



The Gender Inequalities in Work Time Fragmentation and Anxiety: Latest Time Use Evidence in the UK

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Abstract

Due to the increasing work flexibility in the UK over the past decades, work time fragmentation and its gendered mental consequences have been subjects of ongoing debate in sociology and organisational management. This study adopts the time diary data in the UK during the Covid-19 pandemic (2020–2021) and employs a combination of Ordinary Least Squares regression and the Karlson-Holm-Breen method to investigate the nuanced gender-differentiated associations between British workers' work time fragmentation, subjective time pressure and anxiety levels. This study surprisingly finds that both male and female workers tend to report lower anxiety levels when having a more fragmented work schedule. Female workers' anxiety levels remain consistently higher than those of their male counterparts when having similar levels of work time fragmentation. In addition, among female workers, the observed association between fragmented work schedules and lower anxiety levels appears to be partially attenuated (34.1%) by a counteracting pattern involving higher levels of subjective time pressure. In contrast, such a mediation pattern is not observed among male workers. These findings underscore work time fragmentation as a potential form of 'alleviation' or 'compensation' for female workers' higher anxiety levels, led by heavier domestic responsibilities, poorer work-life balance, and disadvantaged positions. However, the current work-family intervention should not solely rely on 'more flexible yet fragmented work arrangements' to alleviate workers' anxiety levels. Instead, policies supporting better work-life balance, such as accessible childcare services and longer paid leave, are essential for effectively reducing anxiety among female workers.

Keywords Anxiety · Gender inequalities · Time fragmentation · Time use · Work-life balance

1 Introduction

Anxiety issues brought on by work-family conflicts have become a global public health concern, attracting widespread attention from policymakers and scholars in the sociology of work (Chandola & Zhang, 2018; Yunus & Mostafa, 2021). Recent trends in the UK

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labour market, including the rise in female labour force participation, the growing prevalence of flexible working arrangements, and advancements in artificial intelligence, have significantly influenced the quality of work time, particularly in terms of unpredictability, multitasking, and flexibility. In this context, work time fragmentation serves as a distinct social indicator for assessing time quality. Specifically, work time fragmentation is defined as the number of distinct and continuous working periods¹ experienced by respondents per day (Lu, 2024; Lyttelton et al., 2022; Merz & Böhm, 2009). Although it has gained attention in a few recent time use studies (Chatzitheochari & Arber, 2012; Cornwell et al., 2019; Lu, 2023; Lyttelton et al., 2022), it remains largely overlooked in broader social science research. This situation raises scholars' concerns about the mental consequences of more fragmented time schedules for workers (Lu, 2024; Sullivan & Gershuny, 2018). However, due to the limitations of general social surveys (e.g., stylised survey questions), obtaining objective and accurate information for measuring time fragmentation remains challenging. Moreover, due to the lack of proper measurement of time fragmentation and empirical investigation of its consequences, whether and how workers' fragmented work schedules are associated with mental health status is subject to ongoing debates.

First, the relevant theoretical frameworks and existing empirical findings have inconsistent predictions about the mental consequences of work time fragmentation. On the one hand, theoretical perspectives from sociologists on time and work suggest a relatively stable temporal rhythm and a rigid temporal boundary between work and life (Clark, 2000; Goode, 1960; Zerubavel, 1985), implying the potential adverse mental consequences of work time fragmentation. Specifically, according to the work-family border theory, work and family are two completely different domains requiring different skills and expectations (Clark, 2000). Thus, placing a rigid temporal/spatial boundary between these two domains can prevent workers from role conflicts and overworking. For example, a continuous episode of work and core hours (e.g., 9 am – 12 am) might ensure the predictability of the schedule and facilitate teamwork and stable health practices (Perlow & Kelly, 2014; Sargent et al., 2020). On the other hand, according to the role expansion and enrichment perspective (Greenhaus & Powell, 2006; Nordenmark, 2004), different social roles might not always compete but sometimes enrich each other. This means that switching from a work role to dealing with private or family demands might benefit by alleviating workloads and increasing enjoyment. Overall, the inconsistencies that remain in the current literature prevent us from understanding the nuanced gender-differentiated associations between British workers' work time fragmentation and anxiety levels.

Second, gender disparities might exist in the associations between British workers' work time fragmentation and anxiety levels due to the persistent gender inequalities that remain in the UK labour market and households (Fagan & Norman, 2013; Kan & Laurie, 2018). However, owing to the lack of investigation, whether male and female workers share different mental consequences of work time fragmentation is unclear. In the UK, female workers are persistently facing structural disadvantages in both the labour market and the household. In the labour market, females encounter occupation barriers such as the glass ceiling and occupational segregation (Bittman et al., 2003; Dinh et al., 2017). In the household, the gendered division of labour places a disproportionate burden of family responsibilities on women.

¹ For example, if a respondent works from 9 a.m. to 12 p.m., then takes a break, resumes work from 1 p.m. to 3 p.m., and works again from 4 p.m. to 6 p.m., their work time fragmentation for the day is three continuous working periods.

These disadvantages often push women into non-standard employment, resulting in more fragmented and unpredictable work schedules. For men, the dual expectations of being both breadwinners and ideal workers (Kelly et al., 2010; Minnotte & Minnotte, 2021) compel them to prioritise work demands, which can result in overworking and increased work-to-family conflict. For example, a strand of studies on career expectations highlights that men are more likely to prioritise salary and prospects while female workers are more likely to prioritise work-life balance (Schweitzer et al., 2011, 2014). In addition, a study finds that female workers report more subjective time pressure when having more fragmented work schedules than men (Lu, 2024). Thus, it is reasonable to expect that male and female workers might share different anxiety levels when having fragmented work schedules through different mechanisms.

