UC Berkeley

Title

For whom did telework not work during the Pandemic? understanding the factors impacting telework satisfaction in the US using a multiple indicator multiple cause (MIMIC) model

Permalink

https://escholarship.org/uc/item/60d4p9zj

Authors

Tahlyan, Divyakant
Said, Maher
Mahmassani, Hani
et al.

Publication Date

DOI

Peer reviewed

For whom did telework not work during the Pandemic? understanding the factors impacting telework satisfaction in the US using a multiple indicator multiple cause (MIMIC) model

Divyakant Tahlyan [a], Maher Said [b], Hani Mahmassani [c, *], Amanda Stathopoulos [d], Joan Walker [e], Susan Shaheen [f]

[a] *Transportation Center, Northwestern University, 600 Foster Street, Evanston, IL 60208, USA*
[b] *Department of Civil and Environmental Engineering, Northwestern University, A308 Technological Institute, 2145 Sheridan Road, Evanston, IL, 60208, USA*
[c] *William A. Patterson Distinguished Chair in Transportation, Northwestern University, 600 Foster Street, Evanston, IL 60208, USA*
[d] *Department of Civil and Environmental Engineering, Northwestern University, A312 Technological Institute, 2145 Sheridan Road, Evanston, IL 60208, USA*
[e] *Department of Civil and Environmental Engineering, University of California, Berkeley, 111 McLaughlin Hall, Berkeley, CA 94720-1720, USA*
[f] *Civil and Environmental Engineering, Co-Director, Transportation Sustainability Research Center, University of California, Berkeley, 408 McLaughlin Hall, Berkeley, CA 94720, USA*

ARTICLE INFO

ABSTRACT

The COVID-19 pandemic required employees and businesses across the world to rapidly transition to work from home over extended periods, reaching what is likely the upper bound of telework in many sectors. Past studies have identified both advantages and disadvantages of teleworking. The pandemic experience offers a unique opportunity to examine employees' experiences and perceptions of telework given the broad participation duration and extent. While employer strategies will play a major role in defining the future forms and adoption of telework, employee preferences and constraints, such as access to appropriate technology to work from home or the home environment, are also going to be important factors. Using data from a U.S. representative sample of 318 working adults, this study uses a *Multiple Indicator Multiple Cause Model* (MIMIC) to understand employee satisfaction with telework. The presented model links telework satisfaction with experienced and perceived benefits and barriers related to telework, and hence provide a causal structure to our understanding of telework satisfaction. We also present an ordered probit model without latent variables that help us understand the systematic heterogeneity in telework satisfaction across various socio-demographic groups. The results suggest younger and older aged individuals experienced/perceived lower benefits and higher barriers to teleworking compared to middle aged individuals. The results also suggest a disproportionate impact on Hispanic or Latino and Black respondents as well as on those with children attending online school from home. Accordingly, this study highlights important factors impacting telework adoption that employers and policy makers should consider in planning future work arrangements and policies in a post-pandemic world.

* Corresponding author.
E-mail addresses: dtahlyan@u.northwestern.edu (D. Tahlyan), MaherSaid@u.northwestern.edu (M. Said), masmah@northwestern.edu (H. Mahmassani), a-stathopoulos@northwestern.edu (A. Stathopoulos), joanwalker@berkeley.edu (J. Walker), sshaheen@berkeley.edu (S. Shaheen).

1. Introduction

One of the most impactful transformations triggered by the COVID-19 pandemic is the massive transition of employees and businesses to work from home. According to a U.S. survey conducted by Pew Research in October 2020 (Parker et al., 2020), while only 20% of working adults reported working from home before the pandemic, the number of working adults that reported working from home during the pandemic had grown significantly to 71%. A key finding from this study is that workers were highly divided: only 54% of working adults would like to work from home once the pandemic is over. This finding is significant; while several studies (Tavares, 2017, Ollo-López et al., 2020) have shown positive impact of the option to telework and of actual telework, the experience from the pandemic has been mixed for many. Thus, the extent of continued future adoption of telework when it is an available option remains an open question for employers and policy makers in a post-pandemic world. On the positive side of the argument, we note that the resources that corporations have spent during the pandemic to make teleworking easier, increased schedule flexibility, and inclusion aspects of telework may permanently change the way Americans expect to work, and this may lead to maintaining high levels of telecommuting (Igeltjørn and Habib, 2020, Bjursell et al., 2021). On the other hand, the current level of adoption may not be sustained in the wake of growing evidence related to decline in innovation and productivity (Miglioretti et al., 2021, Song and Gao, 2020) and lack of clearly defined boundaries between work and private life (Lewis, 2017, Pluut and Wonders, 2020). This is further complicated by the fact that the pandemic forced organizations to suddenly adopt remote work, sometimes without providing employees with the necessary skills and support to thrive in the remote work environment (Errichiello and Pianese, 2021).

While we note that employer strategies will play a major role in defining the future forms and adoption of telework, employee preferences and constraints, such as access to appropriate technology or environment to work from home, are also going to be extremely important factors. Overall, there is consensus that different remote work models will persist and that hybrid forms of work will be sustained post COVID-19 pandemic (Gurchiek, 2021). Yet, there is a need for further research to understand employee perceptions, barriers and assets related to remote work, as well as the variation among different employee groups. The resulting behavioral insight will be an important input to establishing the forms and strategies to maintain productivity, worker well-being and company culture in a remote work world.

The broad and durable nature of telework adoption during the pandemic across sectors and user-groups presents a rare and unique opportunity to study telework. Most studies prior to the pandemic treated teleworking as a choice, part of an intentional telework program from the employer's end. Instead, analysis of remote work in the COVID-19 era needs to account for the fact that the pandemic broadly forced employers and workers to adopt telework for an extended period except for individuals for whom onsite presence was essential.

In past research, telework has been considered as a means to reduce congestion and the environmental impact of the transportation sector for several decades (Lari, 2012, Matthews and Williams, 2005, Irwin, 2004, Larson and Zhao, 2017, Gareis and Kordey, 1999, Mokhtarian et al., 1995, Choo et al., 2005). Employee telework adoption has been tied to schedule flexibility (Shabanpour et al., 2018), worker age and educational attainment (Walls et al., 2007, Noonan and Glass, 2012), and interaction with the employer's expectations (Brewer and Hensher, 2000). In terms of attitudes, telework adoption preferences are linked to both constraints (family effects, commuting, job suitability) as well as opportunities (interaction with co-workers) (Yen et al., 1994, Yen and Mahmassani, 1997, Mokhtarian and Salomon, 1997).

A comprehensive understanding of the long-term viability of remote work and related spatially and temporally flexible work arrangements is still taking shape (Nayak and Pandit, 2021, Salon et al., 2021), and many of the earlier findings may need to be revisited in this new context. For example, earlier research suggests that attitudes may be more consistently important than sociodemographic status like presence of children (Mokhtarian and Salomon, 1997). Among the unique features shaping the COVID-19 telework situation is the frequent occurrence of multiple members of the same household teleworking simultaneously, including children attending school online. Overlapping telework arrangements potentially impose resource, time, and space restriction on individuals and increased work-life conflicts.

In light of the above discussion, this study is focused at understanding the systematic heterogeneity and factors associated with telework satisfaction during the COVID-19 pandemic amongst a representative sample of working adults in the United States. We use data regarding self-reported telework satisfaction ratings, responses to several other questions related to benefits of and barriers to teleworking, and socio-demographics and contextual variables from a survey with *318 working adults*. We employ a *multiple indicator multiple cause* (MIMIC) model capable of measuring both the direct and indirect impact (via the latent factors) of socio-demographic information on telework satisfaction, hence providing a causal structure to our understanding of the drivers of telework satisfaction. Our methodology relates telework satisfaction with the perceived/experienced benefits of and barriers to telework and thus helps in identifying factors that may impact telework frequencies in the future. It is known from prior work that satisfaction acts as an antecedent to future behavioral intentions (Oliver, 1980, Wang et al., 2020, Oliver and Linda, 1981, Bukhari et al., 2013, Allen et al., 2020, de Oña, 2021b, de Oña, 2021a). A common structure in adoption studies is to frame use intentions from the perspective of perceived benefits and barriers, which, in turn, are driven by experiences (Ajzen, 1991, Zunft et al., 1999, Kadir et al., 2019, Pérez et al., 2002, Van Horn and Storen, 2000, Meroño-Cerdán, 2017).

Given the novelty of the setting in which telework is experienced by workers, our chosen approach is to frame the MIMIC modeling around the identification of two latent variables: benefits and barriers. This underpins the three main contributions of this work, namely: defining benefits/barriers of remote work in the unique circumstances of the pandemic, revealing casual structures stemming from the experience during the pandemic, and finally uncovering the systematic differences by respondent features and household status. These findings can help employers determine how to balance employee well-being and aspirations for work flexibility, while

maintaining innovation and productivity. More broadly, insights about remote work intentions can aid urban and transport planners in making decisions related to mobility provision and urban design.

The rest of the paper is structured as following. Section 2 presents the data available for this study, details of the conducted survey, and descriptive statistics of socio-demographic and attitudinal variables. Section 3 presents the mathematical formulation of the ordered probit and MIMIC models. Section 4 presents the estimation results and is followed by summary, policy implications, and limitations of this study in Section 5.

