Safety and Health at Work 12 (2021) 296–303

Contents lists available at ScienceDirect

Safety and Health at Work

journal homepage: www.e-shaw.net

Original Article

Improving the Workplace Experience of Caregiver-Employees: A Time-Series Analysis of a Workplace Intervention☆

Regina Ding [1], Anastassios Dardas [1], Li Wang [2], Allison Williams [1,*]

[1] School of Geography & Earth Sciences, McMaster University, Hamilton, Ontario, Canada
[2] Offord Center for Child Health Study, McMaster University, Hamilton, Ontario, Canada

ARTICLE INFO

Article history:
Received 4 June 2020
Received in revised form
23 November 2020
Accepted 10 December 2020
Available online 16 December 2020

Keywords:
Caregiving
Intervention
Time series
Work–life balance
Workplace support

ABSTRACT

Background: Rapid population aging in developed countries has resulted in the working-age population increasingly being tasked with the provision of informal care.
Methods: An educational intervention was delivered to 21 carer-employees employed at a Canadian University. Work role function, job security, schedule control, work–family conflict, familywork conflict, and supervisor and coworker support were measured as part of an aggregated workplace experience score. This score was used to measure changes pre/post intervention and at a follow-up period approximately 12 months post intervention. Three random intercept models were created via linear mixed modeling to illustrate changes in participants' workplace experience across time.
Results: All three models reported statistically significant random and fixed effects intercepts, with a positive coefficient of change.
Conclusion: This suggests that the intervention demonstrated an improvement of the workplace experience score for participants over time, with the association particularly strong immediately after intervention.

1. Introduction

The cost of healthcare combined with the often chronic and intensive demands of eldercare means that care provision has shifted away from formal institutionalized avenues to family-centered models of care. In Canada, there are 8.1 million informal carers, of which 6.1 million are simultaneously employed [1]. The prevalence of carer-employees (CEs) is projected to burgeon in the future, as the baby boomer cohort ages out of the workforce. By definition, CEs are individuals employed in the labor force while providing unpaid care to someone (usually a relative), with a disability or at least one chronic illness [2,3]. In totality, by performing these unpaid services, CEs contribute approximately $25 billion per year in healthcare labor in Canada [4,5]. Most CEs are predominantly female, between the ages of 45–64, with 48% of carers providing 2–9 hours of weekly caregiving tasks [1,6]. CEs experience consequences to their personal and work life, such as work–life conflict, increased stress and anxiety, and reduced working productivity [7].

Most CEs experience mental and physical stress. Carer burden refers to a condition in which carers may feel mentally strained, often resulting in feelings of isolation, anxiety, stress, mental and physical fatigue, and depression [8]. In a 2012 national survey of 25,021 Canadian CEs, 40% of the survey sample reported they currently sustain high levels of overload in their work and personal life, resulting in burnout-prone behaviors, such as bringing work home, working late, and sacrificing sleep and personal time [1]. In the same year, the General Social Survey found that 1.6 million carers reported a leave from work, with 600,000 reporting reduced work hours due to caregiving responsibilities and 390,000 leaving the workforce to provide care [9]. A conservative estimate from the Employer Panel for Caregivers [9] puts 35% of the Canadian labor force as CEs, with 45% of these CEs being economically impacted by time constraints between caregiving, work, and nonwork. CEs may incur caregiving costs from five domains: lost income, reducing

* Corresponding author. School of Geography and Earth Sciences, McMaster University, 1280 Main Street West, Hamilton, Ontario, L8S 4K1, Canada.
E-mail address: awill@mcmaster.ca (A. Williams).

☆ NOTE: This work was done while the second author was at McMaster University. The second author's current affiliation is with Esri Canada, Toronto, Ontario Canada.

2093-7911/$ – see front matter
https://doi.org/10.1016/j.shaw.2020.12.003

future earning potential, reduced employment benefits, out of pocket caregiving expenses, and unpaid labor [10]. One estimate places Canadian carers at a net $336.8 million worth of lost wages annually [11].

Lack of a sustainable work–life balance not only impacts the CE, but employers as well, in the form of reduced productivity, poor employee morale, employee turnover, and higher overall stress [7]. Other reported consequences include taking a leave; reducing work hours; being denied employment, and;= quitting [9]. Workplaces have incentive to support their CEs beyond social responsibility, particularly given that CEs are often highly skilled in industry-specific knowledge, at the peak of their careers, and in senior positions. From the workplace perspective, it is estimated that Canadian workplaces lost $1.3 billion in reduced productivity per year because of carer absenteeism or turnover [9]. It is evident that employers will need to integrate caregiver-friendly workplace practices (CFWPs) in the near future to ensure a sustainable workforce.

An adaptive and flexible system of work and personal life is becoming increasingly common as it is mutually beneficial for both employers and employees [12–14]. One of the most common forms of workplace support for CEs are flexible working hours, allowing for greater schedule control. One Austrian study illustrated that flexible work hours/flextime was essential for balancing work and caregiving duties among female CEs [15]. Female workers who have flexible options are more likely to remain at their place of employment when compared with their male counterparts. The availability of flextime can be a deciding factor for carers, as some CEs actively seek workplaces where they are more likely to be granted flextime [16], as it allows them 13% more hours of informal care time. However, provision of flextime is sometimes not sufficient on their own; approximately half of CEs in the 2012 General Social Survey indicated that they were not comfortable using flextime as they perceived it as detrimental to their careers because of existing work culture [9].

