Who Works Non–Day Shifts? An Investigation of Population and Within-Cohort Trends

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Objectives: We examined trends in the socioeconomic distribution of work schedules from 1990s to 2010s and how early adulthood disadvantages are associated work schedules over working age. **Methods:** In a representative sample of US workers (Midlife in the U.S. Study (MIDUS), $N = 3328$), we calculated recycled predictions of day, evening, night, and long shift prevalence associated with time period. Logistic regression was used to analyze the association of non–day shifts with age and its variations by early adulthood disadvantage in US baby boomers (National Longitudinal Survey of Youth 79 (NLSY79), $N = 10{,}293$). **Results:** In U.S. workers, between 1990s–2010s, evening shifts increased in adults without college education and night shifts increased in the lowest income quartile. Day shifts decreased in both groups. In US baby boomers, the odds of working non-day shifts decreased with age. However, being Black, not attending college, and poverty were associated with higher odds of non–day shiftwork throughout working age. **Conclusions:** Evening and night shifts may have replaced day shifts in socioeconomically disadvantaged populations between 1990s–2010s. Early adulthood disadvantages may have sustained effects on work schedules.

Keywords: non–day shifts, occupational schedules, disparities, population trends, socioeconomic disadvantage

LEARNING OUTCOMES

- Between 1990s–2010s, evening and night shifts may have replaced day shifts in populations without a college education and adults in poverty.
- Adults become less likely to work non–day shifts as they aged.
- Being Black and experiencing poverty in early adulthood were associated with increased non–daytime shift exposure throughout working age.

Shiftwork refers to employment practices requiring workers to be on duty during hours outside the conventional work day,[1,2] including evening, night, and long schedules.[1,2] Shiftwork has been associated with increased risks of chronic illnesses, such as sleep apnea, hypertension, and obesity.[3–6] Persons without college degrees, racial/ethnic minorities, and persons experiencing poverty may be at a higher risk of engaging in non–day shifts due to the lack opportunities and resources for career development, which can lead to suboptimal occupational choices, including nonconventional work schedules. This possibility is supported by the cumulative advantage-disadvantage framework, which posits that initial disadvantage (e.g., not having a college degree, being in poverty) leads to the accumulation of more disadvantages with age (e.g., working non–day shifts), whereas having an initial advantage leads to accumulating further advantages.[7] Accordingly, socioeconomically disadvantaged populations show a disproportionately high prevalence of shiftwork,[8–10] indicating shiftwork as a potential source of inequalities in health and the need to examine it as a potential cumulative disadvantage. Nonetheless, little is known about how the exposure to shiftwork has changed over time in different population subgroups, despite various transitions in the US occupational structure. In particular, the society-wide demand for low-wage labor (e.g., manufacturing, retail trade) has declined monotonically since the 1970s,[11–13] potentially due to technological advancements that enabled automation and Internet-based trade. However, among low wage labor jobs, the share of service-sector occupations (e.g., food services and janitorial services) has grown consistently since the 1980s.[11,12] Given that low-wage service jobs are often noted for their nonconventional schedules,[11,12] it can be hypothesized that non–day shifts may have become more concentrated in socioeconomically disadvantaged populations over time. Determining trajectories of the prevalence of work schedules in different population subgroups over time is important, as the concentration of non–daytime work schedules in disadvantaged populations may have contributed to increases in income inequality in the recent decades[14] worsening workers' health and preventing them from transition to better jobs.

Furthermore, little is known about how early adulthood experiences of socioeconomic disadvantage affect work schedules over the life course. Intuitively, all individuals may become less likely to work non–day shifts as they acquire occupational skills and experiences that can facilitate the transition to day-shift jobs. Nonetheless, early adulthood disadvantage may be particularly closely related to work schedules later on, as individuals conventionally obtain most of occupation-related training and knowledge at that time. Thus, not having a college degree or experiencing poverty during this period may substantially limit a person's chances of securing a job with reduced exposure to non–daytime work schedules, as in line with the previously-discussed cumulative advantage-disadvantage framework.[7] However, there is no empirical evidence on an individual's early adulthood socioeconomic status (ie, race-ethnicity, income, and educational attainment) and work schedules over the life course.

