Relationship between paid leave, financial burden, and patient-reported outcomes among employed patients who have undergone bone marrow transplantation

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Abstract

Purpose The US does not have universal paid family and medical leave. We examine the direct effects of access to paid leave on patient-reported health, quality of life (QOL), and perceived stress of employed patients who underwent bone marrow transplantation (BMT) to treat advanced blood cancer as well as the indirect effects through reductions in the financial burden (FB) that patients face.

Methods Our cross-sectional observational study took place at three US transplantation centers in 2014 and 2015. All English-speaking cancer patients 6-month post-BMT were mailed a 43-item survey assessing financial situation, employer benefits, and patient-reported health outcomes. The sample includes the 171 respondents who were employed at the time of BMT.

Results Seemingly unrelated regression analysis confirms that patient access to paid leave was associated with reductions in all three measures of FB, and lower levels of financial hardship were related with improved health, QOL, and perceived stress outcomes. For self-reported health and perceived stress outcomes, all of the effects of patient paid leave operate indirectly through reductions in FB. For QOL outcomes, there is both a direct effect (over 80%) of paid leave and an indirect effect through reduction of FB.

Conclusion We found that paid leave affected health outcomes for BMT patients mostly through alleviating FB. These findings suggest universal paid leave policies in the US might alleviate financial hardship and have positive effects on the self-reported QOL of employed patients facing intensive medical treatments.

Keywords Paid leave · Bone marrow transplantation · Financial burden · Cancer treatment · Quality of life · United States

Introduction

The US stands out among countries with a high standard of living as having no nationally guaranteed paid sick leave for a worker to leave work to undergo long-term treatment for illnesses such as cancer [1]. Only 39% of workers have access to short-term disability leave and 72% have paid sick leave [2]. Just over two out of five (41%) workers taking a family or medical leave of longer than 10 days receive full wage replacement [3]. Paid family leave to care for a seriously ill family member or bond with a new child is even less common—only 14% of workers have access to paid family leave from their employers [2].

Despite the relative lack of US coverage, paid time off from employment for own-health medical reasons or to take care of an ill relative may positively influence health outcomes. This is hypothesized to occur primarily through two mechanisms. First, access to paid leave may improve health directly by allowing for the time and care necessary to recover from a serious illness. Indeed, access to paid sick leave within the US decreases the likelihood of delaying or forgoing medical care [4], increases the likelihood of preventative medicine such as mammograms, pap tests, and endoscopies [5, 6], and reduces emergency department visits [7].

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The second mechanism is that paid leave may improve health indirectly by alleviating the financial burden (FB) that seriously ill patients and their families face, with increased costs of care and being out of paid work, by facilitating better compliance with treatment regimens or alleviating stress [8]. There is growing recognition in the US that FB among cancer patients, sometime referred to as financial toxicity, is associated with worse patient-reported health outcomes (PROs) [9–11]. Paid sick leave improves economic outcomes by decreasing the likelihood of job separation for employed US workers [11, 12]. Both mechanisms of improved health and reduced financial stress suggest that paid leave can improve patients' quality of life (QOL) while facing serious health conditions. Yet, there still remains little evidence linking paid sick and family leave to both financial and health outcomes for employed patients undergoing treatment for serious medical conditions.

Here, we examine the implications of paid sick and family leave (hereafter referred to as paid leave) on PROs and financial hardship of cancer patients undergoing bone marrow transplantation (BMT), a resource-intensive potentially curative therapy for advanced blood cancers. Specifically, we explore the association of access to paid leave on reductions in financial hardship among these cancer patients and whether, in turn, reductions in financial hardship are associated with improved patient-reported health, QOL, or perceived stress. We also examine whether paid leave has a direct effect on health outcomes beyond its role in reducing FB.

While the sample explored here is small and focuses on a very particular underlying health condition (blood cancer), patients undergoing BMT provide an excellent test case for the effect of paid leave on financial health and PROs for other patients with life-limiting illness. All the patients we sample have a similar diagnosis, but more importantly have undergone the same treatment and all are surveyed about 6 months following the procedure. Further, all patients must be healthy enough to undergo the treatment. Additionally, this group of patients is a good test case because while the treatment is both time and financially intensive, it is undertaken with the goal of cure, making returning to work a real possibility for people employed at the time of diagnosis.

Treatment for BMT involves an initial regimen of high-dose chemotherapy and/or radiation to destroy the cancerous blood cells followed by an infusion of hematopoietic stem cells to re-establish normal blood cell production. Recovery can take several weeks of hospital stay and months of frequent follow-up appointments, along with an ongoing need to take many medications. In addition to costs in terms of time, compared with other cancer populations, BMT patients may be particularly vulnerable to financial difficulties because they face high medical out-of-pocket costs as well as nonmedical, transplant-related costs associated with creating a sterile home environment. Many also face significant travel costs, as the procedure is only offered at a limited number of centers [13]. The time and FB associated with BMT may be alleviated by paid leave for the patient and caregiver.