The majority of existing carer studies examine carer knowledge or health, as opposed to carer's work quality. A brief literature review yields sparse evidence regarding carer interventions within workplace settings, despite evidence from labor studies research that suggests workplaces are salient resources and avenues for support. Curry et al. (2006) [17] implemented a workplace intervention, in the form of workshops offering carer knowledge and referral to community resources, where participants highly rated the usefulness of the knowledge provided. Other findings from a 2016 meta-analysis across 11 work–life reconciliation intervention studies provide evidence that employer endorsed initiatives, such as workplace resource information or workplace culture training, result in improved quality of work–life balance, wellbeing, physical and mental health, and reduction in absenteeism and work stress for employees [18]. However, it should be noted that, this meta-analysis considers work–life conflicts broadly, grouping eldercare with childcare and other nonwork roles. Overall, the limited existing evidence appears to be supportive of the success of workplace interventions for carers' work–life balance.

The aim of this study is to examine changes of the CEs' workplace experience, before and after implementing an educational intervention at the public post-secondary institution concerned. More notably, it answers the following question: does the implementation of CFWPs, such as an educational intervention, constantly improve workplace experience in the longer term or does it reach a saturation point? These objectives will assess the efficacy of the intervention which, if proven effective, will provide valuable insights for employers.

2. Materials and methods

2.1. Survey specifications

The effectiveness of a CFWP intervention is examined using CE data collected across three separate time periods. This study incorporated the pre/post intervention design. After approval by the university's Research Ethics Board (ISRCTN 16187974), several recruitment strategies, such as postcard distribution, word of mouth, email lists, and screen advertisements, were employed throughout the workplace. Eligibility requirements included 1) working full-time, 2) identifying as the primary caregiver, and 3) actively providing informal care to their care-recipient. A convenience sample of 43 participants were recruited and asked to participate in fill out an interview survey at three different time periods (T1, T2, T3), with the flexibility of either in-person or over the telephone with the primary researcher. At the end of the study (T3), approximately half of the sample size were eliminated because of no longer meeting the eligibility criteria. This was due to the care-recipient no longer requiring care (two participants), or passing away (two participants), or the participant CE leaving the workplace, or reducing work hours from full-time to part-time (three participants). A total of 12 participants voluntarily withdrew from the study, with two stating unavailability due to work and family responsibilities and ten choosing not to disclose reasons for withdrawal. Three participant responses were invalid for use in the study. The total sample size at the end of the two-year study consisted of 21 participants.

Seven different scales were used to measure the following aspects of workplace experience: 1) work role function; 2) job satisfaction; 3) scheduling control; 4) work-to-family conflict; 5) family-to-work conflict; 6) family supportive supervisor behavior, and; 7) coworker support. These specific scales were chosen as they measure correlated but distinct constructs central to employees' work experience. As well, these scales are prevalent within the labor studies literature for their reliability and validity, with all scales demonstrating moderate to very good reliability, validity, and internal consistency across several studies. Short-form versions of scales were used where possible for survey brevity.

Work-role function is the measurement of an employee's productivity based on their health condition and is known to be applicable across different cultural contexts as well as a range of physical and mental health conditions [19,20]. Job satisfaction is five-item scale that factors for global job satisfaction and is known to be correlated with job performance and turnover intentions [21]. Schedule control probes schedule flexibility to assess availability of work–life balance strategies. Work–family and family–work conflict are reciprocal scales that examine the effects of conflict with regards to psychological wellbeing, physical health, and life satisfaction [22,23]. Family supportive supervisor behavior occurs when supervisors allow their employees to effectively manage both their work roles and their family roles and is associated with higher job satisfaction and reduced turnover [24]. Coworker support examines the impact of coworkers on subjects, as a form of social support [24].

2.2. Scale derivation

Questions from each of the scales are structured similarly to the five-point Likert scale, such as from “All of the time” to “None of the time”, or “Excellent” to “Poor” as a measurement of frequency and or quality, respectively. All seven scales were converted to numerical values, with higher Likert scores representing positive experiences and vice versa. Less than 5% of

the entire data set contained missing values. Missing data were observed to be randomly distributed within each scale; thus missing data were imputed using multiple imputation with five iterations via predictive mean matching, for scales with less than 30% missingness [25]. The scales with greater than 30% missingness were not used for analysis for that specific participant. All scales were individually tested for consistency at each time point through a time-series correlation matrix. Given the high internal consistency of each individual scale observed from the correlation and the overlapping topics that each scale probes, all these scales were aggregated together to form a single overall workplace experience score, which would be set as the dependent variable for linear mixed modeling (LMM) analyses. The data sets from both, pre-intervention (T1) and postintervention (T2 and T3), were combined into long format (longitudinal) to conduct LMM. Overall, an increase of the score over time would indicate an improvement of the participant's workplace experience.

2.3. Intervention

The intervention session was an in-person meeting conducted individually with each participant and the authors at the midpoint between T1 and T2. A web-based decision tool was designed and developed to act as a centralized platform for all carer-related resources, services, and content. The authors inputted demographic and employment data for of each participant into a web-based decision tool, which then would generate a customized list of relevant caregiving resources on the community, workplace and at the provincial and federal level (Fig. 1). These resources included participant-eligible accommodations, such as flextime, caregiver or bereavement leaves, and caregiver tax credits. Following this, participants were also provided a list of behavior change goals from a checklist, focusing on better managing carer burden. Participant progress on the checklist activity was followed up on at T2 and T3.