2. Data

2.1. Survey

The data used in this study comes from wave 5 of a 6-wave longitudinal online survey conducted between December 22, 2020 and March 08, 2021 in the United States, using Prolific's panel of individuals aged 18 years or older (Palan and Schitter, 2018). A representative sample in terms of age, gender and ethnicity was recruited using a specialized filter. Although the survey was longitudinal, the data in this survey is extracted from a single wave in the series that focused on telecommuting experiences collected between February 22 and February 28, 2021. A detailed description of the survey design and response rate of the full longitudinal survey can be found in Tahlyan et al. (2021). The telework satisfaction and other related experience and perception questions, which are of primary interest to this study, were presented to 318 working adults and students in the survey. These questions were not asked to individuals who were either retired, out of work or unable to work and hence were excluded from this analysis.

2.2. Available variables in the data

2.2.1. Telework satisfaction rating data

On a 5-point Likert scale (*very dissatisfied* to *very satisfied*), individuals with full-time or part-time employment status and those who have not been working from an office in the past week (i.e. workers with at least some experience of working from home recently) were asked to rate their level of satisfaction with their telework experience using the following question: *"How satisfied are you with your experience of working from home?"* Individuals who are employed but have been working exclusively from an office (i.e., workers with no *recent* experience of working remotely) were instead asked to rate their expected level of satisfaction with teleworking in a hypothetical scenario[1] where telework is a viable option using the following question: *"Imagine you were asked to work from home. How satisfied do you think you would have been working from home?"* Similar questions were asked to students with recent or no experience of working from home in the context of *"attending classes from home"*. In the telework satisfaction rating data, merely 2.52% (8 respondents) of the 318 individuals responded that they were or would have been *very dissatisfied* with teleworking. Hence, we converted the 5-point response scale to a 4-point scale by combining the "very dissatisfied" and "somewhat dissatisfied" response categories. Fig. 1 shows the distribution of reported telework satisfaction with about 74.21% individuals reporting they were or would have been somewhat or very satisfied with telework. This 4-point satisfaction response item is eventually used in the presented models as a dependent variable.

2.2.2. Telework related experience, perception, and contextual data

The study included questions on telework perceptions, experiences and other contextual variables related to household factors and COVID-19 concerns. This data was also collected for cases where telework was not an available option, such as essential workers. Questions asked to the respondents and the response distribution is presented in Table 1. Although the variables shown in Table 1 were measured on a 4- or 5-point scale, they were recoded to binary variables to reduce the complexity of estimated models, given the relatively small sample size[2]. As observed, a significant proportion of individuals did not agree with potential benefits related to telework like productivity gains or quality of life improvements. These findings are in line with the findings by the survey conducted by PwC (2021) in December 2020 in the U.S., however, it contrasts with the research by Baert et al. (2020) in Belgium where respondents mainly attribute positive characteristics to telework. These differences likely reflect the dynamic nature of telework experiences during the pandemic where while early experiences with telework were largely positive but more recent studies suggest a mixed experience. Furthermore, only about 15% of individuals reported lack of technology being a hindrance to telework given that the required technologies like a laptop or a webcam or access to internet have a significantly high market penetration in the U.S.

---

[1] From the data available to us, it is difficult to say whether this was truly a hypothetical scenario or not since the question specifically asked about work location in the "recent" weeks and no particular time frame was provided. It is possible that the respondent did telework in the early period of the pandemic or may have telework experience prior to the pandemic. Further, the hypothetical scenario version of the question was presented to 78 out of 318 respondent and almost all of them were working exclusively on-site due to employer mandates (i.e., working from home was not an available option). Lastly, 59 of 78 individuals were essential workers.

[2] The 5 statements on a 5-point Likert scale were recoded to 1 if the respondent somewhat or strongly agreed with the statements or 0 otherwise. The statement on work location flexibility was recoded as 1 if there was partial or complete flexibility to choose work location and 0 otherwise. The statement on the job's remote work suitability was recoded to 1 if the job was mostly or very suitable to remote work and 0 otherwise. Lastly, the COVID-19 related worry variable was recoded as 1 if the respondent reported being worried or very worried about potentially contracting the virus and 0 otherwise.
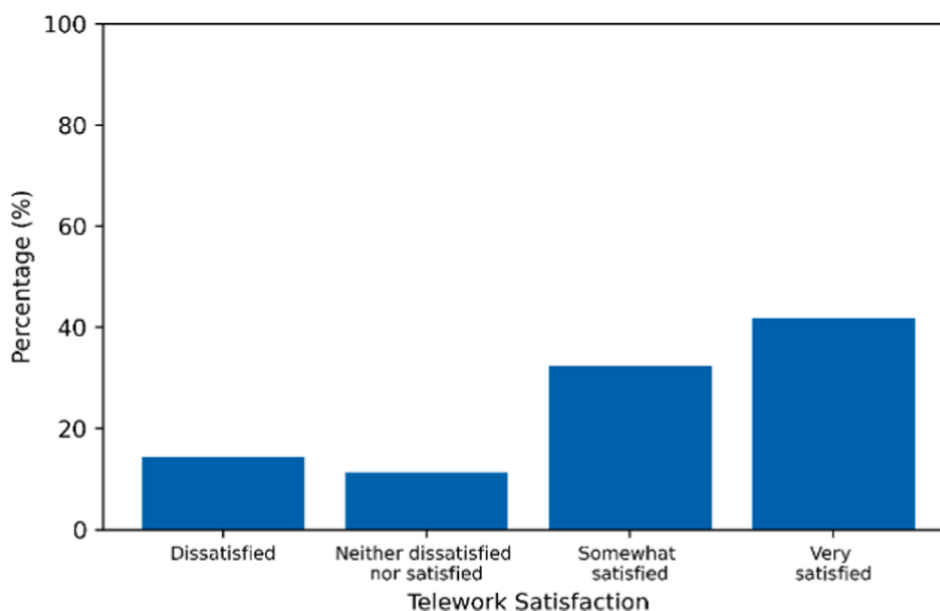
Fig. 1. Distribution of reported telework satisfaction in the data.

Table 1
Distribution of telework related experience, perception, and contextual data.

Indicator/Statement	Abbreviated Variable Name	Disagree	Agree
*I have been/would be more productive working from home.	Work productivity gains	55.0%	45.0%
Not needing to commute to work has improved/would improve my ability to work from home.	Time savings due to not needing to commute	28.6%	71.4%
The option to work from home has improved/would improve my quality of life.	Quality of life improvements	36.2%	63.8%
Lack of technology like a laptop or a webcam has/would hinder my ability to work from home.	Lack of appropriate technology	85.2%	14.8%
Distractions from other household members have/would hinder my ability to work from home.	Distraction from other household members	61.6%	38.4%
Indicate who determines their work location: the employer; there is partial flexibility in the determination of work location; or if there is complete flexibility.	Work location flexibility	57.8%	42.2%
Indicate level of suitability of the respondent's job to remote work: not suitable at all; somewhat suitable; mostly suitable; very suitable.	Job's remote work suitability	45.0%	55.0%
Indicate level of worry (on a 4-point scale of not at all to very worried) about potentially contracting the COVID-19 virus.	Worried regarding contracting COVID-19	61.6%	38.4%

* First five statements measured on a 5-point Likert scale (strongly disagree to strongly agree).

The data from these questions were used to first conduct an exploratory factor analysis, used as foundation to identify factors related to perceived benefit and barriers to telework incorporated into the final MIMIC model. The identification of these latent variables is anchored upon several existing studies on telework before and during the COVID-19 pandemic (Pérez et al., 2002, Baruch, 2000, Tremblay and Thomsin, 2012, Morgan, 2004, Vayre, 2021).
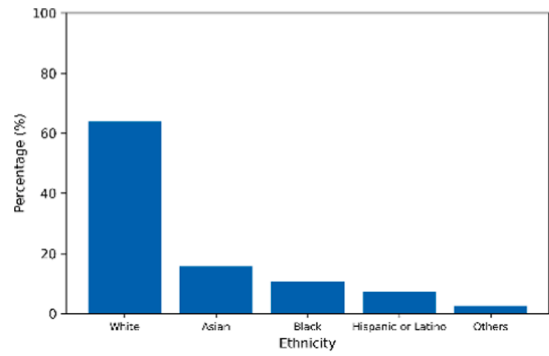
2.2.3. Socio-demographic data

The survey also collected socio-demographic variables that are relevant to study variation in experiences and satisfaction with remote work. Fig. 2 presents the descriptive statistics of the socio-demographics used in this study. The variables include age, ethnicity, household location type (urban, rural, suburban), highest level of education, household setup type (living alone or with others), vehicle ownership status etc. Another important variable that we include in our analysis is whether or not an individual works in one of the following four remote work suitable industries: communications and information technology, educational services, media and communications, and professional and business services.

