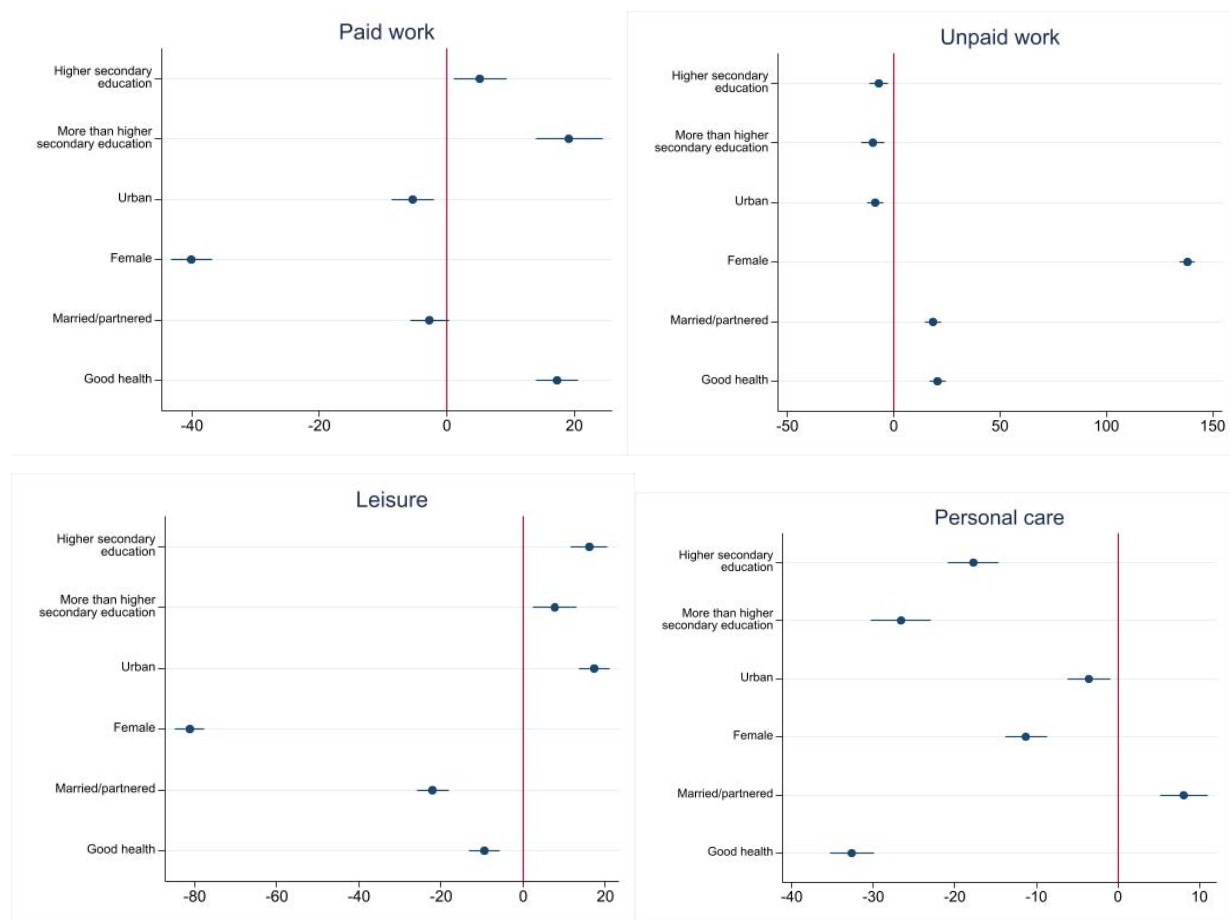


Figure 4 summarizes the results of multivariate regression models (OLS). The x-axis denotes minutes per day. As the previous analysis highlighted, older women spend more time on unpaid work and less time on leisure and paid work than older men. Older people with high education

spend more time on paid work and less time on personal care. However, educational attainment seems uncorrelated with unpaid work and leisure time among older people: Individuals with higher educational attainment spend about five more minutes a day on leisure than individuals with less than higher secondary education and five fewer minutes per day on unpaid work. Good health increases paid and unpaid work time and reduces personal care and leisure time. This last result may be because unhealthy older people spend more time on passive leisure activities (e.g., watching TV), while their healthy counterparts substitute passive leisure with recreational unpaid work activities (e.g., gardening or supervising children).

Overall, the descriptive analysis highlights significant sociodemographic variations in time use among older people.

6. Research Needs and Opportunities

We presented results on time use patterns as individuals age, with special focus on paid work, unpaid work, leisure, and personal care. In particular, we compared age-specific time use profiles for China, India, and a set of high-income countries (Austria, Canada, France, Hungary, Italy, Netherlands, Republic of Korea, Spain, United Kingdom, and United States). We showed that although people in China and India tend to spend more time on paid work than their MTUS counterparts across all ages (including among older adults), the age patterns of time use are similar. Older individuals substitute paid work with leisure and personal care and to a lesser extent with unpaid work.

The study has several limitations, often reflecting scarcity of time use data in general and especially among older people. Most publicly accessible microdata on time use come from developed countries, while information on less developed countries is sparser, especially information related to nonmarket time. Even though many countries provide some aggregate statistics on time use (Charmes, 2019), data are often not detailed enough to provide a precise picture of allocation of time by age or by other sociodemographic characteristics (e.g., health status and education).