Third, there might be an underlying gender-differentiated mechanism for interpreting the nuanced associations between workers' work time fragmentation, time pressure and anxiety levels. Specifically, the existing empirical evidence about the mental consequences of work time fragmentation is limited. One recent time use study in the UK finds significant associations between work time fragmentation and subjective time pressure across gender and parenthood status (Lu, 2024). However, subjective time pressure does not directly indicate mental issues or symptoms. Some scholars in the field of sociology of time claimed that being busy is not necessarily related to anxiety but sometimes even increases job or life satisfaction through self-identity development (Gershuny, 2005). Indeed, following the discussion of gendered ideal worker norms and career expectations (Kelly et al., 2010; Schweitzer et al., 2011, 2014), female workers' higher levels of subjective time pressure might contribute to their anxiety levels, but not for males. Therefore, it is necessary to test the nuanced associations between male and female workers' work time fragmentation, subjective time pressure and anxiety levels.

To address these knowledge gaps, this study utilises the latest time use data from the UK during 2020–2021 to identify British workers' work time fragmentation and uses the combination of Ordinary Least Squares (OLS) regression and the Karlson-Holm-Breen (KHB) method to investigate the gender-differentiated associations between British workers' work time fragmentation, subjective time pressure and anxiety levels. Firstly, following previous studies (Lu, 2024; Merz & Böhm, 2009), this study uses 24-hour time use data to objectively identify the number of distinct continuous work episodes within one diary day to measure workers' work time fragmentation. Secondly, using OLS regression, the study empirically examines to what extent work time fragmentation is associated with workers' anxiety levels across gender. Thirdly, we test the mediating role of subjective time pressure in the association between work time fragmentation and anxiety levels by using the KHB method.

2 Literature Review

2.1 Work Time Fragmentation and Anxiety

During the last decade, there has been increased attention to the mental consequences of work time fragmentation (Lu, 2024; Rusli et al., 2008). However, theoretical predictions about the mental consequences of work time fragmentation from different theoretical per-

spectives have been proposed and tested in parallel. Owing to the data and method limitations, no direct dialogue has been raised in the current literature.

On the one hand, drawn from the temporal regularity thesis and role strain theory, a strand of studies indicates that work time fragmentation might increase workers' cognitive anxiety levels. First, according to the temporal regularity thesis (Zerubavel, 1979), work time fragmentation can lead to more unpredictable work schedules, break individuals' time structure and exacerbate work-life conflicts (Keller et al., 2020; Schneider & Harknett, 2019). Specifically, studies find that work time fragmentation is associated with the temporal disruption that blurs work and family domains (Sargent et al., 2020), leading to worse health practices (e.g., unregular diet), role blurring issues (e.g., multitasking) and time pressure (Cornwell, 2013; Lu, 2024). Second, the role strain theory suggests the role blurring consequence of work time fragmentation (Goode, 1960). In particular, the role strain theory predicts that role expectations (e.g., work and family roles) are incompatible, making it challenging for individuals to fulfil the demands of multiple roles simultaneously (Glavin & Schieman, 2012; Greenhaus & Beutell, 1985). Recent studies have empirically identified work time fragmentation as an index of frequent role switching between different social contexts (Lu, 2024; Lyttelton et al., 2022). As the frequency of role switching increases across different domains, the changing effect of different roles may overwhelm workers' strategies and abilities to allocate finite resources such as energy, emotion, and attention effectively (Cornwell, 2013), thereby undermining workers' mental health (Clark, 2000; Danna-Lynch, 2010). Therefore, workers with more work time fragmentation might have more schedule instability and role conflicts, thereby having higher anxiety levels.

On the other hand, another strand of studies supports the idea that workers with fragmented work schedules might surprisingly have less anxious feelings. Empirically, studies find that within a continuous but over-extended workflow, incorporating regular breaks (e.g., having a cup of coffee or doing some stretching movements) becomes an effective strategy to momentarily step away from the professional sphere, thereby alleviating burnout and anxiety (Kim et al., 2017, 2018; Kossek et al., 2012). Moreover, micro role switching between work and family domains has been found to enhance emotional enrichment for workers through work-family enrichment (Ashforth et al., 2000; Wu et al., 2021a). These findings can be interpreted by the predictions of the role expansion theory (Nordenmark, 2004), which indicates that role expansion might alleviate anxiety and bring a sense of accomplishment through different role tasks (Kossek et al., 2012). Specifically, the achievement or emotional benefits gained from individuals' social roles (e.g., worker, partner or parent) can be expanded to each other. For example, individuals who experience success and recognition in their professional roles as workers may gain increased self-esteem and confidence, which can positively influence their roles as partners or parents by fostering stronger relationships and greater emotional support within their families (Grönlund & Öun, 2010). Similarly, emotional fulfilment from being a parent can provide resilience and a sense of purpose that enhances their capacity to perform effectively in their work roles (Chung, 2020). The work-family enrichment approach (Greenhaus & Powell, 2006) in the field of organisational management has similar arguments. In particular, the work-family enrichment approach emphasises daily micro-role transitions and their connection to the gain of emotional resources, providing a foundation for understanding how enrichment occurs at a momentary level (Wayne et al., 2007; Werbel & Walter, 2002). For instance, some scholars claimed that fulfilling family responsibilities and relaxing through family time improve

individuals' overall self-worth and decrease overall anxiety levels (Mauno et al., 2012; Nordenmark, 2004; Wu et al., 2021b). Thus, it is reasonable to expect that role switching might be a strategy for workers with household responsibilities to juggle between work and family domains (Allen et al., 2013). When role switching happens to meet workers' expectations, work time fragmentation may serve as a buffer and alleviate anxiety.

Taken together, the existing theoretical frameworks have conflicting predictions about the associations between work time fragmentation and workers' anxiety. However, owing to the lack of time diary evidence, we still know little about how work time fragmentation is associated with workers' anxiety levels. These uncertainties motivate us to have our research question:

RQ How and to what extent is work time fragmentation associated with British workers' anxiety levels?