This study conducted two distinct analyses examining secular trends in work schedules. First, we examined trends in the socioeconomic distribution of occupational shifts between the 1990s and the 2010s in a nationally representative sample of US workers, hereafter referred to as the population trend analysis (PTA). Although limited evidence suggests that the crude prevalence of non–daytime occupational shifts has remained stable at around 15% since 1990,[8–10] there is little evidence on differential trends across population subgroups. Second, this research examined the risk of working non–day shifts at different phases of prime working age (i.e., the period between age

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25 and 54 when people are most likely to work during their lifespan) in a nationally representative cohort of baby boomers, hereafter referred to as the within-cohort trend analysis (WTA). We also examined whether the risk of non–day shifts at each phase of prime age varies by early experiences of socioeconomic disadvantage (i.e., educational attainment and poverty status in one's mid-20s) and race-ethnicity. Given public health concerns over non–day schedules, identifying disparities in work schedules at different life stages is necessary to inform time windows for policies aimed at improving the health of shift workers.

METHODS

Data Sources and Eligibility

The "population trends analysis (PTA)" used data collected by the Midlife in the US Study (MIDUS), a nationally representative study of English-speaking US adults aged 25–74.[15,16] This analysis focused on the baseline data from two national probability samples, which mirror each other in age range but were recruited and interviewed at distinct time periods. The first sample is the *Core cohort,* who completed the baseline interview in 1995 or 1996. The second sample is the *Refresher cohort*, who completed the baseline interview between 2011 and 2014. The MIDUS conducted interviews via computer-assisted phone surveys and mail-back Self-Administered Questionnaires on demographic characteristics, socioeconomic status, employment, and health. Both cohorts were sampled using random-digit-dialing and were weighted to approximate the US population in 1995 and 2012, respectively. The eligibility criterion for the current study was working for pay at the time of a given cohort's baseline interview, $N = 3328$. These individuals are assumed to be nationally representative of the US working population with age 25 or older at respective time periods. Supplemental Figure 1 (http://links.lww.com/JOM/B896) outlines processes used to create the analytic sample.

The "within-cohort trend analysis (WTA)" used the National Longitudinal Survey of Youth79 (NLSY79), a survey of a nationally representative cohort of adults born between 1957 and 1964.[17] The NLSY79 used multistage probability sampling with oversamples of underrepresented racial-ethnic groups and economically disadvantaged non-Black individuals. The NLSY79 began in 1979 and conducted follow-up interviews on an annual basis until 1994 and on a biennial basis thereafter using a combination of computer-assisted in-person and phone interviews. The interviews asked about educational attainment, employment, family life, and health. The current analysis used data collected in all survey waves from 1988 until 2018, since the NLSY79 began collecting detailed information on work schedules in 1988. The baseline for each person was the first survey wave since 1988 when the person turned 25 or older and was working for pay, because prime working age begins at age 25. For each wave, the eligibility criteria for this study included the following: (1) being a part of the civilian population, (2) working for pay, and (3) being 25 to 54 years of age. Supplemental Figure 2 (http://links.lww.com/JOM/B896) outlines the process used to create the analytic sample, $N = 10,293$.

The reason for using two different datasets is because the "population trend analysis [PTA]" needs a nationally representative sample of the US working adult population at two time points across the entire working age range, whereas the "within-cohort analysis [WTA]" requires a dataset that follows participants for multiple years. The MIDUS is appropriate for the PTA because it includes a nationally representative sample of individuals who are between 25–74 in the 1990s and in the 2010s. We assume that selecting individuals who reported working for pay among MIDUS participants to yield a nationally representative sample of US working population. In comparison, the NLSY79 follows a representative sample of individuals born between 1957 and 1964. While it cannot be representative of the entire US working adult population at a given time point, it provides longitudinal data throughout prime working age of a nationally representative cohort.

Outcomes

The outcome of the PTA was the occupational shift for a respondent's main job, classified into day, evening, night, and long shifts. During the baseline interview, the MIDUS asked, "At what time of day do you usually begin/end work at your main job?" Using participant-reported information on the beginning and ending times, we defined each work schedule as follows, by adapting the definitions previously used by the Bureau of Labor Statistics[18–20]:

(1) day shifts: the midpoint of the beginning and ending times fall between 08:00 and 16:00;
(2) evening shifts: the midpoint falls between 16:00 and 24:00; and
(3) night shifts: the midpoint falls between 00:00 and 08:00.