At the same time, BMT patients are advantaged compared to other cancer patients because, to undergo BMT, patients must be in relatively good health and have a designated caregiver to facilitate with care following treatment. Most transplantation centers in the US, including the ones in which this study was conducted, require all BMT patients to carry medical insurance. Because of these requirements, studying BMT patients allows us to hold access to caregiving and health insurance fixed throughout the analysis and to reduce the variability of pre-transplant health.

There is existing evidence that financial problems related to medical and health insurance costs and changes in employment status among patients and caregivers are correlated with worse BMT outcomes [14–16]. Retrospective studies suggest that financial concerns are most common among BMT patients who experience significant changes in their QOL [14, 17]. FB may also be a factor in sub-optimal post-BMT treatment adherence and may even compromise outcomes such as survival [18]. But, there is no evidence on whether paid leave reduces FB or improves PROs among BMT patients. Here, we test the association between financial hardship and paid leave, and the association between paid leave and patient-reported measures (health, QOL, and perceived stress) among employed BMT patients.

Methods

We employ a cross-sectional observational study of patients to explore the relationship of paid leave to FB and to three PROs. Six months after their transplant, a 43-item survey was sent to every surviving English-speaking adult BMT patient 18 years and older between June 2014 and January 2015 at three high-volume BMT sites: Dana Farber Cancer Institute (DFCI), Mayo Clinic Arizona (MCA), and Roswell Park Cancer Institute (RPCI). When patients did not respond after 2 weeks, provided they had survived, they were mailed another survey and after 4 weeks with no response, investigators placed follow-up phone calls. Details of our survey methods are described elsewhere [19]. Briefly, the survey instrument was developed after a structured literature review, a focus group of BMT providers, consultation with researchers at the Center for Survey Research at the University of Massachusetts Boston, and seven in-depth cognitive interviews with BMT patients. The Institutional Review Boards at all sites approved the study methods.

There were 574 surveys mailed (395 to patients at DFCI, 105 at MCA, and 69 at RPCI), with 377 responses (65.7%), which is similar to the approximately 60% response rate typical for mailed surveys to cancer patients

[20]. The questionnaire was matched to medical records with information on patients' diagnosis and BMT type. Demographic information on non-responders indicates they were more likely to be younger (mean age of 53 vs. 57 years for responders) and non-white (16% vs. 8% for responders) but not significantly different in terms of type of transplant, gender, or days since transplantation from people who responded to the survey.

For this analysis of the role of paid leave, we include only the 171 respondents (45.5%) with non-missing survey responses who indicated they were working full-time or part-time or were taking a leave but still employed during the week of transplant. This includes 130 DFCI patients, 24 MCA patients, and 17 from RPCI. At the time of the survey, 52% of these respondents were back at work, 12% were no longer employed and the rest were on leave from their job. As they were over-represented in the overall study, DFCI patients are also over-represented in the employed sample.

Measures

We test if the presence of paid leave of the patient or caregiver contributes to improved PROs directly as well as indirectly through a reduction in patient's FB. The key variable of interest is paid leave for patients and caretakers. Adapting a question used in a national survey on family and medical leave [21], paid leave for patients was assessed by asking patients how much time they have taken off work since transplantation and how much of that was paid time off (none, less than half, about half, more than half, all). Paid time off could come from sick days, vacation days, or disability insurance payments. Fifty-one percent of employed respondents indicated that all time off was paid, while 33% indicated none. We create an indicator variable to measure the paid leave of the BMT patient, $PaidSickLeave_i$, which is equal to 1 if patient i reports having half or more of his or her time out of work since transplantation with pay and 0 otherwise. Half or more represents a large enough portion of wage replacement to potentially relieve FB or improve PROs. Fifty-eight percent of patients report receiving pay for half or more of their time away from work. Defining paid leave as receiving any time out of work with pay produces results that are not significantly different from those using our preferred measure of paid leave.

Paid leave for caregivers was assessed by asking patients about their primary caregiver's employment status during the week of their transplant. If a caregiver was employed, they were asked if the caregiver used any vacation time or employer-provided paid sick or medical leave to provide care. Paid leave for the BMT patient's caregiver, $PaidFamilyLeave_i$, is a dichotomous variable equal to 1 if

patient i's caregiver received any paid sick days or vacation time since the time of transplantation and 0 otherwise.

We use three patient-reported health-related measures (PRO_i): health, QOL, and perceived stress. The survey included a single question on patient-reported overall health and a single QOL question adapted from the EORTC QLQ-C30 [22] as well as the perceived stress measure from the Perceived Stress Scale 4 (PSS4) [23]. Patient-reported health and QOL measures were based on responses to "How would you rate your overall health during the past week?" and "How would you rate your overall QOL during the past week?" Patients were asked to circle a number from 1 to 7 with 1 indicating "Very Poor" and 7 indicating "Excellent." The PSS4 asks four questions about feelings and thoughts patients have had over the last month pertaining to the ability to control important things in one's life, confidence in the ability to handle personal problems, if things are going one's way, and ability to overcome difficulties if they were piling up. Each question contains a five-point scale from "Never" to "Often." The PSS4 score is the recoded sum of responses to four questions, with a range of 0 to 16 (often to never stressed). Because each of these three measures captures a somewhat different aspect of patient-reported health, we use the three health measures in separate models. The distribution of responses to each of these measures is depicted in Fig. 1a–c.