Most importantly, harmonization and standardization in the definitions of time use aggregates across countries remain a challenge. In this paper, we mostly rely on data from the MTUS, where individual countries' time use surveys have already been harmonized. However, harmonization is

one of the main difficulties in international comparisons of time use statistics due to the absence of a system of harmonized classifications of time use activities. Efforts to improve international harmonization and comparison in time use statistics are under way (see, e.g., the International Classification of Activities for Time Use Statistics promoted by the United Nations Statistical Commission¹³), but for the time being some imprecision persists when performing international comparisons.

Some time use surveys do not collect data on the very old (e.g., 80+), and sample sizes of older people are relatively small in nationally representative surveys, making precision suboptimal. Health and retirement surveys (which focus on older populations) typically contain information on time use outside of paid work but do not use time use diaries.

Longitudinal data on time use are lacking. All time use surveys based on diaries are cross-sectional, preventing robust analysis of the impact of aging on time allocation. Comparing time uses across different age groups (as we do) risks confounding cohort effects with age effects.

Patterns of time use among older people are policy relevant. Here we mention some policy questions and venues of research related to time use. Policy evaluations require estimating policy impacts on individual well-being. Economic theories of well-being link such well-being directly to consumption activities and indirectly to production activities, and time use categories reflect these activity categories. Paid work determines the ability to purchase consumption goods and services, while time spent on unpaid work and leisure determines the consumption of home-produced goods and services and of recreational activities. Because time use patterns among older people reflect their well-being, such patterns help us understand if they are aging successfully and help us identify interventions that improve the health, emotional, and socioeconomic conditions of older populations.

An important class of policy evaluation applications is in health. Theoretical derivations of individual willingness to pay for health benefits such as quality-adjusted life years or reductions in mortality and morbidity risk show these willingness-to-pay expressions to be functions of lifetime trajectories in paid and unpaid work and leisure (see, e.g., Murphy and Topel, 2006). This

¹³ <https://unstats.un.org/unsd/demographic-social/time-use/icatus-2016/>

makes time use data relevant to cost-utility and cost-benefit analyses of health interventions like, say, vaccination.

The literature broadly recognizes the importance of including the value of time in policy evaluation. For example, if a new health clinic opens in the neighborhood, older people and their caretakers may save time when going to the doctor, and the spare time is a direct benefit of the intervention. When the spare time involves employees, it is common in industrialized countries to use pre-tax wages to value time (Baxter et al., 2017). When nonemployees consume time, nonmarket valuation approaches (e.g., stated preference approaches) are used to estimate the value of time. For example, in industrialized countries a reasonable estimate of travel time savings is found to be 50 percent of pre-tax wage (Boardman et al., 2011). Studies on the value of time in low- and middle-income countries are sparse (Whittington and Cook, 2019). Given the larger size of the informal sector, market wages are less indicative of the value of time for employees, and the assessment of the value of time has to rely mostly on nonmarket valuation approaches. In this context, time use diaries can provide complementary information on the value placed by individuals on different activities.

In this paper, we look at how time use in broad categories varies with age and other sociodemographic characteristics. It would be interesting to explore time use inequalities among older individuals across more fine-grained activities (e.g., active versus passive leisure and specific activities like sleeping, healthcare, and exercising), or inequalities across different days of the week or hours of the day, and how those patterns of time use affect inequalities in well-being. Further analyzing the correlation between time use and well-being would also be interesting. There are different ways to measure individuals' well-being. One methodology that has gained attention is subjective well-being, measured, e.g., in terms of life satisfaction, happiness, or purpose in life. Subjective well-being has been found to positively correlate with some uses of time, e.g., recreational activities (Stephoe and Fancourt, 2019). How does this association vary with age and across countries, and to what extent can the well-being of older individuals increase by extending the set of recreational opportunities for older populations? Subjective well-being increases with age (Blanchflower, 2020), which might in part correlate with differences in patterns of time use by age. Time use diaries typically lack measures of subjective well-being (a notable exception is the Well-Being Module in the 2010, 2012, and 2013 American Time Use Survey), but health and retirement surveys do, as well as some data on time use.

Another reason the study of time use is important relates to population aging and the fears that large unproductive and dependent older populations will greatly strain households, health systems, labor and capital markets, macroeconomies, and governments (in the form of caregiving, health care use, and public and private transfers). Evidence of paid or unpaid time use by older people can serve as a corrective to the entrenched picture of the elderly as an unproductive drain on society. Evidence of active aging (comprising paid and unpaid work and active leisure) is also evidence of older people enjoying a high quality of life and making productive contributions to society (Bloom et al., 2020).

The staggering health and socioeconomic impact of the COVID-19 pandemic is well-documented (Cutler and Summers, 2020). In particular, the pandemic has had profound, and possibly long-lasting, effects on our ways of working, shopping, and socializing. The mental health toll on older people has been significant due to prolonged isolation. The overall impact of COVID-19 on patterns of time use has yet to be investigated, and it is a promising venue of research especially in terms of forging lessons for future epidemic preparedness.

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