2.2 Understanding the Associations Between Work Time Fragmentation and Anxiety Levels from a Gender Lens

Time use is a highly gendered social indicator (Fagan, 2001) due to the persistent gender inequalities in the UK labour market and households (Kan & Laurie, 2018; Zhou et al., 2024). Thus, the theoretical predictions about the associations between work time fragmentation and anxiety levels mentioned in the previous section should be embedded within a gender context. However, gender disparities in the associations between work time fragmentation and anxiety levels have been persistently ignored in the current literature. In this study, we expect that work time fragmentation will be associated with anxiety levels of both male and female workers but through different mechanisms and develop hypotheses, respectively.

For men, we expect that male workers are less likely to benefit from role expansion but suffer more from work schedule instability and role blurring when having more fragmented work schedules. First, male workers are less likely to benefit from role expansion since their role switchings are expected to happen outside of family-related contexts than female workers (Lu, 2024). The 'doing gender' thesis (Kan & Laurie, 2018; West & Zimmerman, 1987) indicates that gender structure expects men to express their masculinity by being the head earner in the household while expecting female workers to express their femininity by playing the housekeeper roles. Such phenomena not only exist in some Eastern societies (e.g., Japan, Korea and China) (Kan et al., 2022) but also have been found in societies with anglo saxon cultural backgrounds (e.g., the UK) (Wang, 2019). Therefore, we expect that men with more fragmented work schedules tend to suffer from violation of gender expectations if they frequently switch from work to the family domain. Indeed, studies find that men are more vulnerable to work-family conflicts even when they actually have less unpaid work than their partners (Abendroth, 2022). Frequent switching from work to family domains, counter to gendered expectations, thus reduces any potential anxiety-buffering effect.

Second, since we expect men in the UK to be work-centred and restricted by ideal worker norms, male workers with more fragmented schedules will likely suffer from work schedule instability and role blurring in terms of long working hours and work-to-family conflicts. According to the temporal regularity thesis, placing a rigid temporal boundary between work and private domains helps prevent working overtime and role conflicts (Hassard,

2017; Zerubavel, 1979). For instance, time use evidence in the UK reveals that male workers have a higher risk of insufficient sleep due to the restriction of long hours than female workers (Chatzitheochari & Arber, 2009). In addition, relevant studies find that workers who have more flexibility in adjusting their daily schedule tend to report more temporal disruptions and unpaid overtime, especially among professional men (Chung & van der Horst, 2020; Sargent et al., 2020). In the UK, men generally and persistently share a higher proportion of paid work in households than female workers (Kan, 2008; Lu et al., 2023b) and are more restricted by ideal worker norms. Therefore, from a role demand perspective, frequent transitions between work and non-work domains by male workers challenge both the ideal worker norms in the labour market and the traditional breadwinner role within the household. However, it is crucial to acknowledge the plurality of masculinity within gender role expectations for men. These expectations include [1] adhering to ideal worker norms and [2] rejecting housework in favour of leisure, both of which can be understood as ‘manhood acts,’ demonstrating how men differentiate themselves from women and assert their entitlement to gender-based privileges (Schrock & Schwalbe, 2009). The latter does not directly conflict with the former. Men can fulfil masculinity norms through leisure activities but not necessarily at the expense of disrupting their work schedules. Hence, our first hypothesis is as follows.

H1 For male workers, a more fragmented work schedule is associated with higher anxiety levels.

Due to the persistent disadvantages that females face in both the labour market and households, we expect that they are more likely to benefit from role expansion and enrichment, but suffer less from work schedule instability and role blurring when experiencing more fragmented work schedules. First, female workers are more likely to benefit from role expansion and enrichment, since their role switchings are more likely to occur in family-related contexts than those of men (Lu, 2024). For instance, studies on work-family conflicts and mental health indicate that female workers are more likely to be adaptive to increased unpaid work and work-family conflicts, especially for those female workers with dependent children (Baxter et al., 2008; Wang & Lu, 2022; Zhao et al., 2017). Female workers’ adaptability helps them to meet their traditional gender norm expectations, which can mitigate the negative effect of role switching and blurring (Plaisier et al., 2008; Singley & Hynes, 2005). It is worth noting that this does not mean that female workers should do more unpaid work due to their potential adaptability. Instead, it indicates the gender disparities in addressing work-family conflicts. In summary, female workers tend to switch roles more frequently when they attempt to balance work and life and while meeting gender expectations. Therefore, work time fragmentation may serve as a buffer, and alleviate anxiety for female workers.

Second, similar to the condition of male workers, female workers with more fragmented work schedules also exhibit worse temporal regularity. However, other than leading to work-to-family conflicts among men, the consequences of blurring the temporal boundary between work and family can also increase family-to-work conflicts for female workers. Drawing from relevant studies on gender work-family conflicts, female workers in the UK persistently suffer more household responsibilities and have experienced lower levels of time quality (Lu, 2024; Sullivan, 2019). Although the UK government has made persistent

efforts² to promote flexible working as a work-family initiative (Li & Wang, 2022), recent studies on the gendered consequences of work flexibility indicate some ‘flexibility paradox’ issues (Chung, 2020) that women with higher work flexibility (e.g., flexible schedules and working from home) may use their flexibility to facilitate unpaid work or caring (Chung & Booker, 2022), thereby suffering more work-family conflicts and perceived temporal irregularity (Lott, 2018; Lu et al., 2023a, b). The growing popularity of flexible working offers female workers, particularly those with heavy family responsibilities, greater flexibility to blur the work-family boundary. This trend both facilitates boundary-blurring and heightens the risk of ‘double jeopardy’ (Bratberg et al., 2002) (i.e., the compounded burdens of work and family demands). Therefore, it is reasonable to assume that female workers’ role switchings occur more frequently within family contexts. A recent study on work time fragmentation and time pressure indicates that female workers tend to report more subjective time pressure than men when having more fragmented work schedules (Lu, 2024). Furthermore, professional female workers in the UK experience more constraints on their free time (e.g., multitasking, time pressure, and time poverty) than their male counterparts (Chatzitheochari & Arber, 2012; Sullivan & Gershuny, 2018). Although there might be adverse effects of time pressure and free time constraints brought by role switching, we expect that they can be partially offset but not totally overshadow the benefits of role expansion.