Financial burden (FB_i) is unobserved. Following Lantz et al. [24], we use the responses from three questions in the survey to measure it. Under the survey heading of "Current Finances," patients were asked: "In general, how satisfied are you with your family's present financial situation?" (1 = completely satisfied, 5 = not satisfied at all); "How difficult is it for you/your family to meet monthly payments on your bills?" (1 = not difficult at all, 5 = extremely difficult); and "How do your family's finances usually work out at the end of the month?" (1 = some money left over, 2 = just enough money, 3 = not enough money). Figure 2a–c depicts the distribution of the responses to each of these questions. The responses to these questions are highly correlated (between 0.64 and 0.75). The three measures are used in separate models to test the robustness of the relationships that we estimate to the exact measure of financial hardship.

Model

Figure 3 depicts the relationship we test among paid leave, FB, and PROs. We hypothesize that paid leave may have a direct positive effect on PROs but it may also have an indirect effect on these outcomes that is mediated through a reduction in FB. We estimate the following two equations simultaneously allowing the error terms to be correlated
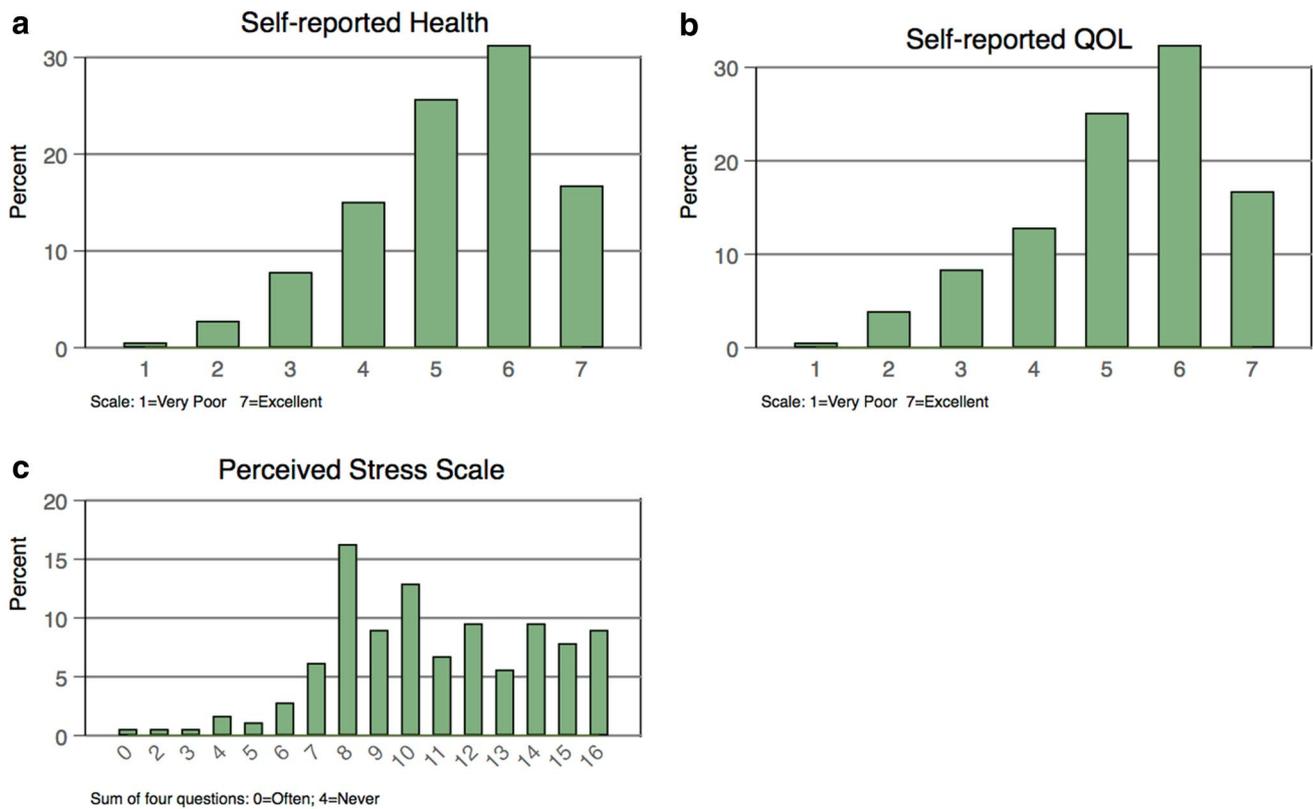
Fig. 1 Distribution of responses of employed BMT patients on patient-reported health-related measures

using seemingly unrelated regression analysis (using Stata/SE 15.1):

$$FB_i = \beta_0 + \beta_1 PaidSickLeave_i + \beta_2 PaidFamilyLeave_i + \beta_c Cost_i + \delta X_i + \phi Y_i + v_i, \tag{1}$$

$$PRO_i = \alpha_0 + \alpha_1 PaidSickLeave_i + \alpha_2 PaidFamilyLeave_i + \alpha_3 FB_i + \alpha_4 Cost_i + \lambda X_i + \varphi Y_i + \mu_i. \tag{2}$$