In addition, we examine long shifts defined as follows:

(4) long shifts: the shift lasts 16 or hours or more, regardless of the midpoint.

The outcome of the WTA was the occupational shift for the main job a respondent held at each wave, classified into day shifts and non–day shifts. As participants completed multiple interviews throughout their working age, the outcome was defined for each wave. During interviews, the NLSY79 asked, "Which of the following categories best describes the hours you work at this job?" Answer choices included: "Regular day shift," "Regular evening shift," "Regular night shift," "Shift rotates," "Split shift," "Irregular hours," or "Other." Participants who reported the first five choices were asked to specify the exact times they started and finished work. Using answers to these questions, we defined each category as follows [18–20]:

(1) day shifts: the midpoint of the beginning and ending times falls between 08:00 and 16:00, the shift does not rotate or is split, and the shift does not last more than 16 hours; and
(2) non–day shifts: all work schedules other than the day shift.

A dichotomous classification was used to focus on the likelihood of conversion to day shifts over time.

Exposure

The exposure for the PTA was the period of baseline interview: the 1990s (the Core cohort) versus the 2010s (the Refresher cohort). This research also examined the following: race (non-Hispanic White; non-White), education (high school or less, some college, college graduate), and household income (quartiles 1–4). The analyses classified race dichotomously due to the limited sample size of non-White individuals in the Core cohort, as noted previously.[21,22]

The exposure for the WTA was the phases of working age, including early (age 25–34 y), mid (35–44 y), and late (45–54 y) phases. Each wave was classified into one of the three phases based on participant age at interview. The investigation sought to answer how changes in work schedules vary by early life socioeconomic disadvantages through also examining the following time-invariant characteristics: educational attainment at 25 years of age (high school or less; some college; college graduate), poverty status at 25 years of age (in poverty, not in poverty), and race-ethnicity (Hispanic, non-Hispanic White, non-Hispanic Black, and non-Hispanic Other). In cases where a participant did not provide information on these characteristics at age 25, data from the next closest available wave before age 30 was used.

Covariates

The PTA accounted for sex, age, and marital status. Age was modeled using linear and squared terms. The WTA accounted for

sex, age in the year 1979 (i.e., when NLSY79 began), age when education and poverty status were reported, and the following information provided at each wave: region and marital status.

Statistical Analysis

The PTA first estimated the odds of working a given occupational shift associated with the interview periods using multinomial logistic regression, adjusting for all covariates listed in Table 1. Recycled predictions of the prevalence of each occupational shift were then estimated for each period, holding the other covariates as observed for the entire sample. Subsequently, multinomial logistic regression was used to estimate the odds of working a given shift associated with the interaction between the interview period and each of the following characteristics: educational attainment, income, and race. Each interaction was examined using separate models. Each model's estimates were used to calculate recycled predictions of the prevalence of a given occupational shift by period within each sociodemographic category, holding the other covariates as observed. Z-tests were used to compare recycled predictions between the 1990s and the 2010s. All models were weighted using survey weights aimed to approximate the US population. The weights were adjusted for missing data by multiplying the original survey weights with the inverse of the probability that an eligible participant will not have missing data based on their social and demographic characteristics.

The WTA estimated the association between working a non–day shift and the three phases of working age. The analysis was conducted at the person-wave level using binomial mixed-effects logistic regression with individual-specific random intercepts to account for repeated observations within an individual, as well as adjusting for all time-invariant difference between individuals. Subsequently, interaction terms were used to estimate variations in this association by educational attainment at age 25, poverty status at age 25, and race-ethnicity, using separate models. All models were weighted using survey weights from each participant's first, nonmissing wave.

All analyses were conducted using STATA/MP, v17.0 (StataCorp LP, College Station, TX). This project included the secondary analyses of already-collected, publicly available, and deidentified data, classified as nonhuman subjects research by the Institutional Review Board at New York University. Analyses were conducted from November 2022 to November 2023. The current investigation followed STROBE guidelines and the STROBE checklist can be found in Supplementary Table 1 (SDC 1, http://links.lww.com/JOM/B937).