Table 1
Descriptive statistics containing demographics, general caregiving-related

Variable	Value	Time 1 (n = 43)	Time 2 (n = 30)	Time 3 (n = 21)
Age	18 – 45	30.2%	20.0%	38.1%
	46+	69.8%	80.0%	61.9%
Gender	Male	11.6%	10%	14.3%
	Female	88.4%	90%	85.7%
Marital	Married/ common-in law	58.1%	56.6%	57.1%
	Widowed, divorced, separated	16.3%	13.4%	19.1%
	Single	23.3%	26.7%	23.8%
	Other	2.3%	3.3%	0.0%
Race	Euro/Caucasian	100%	100%	100%
Highest education	College GCEP or less	30.2%	23.3%	19.0%
	Bachelors	32.6%	36.7%	28.6%
	Graduate	37.2%	40.0%	52.4%
Household income	$15k – 29.9k	2.3%	0.0%	0.0%
	$30k - 49.9k	7.0%	0.0%	4.7%
	$50k – 69.9k	9.3%	23.3%	14.3%
	$70k – 99.9k	27.9%	13.3%	14.3%
	$100k +	46.5%	43.3%	61.9%
	Prefer Not to Answer	7.0%	20.0%	4.7%
Place of residence	Hamilton Metro.	67.4%	70.2%	67.0%
	GTA	21.0%	19.9%	19.0%
	Other	11.6%	9.9%	14.0%
Years at current job	Less than 5 yrs.	37.2%	36.7%	47.6%
	5 to 10 yrs.	27.9%	27.0%	19.0%
	11 to 15 yrs.	16.2%	16.7%	14.3%
	16 to 20 yrs.	6.9%	3.3%	0.0%
	21+ yrs.	9.3%	10.0%	14.3%
Current health	Poor	2.3%	0.0%	0.0%
	Fair	9.3%	3.3%	14.3%
	Good	34.8%	23.3%	28.6%
	Very good	34.8%	60.0%	33.3%
	Excellent	18.6%	13.3%	23.8%
Number of care-recipients	1	62.7%	63.3%	76.2%
	2	23.3%	30.0%	14.3%
	3	14.0%	6.7%	4.8%
Did the caregiver postpone their's career or/ education?	No	46.5%	80.0%	76.2%
	Yes	20.9%	16.7%	23.8%
	N/A	32.6%	3.3%	0.0%

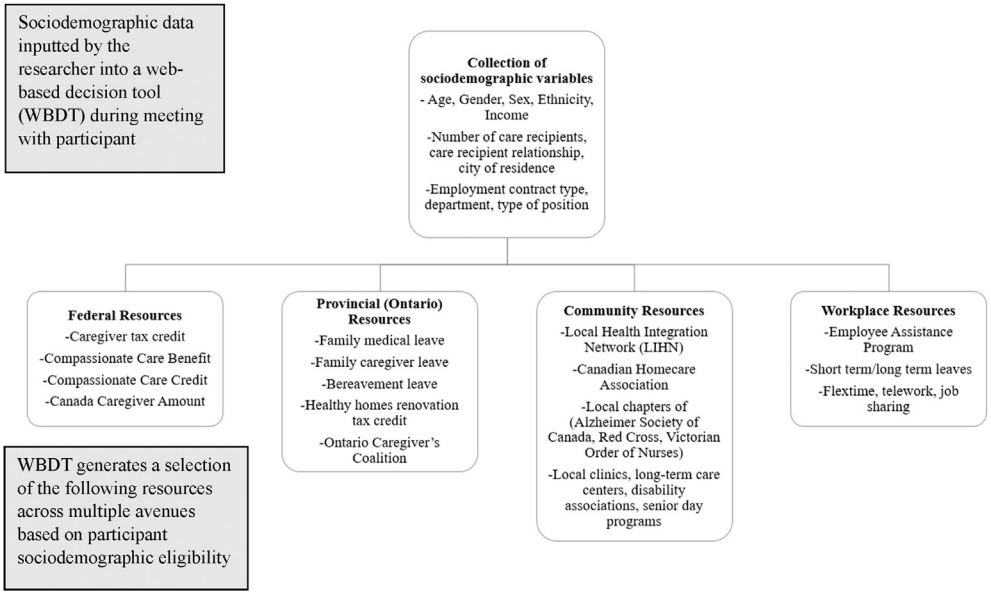

Fig. 1. Diagram of the intervention process. Descriptive data was first collected from participants, who were then presented with a variety of eligible resources based on their sociodemographic profile from a web-based decision tool. Resources shown are only a selection of all potential resources.

Table 2
Correlation matrix of all variables across three time periods

Correlation	T1	T2	T3
Work role to job security	0.34	0.68	0.66
Work role to schedule control	0.12	0.20	0.14
Work role to work–family conflict	0.22	0.48	0.54
Work role to family–work conflict	0.22	0.56	0.57
Work role to supervisor support	0.20	0.25	-0.01
Work role to coworker support	-0.15	0.06	0.16
Job security to schedule control	0.29	0.39	0.23
Job security to work–family conflict	0.39	0.24	0.75
Job security to family–work conflict	0.37	0.45	0.50
Job security to supervisor support	0.35	0.26	0.28
Job security to coworker support	0.19	0.06	0.43
Schedule control to work–family conflict	-0.01	0.06	0.07
Schedule control to family–work conflict	-0.20	-0.04	0.03
Schedule control to supervisor support	0.15	0.21	-0.07
Schedule control to coworker support	-0.15	0.05	-0.18
Work–family fonflict to family–work conflict	0.57	0.40	0.41
Work–family conflict to supervisor support	0.21	0.29	0.26
Work–family conflict to coworker support	0.38	0.28	0.41
Family–work conflict to supervisor support	-0.17	-0.22	-0.31
Family–work conflict to coworker support	0.17	-0.35	0.07
Supervisor support to coworker support	0.48	0.36	0.53

2.4. Linear mixed modeling

Linear mixed modeling was used for the time-series analysis as LMM is capable of analyzing changes in work variables while controlling for variation between participants [26]. LMM functions similarly to simple linear regression modeling, while also accounting for the differences, that is, the random effects between grouped categories [26]. The random effect variable is a categorical variable, which is assumed to be a random composition of all feasible levels [27]. For this context, the participant ID is used as the random effect, where it is assumed that our sample is a random selection from all CEs, to account for the amount of variation between participants regarding changes in their work scores over time. The fixed effect in this analysis is the change in workplace experience score over time. A dummy variable of each time period (T1–3) was also created and later used to form an intervention dummy variable, to examine if changes in work experience score was contingent on the time point, specifically differences between the pre-intervention (T1) and postintervention (T2 and T3) points.