3. Methodology

To understand the drivers of satisfaction and heterogeneity in the self-reported telework satisfaction, we present two models based on the available data. The reference model is an *ordered probit* model controlling for socio-demographic variable effects on telework satisfaction levels. This model is useful to understand the heterogeneity in telework satisfaction across various socio-demographic groups. The second model is a MIMIC model with an ordered probit component relating socio-demographic information as well as
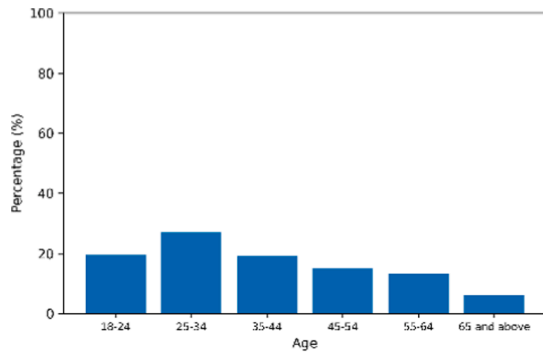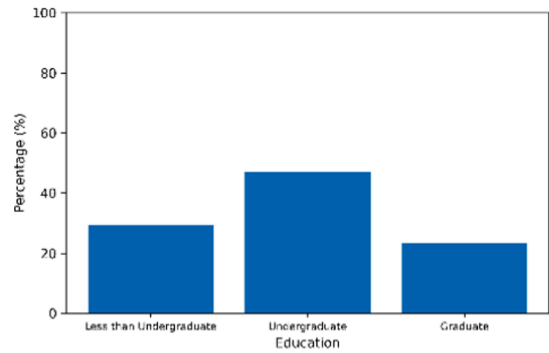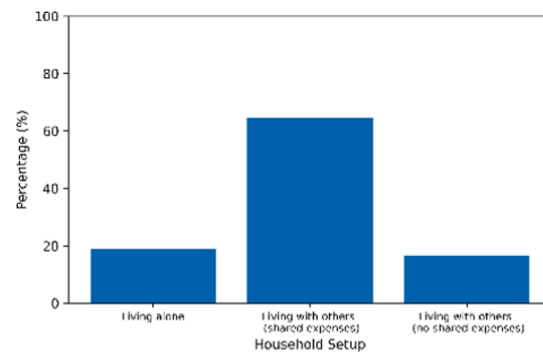
(a) Age

(b) Ethnicity
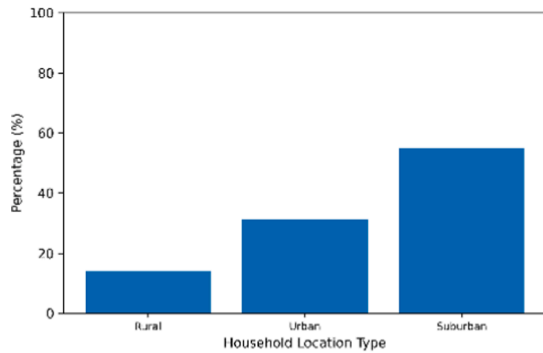
(c) House location type

(d) Education level

(a) Household setup
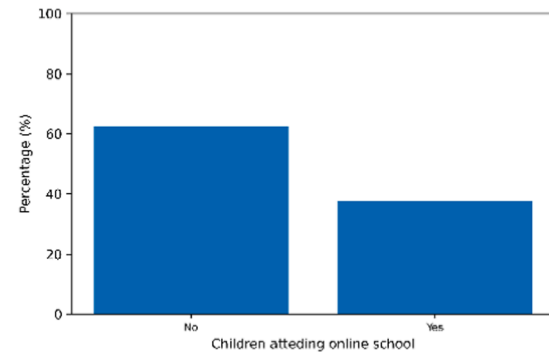
(f) Presence of children attending online school

Fig. 2. Descriptive Statistics of socio-demographic variables available in the data.

latent variables with self-reported telework satisfaction. The model provides a causal structure to our analysis for understanding telework satisfaction. Mathematical details related to both models are presented in the following sections.

3.1. Ordered probit model

An ordered probit model (Washington et al., 2020) consists of a latent variable (sometimes also referred to as a latent propensity) y^* such that:

$$y^* = z\gamma + u \tag{1}$$

where z is a vector of exogenous variables, γ is a vector of estimable parameters and u is standard normally distributed error term. The
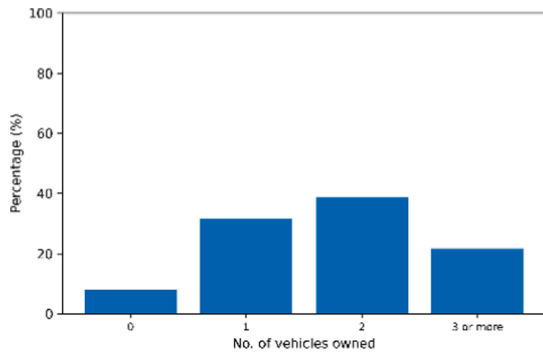
(g) Number of vehicles in the household

(h) Essential workers or on-site work required

(i) Work Industry

Fig. 2. (*continued*).

latent propensity function y^* is related to the reported $J-point$ response item y (4-point scale satisfaction rating this case) in the following manner:

$$y = \begin{cases} 1 & \text{if} & y^* \leq \psi_1 \\ j & \text{if} & \tau_{j-1} < y^* \leq \tau_j \forall j \epsilon(2, \cdots, J-1) \\ J & \text{if} & \tau_{J-1} \leq y^* \end{cases} \qquad (2)$$

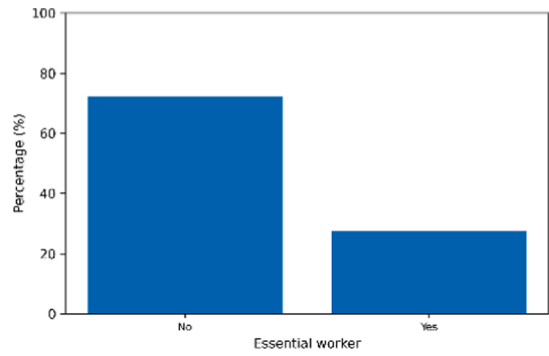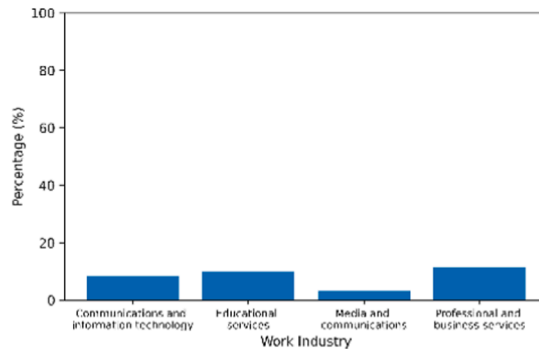where τ_j $(j = 1, 2, \cdots, J-1)$ are estimable thresholds dividing the propensity function. Note here that to ensure model identification, either τ_1 or a constant in y^* can be estimated and the other parameter should be fixed to zero. Given the above equations, probability $P(y)$ of observing the self-reported satisfaction rating y is written as:

$$P(y) = \begin{cases} \Phi(\tau_1 - z'\gamma) \\ \Phi(\tau_j - z'\gamma) - \Phi(\tau_{j-1} - z'\gamma) \forall j \epsilon(2, \cdots, J-1) \\ 1 - \Phi(\tau_{J-1} - z'\gamma) \end{cases} \qquad (3)$$

where $\Phi(\cdot)$ is standard normal cumulative distribution.

3.2. MIMIC model

The MIMIC model used in this study falls in the category of a generalized structural equation model with categorical data as it takes into account the binary nature of the indicators used for measuring the latent variables. (Muthén, 1984). The MIMIC model consists of an ordered probit component and relates socio-demographic information to perceived/experienced[3] benefits of and barriers to telework satisfaction and to telework satisfaction itself. Similar to other structural equation models, the presented model consists of two

---

[3] Note here that we use to perceived / experienced terminology here instead of just experienced due to presence of individuals in the data with no telework experience, for example, essential workers. While using the experienced benefits or barriers is more relevant for individuals who had at least some telework experience during the pandemic, for individuals with no experience of telework during the pandemic, our data only reflects their perception of telework which may not be formed by personal experiences.

components: 1) *a structural model*, capturing the inter-relationship between different latent variables and the relationship between socio-demographic information and latent variables; 2) *a measurement model*, capturing the relationship between continuous latent variables and their observed indicators (all of which are categorical in this study) (Skrondal and Rabe-Hesketh, 2005).

3.2.1. Structural model

The structural model defines the inter-relationships between continuous latent variables and the relationship between the latent variables and observed socio-demographic information. In its general form, the structural model can be written as:

$$\eta = \alpha + B\eta + \Gamma X + \epsilon \qquad (4)$$

where η is a vector of latent variables, α is a vector of intercepts, B is matrix of parameters governing the relationship between latent variables, Γ is a matrix of regression parameters representing the relationship between observed socio-demographic information and latent variables and ϵ is a vector of error terms.

3.2.2. Measurement model

The measurement model specifies the relationship between the latent variables and its indicators using the following equation:

$$y^* = \nu + \Lambda\eta + KX + \mu \qquad (5)$$

where y^* is a vector of continuous latent variables (assuming that the indicators are categorical), ν is a vector of intercepts, Λ is a factor loading matrix and μ is a vector of measurement errors, and K is the regression parameter matrix defining the relationship between y^* and X. The relationship between y^* and the observed response to the indicator can be defined as in equation (2) since the indicators are assumed to be ordered categorical in nature.