TABLE 1. Sample Characteristics, MIDUS*

	Analytic Sample		1990s		2010s	
Characteristics	**%**	***n***	**%**	***n***	**%**	***n***
Cohort						
Sampled in 1990s	56.70	1915				
Sampled in 2010s	43.30	1413	N/A	N/A		
Work schedule						
Day	85.37	2896	85.82	1657	84.79	1239
Evening	7.91	236	7.73	146	8.15	90
Night	3.34	98	3.21	56	3.52	42
Long	3.37	98	3.24	56	3.55	42
Sex						
Male	51.96	1712	52.19	1001	51.65	711
Female	48.04	1616	47.81	914	48.35	702
Race-ethnicity						
White	79.55	2728	79.27	1592	79.90	1136
Non-White	20.45	600	20.73	323	20.10	277
Age, med [IQR]	43 [34–52]		41 [33–50]		46 [35–54]	
Marital status						
Married	66.31	2198	67.72	1233	64.46	965
Never married	14.48	439	12.05	238	17.66	201
Other	19.21	691	20.22	444	17.88	247
Educational attainment						
High school or less	38.07	850	43.12	633	31.46	217
Some college	27.88	1004	27.75	619	28.04	385
College graduate	34.05	1474	29.13	663	40.50	811
Income†						
Q1	16.62	500	17.67	334	15.25	166
Q2	25.54	799	26.68	493	24.05	306
Q3	28.03	918	27.20	512	29.12	406
Q4	29.80	1111	28.45	576	31.58	535

Source: Midlife in the U.S. Study.[15,16]

IQR, interquartile range.

*Weighted to approximate the US adult population.

†Q1 indicates the lowest income quartile.

RESULTS

Table 1 shows the characteristics of the MIDUS sample used in this study. In the full analytic sample, day shift workers accounted for 85.4%, evening workers for 7.9%, night workers for 3.3%, and long shift workers for 3.4%. The prevalence of the four occupational shifts did not differ significantly between the 1990s and the 2010s at the $P < 0.05$ level, which mirrors limited prior findings.[8–10] The distribution of sex, race, and income quartiles were also comparable between the two periods. On the other hand, the distributions of age, marital status, and educational attainment significantly differed between the two periods, mirroring other population estimates.[10] In particular, the cohort interviewed in the 2010s showed increased proportions of older individuals, nonmarried people, and college graduates relative to their counterpart interviewed in the 1990s.

Table 2 shows the predicted prevalence of each work schedule by period, adjusting for differences in sample composition between the two cohorts. From the model without interactions, the adjusted, sample-wide prevalence of day shifts was 86.4% in the 1990s, which is not significantly different from 84.0%, the estimate associated with the 2010s. The prevalence of evening, night, and long shifts also did not vary significantly between the two periods. Nonetheless, when the model with an interaction between period and educational attainment was used to calculate recycled predictions, the prevalence of work schedules among adults without a college education varied significantly between the 1990s and the 2010s. Specifically, the prevalence of day shifts decreased by 8.6 percentage points (PP), changing from 86.0% in the 1990s to 77.4% in the 2010s, $Z = 2.54$, $P = 0.01$. On the other hand, the prevalence of evening shifts increased by 6.2 PP, changing from 6.5% to 12.7%, $Z = 2.29$, $P = 0.02$. Among adults with some college education or 4-year college degrees, the prevalence of day and evening shifts remained stable over the two periods. The predicted prevalence of night and long shifts did not vary between the two periods for all educational attainment groups. Figure 1A graphically shows trends in the predictive prevalence of each work schedule within subgroups of educational attainment.

Furthermore, between-period differences in the prevalence of work schedules in the lowest income quartile were found when the model with an interaction between period and income was used to calculate recycled predictions (Table 2). In the lowest income quartile, the prevalence of day shifts decreased by 9.2 PP, changing from 83.0% in the 1990s to 73.7% in the 2010s, $Z = 2.02$, $P = 0.04$. The prevalence of night shifts increased by 4.5 PP, changing from 2.2% in the 1990s to 6.7% in the 2010s, $Z = 2.12$, $P = 0.03$. In the other three quartiles, the prevalence of work schedules did not differ significantly between the two periods. Figure 1B graphically shows trends in the predictive prevalence of each work schedule within subgroups of income. Finally, between-period differences in the prevalence of work schedules did not vary significantly by race.