H2 For female workers, a more fragmented work schedule is associated with lower anxiety levels.

2.3 The Underlying Mechanism of Subjective Time Pressure

This section tends to explain the nuanced mechanism between work time fragmentation, subjective time pressure, and cognitive anxiety level by gender. Specifically, subjective time pressure is defined as individuals’ feelings of being rushed, which has been identified as a potential stressor (Craig & Brown, 2017; Sussman & Sekuler, 2022). However, it does not necessarily increase anxiety levels for the following reasons. First, some scholars have found that subjective time pressure is not only brought about by time poverty but also led by an increasingly enriched leisure life (e.g., the increased diversity of social activities and social media usage) (Mattingly & Sayer, 2006). For example, we might attend a dinner party on a weekday evening, or our free time could be filled up with playing mobile games and binge-watching TV shows, leading to a sense of busyness. Such an enriched leisure life can create a sense of busyness without necessarily leading to higher anxiety, as people may find both happiness and a sense of emptiness in these diverse activities (Zuzanek & Zuzanek, 2014). Second, self-perceived time pressure is subjective and can be restricted by social norms and expectations. According to Gershuny (2005), after entering the 21st century, busyness has become ‘a badge of honour’ for the privileged class. This is because machines are gradually replacing routine and manual assembly line jobs (Kamerāde et al., 2019), which means workers with lower professional skills and bargaining power have fewer employment opportunities and passively have more free time, especially during the recession (Heyes et al., 2017; Warren, 2015). Third, the dynamics stress process thesis (Cornwell,

² 2002: Right to request flexible working introduced for parents of young or disabled children. 2007: Extended to carers. 2014: Expanded to all employees. 2024: two requests per year and removes justification requirement.

2013; Cornwell et al., 2019) and the affective event assumptions (Brief & Weiss, 2002) in sociological psychology support the mechanism that instantaneous feelings (e.g., time pressure, work enjoyment) can explain the associations between individuals' work-related behaviours and cognitive judgement (e.g., cognitive anxiety). In addition, following a series of relevant studies using cross-sectional time diary data (Cha & Papastefanou, 2020; Craig & Baxter, 2016; Craig & Brown, 2017; Sullivan & Gershuny, 2018), testing the associations between work-family time use patterns and subjective time pressure is an established approach in time use research. Moreover, experimental evidence from psychological studies suggests only that anxiety can make time feel as though it is passing more slowly, rather than leading to increased perceptions of subjective time pressure (Bar-Haim et al., 2010; Rankin et al., 2019). Drawing on the existing literature, there is limited evidence to support the claim that higher levels of anxiety lead to increased subjective time pressure. Therefore, we do not expect reverse causality³ that cognitive anxiety might shape work time fragmentation through time pressure. Overall, this study assumes that subjective time pressure might mediate the associations between work time fragmentation and anxiety levels for both male and female workers but through different mechanisms.

For male workers, we expect that the higher levels of anxiety among male workers with more fragmented work schedules cannot be explained by their higher levels of subjective time pressure. As discussed in the previous section, men are expected to play breadwinner and ideal worker norms well at the same time, thereby being more likely to take busyness as 'a badge of honour' (Gershuny, 2005), especially for those with children. Therefore, men's subjective time pressure brought by time fragmentation may not further enhance anxiety. In addition, it is worth noting that a relevant study finds that only men with dependent children report higher levels of subjective time pressure when having a more fragmented work schedule, but not for men without children (Lu, 2024). This might be because of work time fragmentation or frequent role switching that happens outside of family contexts among men without children due to their fewer household responsibilities and role expectations. Therefore, for men with fewer household responsibilities, subjective time pressure might be correlated to frequent role switching from work to leisure or personal activities, which does not further enhance anxiety levels.

H3 The higher levels of anxiety among male workers with more fragmented work schedules (if so) cannot be explained by their higher levels of subjective time pressure.

For female workers, while there might be an expectation to benefit from role expansion during work time fragmentation, we assume that such benefits might be partly offset by accompanying subjective time pressures. First, female workers' work time fragmentation is more likely to be family-oriented and driven by their heavier family demands, thereby leading to more subjective time pressure, regardless of parenthood status (Lu, 2024). Second, compared with male workers, female workers are less likely to expect busyness as 'a badge of honour'. Conversely, female workers are suffering double jeopardy (Bratberg et al., 2002). In the labour market, being too busy juggling between work and family demands can lead to occupational penalties or stigma (Munsch, 2016). In households, being 'work-oriented' is against the traditional gender expectations and the 'homemaker' role (Fagan & Norman, 2013; Knight & Brinton, 2017). Therefore, we expect that while female workers can take

³ The reverse causality is further discussed in the limitation section.

mental advantages from work time fragmentation on anxiety levels, subjective time pressure may be related to mental disadvantages in this relationship. However, these drawbacks are insufficient to offset the whole benefit.

H4 Female workers' higher levels of subjective time pressure (if so) can partly offset the benefit on their anxiety level from work time fragmentation.