Fig. 3 presents the structure of the MIMIC model used in this study. The indicators for each of the latent variables were determined following an exploratory factor analysis that allowed for polychoric correlations (Holgado–Tello et al., 2010). In the MIMIC model, the structural equation relates the socio-demographic information with the identified latent variables (i.e., benefits of and barriers to telework), the measurement equations relate each latent variable with their indicators, and the telework satisfaction response propensity is related with the latent variables and the socio-demographic information using an ordered probit type model. All models in this paper are estimated using the R programming package *lavaan* (Rosseel, 2012), which uses mean and variance adjusted weighted least square (WLSMV) procedure (Suh, 2015). WLSMV estimator is the most appropriate estimator for non-normal data and makes minimum assumptions about the distribution of the observed variables (Allen et al., 2020, Bollen, 1989).

4. Estimation results

4.1. Exploratory factor analysis

We began the exploratory factor analysis with the Kaiser – Meyer – Olkin (KMO) test (Kaiser, 1970, Kaiser and Rice, 1974) of sample adequacy and the Bartlett's test of sphericity (Bartlett, 1937) using the 8 indicator variables. A KMO value of 0.66 (minimum acceptable value 0.6) and Bartlett's K squared value of 50.371 (degrees of freedom = 7 and p-value = $1.22*10^{-8}$) showed that the data is appropriate for a factor analysis. Table 2 presents the results from a 2-factor solution with *varimax* rotation from an exploratory factor analysis (EFA) conducted using the available telework related experience, perception, and contextual variables. The COVID-19 related concern variable has been excluded from the presented solution since it had a small loading value on the 2-factor and 3-factor solutions attempted. Hence, we include the COVID-19 worry related variable directly into the ordered probit part of the model[4]. Admittedly, some loadings are lower than the generally accepted cutoff values, but we decided to keep the corresponding indicators given that they were extremely important aspects (Hoffman, 2021, Landon-Murray and Anderson, 2021). The two identified latent variables were named as 1) Telework Benefits and 2) Barriers to Telework. Overall, the 2-factor solution explains 52.7% of the common variance in the 7 indicators with 2 cross-loadings across the factors. Given that cross-loadings are reasonably high, we decided to keep these to explicitly account for cross-correlations in the final MIMIC model while defining the latent variables. Given the increasing concerns regarding the use of Cronbach's α for measuring internal consistency reliability in non-continuous data (McNeish, 2018), we use ω total measure of composite reliability proposed by McDonald (1999), McDonald (1970). The ω are estimated using the *psych* R programing package (Revelle, 2013) and were found to be 0.77 and 0.58 for factor 1 and factor 2, respectively, which showcases reasonable reliability for the identified factors.

---

[4] Despite the risk of endogeneity, since we do not have the longitudinal measures of both satisfaction and COVID-19 concerns to resolve the complexity of simultaneous effects, we determined that this variable is a relevant factor during the time of the pandemic where individuals with higher COVID-19 concern might feel more satisfied with telework. Notably, removing this variable from the presented models did not change the remaining parameter estimates or their statistical significance. Capturing COVID-19 concerns and related risk-avoidance or tolerance behaviors remains an important avenue for further research.
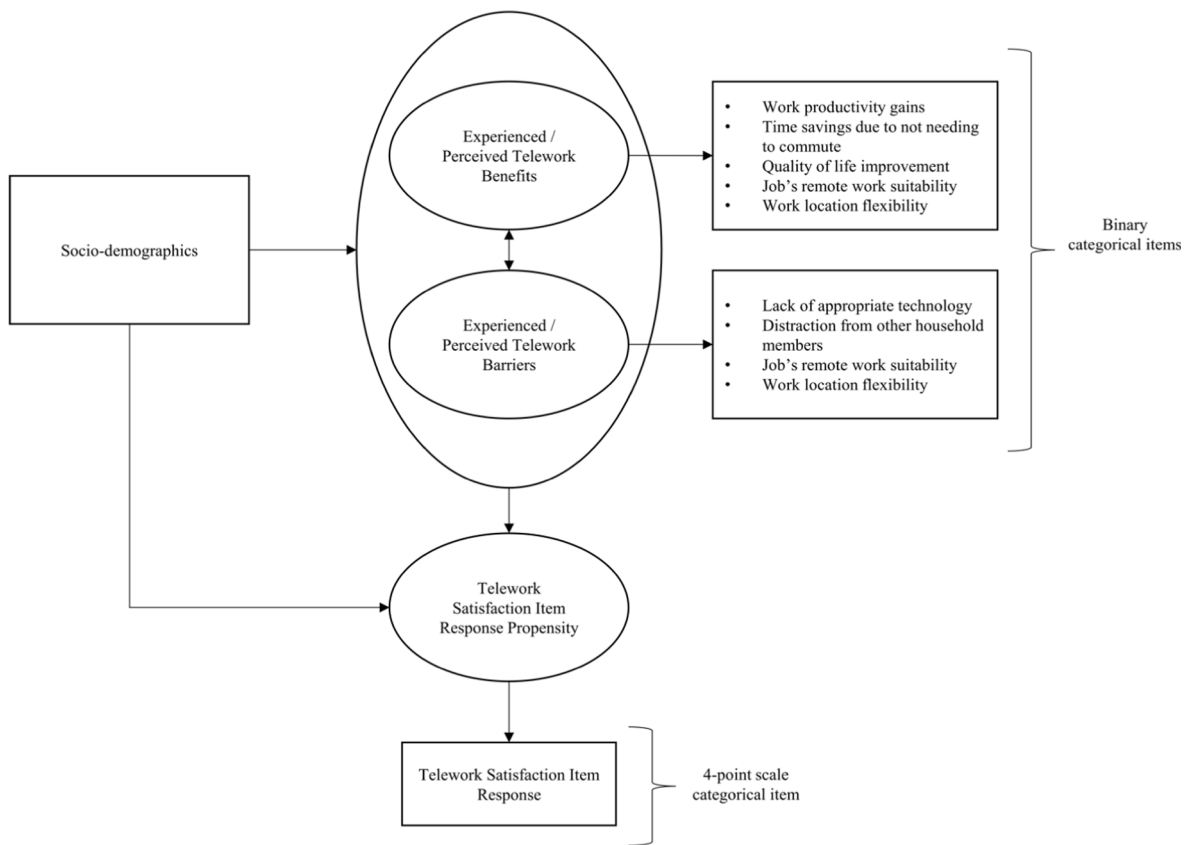
Fig. 3. Structure of the MIMIC Model.

Table 2
Results from the exploratory factor analysis.

Indicator	Factor Loadings	
	Factor 1 (Telework Benefits)	Factor 2 (Barriers to Telework)
Work productivity gains	0.816	–
Job's remote work suitability	0.576	−0.815
Time savings due to not needing to commute	0.680	–
Quality of life improvements	0.852	–
Lack of appropriate technology	–	0.454
Distraction from other household members	–	0.267
Work location flexibility	0.319	−0.649
ω total	0.77	0.58

% of common variance explained by two factors = 52.7%
rotation = varimax

4.2. Estimation results

4.2.1. Model of socio-demographic determinants of telework satisfaction

Table 3 presents the results from the ordered probit model with socio-demographic information but without latent variables. This model helps to gain a fundamental understanding of the distribution of satisfaction across the respondents in the data. According to the R^2 value (Hair et al., 2011, Hair et al., 2012), the presented model explains 21.9% of the variance in the *latent propensity function* of the telework satisfaction equation. Note that the typically reported log-likelihood based fit measures are not available here since the model has been estimated using the WLSMV estimator instead of maximum likelihood estimator.

As seen in Fig. 4, there is a parabolic relationship between telework satisfaction and age. Specifically, results indicate that while middle aged individuals were more satisfied with teleworking, the satisfaction was lower for younger and older individuals. As reported by some news articles (Atlantic, 2020), this might be related to either loss of networking and mentoring opportunities that

younger individuals benefit from in the early stages of their careers or to lack of proper remote working conditions at their homes as many younger individuals often live in shared apartment. For older individuals, the lower satisfaction may be related to higher position ranks, echoing findings in Carillo et al. (2021) where managers adjusted less well to telework than non-managers, related to the difficulty of managing teams in the uncertain environment. Lower satisfaction of older workers may also be associated with challenges to use technology as a primary work tool. Results also suggest that the satisfaction was lower for individuals with at least an undergraduate degree and for households with children attending school virtually from home. A likely reason for presence of children attending school from home impacting satisfaction is that it may strain individual's attention span (DeFilippis et al., 2020, Alexander et al., 2021). Furthermore, telework satisfaction for individuals with a graduate degree was marginally higher than for individuals with just an undergraduate degree, but the corresponding parameter was not highly significant. However, we decided to retain this parameter to control for the effect of having a graduate education, given the consistent importance of this variable in past research.

Hispanic or Latino respondents reported higher satisfaction with teleworking compared to other ethnic groups. A conjecture is that Hispanic or Latino respondents tend to be overrepresented in work requiring in-person activities, which are less telework friendly, even before the pandemic (Cerullo, 2020). Hence, their reported satisfaction is higher when they were given a hypothetical situation of teleworking being an available option or when their employers were forced to give telework as an option. Individuals living in suburban areas also reported higher satisfaction with teleworking compared to both rural and urban residents, potentially related to several factors including relocating to suburban areas since telework was possible[5] or to not needing to commute to work anymore (Bowman, 2020, Wu and Melgar, 2021, Sheffey, 2021). Lastly, the model also suggests higher satisfaction amongst individuals who were more worried about contracting the COVID-19 virus. This result suggests that satisfaction with remote work can also be driven by factors external to the nature of the work and household environment, to encompass concerns about viral exposure.