TABLE 2. Adjusted Prevalence of Work Schedules by Period, MIDUS*

Model	Work Schedule	Subgroup	Prevalence, %		Difference, PP	*P*
			Cohort 1, the 1990s	Cohort 2, the 2010s		
No interaction	Day	N/A	86.35	83.98	−2.37	0.14
	Evening		7.41	8.65	1.24	0.34
	Night		3.08	3.73	0.65	0.42
	Long		3.17	3.65	0.48	0.57
Work schedule X education	Day	HS grad or less	86.04	77.43	−8.61	0.01‡
		Some college	81.72	82.96	1.24	0.64
		College grad	90.43	91.97	1.54	0.36
	Evening	HS grad or less	6.49	12.72	6.23	0.02‡
		Some college	10.44	8.40	−2.04	0.32
		College grad	6.13	4.51	−1.62	0.23
	Night	HS grad or less	3.77	5.25	1.48	0.39
		Some college	4.48	3.59	−0.89	0.50
		College grad	0.96	2.03	1.07	0.15
	Long	HS grad or less	3.71	4.60	0.89	0.61
		Some college	3.35	5.05	1.69	0.25
		College grad	2.48	1.49	−0.99	0.22
Work schedule X income†	Day	Q1	82.97	73.74	−9.23	0.04‡
		Q2	85.36	86.80	1.44	0.63
		Q3	86.71	84.75	−1.96	0.49
		Q4	89.63	87.73	−1.90	0.47
	Evening	Q1	9.86	16.64	6.79	0.09
		Q2	7.67	8.04	0.37	0.88
		Q3	5.63	8.01	2.38	0.25
		Q4	7.34	4.05	−3.29	0.05
	Night	Q1	2.23	6.69	4.45	0.03‡
		Q2	3.71	2.80	−0.91	0.50
		Q3	4.51	2.72	−1.78	0.25
		Q4	1.33	3.61	2.28	0.08
	Long	Q1	4.94	2.93	−2.01	0.30
		Q2	3.26	2.36	−0.90	0.51
		Q3	3.15	4.52	1.36	0.38
		Q4	1.70	4.61	2.91	0.11
Work schedule X race	Day	White	85.78	83.62	−2.15	0.24
		Non-White	88.20	85.24	−2.96	0.36
	Evening	White	8.34	8.82	0.48	0.75
		Non-White	4.26	8.27	4.01	0.09
	Night	White	2.99	3.73	0.74	0.41
		Non-White	3.37	3.68	0.31	0.85
	Long	White	2.90	3.83	0.93	0.31
		Non-White	4.18	2.81	−1.36	0.43

Source: Midlife in the U.S. Study.[15,16]
HS, high school; PP, percentage point.
*Weighted to approximate the U.S. adult population.
†Q1 indicates the lowest income quartile.
‡Indicates statistical significance at the level of $P < 0.05$.

Table 3 shows the baseline characteristics of the NLSY79's respondents included in this study. The median age when people entered this study was 28. At baseline, 69.5% of respondents worked day shifts, while 30.5% worked non–day shifts. The sample included a slightly higher proportion of males (51.1%) than females (48.9%). White participants accounted for 52.7%, Black participants 13.8%, Hispanic participants 6.5%, and other 27.0% (including biracial White people). Furthermore, by their mid-20s, 57.6% had stopped their formal education at high school graduation or before, 21.8% had attended some college, and 20.5% had graduated from a 4-year college or a university. In addition, by their mid-20s, 12.6% were in poverty. Please see Table 3 for more information on sample characteristics, including marital status and region of residence.

Table 4 shows within-cohort trends in the odds of working a non–day shift associated with different phases of prime working age in NLSY79 participants. In the model without interactions, the odds of working non–day shifts were greatest in the early phase (age 25–34) and the odds monotonically decreased in the subsequent phases. Relative to the early phase, participants had 18% lower odds of working non–day shifts in the mid phase (age 35–44; 95% CI = 12%, 22%) and 35% lower odds of working non–day shifts in the late phase (age 45–54; 95% CI = 30%, 40%).