3 Method

3.1 Data and Sample

This study employs the CTUR UK Time Use Survey 6-Wave Sequence, which was collected from 2016 to 2021. This survey applied an online time-use diary instrument (the Click and Drag Diary Instrument, CaDDI) to collect data, which is suitable for rapid development in real-time situations and beneficial for data accuracy and timeliness (Sullivan et al., 2020). Respondents were asked to record six diary fields, such as “main” and “other simultaneous” activities, location, copresence, digital device usage, and instantaneous enjoyment, for each successive episode throughout 144 10-minute episodes across the day. As only the last five waves introduced full questionnaires and coincided with the outbreak of the pandemic, this study keeps data from 2020 to 2021. Each survey wave collected between one and three time use diaries from participants, resulting in a dataset that includes 5885 diaries in total across the years 2020 and 2021. To construct the analytical sample, we only included those who were employed. In addition, we only keep workers' typical days for the analyses due to our focus on workers' work schedules. This study adopts a listwise method in the main analyses, excluding cases with missing information in our target measurements ($N=101$). In the robustness check, the study adopts multiple imputations to repeat the analyses. Subsequently, the final analytic sample comprises 1707 diaries (see Fig. 1 for more details about the data cleaning procedure). Table 1 shows the weighted descriptive overview of the analytic sample, indicating systematic variations regarding time use patterns and mental issues across gender.

3.2 Measurements

This study's dependent variable is anxiety level, measured by a single, validated question asking participants to rate their overall anxious feelings on a ten-point scale. This scale ranges from 1 (not at all anxious) to 10 (completely anxious). The study's independent variable is work time fragmentation. Following previous relevant studies (Lu, 2024; Merz & Böhm, 2009), work time fragmentation is measured by the number of distinct working episodes experienced by respondents per day. Specifically, we first counted how many 10-minute working episodes they had throughout one day and subsequently calculated the number of distinct continuous workflows on that same day. A greater number of distinct continuous workflows indicates higher work time fragmentation (see Appendix in the Supplementary Material for more details about the measurement of work time fragmentation).

The mediator in this study is subjective time pressure. Following previous studies (Cornwell, 2013; Lu, 2024), we measured it by using a single, validated question. Respondents

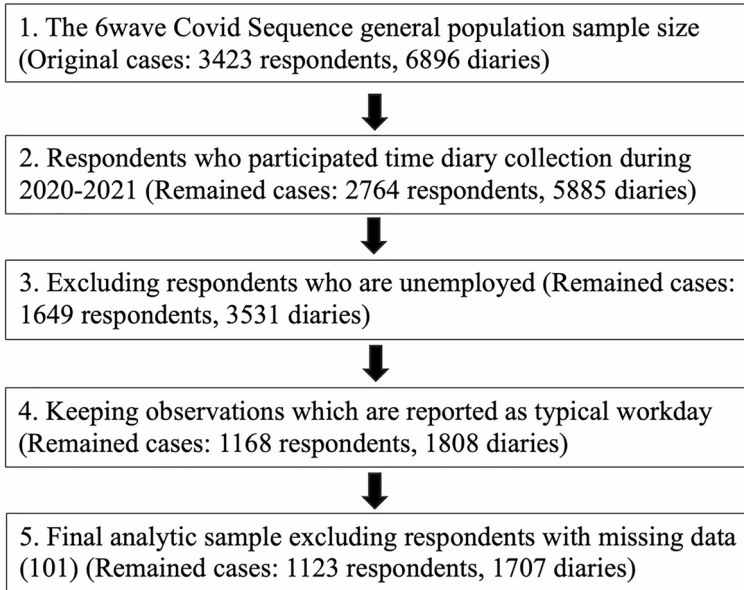


Fig. 1 Analytic sample construction process

were asked to rate their overall level of time pressure on a seven-point scale. This scale ranges from 1 (not time pressured) to 7 (very time pressured). As with all observational data, selection effects may bias the results. Following previous research (Powell & Craig, 2015; Zhou & Kan, 2021), we identified a series of social, demographic and time-quality-related characteristics that might be associated with work time fragmentation and anxiety level relationships. Specifically, we include the number of children in the household, marital status, social class, dairy day type, duration of paid work, unpaid work and personal care as covariates in the analysis.

3.3 Analytical Strategy

This study begins with a descriptive overview of samples, describing the differences in workers' time quality and socio-demographic characteristics by gender (see Table 1 for more details). Then, this study employs the weighted ordinary least squares (OLS) to examine the association between workers' work time fragmentation and anxiety levels. Since we hypothesise that such association may vary by gender, following many studies on gendered consequences of time use patterns (Craig & Brown, 2017; Powell & Craig, 2015), our analyses use gender-specific samples. Next, this study investigates whether changes in anxiety levels brought by work time fragmentation can be explained by subjective time pressure. Specifically, we apply the Karlson-Holm-Breen (KHB) method, which decomposes the total effect of the variable into direct and indirect effects, as well as the proportion of the main association explained by the mediator (Breen et al., 2013). All models have passed multicollinearity tests (all VIF scores are smaller than 5). Furthermore, this study incorporates weights suggested by the CTUR UK Time Use Survey 6-Wave Sequence to account for uneven sample distributions in all models. Our main findings are presented in

Table 1 Weighted descriptive statistics

	Male	Female	<i>F</i> / χ^2
Panel A: Respondent Level			
Anxiety Level, M (SD)	3.66 (2.97)	4.38 (2.77)	<i>P</i> <0.001
Subjective Time Pressure, M (SD)	3.33 (1.58)	3.60 (1.56)	<i>P</i> <0.01
Number of Children, M (SD)	0.66 (0.93)	0.58 (0.86)	<i>P</i> >0.05
Marital status, %			<i>P</i> >0.05
Single	25.33	29.96	
Married/living with partner	69.19	63.08	
Divorced/widowed	5.49	6.96	
Social Class, %			<i>P</i> <0.01
Higher occupations	61.00	51.40	
Intermediate occupations	22.81	32.52	
Routine and manual occupations	16.19	16.08	
Number of Respondents	633	490	
Panel B: Diary Level			
Work Fragmentation Times, M (SD)	1.65 (0.87)	1.56 (0.82)	<i>P</i> <0.05
Paid Work Time, M (SD)	46.18 (13.52)	45.83 (14.40)	<i>P</i> >0.05
Unpaid Work Time, M (SD)	6.14 (8.34)	8.56 (9.79)	<i>P</i> <0.001
Personal Care Time, M (SD)	58.75 (13.40)	61.02 (11.48)	<i>P</i> <0.001
Day Type, %			<i>P</i> >0.05
Working Day	88.06	89.18	
Weekends	11.94	10.82	
Diary Order, %			<i>P</i> >0.05
1	41.16	45.38	
2	32.49	31.53	
3	26.35	23.08	
Number of Observations	1004	703	