We test for direct and indirect effects of paid leave on PROs using product coefficients. For example, α_1 in Eq. (2) represents the direct effect of patient paid leave on patient-reported health. The indirect effect of paid leave on patient-reported health that is mediated through FB can be calculated by multiplying the direct effect of FB on patient-reported health ($\beta_1 * \alpha_3$). Though the measures of FB and PROs are ordinal scales, we estimate the models using ordinary least squares (OLSs) for ease of presentation and discussion. The results using ordered logit models are similar. The use of multiple measures for FB and health results in three separate OLSs specifications for Eq. (1) and nine separate OLS specifications for Eq. (2).

The control variables include $Cost_i$ which is a scale indicating difficulty associated with paying for three non-medical BMT costs: relocating for transplantation, travel for visits to transplantation center, and keeping and maintaining a sterile home environment each of which is measured on a scale of 1 to 5 (1 = not difficult at all and 5 = extremely difficult). Those indicating that the cost did not apply were coded as 1. $Cost_i$ is the sum of the responses for the three measure of transplantation cost difficulties and ranges from 3 to 15. We control for BMT-related costs because we want to examine the effect of paid leave on FB net of the additional costs due to transplantation.

X_i is a set of demographic and patient disease characteristics including age; dummy variables for race, gender, and marital status; whether the transplant is allogeneic (blood cells come from another person and is associated with more complications than transplantation from own stem cells); the natural log of the number of days with cancer; distance measured in miles from transplantation center (capped at 500); and being at DFCI, the largest treatment site. Also included in X_i are indicator variables equal to 1 if patient i's caregiver is in the labor force, and if patient i is receiving any employer-based health insurance (compared to individually purchased insurance or government provided only). Employer-provided insurance may be correlated with paid leave and may influence health and FB directly, so it is included as a control.
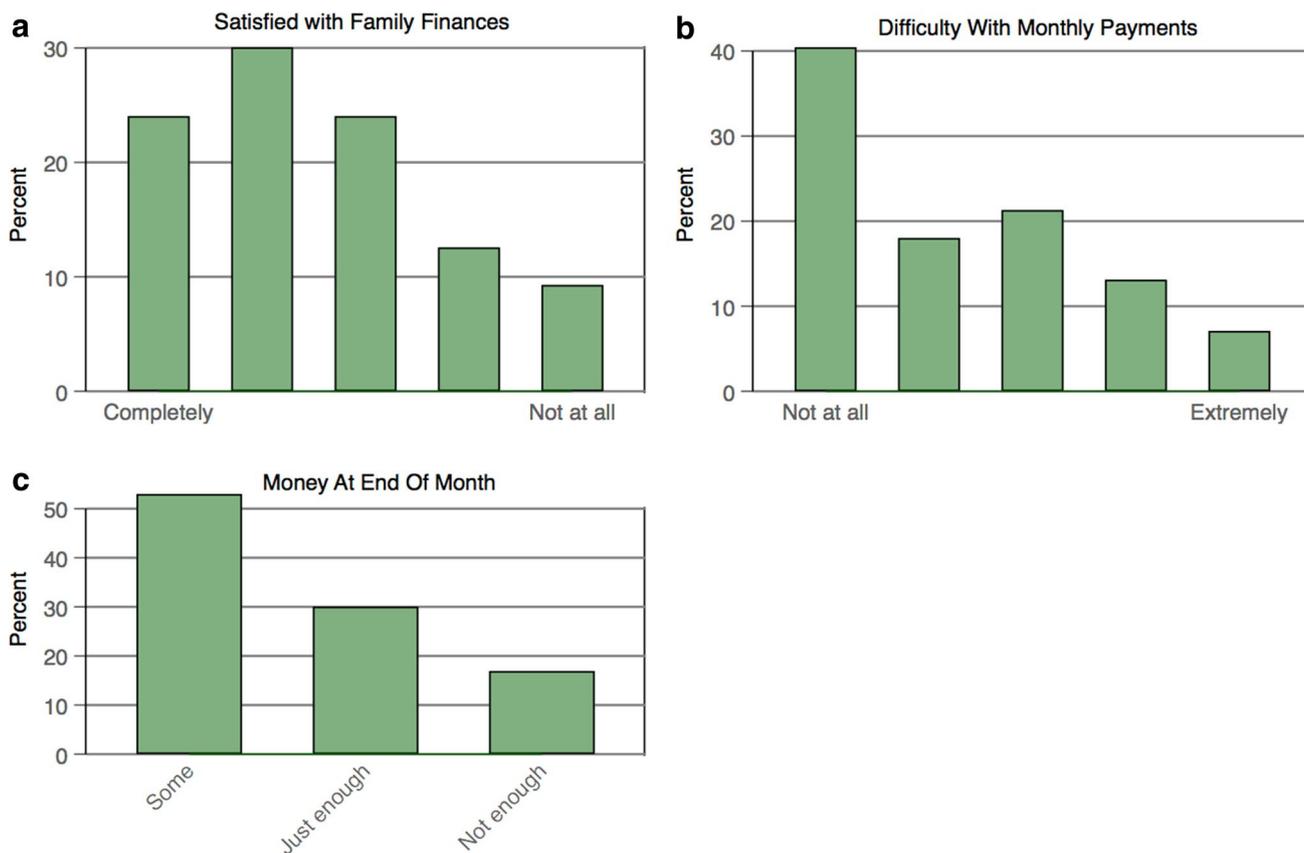
Fig. 2 Distribution of responses of employed BMT patients on financial burden measures