Table 4 also shows the variations of within-cohort trends in the odds of working non–day shifts by: educational attainment at 25 years of age, poverty at 25 years, and race-ethnicity. The reference is the odds of working non–day shifts associated with the early phase for the same sociodemographic category. First, the model with an interaction between educational attainment at 25 years and the phases of working age showed monotonic decreases in the odds of non–day shifts among college graduates, adults with some college education, and adults without a college education. Evaluating pairwise comparisons of estimates found a larger decrease in the odds of working non–day shifts from early to mid phases among adults with some college education (odds ratio = 0.71, 95% CI = 0.63, 0.80) than the other

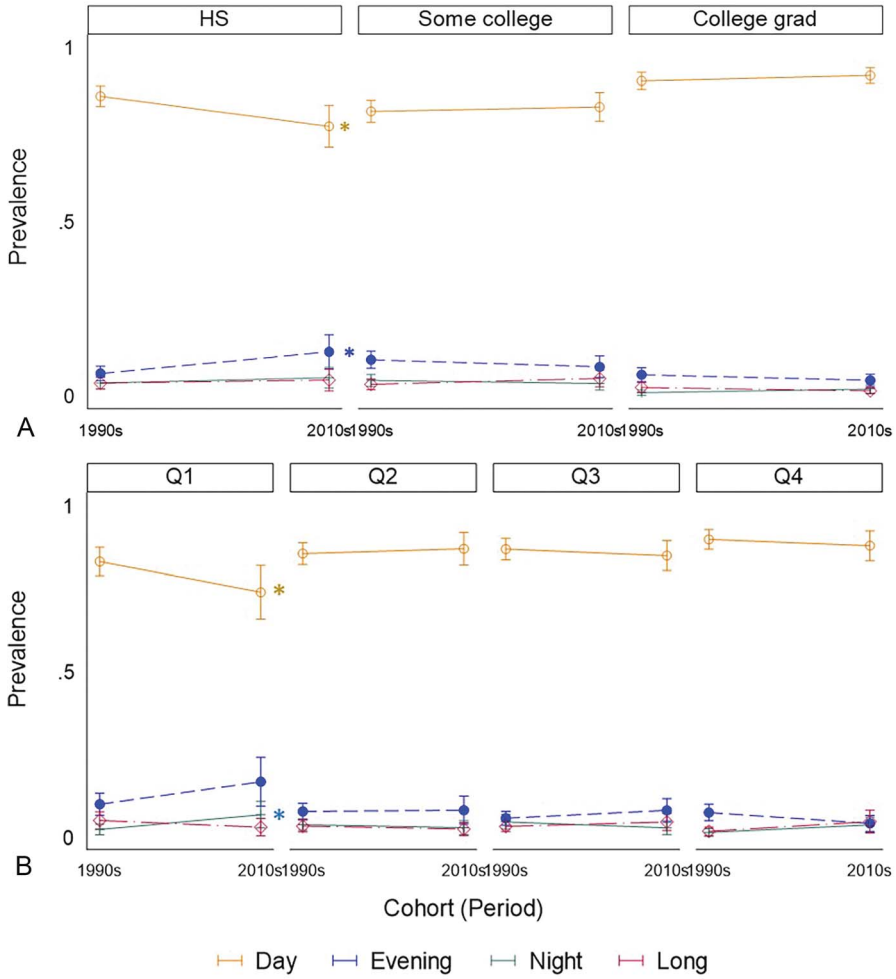

FIGURE 1. Trends in the adjusted prevalence of work schedules between the 1990s–2010s by educational attainment (A) and income (B), MIDUS.

two educational attainment groups, *P*s < 0.05. Second, in the model with an interaction between poverty at 25 years and the phases of working age, the odds of working non–day shifts monotonically decreased among all groups. Pairwise comparisons were not significant. Finally, the model with an interaction between race-ethnicity and prime age phases showed the odds of working non–day shifts to decrease monotonically in White, Black, and Hispanic adults. All pairwise comparisons did not reach statistical significance, *P*s > 0.05.