In broad terms, this study investigates the magnitude of changes in workplace experience score of participants across time and the association with time postintervention (T2, T3, or both aggregated). For instance, does the entire postintervention period (T2 and T3 combined) have more influence on the participants' work condition score than either T2 or T3 individually? Three random intercept models were developed to investigate this. Model 1 aggregates T2 and T3 as a single postintervention dummy variable, to examine changes in work experiences score over the course of the entire project. Model 2 and 3 are extensions on Model 1, where additional dummy variables for T2 and T3 are added as independent variables in the regression to examine the specific impacts of T2 or T3 on the participant work experience score.

2.5. Participant retention

From the original 43 recruited participants, a total of 22 participants withdrew. This high drop-out rate presents significant limitations, as expanded upon in the discussion. Survey data from these participants were removed from the study as per ethics guidelines. Table 1 illustrates fluctuations in the sociodemographic profile of the participant sample over time. From T1–T3, the sociodemographic profile was observed to be fairly stable over time. While we cannot argue for the random distribution of participant drop-out, we observe that there does not appear to be an overt sociodemographic pattern of participant withdrawals.

Table 3
Test–retest one-way random effects model using single measures

Variable	ICC	95% confidence interval		F test with true value 0			
		Lower	Upper	Value	df1	df2	Sig.
Work role	0.33	0.07	0.608	2.48	20	42	0.006
Job security	0.66	0.435	0.828	6.79	20	42	0.000
Schedule control	0.809	0.655	0.910	13.7	20	42	0.000
Work–family conflict	0.685	0.472	0.844	7.54	20	42	0.000
Family–work conflict	0.519	0.263	0.743	4.24	20	42	0.000
Supervisor support	0.697	0.488	0.85	7.91	20	42	0.000
Coworker support	0.684	0.47	0.843	7.5	20	42	0.000
Work condition scale	0.592	0.35	0.789	5.36	20	42	0.000

Intraclass correlation (ICC) is a measure of reliability within grouped data, where scores close to 0 denote low similarities between values within the same scale and score close to 1 indicate high similarity. The ICC scores range from low similarity within the scale (work role) to high similarity (schedule control).

3. Results

3.1. Correlations across time

The correlation matrix reported mixed results for all manifest variables across all time periods (Table 2). Some correlations have changed vastly, such as the association between job security and work–family conflict from 0.39 in T1 to 0.75 in T3. Most correlations have particularly increased significantly from T1 to T2. Other correlations show fluctuations from T1 to T3; thus, indicating a relative inconsistency over time. The intraclass correlation test–retest results (Table 3) illustrate a range of poor (work role) to excellent (schedule control) inter-rater agreement measures. Most items were considered to be good. Except for the work role item, all the items and the work condition scale in all time periods are reliable, allowing us to proceed with analysis.

3.2. Descriptive statistics

Table 1 depicts the sociodemographic characteristics of the sample population. The recruited population appears to be homogenous, mainly consisting of: females aged, 45 years or older, Caucasian, and likely to be educated (Bachelor's degree or higher). This degree of homogeneity in the population allows for us to informally control sociodemographic factors within our data and analysis.

Fig. 2 and Table 4 illustrates the workplace experience score of each participant across the three time periods. Most participants experience an improvement in the workplace from pre-intervention (T1) to the postintervention (T2), as evident in the upward trend of the workplace experience score. From T2 to T3, mixed results are found, with few getting worse and others experiencing negligible improvements. These trends reflect average workplace experience scores from 222 (T1) to 237 (T2) to 238 (T3), which shows overall improvement postintervention.

3.3. Power analysis

A power analysis was conducted to verify validity of any potential findings, given our reduced sample size from participant