4.2.2. MIMIC model

Table 4 presents the ordered probit component of the MIMIC model, which is an extension of the model presented in the previous subsection. This model now includes latent variables which were not included in the previous model. To provide a more causal structure to the model and capture heterogeneity in the latent variables, socio-demographic information was included in both the ordered probit component as well as the structural model where significant, as presented in Table 5. However, preference was given to include socio-demographic information in the structural model when a parameter was significant in only one model components. Hence some of the socio-demographic variables – like age – do not appear in the ordered probit component of the MIMIC model but rather have an indirect impact on satisfaction via the latent variables. Table 5 presents the results from the structural model and Table 6 presents the results from the measurement model. Furthermore, Fig. 5 presents a path diagram with all statistically significant paths, as well as various model fit measures typically reported in the structural equation models.

4.2.2.1. Model fit.
As can be seen from Table 4, the R^2 value of the ordered probit model with latent variables is 0.648, which is a significant improvement from the value of 0.219 reported earlier in the model without latent variables. Moreover, the typically reported structural equation based fit measures (see Fig. 5) are within the acceptable ranges except SRMR. For example, the acceptable range for TLI and CFI is of greater than 0.95 and both satisfy this criterion. The model is acceptable if the upper bound of 90% confidence interval of RMSEA is below 0.08, which is satisfied in our model as well. While SRMR is slightly above the acceptable threshold of 0.08, SRMR tends to be higher in models with smaller sample sizes and with greater complexity (Kenny, 2015). Given that the inclusion of latent variables significantly improves the R^2 in the ordered probit component and that the typically reported structural equation model fit measures are all within the acceptable ranges, the presented model's results are believed to be trustworthy.

4.2.2.2. Ordered probit model of telework satisfaction.
As can be seen from Table 4, there is an intuitive link between satisfaction and the latent variables. Namely, individuals which rank higher on telework benefits also report higher satisfaction, and vice versa for barriers. Furthermore, the results related to COVID-19 related worry, level of education and Hispanic or Latino ethnicity remained the same as in the earlier model. It is noted that a few of the variables, like age, which were earlier present in the ordered probit model, are now more appropriately included in the structural component of the overall model, suggesting an indirect effect on telework satisfaction. This indicates that age was structurally correlated with benefits of and barriers to telework variables rather than being a direct causal factor driving telework satisfaction.

4.2.2.3. Structural model.
Table 5 presents the estimation results from the structural model that captures the heterogeneity in the latent variables included in the ordered probit component. For the *telework benefits*, we found that these were higher for individuals living in suburban areas and individuals without access to a vehicle. Further, the experienced/perceived benefits were lower for Black individuals, individuals living alone, and individuals with children attending school from home. Lastly, age had a non-linear impact on

---

[5] Several independent data sources point out to a significant relocation across regions in the U.S. during the pandemic. For example, a study by Zillow, which is a major online real estate marketplace company in the U.S., reported about 11% of American moved during the pandemic of which about 75% did so due to reasons like moving closer to family. Another two studies that use data from United States Postal Service (USPS) found a significant increase movement for individuals from big cities to suburban areas. The studies also found a 27% increase in temporary movers in 2020 compared to the same time-period in 2019. Even in our own data where we asked some of the respondents whether they moved since the beginning of the pandemic, 69 out of 418 (~16.5%) reported doing so.

Table 3

Ordered probit model of telework satisfaction with only socio-demographic information.

| Variable	Parameter Estimate	t-statistic
Age (in years)	0.091	3.800
Age^2 (in years squared)	−0.001	−3.128
Hispanic or Latino indicator	0.653	1.991
Suburban household indicator	0.324	2.462
At least an undergrad degree indicator	−0.334	−2.215
Graduate degree indicator	0.214	1.185
Presence of at least one child attending school from home indicator	−0.594	−3.812
Worried about contracting COVID indicator	0.291	2.059
Thresholds		
$\tau_1 \mid \tau_2$	0.990	1.881
$\tau_2 \mid \tau_3$	1.454	2.747
$\tau_3 \mid \tau_4$	2.429	4.458
Fit Measures		
No. of estimated parameters	11	
No. of observations	318	
R^2 (for ordered probit component)	0.219	
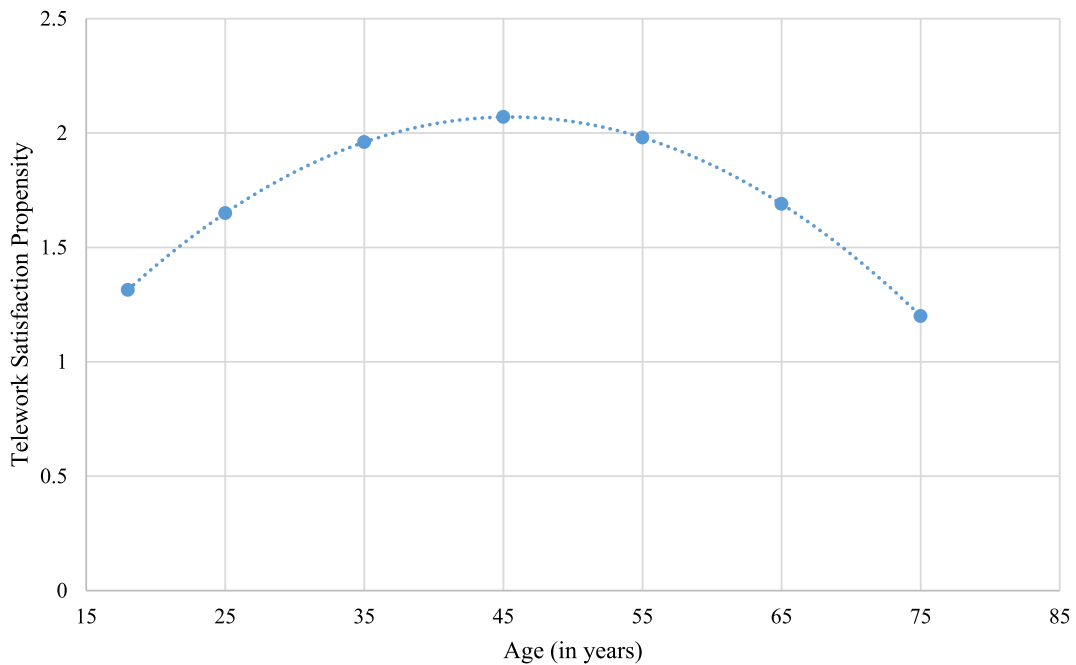
Fig. 4. Variation of telework satisfaction as a function of respondent's age.

the experienced/perceived benefits as shown for the satisfaction probit model. Regarding households without a vehicle, higher telework satisfaction is expected since many of these individuals are potentially transit users, pedestrians, bicyclists, carpoolers etc. for whom telework potentially is a way to save commute time and to reduce COVID-19 exposure by not using transit or other shared modes (Barbieri et al., 2021). Furthermore, lower satisfaction for individuals living alone is likely associated with the issue of social isolation and emotional well-being (Fingerman et al., 2021). Interestingly, we found that individuals with Black ethnicity perceived/experienced lower benefits of telework. This is potentially due to several factors including individuals with Black ethnicity being

Table 4
Ordered Probit Component of the MIMIC Model.

Variable	Parameter Estimate	t-statistic
Hispanic or Latino indicator	0.597	1.926
At least an undergraduate degree indicator	−0.375	−2.300
Graduate education indicator	0.180	0.960
Presence of at least one child attending school from home indicator	−0.186	−1.338
Worried about contracting COVID indicator	0.280	1.924
Latent Variables		
Experienced/perceived telework benefits	0.816	10.958
Experienced/perceived barriers to telework	−1.033	−2.023
Thresholds		
τ_1	0.721	1.278
τ_2	1.205	2.118
τ_3	2.202	3.766
Fit Measures		
No. of estimated parameters in entire model	39	
No. of observations	308	
R^2 (for ordered probit component)	0.648	

Note: Income information was missing for 10 individuals in the data, hence the number of observations dropped to 308 instead of 318 in this model. However, this did not alter the results significantly.

Table 5
Structural component of the MIMIC model.

Variable	Parameter Estimate	t-statistic
Experienced/perceived telework benefits		
Black ethnicity	−0.464	−2.429
Living alone	−0.372	−2.049
Presence of at least one child attending school from home	−0.294	−1.918
No vehicle household	0.308	1.370
Age (in years)	0.083	3.397
Age^2 (in years squared)	−0.001	−3.191
Suburban household	0.249	1.961
Experienced/perceived telework barriers		
Essential worker	0.298	2.225
Remote work suitable industry	−0.190	−2.048
Presence of at least one child attending school from home	0.146	1.811
Age (in years)	−0.022	−1.734
Age^2 (in years squared)	0.0002	1.396
Household Income (in $10,000)	−0.006	−1.171

disproportionately employed in less telework friendly job sectors (Cerullo, 2020), or not experiencing much productivity gains or quality of life improvements as a results of the telework due to lack of access to necessary resources and environment at home.