Note: % = Proportion, M=Mean, SD=Standard deviation, N=number of observations

F/ χ^2 tests were used to assess differences in means or proportions between males and females for continuous and categorical variables, respectively

the tables, and the full models are presented in the Supplementary Material Appendix. This study also includes a series of robustness checks to ensure the robustness of the analyses. First, we applied the Tobit model for all three regressions by using the total samples and different gender samples. This is because some scholars argue that the Tobit model might be more appropriate for time use data, assuming a latent propensity to do an activity and that negative values of this propensity are censored at zero (Craig & Brown, 2017; Foster & Kalenkoski, 2013). Then, we applied the multiple imputation by chained equations (MICE) method to check the robustness of using listwise deletion in the main analyses. MICE is widely used due to its ability to handle missing data regardless of variable distributions or missing patterns (Lee & Carlin, 2010). Our results of the robustness check findings are presented in the Supplementary Material Appendix as well.

4 Results

4.1 The Association Between Work Time Fragmentation and Anxiety Level by Gender

Table 2 shows several weighted OLS regression models examining the association between work time fragmentation and anxiety level. Model 1 in Table 2 indicates that those who report higher levels of work time fragmentation tend to have significantly lower anxiety levels. Next, this analysis was repeated using gendered samples. For male workers, the results of Model 2 in Table 2 reveal a finding similar to that of Model 1 with a greater R-squared. Male workers who report higher levels of work time fragmentation tend to have significantly lower anxiety levels. Thus, the results of Model 2 reject Hypothesis 1, which predicts that male workers with more fragmented work schedules tend to report higher anxiety levels than their counterparts.

As shown in Model 3, female workers who report higher levels of work time fragmentation tend to have significantly lower anxiety levels, which is consistent with what we expect in Hypothesis 2. Female workers with more fragmented work schedules tend to report lower anxiety levels than their counterparts. The margin effects based on Models 2 and 3 are plotted and presented in Fig. 2. Specifically, as shown in Fig. 2, workers tend to have significantly lower anxiety levels when their distinct working episodes increase, regardless of gender. Overall, the findings presented in Table 2; Fig. 2 do not reject Hypothesis 2 but reject Hypothesis 1. Both male and female workers report significantly lower anxiety levels when having more fragmented work schedules.

4.2 The Mediating Role of Subjective Time Pressure

Finally, this study examines the potential mediating role of subjective time pressure. Table 3 presents the results of the mediating analysis by using the KHB decomposition method. Firstly, panel A, which utilises the total sample, indicates that subjective time pressure negatively mediates the associations between work time fragmentation and anxiety level

Table 2 OLS regression models predicting the associations between anxious feelings and work fragmentation

	All gender groups	Male Group	Female Group
	Model 1	Model 2	Model 3
Work Fragmentation	-0.25** (0.08)	-0.23* (0.09)	-0.29* (0.15)
Gender (Ref. = Male)			
Female	0.91*** (0.15)		
Constant	5.35*** (0.65)	5.35*** (0.83)	5.29*** (0.94)
Observation	1707	1004	703
R-Squared	0.08	0.13	0.03

Note: Standard errors are in parentheses. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, + $p < 0.1$; ref. = reference category. All models control for occupational class, number of children under 16, respondents' time spent on personal care and paid/unpaid work, marital status and day type (i.e., weekday or weekend), and diary order

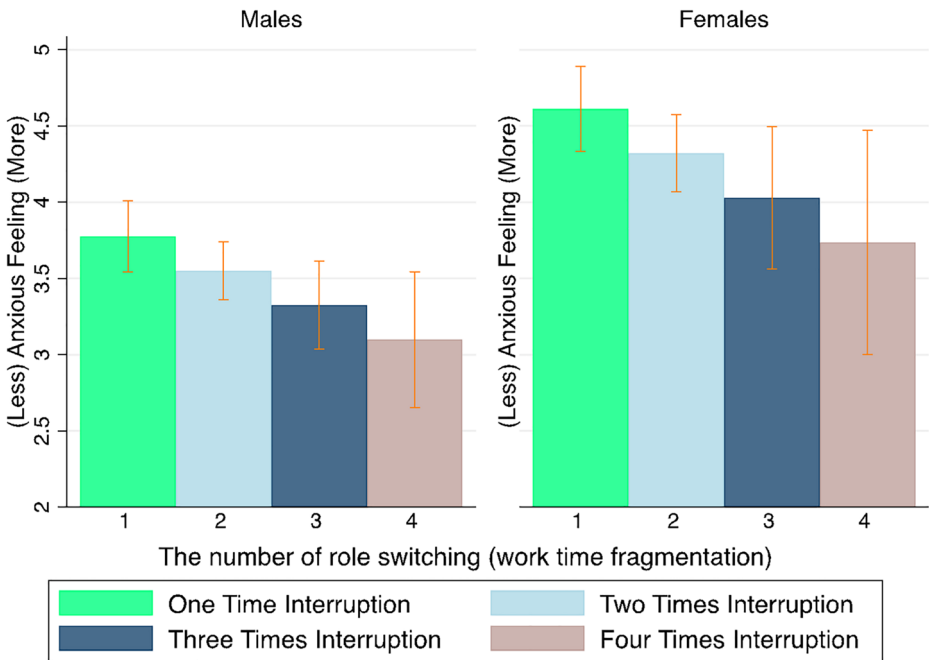


Fig. 2 Margin effects of work time fragmentation on anxiety level (by gender). **Note:** The independent variable ‘work time fragmentation’ is a continuous variable. Figure 2 aims to illustrate the general trend and variability across categories rather than to test for significant differences between specific levels of fragmentation