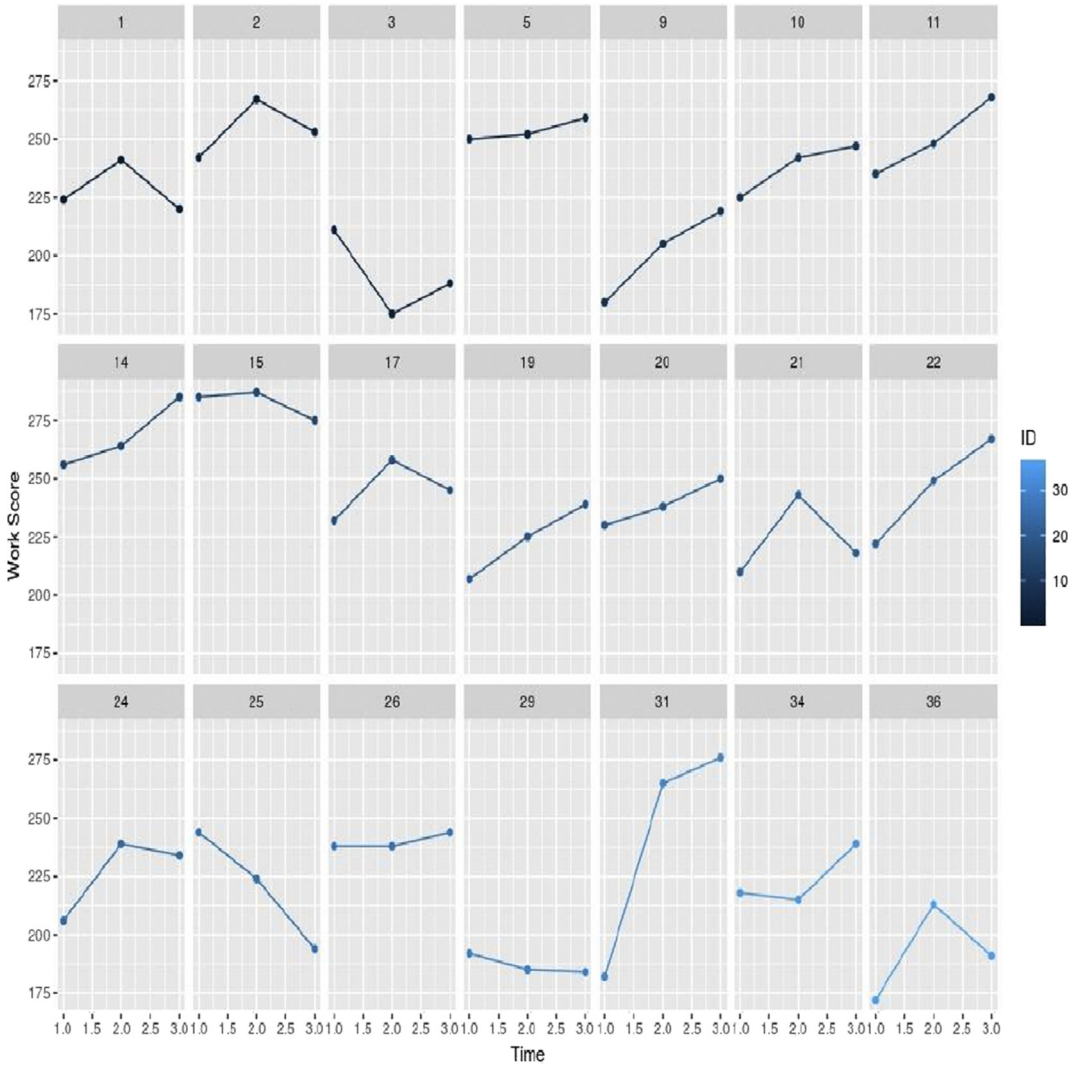

Fig. 2. The time-series plot of the aggregated work condition scale for each participant.

drop-out. Using a type 1 error value of 0.05 (paired) and a statistical power of 0.8 (1-β), Fig. 3 was plotted to visualize the minimum sample size required for a specific effect size. In the context of our study, we hypothesize a moderate to large effect size ($d > 0.5$) resulting from our intervention [28]. Fig. 3 highlights that for such an effect size, a relatively small sample size of approximately 20 or less is required. Based on this result, we can postulate the appropriateness of our analysis, even with a smaller than anticipated sample size.

3.4. Principal component analysis

A particular constraint of the small sample size is the need to control for sociodemographic and economic variables. Principal component analysis (PCA) was used to create a socioeconomic index to investigate any potential underlying patterning or confounding elements specific to the social and demographic factors within our sample population [29]. Categorical demographic characteristics of each participant was converted into a binary format, as indicated in Table 5. Tetrachoric correlation was selected for use in the PCA because of these binary variables.

PCA is utilized to reduce high dimensional socioeconomic variables into lower dimensionalities. Specifically, in our study the following demographic characteristics were examined: age, sex, education level, income, and marital status. An index was created with these variables. The first principal component (PC1) contains the orthogonal linear combination of the variables that will account for the maximum variance in the data, with subsequent components conveying lesser and unrelated variances [30,31]. Table 6 highlights the loadings of each variable resulting from the PCA, with large loadings bolded. These loadings represent eigenvalues, where variable with larger values indicate a larger constituent of variance for each component [32]. PC1 had a proportion variance of 38%, meaning, PC1 accounts for 38% of the total variance in the model. PC2 and PC3 had 32% and 23%, respectively. The first three components were retained in the index, as the sum variance across PC1 – PC3 account for 93% of the total variation. PC1 contains

Table 4
Mean values and standard deviation of aggregated work condition scores in a sample of n = 21

Time period	Mean aggregated work condition score (N = 21)	Standard deviation
T1	222	27.3
T2	237	27.3
T3	238	31.1

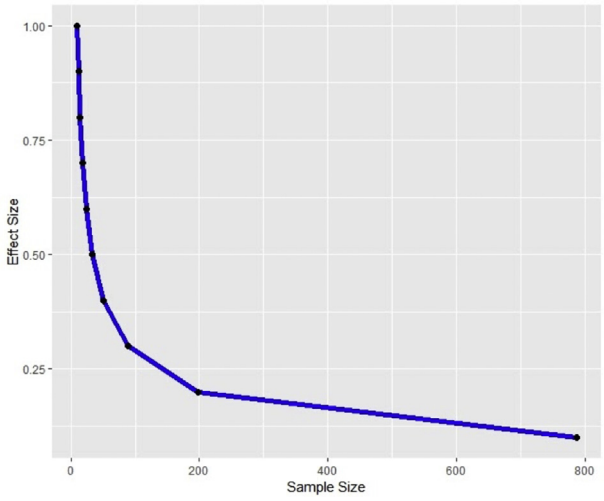

Fig. 3. Generated minimum sample size required for changes in effect size.

relatively large positive loadings on income and marital status, while loading negatively on gender; this implies that income and marital status are inversely proportional to gender. Conversely, PC2 indicates positive loadings on age and gender while negative loading negatively on education. PC3 only contains large negative loadings on gender, marital status, and education.