For the barriers to telework[6], we found that the barriers were higher for essential workers and lower for individuals in remote work friendly industries. This highlights that the nature of the work tasks/telework friendliness of the job is a highly important factor driving barriers to telework. Additionally, the barriers were higher for individuals with presence of a child attending school from home and were lower for higher income households (who potentially are in higher ranks in their jobs). Lastly, perceived/experienced telework barriers varied parabolically with age, with higher barriers for younger and older individuals and lower barriers for middle-aged individuals.

4.2.2.4. Measurement model. Table 6 presents the results from the measurement model with standardized parameters estimated to measure the two latent variables. The signs of all the parameters are intuitively correct, providing more confidence in the results. For *benefits* our results echo the importance of saving commute time, which was a leading factor supporting remote work productivity in Shamshiripour et al. (2020). Considering barriers, the importance of remote work suitability reflects earlier telework research

---

[6] In earlier drafts of this paper, it was suggested to us to incorporate a dummy or interaction variable representing whether an individual was given a potentially hypothetical situation on telework or not so that differences in satisfaction levels or benefits and/or barrier latent variables or the two groups can be captures. However, since almost all individuals in the hypothetical group were working on-site due to employer set mandates (i.e. had no work location flexibility) and large portion of them were essential workers or from non-telework friendly industries, this variable was highly correlated the variables already present in the barriers structural model and hence was dropped from presented model. However, our analysis suggests that the respondents who were given a hypothetical situation regarding telework perceived/experienced higher barriers, which makes sense since they didn't have work location flexibility.

Table 6

Measurement component of the MIMIC model (standardized parameters).

Variable	Parameter Estimate	t-statistic
Experienced/perceived telework benefits		
Work productivity gains	0.882	—
Time savings due to not needing to commute	0.691	8.905
Quality of life improvements	0.832	11.537
Job's remote work suitability	0.440	7.416
Work location flexibility	0.237	3.155
Experienced/perceived barriers to telework		
Lack of appropriate technology	0.318	—
Distraction from other household members	0.215	1.550
Job's remote work suitability	−0.845	−2.301
Work location flexibility	−0.670	−2.214
Thresholds		
Work productivity gains $\mid\tau_1$	1.636	2.675
Time savings due to not needing to commute $\mid\tau_1$	0.879	1.342
Quality of life improvements $\mid\tau_1$	1.298	2.109
Job's remote work suitability $\mid\tau_1$	3.306	4.197
Work location flexibility $\mid\tau_1$	1.842	2.558
Lack of appropriate technology $\mid\tau_1$	0.552	0.639
Distraction from other household members $\mid\tau_1$	−0.195	−0.271

— t-statistic not available since the parameter was fixed for identification.

τ_1: first thresholds for the binary indicator measurement model.

(Mokhtarian and Salomon, 1997) while location flexibility is likely a new feature shaped by the notable professional and personal uncertainty surrounding the pandemic work policies (Carillo et al., 2021). As previously discussed, although some loadings are smaller in magnitude than the generally acceptable values, they were retained in the model because they captured important information and had intuitively plausible signs.

5. Summary, policy Implications, and limitations

Using data from a U.S. representative sample (based on gender, age and ethnicity variables) of 318 working adults, this study uses a multiple indicator multiple cause model (MIMIC) to understand individual's satisfaction with telework. The study also presents an ordered probit model without the latent variables, which reveals systematic heterogeneity in telework satisfaction. The MIMIC model consists of an ordered probit component relating socio-demographic information and perceived/experienced telework benefits and barriers to telework satisfaction. Additionally, we anchor the modeling on personal, work, and household environment factors that help disentangle structural differences in how people experienced remote work.

The results from the ordered probit model without latent variables suggests that the telework satisfaction was higher for middle aged individuals compared to younger and older individuals, Hispanic or Latino respondents, respondents with less than an undergraduate degree, and respondents with higher levels of concern about contracting the COVID-19 virus. On the other hand, satisfaction was found to be lower for individuals with children attending school virtually from home. The results from the MIMIC model confirms the ordered probit reference findings, namely that Hispanic or Latino ethnicity, education level, presence of an online-schooling child and worry related to contracting the COVID-19 virus are the main factors to drive satisfaction. Age, however, is now included in the structural component of the MIMIC model, revealing instead an indirect impact on satisfaction. The model also suggests a positive impact of telework related benefits and negative impact of barriers to telework. Epidemic-induced telework *benefits* can be associated with several demographic and household factors, namely: it is lower for individuals with Black ethnicity, those living alone or with presence of at least one child attending online school from home. The benefits were found to be higher for individuals without a vehicle and those who are suburban dwellers. Lastly, the barriers to telework were found to be most pronounced for essential workers and those with a remote-schooled child in the household. On the other hand, barriers were found to be lower for individuals employed in remote work suitable jobs and those with higher household income. A non-linear impact of age was also found to be a significant factor for both benefits and barriers latent variables.

Overall, three important take-aways emerged from the presented analysis. First, benefits and barriers to telework are disproportionately distributed across age groups. For younger individuals, this may be related to loss of networking opportunities that they need to advance in their careers or maybe related to the younger individuals mostly being employed in jobs that are not suitable for telework. For older individuals, the issue might be related to workplace anchoring, difficulty of managing their teams in more senior positions, and possible technology limitations in performing usual work activities. A second important finding is the evidence for inequity along the lines of racial/ethnic identity. Our findings are in line with other reports that Black and Hispanic or Latino individuals are disproportionately impacted in term of not being able to telework (Cerullo, 2020). Third, the presence of children attending online school is a consistently important factor impacting telework satisfaction. This is not surprising since several recent studies have pointed to negative impact of the pandemic on working parents with younger children (Feinberg et al., 2021, Patrick et al., 2020).
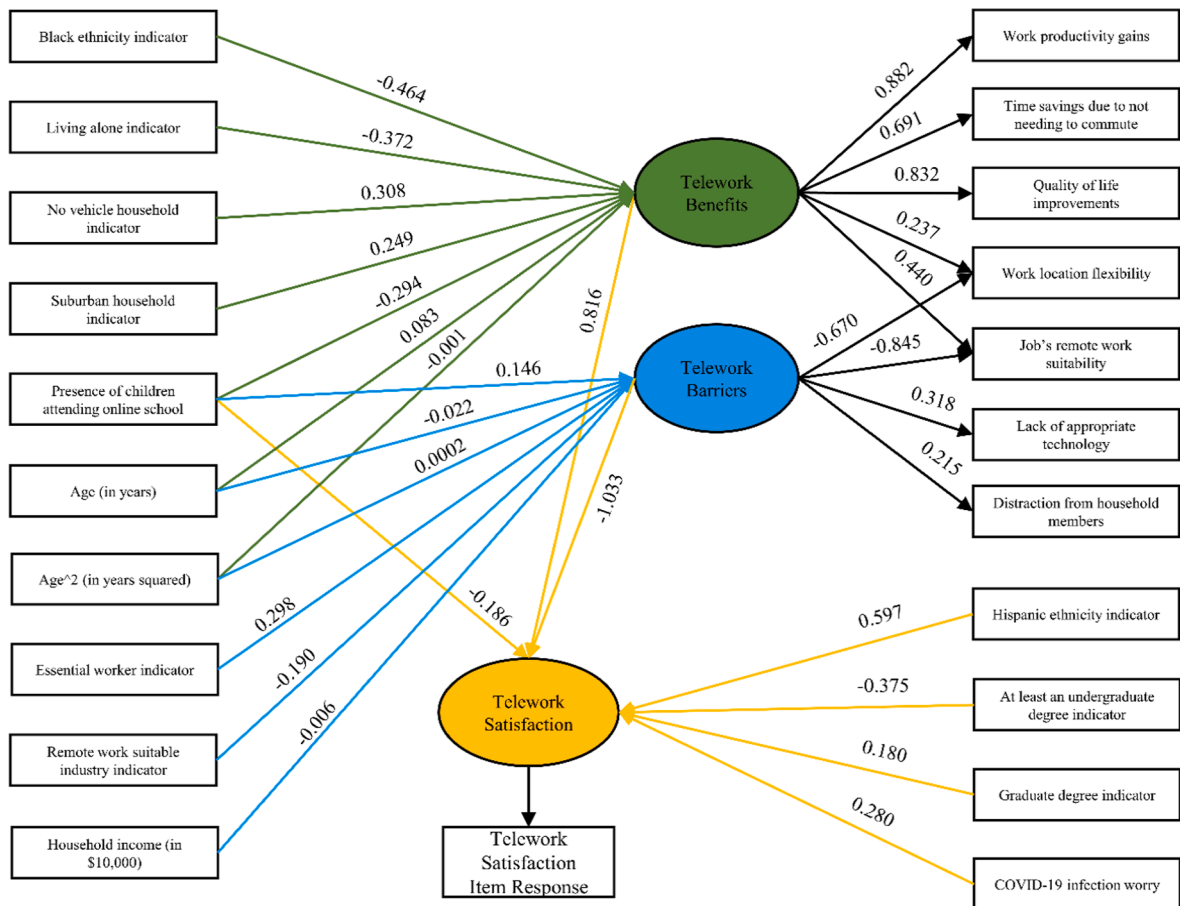
Fig. 5. Path diagram for the MIMIC model.