Supplemental Table 2 (http://links.lww.com/JOM/B896) shows sociodemographic differences in the odds of working non–day shifts observed at each phase of prime age obtained from same models used to examine interactions between working-age phases and sociodemographic characteristics. The model with an interaction between educational attainment in the mid-20s and prime age phases showed that in all three phases, college graduates had the lowest and significantly lower odds of working non–day shifts than the other two groups without 4-year college degrees. The model with an interaction between poverty in the mid-20s and phases showed that people who had been in poverty were more likely to work non–day shifts in all three phases than people who had not been in poverty. Finally, the model with an interaction between race-ethnicity and phases showed that Black adults were more likely to work non–day shifts than White adults in all three prime age phases, while Hispanic adults had comparable odds of working non–day shifts as White adults throughout prime working age.

DISCUSSION

This study examined population trends in socioeconomic distribution of work schedules between the 1990s and the 2010s. The findings suggest that evening and night shifts may have replaced day shifts in populations without a college education and adults in poverty. The analyses did not find evidence of major changes in work schedules among adults with at least some college education and those with higher income, who, in general, showed higher prevalence of day shifts and lower prevalence of non–day shifts. Prior research showed employment inequality, defined as disparities in access to quality jobs and the nature of on-the-job experiences,[13] to have increased in the US throughout the 20th century, including unemployment rates and wages.[11,12] The current study adds to this line of research on trends in employment inequality by suggesting that disparities in work schedules may have widened over time as well. While the underlying sources of the observed trends remain unclear, decreased demand for low-wage workers may have forced individuals with socioeconomic disadvantages to pursue non–daytime jobs despite their known physical and psychosocial side effects. For many without a college education and workers in poverty, the "low-skills trap" (ie, limited career development opportunities, the lack of on-the-job training, and frequent incidences of unemployment)[23] may have made it particularly challenging to navigate career decisions amidst such macroeconomic transitions.

TABLE 3. Baseline Characteristics, NLSY79*

Characteristics	%	n
Shift		
Fixed day	69.49	7,026
Non–day	30.51	3,267
Sex		
Male	51.08	5,096
Female	48.92	5,197
Race-ethnicity		
White	52.68	3,840
Black	13.77	2,659
Hispanic	6.52	1,712
Other (including biracial White)	27.02	2,082
Baseline age, med [IQR]	28 [26–30]	
Educational attainment at age 25		
HS grad or less	57.64	6,371
Some college	21.83	2,197
College grad	20.52	1,725
Marital status		
Never married	33.35	3,695
Married	52.34	4,996
Other	14.31	1,602
Income		
Not in poverty	87.40	8,459
In poverty	12.60	1,834
Region		
Northeast	19.52	1,864
North central	27.70	2,389
South	34.61	4,005
West	18.16	2,035

Source: National Longitudinal Surveys, Bureau of Labor Statistics.[17]
HS, high school; IQR, interquartile range.
*Proportions were weighted to approximate the US population.

In addition, the within-cohort trend analysis showed that the odds of working non–day shifts decreased throughout working age among baby boomers of all sociodemographic statuses. Comparing across education groups, the magnitude of decrease in the odds of working non–day shifts from the early to mid phases was greatest in adults who had some college education by their mid-20s, presumably because they obtained a college degree later on. Nonetheless, compared to college graduates, adults with some college education and those without a college education by their mid-20s remained more likely to work non–day shifts throughout all phases of prime working age. Furthermore, adults experiencing poverty in their mid-20s (vs not in poverty), and Black workers (vs White) remained more likely to work non–day shifts throughout all phases of prime working age. Taken together, although people generally convert to day shifts as they gain more occupational knowledge and experience, early adulthood experiences of social disadvantage may have long-term implications on work schedules. Future research may examine whether providing resources and opportunities for career development early on in working age may reduce the odds of non–day shifts in subsequent life stages. Future research may also investigate whether decreases in work schedule disparities, in turn, may contribute to a narrowing of inequalities in health.