For each variable, factor scores were created by multiplying the principal component loadings with the variance proportions and summed for each of through PC1 − PC3 (Table 5). Each factor score represents a positive or negative weighting of each respective variable, thus providing an overview of the CE's socioeconomic status. In this context, age (46+ yrs.), marital status (married/common-in law), and income ($70k+) have positive weights, which indicate a higher socioeconomic status of the CE. These results match the demographic characteristics within the caregiving literature [7]. Education (Bachelor's or higher) and gender (female) present negative scores; thereby, negatively impacting the lowering socioeconomic status of the CE. One possible explanation for the gender variable is may be that women are more likely to do caregiving responsibilities than men, which may impact their career potential. With the addition of caregiving responsibilities, paid work that requires a higher educational background likely has greater job responsibilities and may consequently impact the stress; thus, the CEs experience more stress at work. Overall, the socioeconomic variation within our sample population is not robust, which demonstrates that the demographic items are likely not essential confounding factors within the dataset.

3.5. Linear mixed models

All three models outlined statistically significant intercepts on both random and fixed effects and share similar goodness of fit (Tables 7–9). The first model (Table 7) was specific to the relationship between workplace experience and the overall intervention. It displayed intercepts on both effects to be statistically significant with low standard errors. The coefficient for the intervention dummy variable is over 15 with statistical significance, which indicates an overall improvement of workplace experience during the entirety of the study, from T1 to T3. This finding uniformly reflects the plot, where it conveys many participants improving their workplace experience score at T2 with a slight general increase in reported workplace experience at T3. The second model (Table 8) builds upon the first model by including T2 as a factor within the regression equation and examining the impact of T2 as a separate variable from the intervention. From the model, the time of the intervention has improved workplace experience by approximately 16 when adding T2 as the dummy independent variable. T2 had an approximate estimation of −1; however, it is not statistically significant. The final model, like the second model, utilizes T3 as a factor within the regression equation, alongside the aggregated intervention variable. Model 3 illustrates similar results as the 2nd model, except the statistically insignificant T3 dummy independent variable has an approximate estimation of 1. As a whole, the first model seems to be the most fitting as it is simpler model with easily interpreted results. Furthermore, the first model has slightly better Akaike information criterion and Bayesian information criterion scores.

Table 5
Assignment of participant categorical data into binary values

Variable	Reference
Age	1 = 46+ yrs.
Marital	1 = Married/common-law
Education	1 = Bachelor's degree or higher
Income (annual)	1 = $70k+
Gender	1 = Female

Table 6
Variable loadings of first three principal components

Variable	PC1	PC2	PC3	Factor score	Mean index
Age	0.337	0.603	N/A	0.2580	0.2434
Gender	-0.422	0.462	-0.536	-0.1320	-0.1261
Marital	0.489	0.210	-0.601	0.1151	0.0722
Education	-0.219	-0.511	-0.576	-0.3748	-0.2965
Income	0.649	-0.343	-0.123	0.1067	0.0932
Proportion of variance	0.38	0.32	0.23	N/A	N/A

4. Discussion

Our findings demonstrate meaningful evidence of the effectiveness of our CFWP intervention at improving the work experience for CEs, particularly within the time point after the delivery of an intervention. LMM analysis of participants postintervention (n = 21) reported a significantly ($p < 0.05$) improved overall workplace experience as compared to pre-intervention assessments throughout our participant sample (Table 7). Specifically, increases in workplace experience appear to be most salient between T1 and T2 (Fig. 2). Improvement in workplace experience outcomes are evident across all 3 LMM models; however, Model 1 is the best representation of the data because of simplicity of the model. The specific effects of time on intervention effects is unclear, as T2 and T3 as dummy regression variables in Model 2 and 3 are non-significant, despite significant postintervention effects.

While the model demonstrated overall success with the intervention across the participant sample, Fig. 2 revealed that not all participants benefited equally. Some participants' work experience scores were either maintained near intervention levels or returned to baseline (Table 4). This mixed response is likely attributed to individual variation in response to our intervention. It is likely that for participants whose scores returned to pre-intervention levels, the protective effect of the delivered intervention weakened over time and their behavior regressed back toward their prior routine, suggesting some decay of intervention effects over time. However, across the sample, workplace experience scores at T3 were generally greater ($p < 0.05$) than at T1 (Table 4), implying that overall, the

Table 7
Random intercept Model 1: intervention (T2 and T3 aggregated)

Formula: Work condition ~ intervention + (1 | ID)							
Random effects							
Groups	Name	Lower var.	Variance	Upper var.	Std. Error	Pr (>|t |)	Sig.
ID	Intercept	361.0	498.7	734.0	2.81	0.007	**
Residual		192.9	266.5	392.2	2.06	0.044	*
Fixed effects							
Variable	Estimate	Std. Error	Df	T-value	Pr (>|t |)	Sig.	
Intercept	221.95	6.04	34.1	36.8	0.000	***	
Intervention	15.38	4.36	42.0	3.53	0.001	**	

Akaike information criterion (AIC) = 578.3; Bayesian Information Criteria (BIC) = 586.9.
* = p-value <0.05. **= p-value < 0.01. *** = p-value < 0.001.

effects of the intervention were not completely lost. Overall, we observe evidence that the CFWP intervention may have an observable influence on workplace experience outcomes.

Our intervention is largely supportive of previous carer literature, where psychosocial or educational interventions for carers are useful in carer outcomes related to role strain, burden, and ability/knowledge [33]. Indeed, we observe that within carers' work lives, their overall work experience and working environment has improved with our intervention. These findings supplement our previous results, where this intervention is associated with improved CE health, relating to self-reported health, depression, and psychosocial health [34]. Given this, it is reasonable to infer that this intervention has improved role strain between work and nonwork domains in our participants.

CFWPs are paramount to the success of CEs in the working environment and to employers as global population and the labor supply ages. Employer endorsement of CFWPs promote employee productivity, retention rates, engagement levels, and an encouraging work culture, where discourse surrounding worklife balance is acknowledged and supported [35]. A scoping review by Ireson et al. [3] found evidence of only 88 workplaces worldwide that currently offer caregiver supportive policies, with the financial, healthcare, and technology sectors leading by proportion. This underscores the need for more widespread implementation of CFWPs. Our findings highlight the effectiveness of an educational intervention for CEs employed in the post-secondary education sector in Canada. That said, further research may need to be conducted to assess generalizability of our findings across different workplaces and sectors.