From a policy standpoint, our results suggest several implications for employers and policy makers in planning for the pandemic and post-pandemic periods. For employers who plan to adopt a hybrid or remote workplace in the long run, our study highlights several core factors that shape barriers and benefits of telework that can be used for communication and promotion of future efforts (e.g., the benefits of commute time savings). Furthermore, the causal structure of the model reveals the diverse experiences of different employer segments with regard to barriers and benefits. These insights can be used to design worker support strategies (e.g., on-site school/day-care pods assisting with challenges of inconsistent schooling access). If remote work were to become a norm at least for positions or tasks where physical presence is not necessary, employers must ensure support that is mindful of the diverse experiences and circumstances of workers, including the more complex non-linear effects such as those related to worker age. For younger employees, a hypothesis is that higher barriers or lower benefits are perceived due to lack of networking opportunities that they need to excel and advance in their careers. Employers could alleviate these by creating an environment to facilitate networking opportunities like organizing mandatory on-site days at regular intervals or hosting online networking hours. For older individuals who might perceive high barriers and lower benefits to teleworking potentially due to difficulty with technology, employers must invest in providing technology support. Concerns about social isolation, especially for workers for whom work provides an important environment for social interaction may also need to be addressed.

On the other end, if employers opt to have an in-person/office-centric plan for the future, creating a safe working environment will

be important to phase in the return to the office since our results indicates a positive relationship between telework satisfaction and COVID-19 related worry. This could potentially be achieved by clear policies on social distancing, masking, and vaccination. As employers seek to determine the appropriate mix of telework and in-person presence, the factors identified in this study could assist in bringing out the positive features of each mode while mitigating some of the negative aspects. As a broader implication for public agencies planning for transportation and other infrastructure, it is important to thoroughly gauge the extent to teleworking in the post pandemic era, since basing future policies solely on trends during the pandemic could be erroneous (Hensher et al., 2021).

Some limitations of this study are worth mentioning here. First, for at least for some of the respondents, the satisfaction data was related to a hypothetical scenario of teleworking, and results could potentially be impact by the hypothetical bias (Hensher, 2010). Second, our study uses a relatively small sample size and additional insights could potentially be derived from a larger sample. Third, our study provides only a snapshot in time in an otherwise dynamic process; it would be important to examine the longer-term impacts of telework on both employees and employers, particularly with regard to factors such as productivity, creativity and worker retention, as well as personal satisfaction, work-life balance and happiness. The results presented in this study highlight important factors impacting telework satisfaction and provide insights for employers and policy makers to help design future telework policies.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Author Contributions

The authors confirm contribution to this paper as follows: study conception and design: DT, MS, HM, AS, JW, SS; data collection: DT, MS, HM, AS, JW, SS; analysis and interpretation: DT, MS, HM, AS, JW, SS; draft manuscript preparation: DT, MS, HM, AS. All authors reviewed the results and approved the final version of the manuscript.

References

Ajzen, I. 1991. The theory of planned behavior. Organizational behavior and human decision processes, 50, 179-211.

Alexander, A., De Smet, A., Langstaff, M., Ravid, D. 2021. What employees are saying about the future of remote work. McKinsey & Company [Online]. Available: https://www.mckinsey.com/business-functions/people-and-organizational-performance/our-insights/what-employees-are-saying-about-the-future-of-remote-work [Accessed November 16, 2021].

Allen, J., Eboli, L., Mazzulla, G., Ortúzar, J.d.D., 2020. Effect of critical incidents on public transport satisfaction and loyalty: an Ordinal Probit SEM-MIMIC approach. Transportation 47 (2), 827–863.

Atlantic, T. 2020. Generation Work-From-Home May Never Recover [Online]. Available: https://www.theatlantic.com/magazine/archive/2020/10/career-costs-working-from-home/615472/ [Accessed July 30, 2021].

Baert, S., Lippens, L., Moens, E., Weytjens, J., Sterkens, P. 2020. The COVID-19 crisis and telework: A research survey on experiences, expectations and hopes. IZA – Institute of Labor Economics.

Barbieri, D.M., Lou, B., Passavanti, M., Hui, C., Hoff, I., Lessa, D.A., Sikka, G., Chang, K., Gupta, A., Fang, K., 2021. Impact of COVID-19 pandemic on mobility in ten countries and associated perceived risk for all transport modes. PLoS ONE 16, e0245886.

Bartlett, M.S. 1937. Properties of sufficiency and statistical tests. In: Proceedings of the Royal Society of London. Series A-Mathematical and Physical Sciences, 160, 268-282.

Baruch, Y., 2000. Teleworking: benefits and pitfalls as perceived by professionals and managers. New Technol. Work Employment 15, 34–49.

Bjursell, C., Bergmo-Prvulovic, I., Hedegaard, J., 2021. Telework and lifelong learning. Front. Sociol. 6.

Bollen, K.A., 1989. Structural equations with latent variables. John Wiley & Sons.

BOWMAN, C.P. 2020. Coronavirus Moving Study: People Left Big Cities, Temporary Moves Spiked In First 6 Months of COVID-19 Pandemic. MyMove [Online]. Available: https://www.mymove.com/moving/covid-19/coronavirus-moving-trends/ [Accessed November 16, 2021].

Brewer, A.M., Hensher, D.A., 2000. Distributed work and travel behaviour: the dynamics of interactive agency choices between employers and employees. Transportation 27, 117–148.

Bukhari, S.M.F., Ghoneim, A., Dennis, C., Jamjoom, B., 2013. The antecedents of travellers'e-satisfaction and intention to buy airline tickets online: A conceptual model. J. Enterprise Information Manage.

Carillo, K., Cachat-Rosset, G., Marsan, J., Saba, T., Klarsfeld, A., 2021. Adjusting to epidemic-induced telework: Empirical insights from teleworkers in France. Eur. J. Information Syst. 30, 69–88.

Cerullo, M. 2020. Black and Hispanic workers less able to work from home [Online]. Available: https://www.cbsnews.com/news/work-from-home-black-hispanic-workers/ [Accessed July 30, 2021].

Choo, S., Mokhtarian, P.L., Salomon, I., 2005. Does telecommuting reduce vehicle-miles traveled? An aggregate time series analysis for the US. Transportation 32, 37–64.

De Oña, J., 2021a. Service quality, satisfaction and behavioral intentions towards public transport from the point of view of private vehicle users. Transportation 1–33.

De Oña, J., 2021b. Understanding the mediator role of satisfaction in public transport: A cross-country analysis. Transp. Policy 100, 129–149.

Defilippis, E., Impink, S.M., Singell, M., Polzer, J. T., Sadun, R. 2020. Collaborating during coronavirus: The impact of COVID-19 on the nature of work. National Bureau of Economic Research.

Errichiello, L., Pianese, T., 2021. The Role of Organizational Support in Effective Remote Work Implementation in the Post-COVID Era. Handbook of Research on Remote Work and Worker Well-Being in the Post-COVID-19 Era IGI Global.

Feinberg, M.E., Mogle, J.A., Lee, J.K., Tornello, S.L., Hostetler, M.L., Cifelli, J.A., Bai, S., Hotez, E., 2021. Impact of the COVID-19 Pandemic on Parent, Child, and Family Functioning. Family Process.

Fingerman, K.L., Ng, Y.T., Zhang, S., Britt, K., Colera, G., Birditt, K.S., Charles, S.T., 2021. Living alone during COVID-19: Social contact and emotional well-being among older adults. J. Gerontol.: Ser. B 76, e116–e121.

Gareis, K., Kordey, N., 1999. Telework-an Overview of Likely Impacts on Traffic and Settlement Patterns. NETCOM: Réseaux, communication et territoires/Netw. Commun. Studies 13, 265–286.

Gurchiek, K. 2021. *Hybrid Work Model Likely to Be New Norm in 2021* [Online]. Society for Human Resource Management. Available: https://www.shrm.org/hr-today/news/hr-news/pages/hybrid-work-model-likely-to-be-new-norm-in-2021.aspx [Accessed September 1, 2021].

Hair, J.F., Ringle, C.M., Sarstedt, M., 2011. PLS-SEM: Indeed a silver bullet. J. Marketing Theory Pract. 19, 139–152.

Hair, J.F., Ringle, C.M., Sarstedt, M., 2012. Partial least squares: the better approach to structural equation modeling? Long Range Plan. 45, 312–319.

Hensher, D.A., 2010. Hypothetical bias, choice experiments and willingness to pay. Transp. Res. Part B: Methodol. 44, 735–752.

Hensher, D.A., Beck, M.J., Wei, E., 2021. Working from home and its implications for strategic transport modelling based on the early days of the COVID-19 pandemic. Transp. Res. Part A: Policy Pract. 148, 64–78.

Hoffman, C.L., 2021. The experience of teleworking with dogs and cats in the United States during COVID-19. Animals 11, 268.

Holgado-Tello, F.P., Chacón-Moscoso, S., Barbero-García, I., Vila-Abad, E., 2010. Polychoric versus Pearson correlations in exploratory and confirmatory factor analysis of ordinal variables. Qual. Quant. 44, 153–166.

Igeltjørn, A. & Habib, L. Homebased telework as a tool for inclusion? A literature review of telework, disabilities and work-life balance. In: International Conference on Human-Computer Interaction, 2020. Springer, 420-436.