Fig. 3 Model directly and indirectly (through financial burden measures) linking paid leave to patient-reported health outcomes
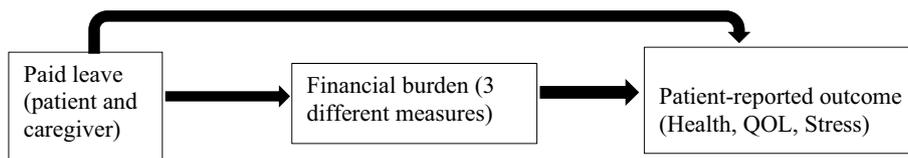
Y_i is a set of controls for the economic status of patient i prior to transplant that include broad occupational category of patient at time of transplant, years of schooling, and an indicator variable for whether the patient was low income (monthly household income of $3000 or less) at time of survey. Occupation is measured in four categories: service, sales, and administrative support; managerial; professional; and construction, maintenance, production, transportation, and military. These were generated by matching the patient's self-described occupation at time of transplant to the Bureau of Labor Statistics, 2010 Standard Occupational Classifications (at http://www.bls.gov/soc/major_groups.htm). Years of schooling is reported by the patient in the survey. These measures are included because receiving paid leave could be correlated with prior earnings which also affects current FB, and because of the relationship between socio-economic status (SES) and health throughout the life course.

This empirical strategy is a control function approach and thus we do not interpret results as strictly causal. Perhaps, the greatest concern is about whether SES prior to BMT is sufficiently controlled for by years of schooling, occupation, and current low-income status. Patients with fewer economic resources prior to the transplant may be less likely to have paid leave, more likely to experience financial hardship, and have worse health outcomes which would bias our results toward finding that paid leave reduces financial hardship and improves health outcomes when all three outcomes may simply be correlated through SES prior to transplant. The easiest solution would be to control for income prior to the transplant but it was not included in the survey questionnaire. Instead, the estimation includes controls for occupation and educational attainment at the time of the transplant as broad controls for SES. Though the indicator of whether a patient is low income at the time of the survey is endogenous, it is

included as a control because low-income status is likely correlated over time. The inclusion of this control may be too conservative as its inclusion means Eqs. (1) and (2) measure the relationship between paid leave and FB or health status, holding whether one is low-income constant.

Results

Descriptive statistics

Table 1 provides summary statistics of all variables used in the model and by whether the patient received half or less of their pay when on leave since their transplant. Patients with

Table 1 Summary statistics of employed BMT sample by paid leave

Respondent characteristics	All patients employed or on leave from work week of transplantation $N=171$	Patients with none or less than half paid time off	Patients with at least half paid time off	
Percent paid sick leave		57.9	42.1	
Patient-reported health-related outcomes (mean)				
Health (1–7)	5.24	5.04	5.38	
Quality of life (1–7)	5.23	4.93	5.44	**
Perceived stress: PSS4 (0–16)	10.85	10.38	11.19	
Financial burden (mean)				
Satisfied with present finances (1–5)	2.51	3.01	2.15	***
Difficulty meeting monthly payments (1–5)	2.27	2.65	2.00	***
Money at the end of the month (1–3)	1.64	1.83	1.49	***
Paid family leave				
Percent caregiver received paid vacation or sick days	35.7	38.9	33.3	
Transplant costs (mean)				
Transplantation cost difficulty (range 3–15)	5.45	5.58	5.35	
Patient demographic and disease characteristics				
Mean age (years)	54.36	53.51	54.97	
Mean miles from transplant center (capped at 500)	81.79	95.70	71.67	
Mean of log of days with cancer	5.70	5.64	5.74	
Percent white	91.8	91.7	91.9	
Percent female	35.7	37.5	34.3	
Percent married	76.0	76.4	75.8	
Percent with allogeneic transplant	48.5	51.4	46.5	
Percent at DFCI	76.0	75.0	76.8	
Percent with any employer insurance	79.5	66.7	88.9	***
Percent with a caregiver in labor force	64.9	56.9	70.7	**
Income and SES characteristics				
Mean years of schooling	15.52	15.3	15.7	
Percent with low income (monthly household income < \$3000)	21.6	31.9	14.1	***
Occupational category				
Percent service, sales, and administrative support	19.9	27.8	14.1	**
Percent managerial	33.3	25.0	39.4	
Percent professional	34.5	31.9	36.4	
Percent construction, production, transportation, maintenance, military	12.3	15.3	10.1	