Table 3 KHB decomposition method examining the mediation effects of subjective time pressure on anxious feeling level

Anxious feeling	Coefficient	95% CI	P value	Mediation
Panel A: Total sample (N=1707); R-squared=0.26				
Work Fragmentation				
Total	-0.25 (0.07)	-0.38 ~ -0.11	<0.001	
Direct	-0.32 (0.07)	-0.45 ~ -0.19	<0.001	
Indirect via subjective time pressure	0.07 (0.37)	0.00~0.14	<0.1	21.9%
Panel B: Male workers (N=1004); R-squared=0.30				
Work Fragmentation				
Total	-0.23 (0.08)	-0.39 ~ -0.07	<0.01	
Direct	-0.24 (0.08)	-0.40 ~ -0.08	<0.01	
Indirect via subjective time pressure	0.02 (0.05)	-0.07~0.11	>0.1	8.3%
Panel C: Female workers (N=703); R-squared=0.22				
Work Fragmentation				
Total	-0.29 (0.13)	-0.54 ~ -0.05	<0.05	
Direct	-0.44 (0.13)	-0.69 ~ -0.20	<0.001	
Indirect via subjective time pressure	0.15 (0.58)	0.04~0.26	<0.01	34.1%

Note: Standard errors are in parentheses. CI=Confidence interval. All models control for occupational class, number of children under 16, respondents’ time spent on personal care and paid/unpaid work, marital status and day type (i.e., weekday or weekend), and diary order

(21.9% of the total effect). Notably, the direct effect⁴ of work time fragmentation on anxiety level is -0.32 ($p < 0.001$), whereas the indirect effect via subjective time pressure is 0.07 ($p < 0.1$), suggesting a negative mitigation effect on anxiety level. However, these findings show inconsistency when repeating the analyses using a sample of men. In panel B (men), only 8.3% of the total effect can be mediated by subjective time pressure, and the indirect effect has not passed the significance test. Thus, the results in panel B of Table 3 reject Hypothesis 3.

By contrast, panel C (women) in Table 3 presents consistent results with the total sample in panel A. Subjective time pressure negatively mediates the associations between work time fragmentation and anxiety level among female workers (31.4% of the total effect). Although subjective time pressure brings more mental disadvantages to females' anxiety levels, the much greater mental benefits led by work time fragmentation cannot be fully offset. This is consistent with the prediction of Hypothesis 4, indicating that female workers' higher levels of subjective time pressure can partly offset the benefit on their anxiety level from work time fragmentation. Taken together, subjective time pressure partially offsets the impact of mental benefits on anxiety levels, while such a mediating role is only significant among female workers. Results from Table 3 do not reject Hypothesis 4 but reject Hypothesis 3.

4.3 Robustness Check

All robustness checks are shown in Table A1 and Table A2. First, all results of the Tobit models are similar to the previous OLS regressions which are shown in Table A1. The result of Model 2 demonstrates that, for males, higher work time fragmentation is significantly associated with lower anxiety levels, aligning with the findings from Table 2 and rejecting Hypothesis (1). In addition, the results from Model 3 in Table A1 indicate a similar trend of alleviated anxiety levels with increasing work time fragmentation among female workers, which is consistent with our findings from Table 2 and supports Hypothesis (2). Then, the results after imputation, as shown in Table A2, are generally consistent with the main findings of this study. Overall, the results of the above robustness checks suggest that our findings are robust to model specifications and alternative models.

5 Discussion and Conclusions

In recent decades, the labour market in the UK, and even globally, has witnessed various significant changes, leading to the increased risks of work-related anxiety among workers. For example, the development of artificial intelligence has replaced many repetitive manual and service jobs (Huang & Rust, 2018), increasing work-related anxiety and insecurity among the lower occupational groups. In addition, the Covid-19 pandemic has promoted the popularity of flexible working arrangements, making workers' work and life schedules more fragmented than before (Lu, 2024; Lyttelton et al., 2022). The continually speeding-up society has also introduced new challenges in understanding workers' conditions and anxiety (Sullivan & Gershuny, 2018; Sussman & Sekuler, 2022). However, few studies have paid

⁴ Please note that we use the terms 'total', 'direct', and 'indirect effects' in the results of our mediation analysis for ease of understanding. The use of the word 'effect' does not imply a causal relationship.

attention to the gender-differentiated associations between work time fragmentation and anxiety levels. Using the latest time use data during 2020–2021 in the UK, this study aims to fill the knowledge gaps remaining in the current literature on workers' work conditions and anxiety by investigating how British workers' work time fragmentation is associated with their anxiety levels across gender. Overall, the study yields several vital findings, suggesting the gendered inequalities in work-life balance and the associations between work time fragmentation and anxiety levels.

First, this study finds that workers with more fragmented work schedules tend to report lower anxiety levels, regardless of gender. For female workers, work time fragmentation might be a buffer for their higher anxiety levels in dealing with the double burden that comes from both professional and family roles. Overall, the findings suggest that female workers tend to report higher anxiety levels than male workers. This is because of the persistent disadvantages females face in both the labour market and households. In the labour market, female workers suffer penalties (e.g., motherhood wage penalty and glass ceiling) and stigma when using maternity leave and flexible working to balance their multiple demands from work and family (Chung, 2020; Mari & Cutuli, 2021; Munsch, 2016). In the household, female workers also need to take more domestic work than their male counterparts disproportionately (Kan & Laurie, 2018). The findings of this study suggest the assumption that female workers tend to benefit more from role expansion and enrichment (Nordenmark, 2004; Wu et al., 2021b) when they have more fragmented work schedules accompanied by more role switching from work to family. However, such 'benefits' stem from gender inequalities. Female workers' anxiety levels remain consistently higher than their male counterparts when having similar levels of work time fragmentation.