Irwin, F., 2004. Gaining the air quality and climate benefit for telework. World Res. Institute. Retrieved from http://goo. gl/IvdkU.

Kadir, M.A., Kubacki, K., Rundle-Thiele, S., 2019. Perceived benefits and barriers of walking among overweight and obese adults. Health Mark. Q. 36, 54–70.

Kaiser, H.F., 1970. A second generation little jiffy. Psychometrika 35, 401–415.

Kaiser, H.F., Rice, J., 1974. Little jiffy, mark IV. Educ. Psychol. Measur. 34, 111–117.

Kenny, D.A. 2015. Measuring model fit [Online]. Available: http://davidakenny.net/cm/fit.htm [Accessed July 25 2021].

Landon-Murray, M., Anderson, I., 2021. Making intelligence telework work: mitigating distraction, maintaining focus. Intell. National Security 1–4.

Lari, A., 2012. Telework/Workforce flexibility to reduce congestion and environmental degradation? Procedia-social Behav. Sci. 48, 712–721.

Larson, W., Zhao, W., 2017. Telework: Urban form, energy consumption, and greenhouse gas implications. Econ. Inq. 55, 714–735.

Lewis, R. 2017. Telecommuting extends the work week, at little extra pay. Iowa Now [Online]. Available: https://now.uiowa.edu/2017/01/telecommuting-extends-work-week-little-extra-pay [Accessed November 16, 2021].

Matthews, H.S., Williams, E., 2005. Telework adoption and energy use in building and transport sectors in the United States and Japan. J. Infrastruct. Syst. 11, 21–30.

Mcdonald, R.P., 1970. The theoretical foundations of principal factor analysis, canonical factor analysis, and alpha factor analysis. Br. J. Math. Stat. Psychol. 23, 1–21.

Mcdonald, R.P. 1999. Test theory: A unified approach.

Mcneish, D., 2018. Thanks coefficient alpha, we'll take it from here. Psychol. Methods 23, 412.

Meroño-cerdán, A.L., 2017. Perceived benefits of and barriers to the adoption of teleworking: Peculiarities of Spanish family firms. Behav. Information Technol. 36, 63–74.

Miglioretti, M., Gragnano, A., Margheritti, S., Picco, E., 2021. Not all telework is valuable. J. Work Organ. Psychol. 37, 11–19.

Mokhtarian, P.L., Handy, S.L., Salomon, I., 1995. Methodological issues in the estimation of the travel, energy, and air quality impacts of telecommuting. Transp. Res. Part A: Policy Pract. 29, 283–302.

Mokhtarian, P.L., Salomon, I., 1997. Modeling the desire to telecommute: The importance of attitudinal factors in behavioral models. Transp. Res. Part A: Policy Practice 31, 35–50.

Morgan, R.E., 2004. Teleworking: an assessment of the benefits and challenges. Eur. Bus. Rev. 16 (4), 344–357.

Muthén, B., 1984. A general structural equation model with dichotomous, ordered categorical, and continuous latent variable indicators. Psychometrika 49, 115–132.

Nayak, S., Pandit, D., 2021. Potential of telecommuting for different employees in the Indian context beyond COVID-19 lockdown. Transp. Policy 111, 98–110.

Noonan, M.C., Glass, J.L., 2012. The hard truth about telecommuting. Monthly Lab. Rev. 135, 38.

Oliver, R.L., 1980. A cognitive model of the antecedents and consequences of satisfaction decisions. J. Mark. Res. 17, 460–469.

Oliver, R.L., Linda, G., 1981. Effect of satisfaction and its antecedents on consumer preference and intention. ACR North Am. Adv.

Ollo-López, A., Goñi-Legaz, S., Erro-Garcés, A., 2021. Home-based telework: usefulness and facilitators. Int. J. Manpower 42 (4), 644–660.

Palan, S., Schitter, C., 2018. Prolific. ac—A subject pool for online experiments. J. Behav. Experimental Finance 17, 22–27.

Parker, K., Horowitz, J., Minkin, R., 2020. How the coronavirus outbreak has–and hasn't–changed the way Americans work. Pew Res Center.

Patrick, S.W., Henkhaus, L.E., Zickafoose, J.S., Lovell, K., Halvorson, A., Loch, S., Letterie, M., Davis, M.M., 2020. Well-being of parents and children during the COVID-19 pandemic: a national survey. Pediatrics 146.

Pérez, M.P., Sánchez, A.M., de Luis Carnicer, M.P., 2002. Benefits and barriers of telework: perception differences of human resources managers according to company's operations strategy. Technovation 22 (12), 775–783.

Pluut, H., Wonders, J., 2020. Not able to lead a healthy life when you need it the most: Dual role of lifestyle behaviors in the association of blurred work-life boundaries with well-being. Front. Psychol. 11, 3600.

PWC, U. 2021. It's time to reimagine where and how work will get done: PwC's US Remote Work Survey-January 12, 2021. January.

Revelle, W. 2013. Using R and the psych package to find ω. Computer Software]. http://personality-project. org/r/psych/HowTo/omega. tutorial/omega. html# x1-150005.1.

Rosseel, Y., 2012. Lavaan: An R package for structural equation modeling and more. Version 0.5–12 (BETA). J. Stat. Softw. 48, 1–36.

Salon, D., Conway, M.W., Da Silva, D.C., Chauhan, R.S., Derrible, S., Mohammadian, A.K., Khoeini, S., Parker, N., Mirtich, L., Shamshiripour, A., 2021. The potential stickiness of pandemic-induced behavior changes in the United States. Proc. National Acad. Sci. 118.

Shabanpour, R., Golshani, N., Tayarani, M., Auld, J., Mohammadian, A.K., 2018. Analysis of telecommuting behavior and impacts on travel demand and the environment. Transp. Res. Part D: Transp. Environ. 62, 563–576.

Shamshiripour, A., Rahimi, E., Shabanpour, R., Mohammadian, A.K., 2020. How is COVID-19 reshaping activity-travel behavior? Evidence from a comprehensive survey in Chicago. Transp. Res. Interdiscipl. Perspectives 7, 100216.

Sheffey, A. 2021. 11% of Americans moved during the pandemic, survey finds [Online]. Available: https://www.businessinsider.com/how-many-americans-moved-during-pandemic-housing-real-estate-zillow-2021-4 [Accessed November 16, 2021].

Skrondal, A., Rabe-Hesketh, S., 2005. Structural equation modeling: categorical variables. Encyclopedia Statistics Behav. Sci.

Song, Y., Gao, J., 2020. Does telework stress employees out? A study on working at home and subjective well-being for wage/salary workers. J. Happiness Stud. 21, 2649–2668.

Suh, Y., 2015. The performance of maximum likelihood and weighted least square mean and variance adjusted estimators in testing differential item functioning with nonnormal trait distributions. Struct. Equation Modeling: A Multidiscipl. J. 22, 568–580.

Tahlyan, D., Said, M., Mahmassani, H., Stathopoulos, A., Walker, J., Shaheen, S., 2021. Latent Transition Analysis of Consumer Spending Behavior and Adaptation Across Online and In-Person Channels Through the Pandemic. Northwestern University.

Tavares, A.I., 2017. Telework and health effects review. Int. J. Healthcare 3, 30.

Tremblay, D.-G., Thomsin, L., 2012. Telework and mobile working: analysis of its benefits and drawbacks. Int. J. Work Innovation 1, 100–113.

Van Horn, C.E., Storen, D. Telework: Coming of age? Evaluating the potential benefits of telework. In: Telework: The new workplace of the 21st Century symposium, New Orleans, 2000.

Vayre, E., 2021. Challenges in Deploying Telework: Benefits and Risks for Employees. Digital Transformations in the Challenge of Activity and Work: Understanding and Supporting Technological Changes 3, 87–100.

Walls, M., Safirova, E., Jiang, Y., 2007. What drives telecommuting? Relative impact of worker demographics, employer characteristics, and job types. Transp. Res. Rec. 2010, 111–120.

Wang, Y., Zhang, Z., Zhu, M., Wang, H., 2020. The impact of service quality and customer satisfaction on reuse intention in urban rail transit in Tianjin, China. SAGE Open 10, 2158244019898803.

Washington, S., Karlaftis, M.G., Mannering, F., Anastasopoulos, P., 2020. Statistical and econometric methods for transportation data analysis. CRC Press.

Wu, Y., Melgar, L. 2021. Americans Up and Moved During the Pandemic. Here's Where They Went. Wall Street Journal. [Online]. Available: https://www.wsj.com/articles/americans-up-and-moved-during-the-pandemic-heres-where-they-went-11620734566 [Accessed November 16, 2021].

Yen, J.-R., Mahmassani, H.S., Herman, R., 1994. Employer attitudes and stated preferences toward telecommuting: An exploratory analysis. Transp. Res. Rec. 1463, 15–25.

Yen, J.-R., Mahmassani, H.S., 1997. Telecommuting adoption: Conceptual framework and model estimation. Transp. Res. Rec. 1606, 95–102.

Zunft, H.-J.-F., Friebe, D., Seppelt, B., Widhalm, K., de Winter, A.-M.-R., de Almeida, M.D.V., Kearney, J.M., Gibney, M., 1999. Perceived benefits and barriers to physical activity in a nationally representative sample in the European Union. Public Health Nutr. 2, 153–160.