Difference in means of patients with paid leave versus those without

***$p<0.01$, **$p<0.05$

paid leave report higher mean levels of PROs (only mean QOL scores are statistically significant) and significantly lower levels of for all three measures of financial hardship. Demographic and disease characteristics are remarkably balanced between patients with and without paid leave. The likelihood of having a caregiver with paid leave is the same across the two groups but those with paid leave are more likely to have a caregiver in the labor force which suggests that access to paid leave from employers is correlated across couples. Individuals with paid leave are more likely to have employer-sponsored health insurance and are less likely to be poor or be in service, sales, or administrative occupations, which motivates the need for multivariate regression analysis.

Association between financial burden and paid leave

Table 2 shows the coefficients and 95% confidence intervals from estimating Eq. (1). Paid leave for both the patient and the caregiver reduces FB. Paid leave for the patient is associated with statistically significant reductions in FB for all three FB measures. The reductions in financial hardship when a caregiver has paid leave are statistically significant (at the 5% or 10% level) for two of the FB measures. The coefficients on patient paid leave and caregiver paid leave are also jointly statistically significant for all three measures. Unsurprisingly, patients who report difficulty with BMT-related costs report more financial hardship. The control variables of being low income and being further away from the transplantation center are also associated with increases in FB (reported with full results in Appendix Table 5).

Association between patient-reported health measures, financial burden, and paid leave

Table 3 provides the coefficients and 95% confidence intervals from the nine regressions run using Eq. (2), depicting the direct effects of FB and paid leave on PROs. Higher FB is associated with statistically significant reductions in PROs (at the 1%, 5%, or 10% level) in all of the nine specifications (three health outcomes with three FB measures), even after controlling for various patient characteristics, including those that reflect prior SES and patient disease characteristics. We also find limited evidence of a direct effect of paid sick leave on PROs above that which operates through FB. Access to paid leave for the patient improves QOL in two of the three specifications, as shown in Table 3. Family leave of the caregiver does not have a statistically significant impact on PROs beyond that which operates through reducing FB. We note though that our sample size is quite small which reduces statistical power. Of all the control variables included, only being at DFCI improved patient-reported health and QOL outcomes consistently at the 1% or 5% level (reported with full results Appendix Table 6).

Direct and indirect effects of paid leave on patient-reported health measures

As Table 3 shows, for the self-reported overall health and perceived stress outcomes, all of the effects of paid leave operate indirectly through reductions in FB. But, for QOL outcomes, there appears to be both a direct and indirect effect of paid leave on patient-reported health. Table 4 shows the percent of the total effect of paid leave on QOL that operates directly and the percent that operates indirectly through reducing FB. In both cases where paid leave has a significant effect, over 80% of the effect of paid leave on

Table 2 Seemingly unrelated regression results for key variables: paid sick leave and paid family leave and financial burden (OLS coefficients, 95% confidence interval)

	Dependent variables		
	Dissatisfied with financial situation	Difficulty paying bills	Not enough money at the end of the month
Paid sick leave	−0.775*** (−1.108, −0.442)	−0.387** (−0.724, −0.050)	−0.312*** (−0.523, −0.102)
Caregiver received paid vacation or sick days	−0.417** (−0.814, −0.020)	−0.212 (−0.615, 0.190)	−0.284** (−0.536, −0.033)
Transplantation cost difficulty	0.165*** (0.103, 0.226)	0.212*** (0.150, 0.274)	0.090*** (0.052, 0.129)
Observations	171	171	171
χ^2-Test for joint significance of patient paid leave and caregiver paid leave	22.62***	5.54†	11.57***

95% Confidence intervals in parentheses. All demographic and disease controls and income and SES controls are included in regressions. Full results are shown in Table 5 in the Appendix

***$p < 0.01$, **$p < 0.05$, $^\dagger p < 0.1$

Table 3 Seemingly unrelated regression results for key variables: patient-reported health and three financial burden (FB) measures with paid leave (OLS coefficients, 95% confidence interval)