This research is not without its limitations. First, the MIDUS has a relatively small sample size. Nonetheless, it has been regarded as a representative sample of community-residing US adults. Hence, it is likely that our findings, to some extent, represent actual trends in the population. Second, some participants of the second MIDUS cohort were interviewed in the early 2010s, when the US economy had not fully recovered from the 2008 economic crisis. Hence, our findings may, at least in part, be due to the residual impact of the economic downturn. Third, the Core cohort was sampled using random digit dialing of households that have one or more telephones,[24] while the Refresher cohort used random digit dialing to recruit both landline and cell phone users,[16] and this change in sampling method may have contributed to the findings of this study. For example, there may be an increased proportion of low-income and immigrant workers in the Refresher cohort who are unlikely to have landlines, which could have contributed to the observed increase in night shifts in the lowest income quartile in the 2010s. Fourth, attrition patterns vary by race-ethnicity and sex for the NLSY79, where Black adults and women were less likely to drop out over time.[25] However, prior research showed that differential attrition rates do not significantly bias employment-related estimates.[25,26] Fifth, some participants of the NLSY79 were over the age of 25 by 1988, which is the baseline used in this study. However, the results were not sensitive to excluding these participants from the sample. Lastly, the rate of missing data was highest among night shift workers and the lowest among day shift workers in the MIDUS.

TABLE 4. Odds of Working a Non–Day Shift by Prime Age Phase and Socioeconomic Status, NLSY79

		Phases of Prime Working Age					
			Mid (35–44 y)			Late (45–54 y)	
Model*		Early (25–34 y)	OR	95% CI	OR		95% CI
No interaction		Ref	0.82	‡ [0.78–0.88]	0.65	‡,‖	[0.60–0.70]
Education x Phase	College grad	Ref	0.95	[0.82–1.10]	0.62	‡,‖	[0.51–0.74]
	Some college	Ref	0.71	‡,§ [0.63–0.80]	0.59	‡,‖	[0.50–0.70]
	HS or less	Ref	0.83	‡ [0.77–0.90]	0.69	‡,‖	[0.62–0.76]
Income x Phase	In poverty	Ref	0.78	‡ [0.67–0.91]	0.68	‡	[0.56–0.82]
	Not in poverty	Ref	0.83	‡ [0.78–0.89]	0.65	‡,‖	[0.59–0.70]
Race–ethnicity † x Phase	NH White	Ref	0.81	‡ [0.75–0.89]	0.67	‡,‖	[0.60–0.75]
	NH Black	Ref	0.82	‡ [0.75–0.90]	0.76	‡	[0.67–0.85]
	Hispanic	Ref	0.80	‡ [0.70–0.91]	0.70	‡	[0.60–0.83]

Source: National Longitudinal Surveys, Bureau of Labor Statistics.[17]
CI, confidence interval; HS, high school; OR, odds ratio.
*The estimates were weighted to approximate the US adult population. All pairwise comparisons of estimates between the phases were evaluated at the level of $P = 0.05$.
†Race-ethnicity includes non-Hispanic other as well, which was omitted from this table.
‡Indicates statistical significance at the level of $P < 0.05$.
§Pairwise comparisons between educational attainment groups show that this estimate was significantly larger than the estimates associated with college graduates and that associated with HS or less during the same phase.
‖This estimate associated with the late phase was significantly lower than the estimate associated with the mid phase within the same sociodemographic category.

Because this study conducted complete case analyses, the prevalence of night shift workers may have been underestimated in both periods.

CONCLUSIONS

Our findings suggest that evening and night shifts may have replaced day shifts in populations without a college education and adults in poverty. Furthermore, adults who experienced socioeconomic disadvantages in early adulthood (e.g., poverty and not having a 4-year college degree) had increased odds of working non–day shifts throughout their prime working age. Future research may examine whether disparities in work schedules mediate socioeconomic inequalities in chronic disease burden.

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3. Data Availability: This research used data provide by the Midlife in the US Study and the National Longitudinal Study of Youth 79 (US Bureau of Labor Statistics). Data can be downloaded from data owners' websites.

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4. EQUATER Network Reporting Guidelines: This study adhered to the STROBE guidelines for observational cohort studies and a checklist for cohort studies has been completed and attached as a SDC (Supplementary Table 1).

Ethics considerations and disclosures: This project included the secondary analyses of already-collected, publicly available, and deidentified data, classified as nonhuman subjects research by the institutional review board at New York University.

5. No AI was utilized at any stage during research development, design, data analysis, and manuscript preparation.

6. The findings or views expressed in this article are those of the authors and do not necessarily reflect the views of the MIDUS or NLSY79.

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