Table 8
Random Intercept Model 2: T2 and Intervention (T2 and T3 aggregated)

Formula: Work condition ~ intervention + T2 + (1 | ID)							
Random effects							
Groups	Name	Lower var.	Variance	Upper var.	Std. Error	Pr (>|t |)	Sig.
ID	Intercept	361.1	498.8	734.1	2.81	0.007	**
Residual		192.7	266.2	391.8	2.06	0.044	*
Fixed effects							
Variable	Estimate	Std. Error	Df	T-value	Pr (>|t |)	Sig.	
Intercept	221.95	6.04	34.0	36.8	0.000	***	
Intervention	15.91	5.04	42.0	3.16	0.003	**	
Time2	-1.05	5.04	42.0	-0.21	0.836		

Akaike information criterion (AIC) = 580.3; Bayesian Information Criteria (BIC) = 591.0.
* = p-value <0.05. **= p-value < 0.01. *** = p-value < 0.001.

Table 9
Random Intercept Model 3: T3 and Intervention (T2 and T3 aggregated)

Formula: Work condition ~ intervention + T3 + (1 | ID)							
Random effects							
Groups	Name	Lower var.	Variance	Upper var.	Std. Error	Pr (>|t |)	Sig.
ID	Intercept	361.1	498.8	734.1	2.81	0.007	**
Residual		192.7	266.2	391.8	2.06	0.044	*
Fixed effects							
Variable	Estimate	Std. Error	Df	T-value	Pr (>|t |)	Sig.	
Intercept	221.95	6.06	34.2	36.6	0.000	***	
Intervention	15.91	5.04	42.0	3.16	0.003	**	
Time3	1.05	5.04	42.0	-0.21	0.836		

Akaike information criterion (AIC) = 580.3; Bayesian Information Criteria (BIC) = 591.0.
* = p-value <0.05. **= p-value < 0.01. *** = p-value < 0.001.

We recognize our findings must be approached within the limitations of the study. The most prominent limitation is the lack of a control group due to recruitment challenges, which disallows meaningful conclusions of this intervention's outcome in other environments and populations. The generalizability of our results is difficult to determine without a control group, especially given our small sample size. Our understanding of the effectiveness of the intervention would be enhanced by further studies which assess intervention implementation across different contexts, and with a control group using cross over design. Another notable limitation is our small sample size. While we originally recruited 43 participants, only 21 participants were retained by T3. This small sample size influences the significance of the analyses by reinforcing outliers and emphasizing random noise in the data.

5. Conclusions

Our present study is an attempt to fill the gaps in the current literature concerning effectiveness of implementing a CFWP intervention over time, through determining its impact on CE work outcomes. What has emerged is evidence that our intervention was successful in significantly increasing the workplace experience. This was evident in the improvement in participant reported evaluations of: work role functioning; job satisfaction; schedule control; work-to-family conflict; family-to-work conflict; family supportive supervisor behavior, and coworker support. Intervention effects are generally short lived, with the greatest differential in work condition assessments between the three- and six-month window after the intervention. Beyond this window, we observed mixed results in participant work indices. Overall, our study demonstrates evidence of improvements in working conditions for CEs. Following this, further research will investigate the generalizability of our findings when applied to different employment sectors.

Conflicts of interest

All authors have no conflicts of interest to declare.

Acknowledgments

This research was funded through a Canadian Institutes of Health Research Operating Grant (2014) MOP 137044. In addition, this research is supported by the Canadian Institutes of Health Research program, and specifically Dr. Allison Williams – Chair in Gender, Work & Health, which examines Gender, Health and Caregiver Friendly Workplaces (CG1 1265885).