	Dependent variables		
	Health (1 = very poor, 7 = excellent)	Quality of life (1 = very poor, 7 = excellent)	Perceived stress (0 = often, 16 = never)
Panel A: regression using FB1			
Dissatisfied with financial situation	−0.331*** (−0.501, −0.161)	−0.295*** (−0.473, −0.118)	−1.093*** (−1.496, −0.689)
Paid sick leave	−0.0503 (−0.475, 0.375)	0.286 (−0.157, 0.729)	0.00782 (−1.000, 1.016)
Caregiver received paid vacation or sick days	−0.149 (−0.637, 0.339)	0.184 (−0.324, 0.693)	0.004 (−1.153, 1.162)
χ^2 Test for joint significance of patient paid leave and caregiver paid leave	0.37	1.84	0
Panel B: regression using FB2			
Difficulty paying bills	−0.270*** (−0.433, −0.108)	−0.177** (−0.348, −0.006)	−0.720*** (−1.118, −0.321)
Paid sick leave	0.106 (−0.308, −0.520)	0.447** (0.0126, 0.882)	0.583 (−0.429, 1.595)
Caregiver received paid vacation or sick days	−0.0621 (−0.552, 0.428)	0.271 (−0.244, 0.786)	0.315 (−0.883, 1.514)
χ^2 Test for joint significance of patient paid leave and caregiver paid leave	0.36	4.59	1.39
Panel C: regression using FB3			
Not enough money at end of the month	−0.404*** (−0.680, −0.128)	−0.312** (−0.601, −0.024)	−0.943*** (−1.625, −0.261)
Paid sick leave	0.084 (−0.335, 0.503)	0.419[†] (−0.019, 0.857)	0.562 (−0.474, 1.597)
Caregiver received paid vacation or sick days	−0.122 (−0.618, 0.375)	0.22 (−0.298, 0.739)	0.189 (−1.037, 1.415)
χ^2 Test for joint significance of patient paid leave and caregiver paid leave	0.46	3.78	1.14
Observations	171	171	171

95% Confidence intervals in parentheses. All demographic and disease controls and income and SES controls are included in regressions. Full results are shown in Table 5 in the Appendix

***$p < 0.01$, **$p < 0.05$, [†]$p < 0.1$

Table 4 Direct and indirect effect of patient paid leave on quality of life of BMT patients

	Mediating financial burden measure			
	Difficulty paying bills		Not enough money at end of the month	
	Effect size	Percent	Effect size	Percent
Direct effect	0.447	86.7	0.419	81.1
Indirect effect	0.068[a]	13.3	0.097[b]	18.9
Total effect	0.515	100.0	0.516	100.0

[a]The product of (−.177) and (−.388) from Tables 2 and 3
[b]The product of (−.312) and (−.312) from Tables 2 and 3

improvements in QOL are direct while the remaining effect (13.3% and 18.9%, respectively) operates indirectly through reductions in FB.

Discussion

We provide evidence that paid leave affects PROs for BMT patients mostly through the indirect channel of alleviating FB. Controlling for BMT-related costs and underlying SES, the provision of paid leave for employed BMT patients and their caregivers ameliorates FB in the period following transplant. In turn, we show that higher levels of FB are associated with worse health outcomes among employed patients facing BMT. These results are consistent with the larger literature on financial toxicity among US cancer patients, which shows that higher levels of FB are associated with worse PROs among employed patients [6–8, 19].

Medical providers, insurers, and patients bear a high cost for BMT and similarly intensive cancer treatments with the hope and intention that previously employed patients will return to employment. Current US policy, which does not assure wage replacement for employed patients (or for their

caregivers) taking medical leaves for a serious health condition, may be at odds with this goal by increasing FB which in turn contributes to poorer PROs. Paid family and medical leave would reduce financial difficulty, which in turn might improve outcomes but may also influence health outcomes like QOL directly.

Our results are consistent with other literature that examines the effects of paid leave in the United States including the positive health effects of paid maternity leave on mothers and new born children [25–27] and positive effects of paid sick leave on treatment compliance [5]. In each of these cases, the financial and time benefits of paid leave likely play a role. Through examining the direct and indirect effects of paid leave on a population of patients facing potentially long absences from work, our results suggest that for BMT patients, the financial benefits of paid leave seem particularly critical.

Our study has limitations. We are only examining a small sample of blood cancer patients that underwent a potentially life-saving procedure. The small sample size may make it difficult to detect the direct effects of paid leave on PROs. Perhaps more importantly, the characteristics of BMT patients may differ from patients with other types of illness. For example, we found that patients reported quite positive health outcomes at 6 months, which may be different for patients with other illnesses. On the other hand, these and other characteristics of BMT patients likely bias us against finding effects of paid leave and FB because patients must have access to health insurance, must be healthy enough to undergo treatment, and must have a caregiver to be eligible to undergo treatment. The study is also limited in that we only use a single scale for patient-reported health and QOL outcomes.