Second, for male workers, the findings are inconsistent with the predictions of our hypothesis. Specifically, this study predicts that male workers are less likely to benefit from role expansion but suffer more from work schedule instability and role blurring than their female counterparts when having more fragmented work schedules. This is because of the assumption that men tend to suffer from a violation of gender expectations if they frequently switch from work to private and family domains (Abendroth, 2022). However, this study's findings do not support such a prediction. Instead, male workers might benefit from work time fragmentation since they are likely to have fragmented work schedules to facilitate personal demands rather than family demands (Lu, 2024). This is aligned with previous studies' predictions and empirical findings that suggest stepping away from a continuous but over-extended workflow can help reduce anxiety levels (Kim et al., 2017, 2018; Kossek et al., 2012). Therefore, it is possible for male workers to benefit from role enrichment when having more fragmented work schedules outside the family context but focusing on personal needs. Such gender-differentiated associations between work time fragmentation and anxiety levels might further reinforce the gender inequalities in work-life balance (Sullivan, 2019).

Third, previous studies find that work time fragmentation can lead to more subjective time pressure for both male and female workers (Lu, 2024). The findings of this study further suggest that the increased subjective time pressure partially offsets the benefits of work time fragmentation in alleviating female workers' anxiety levels. Due to the comprehensive nature of subjective time pressure, this study assumes that subjective time pressure or feelings of rushing might not always lead to higher anxiety levels. On the one hand, this study expects that individuals' subjective time pressure can increase anxiety levels when it is

solely caused by worse job quality or family demands (Linden & Muschalla, 2007; Yunus & Mostafa, 2021). On the other hand, subjective time pressure might not necessarily increase anxiety levels when it is restricted by social norms and expectations (Sussman & Sekuler, 2022). The associations between work time fragmentation and anxiety levels are regulated by gendered ideal worker norms (Kelly et al., 2010). Men, especially those in higher occupational class are expected to work longer and harder than women. Thus, the traditional social norms construct the concept of ‘busyness as a badge of honour’ (Gershuny, 2005). Being busy doing paid work aligns with the image of a ‘breadwinner’ but not a ‘homemaker’ and goes against society’s expectations of women. Although women with more fragmented work schedules may experience reduced anxiety due to role expansion and fulfilling family expectations, the accompanying inevitable subjective time pressure cannot be offset by social recognition in the same way it can for men. This is due to the longstanding societal failure to recognise that ‘unpaid work’ is also a form of work (MacDonald et al., 2005).

This study has some limitations. First, the research design of the study is cross-sectional but not longitudinal due to the limitation of the data. Although some respondents (45.3%) report more than one typical workday diary, the smaller sample size will still introduce bias when conducting further longitudinal analysis. Thus, the study’s results do not imply causal inference due to the absence of reverse causality tests. However, future studies can further examine the topic by using a longitudinal design and upcoming time use data with a bigger sample size. Second, although the analyses in this study have controlled for a series of respondents’ socio-demographic characteristics, there are still unobserved confounders that might lead to inaccuracies during estimations. Third, although the time diary approach is widely recognised as a golden standard and the most accepted approach in measuring time use and instantaneous enjoyment (Cornwell et al., 2019; Gershuny & Sullivan, 1998), it still has some bias during data collection. For example, respondents might be tired of recording their activities when they have fragmented schedules or have many multitasking episodes. However, time diary data is still the most accurate approach in terms of cost and accuracy. Scholars might help reduce the bias by creating applications in digital devices with the function of auto-recording (e.g., smart watches) in the future. In addition, we need to admit that job demand is a comprehensive latent structure, including [1] quantitative demand (e.g., workload) and [2] qualitative demand (e.g., emotional demands and autonomy) (Schaufeli, 2017; Väänänen & Toivanen, 2018). Owing to the limitation of the time use data we used in this study, we can only control for quantitative workload by including the duration of paid work of the day in the analysis. Time diary data provides a more accurate and objective measurement of paid working hours of the day, which has been widely accepted by previous studies as a proxy of job demand (Yeh, 2015). Since emotional demand might mediate the associations between work time fragmentation and anxiety, and there is no suitable measurement in the dataset, we expect future studies to test the potential mediation effects with innovative approaches and data. Finally, intersectional inequalities of gender and occupational class may also influence the relationship between work time quality and mental health. Future research could investigate how social class shapes work time fragmentation and its association with anxiety.

These limitations should not, however, overshadow the contributions of the study. This study, for the first time, empirically tests the associations between workers’ work time fragmentation and anxiety levels using robust time diary data and yields significant findings in supporting the persistently remaining gender inequalities in work-life balance (Sullivan,

2019). Previous studies ignored the gender inequalities in the mental consequences of work time fragmentation, preventing us from understanding the influences of current work-family interventions and trending work arrangements (e.g., flexible schedules, working from home and gig work) that might break the temporal regularity of workers' schedules (Lu, Wang, Ling et al., 2023). This study indicates that female workers tend to have higher levels of anxiety and are more vulnerable (i.e., higher subjective time pressure levels) when having more fragmented work schedules. Although female workers seem to report lower anxiety levels when having more fragmented work schedules compared to a single continuous work block in a typical workday, this decrease in anxiety levels should not be identified as a 'benefit'. Instead, it should be recognised as a form of 'alleviation' or 'compensation' for their heavier domestic responsibilities, worse work-life balance and disadvantaged positions. Therefore, the current work-family intervention should not solely rely on 'more flexible yet fragmented work arrangements' to alleviate their anxiety. Instead, alleviation of anxiety can be achieved through policies that support better work-life balance for women, such as freer childcare services and longer paid leave.

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Data Availability Data is available from an open-access public depository (UK Data Service); see more details from: <https://www.timeuse.org/>.

Declarations

Ethical approval Ethical approval was not needed for the present study because this study involves a routinely available, functionally anonymised, secondary dataset (with data subjects having consented to secondary research use).

Informed Consent Informed consent has been obtained by UK time use centre; see more details from: <https://www.timeuse.org/>.

Competing Interests The authors declare no competing interests.

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