References

[1] Duxbury L, Higgins C. Balancing work, childcare and eldercare: a view from the trenches; 2012.
[2] Health Canada. National profile of family caregivers in Canada - 2002: final report; 2004.. https://www.canada.ca/en/health-canada/services/health-care-system/reports-publications/home-continuing-care/national-profile-family-caregivers-canada-2002-final-report.html. [Accessed 11 May 2020].
[3] Ireson R, Sethi B, Williams A. Availability of caregiver-friendly workplace policies (CFWPs): an international scoping review. Health Soc Care Community 2018;26. https://doi.org/10.1111/hsc.12347 e1–14.
[4] Bastawrous M. Caregiver burden—a critical discussion. Int J Nurs Stud 2013;50:431–41. https://doi.org/10.1016/j.ijnurstu.2012.10.005.
[5] Hollander M, Liu G, Chappell N. Who cares and how much? The imputed economic contribution to the Canadian healthcare system of middle-aged and older unpaid caregivers providing care to the elderly. Healthc Q 2009;12:42–9. https://doi.org/10.12927/hcq.2009.20660.
[6] Sinha M. Portrait of caregivers, 2012. Stat Can. 2012.. https://www150.statcan.gc.ca/n1/pub/89-652-x/89-652-x2013001-eng.htm. [Accessed 2 June 2018].
[7] Fast JE, Lero D. Modern caregiving in Canada, vol. 44. Vanier Inst Fam; 2014.
[8] Fast J, Eales J, Keating NC. Economic impact of health, income security and labour policies on informal caregivers of frail seniors. Ottawa: Status of Women Canada; 2001.
[9] Government of Canada E and SDCanada. When work and caregiving collide : how employers can support their employees who are caregivers : em12-8/2015E-PDF. Government of Canada Publications - Canada.ca. 2002.. http://www.publications.gc.ca/site/eng/9.700220/publication.html. [Accessed 11 May 2020].
[10] Fast JE, Williamson DL, Keating NC. The hidden costs of informal elder care. Fam Econ Nutr Rev 2001;13. 120–120.
[11] Fast JE, Dosman D. Monetizing the costs of eldercare-related employment consequences. Gatineau, Canada. Human Resources and Skills Development Canada; 2014.
[12] Bulger CA, Matthews RA, Hoffman ME. Work and personal life boundary management: boundary strength, work/personal life balance, and the segmentation-integration continuum. J Occup Health Psychol 2007;12:365–75. https://doi.org/10.1037/1076-8998.12.4.365.
[13] Eikhof D, Warhurst C, Haunschild A. Introduction: what work? What life? What balance? Critical reflections on the work-life balance debate. Empl Relat 2007;29:325–33. https://doi.org/10.1108/01425450710839452.
[14] Kalliath T, Brough P. Work–life balance: a review of the meaning of the balance construct. J Manag Organ 2008;14:323–7. https://doi.org/10.1017/S1833367200003308.
[15] Schneider U, Trukeschitz B, Mühlmann R, Ponocny I. "Do I stay or do I go?"—job change and labor market exit intentions of employees providing informal care to older adults. Health Econ 2013;22:1230–49. https://doi.org/10.1002/hec.2880.
[16] Bryan ML. Access to flexible working and informal care. Scott J Polit Econ 2012;59:361–89. https://doi.org/10.1111/j.1467-9485.2012.00585.x.
[17] Curry LC, Walker C, Hogstel MO. Educational needs of employed family caregivers of older adults: evaluation of a workplace project. Geriatr Nur 2006;27:166–73. https://doi.org/10.1016/j.gerinurse.2006.03.008 (Lond).
[18] Ropponen A, Känsälä M, Rantanen J, Toppinen-Tanner S. Organizational initiatives for promoting employee work-life reconciliation over the life course. A systematic review of intervention studies. Nord J Work Life Stud 2016;6. https://doi.org/10.19154/njwls.v6i3.5529.
[19] Abma FI, van der Klink JJL, Bültmann U. The work role functioning questionnaire 2.0 (Dutch version): examination of its reliability, validity and responsiveness in the general working population. J Occup Rehabil 2013;23:135–47. https://doi.org/10.1007/s10926-012-9379-8.
[20] Harris M, Gladman B, Hennessy N, Lloyd C, Mowry B, Waghorn G. Reliability and validity of a measure of role functioning among people with psychiatric disabilities. Aust Occup Ther J 2011;58:203–8. https://doi.org/10.1111/j.1440-1630.2010.00921.x.
[21] Rentsch JR, Steel RP. Construct and concurrent validation of the andrews and withey job satisfaction questionnaire. Educ Psychol Meas 1992;52:357–67. https://doi.org/10.1177/0013164492052002011.
[22] Antoniou A-SG, Cooper CL. Research companion to organizational health psychology. Edward Elgar Publishing; 2005.
[23] Li A, Shaffer J, Bagger J. The psychological well-being of disability caregivers: examining the roles of family strain, family-to-work conflict, and perceived supervisor support. J Occup Health Psychol 2015;20:40–9. https://doi.org/10.1037/a0037878.
[24] McMullan AD, Lapierre LM, Li Y. A qualitative investigation of work-family-supportive coworker behaviors. J Vocat Behav 2018;107:25–41. https://doi.org/10.1016/j.jvb.2018.03.007.
[25] Lodder P. To impute or not impute, that's the question. In: Mellenbergh GJ, Adèr HJ, editors. Advis. Res. Methods. Johannes van Kessel Publishing; 2014.
[26] UCLA Institute for Digital Research and Education. Introduction to linear mixed models. Stat Couns. 2018.. https://stats.idre.ucla.edu/other/mult-pkg/introduction-to-linear-mixed-models/. [Accessed 11 May 2020].
[27] University of Texas at Austin. Fixed vs random factors; 2013.. https://web.ma.utexas.edu/users/mks/statmistakes/fixedvsrandom.html. [Accessed 11 May 2020].
[28] Cohen J. A power primer. Psychol Bull 1992;112:155–9. https://doi.org/10.1037/0033-2909.112.1.155.
[29] Vyas S, Kumaranayake L. Constructing socio-economic status indices: how to use principal components analysis. Health Policy Plan 2006;21:459–68. https://doi.org/10.1093/heapol/czl029.
[30] Filmer D, Pritchett LH. Estimating wealth effects without expenditure data—or tears: an application to educational enrollments in states of India. Demography 2001;38:115–32. https://doi.org/10.1353/dem.2001.0003.
[31] Krishnan V. Constructing an area-based socioeconomic index: a principal components analysis approach. Edmonton, Alberta: University of Alberta; 2010.
[32] Friesen CE, Seliske P, Papadopoulos A. Using principal component analysis to identify priority neighbourhoods for health services delivery by ranking socioeconomic status. Online J Public Health Inform 2016;8. https://doi.org/10.5210/ojphi.v8i2.6733.
[33] Walter E, Pinquart M. How Effective Are Dementia Caregiver Interventions? An Updated Comprehensive Meta-Analysis. The Gerontologist n.d. https://doi.org/10.1093/geront/gnz118.
[34] Ding R, Dardas AZ, Wang L, Williams A. Evaluation of a caregiver-friendly workplace program (CFWP) intervention on the health of full-time caregiver employees (CEs): a time series analysis of intervention effects. J Occup Environ Med 2020. https://doi.org/10.1097/jom.0000000000001980.
[35] Richman AL, Civian JT, Shannon LL, Hill EJ, Brennan RT. The relationship of perceived flexibility, supportive work–life policies, and use of formal flexible arrangements and occasional flexibility to employee engagement and expected retention. Community Work Fam 2008;11:183–97. https://doi.org/10.1080/13668800802050350.