Despite these limitations, BMT patients are an apt case study, not only because of the intensity of treatment but also because of the curative potential of the procedure. In addition, unlike other cancers that primarily affect older and often retired patients, blood cancers also affect the young, which allow us to explore the impact of paid leave on younger patients for whom paid leave is more salient. Our results ultimately suggest that mandated wage replacement in the form of paid medical and family leave has the potential to lead to reduced FB and improved PROs for the employed population facing cancer treatment.

Compliance with ethical standards

Appendix

Table 5 OLS seemingly unrelated regression full results: paid sick leave and paid family leave and financial burden (OLS coefficients, 95% confidence Interval)

	Dissatisfied with financial situation	Difficulty paying bills	Not enough money at end of the month
Paid sick leave	−0.775*** (−1.108 to −0.442)	−0.388** (−0.726 to −0.0506)	−0.312*** (−0.523 to −0.102)
Caregiver received paid vacation or sick days	−0.417** (−0.814 to −0.020)	−0.212 (−0.615 to 0.190)	−0.284** (−0.536 to −0.033)
Caregiver in labor force	0.359* (−0.027 to 0.746)	0.263 (−0.129 to 0.654)	−0.003 (−0.248 to 0.242)
Transplantation cost difficulty	0.165*** (0.103 to 0.226)	0.212*** (0.150 to 0.274)	0.090*** (0.052 to 0.129)
Received employer-based insurance	−0.163 (−0.579 to 0.252)	−0.657*** (−1.079 to −0.236)	−0.00752 (−0.271 to 0.256)
Miles away from transplant center	−0.000546 (−0.003 to 0.001)	−0.00175** (−0.003 to −0.000)	−0.00139** (−0.002 to −0.0003)
Days since diagnosis (ln)	0.049 (−0.112 to 0.210)	−0.034 (−0.198 to 0.129)	−0.004 (−0.106 to 0.0986)
Female	0.147 (−0.203 to 0.498)	0.075 (−0.280 to 0.430)	−0.017 (−0.239 to 0.205)
White	0.225 (−0.350 to 0.800)	0.159 (−0.424 to 0.743)	−0.027 (−0.391 to 0.338)
Age	0.080† (−0.005 to 0.164)	0.025 (−0.061 to 0.111)	0.026 (−0.028 to 0.080)
Age^2	−0.0009** (−0.002 to 0.000)	−0.0003 (−0.001 to 0.001)	−0.0003 (−0.001 to 0.003)
Married	0.114 (−0.279 to 0.507)	0.22 (−0.179 to 0.619)	−0.133 (−0.382 to 0.116)
Allogeneous BMT	0.0955 (−0.214 to 0.405)	0.292† (−0.0224 to 0.606)	0.107 (−0.0894 to 0.303)
At Dana Farber	−0.0462 (−0.421 to 0.328)	0.0823 (−0.297 to 0.462)	0.0371 (−0.200 to 0.274)
Managerial occupation	−0.00957 (−0.455 to 0.436)	−0.181 (−0.633 to 0.270)	0.108 (−0.174 to 0.390)
Professional occupation	−0.153 (−0.618 to 0.312)	−0.157 (−0.629 to 0.315)	0.165 (−0.130 to 0.460)
Construction, production, transportation occupation	−0.0617 (−0.628 to 0.505)	−0.26 (−0.835 to 0.315)	−0.0382 (−0.397 to 0.321)
Years of education	−0.0142 (−0.082 to 0.054)	−0.0596† (−0.129 to 0.010)	−0.0559** (−0.099 to −0.013)
Is low income	0.727*** (0.303 to 1.151)	0.653*** (0.223 to 1.083)	0.403*** (0.134 to 0.672)
Observations	171	171	171
R^2	0.367	0.419	0.326

95% CI in parentheses

***$p < 0.01$, **$p < 0.05$, $^\dagger p < 0.1$

Table 6 Seemingly unrelated regression full results: patient-reported health and three financial burden (FB) measures with paid leave (OLS coefficients, 95% confidence interval)

	Regression using FB1			Regression using FB2			Regression using FB3		
	Health (1=very poor, 7=excellent)	Quality of life (1=very poor, 7=excellent)	Perceived stress (0=often, 16=never)	Health (1=very poor, 7=excellent)	Quality of life (1=very poor, 7=excellent)	Perceived stress (0=often, 16=never)	Health (1=very poor, 7=excellent)	Quality of life (1=very poor, 7=excellent)	Perceived stress (0=often, 16=never)
Dissatisfied with financial situation	−0.331*** (−0.501, −0.161)	−0.295*** (−0.473, −0.118)	−1.093*** (−1.496, −0.689)						
Difficulty paying bills				−0.270*** (−0.433, −0.108)	−0.177** (−0.348, −0.005)	−0.720*** (−1.118, −0.321)			
Not enough money at end of the month							−0.404*** (−0.680, −0.128)	−0.312** (−0.601, −0.024)	−0.943*** (−1.625, −0.261)
Paid sick leave	−0.0503 (−0.475, 0.375)	0.286 (−0.157, 0.729)	0.00782 (−1.000, 1.016)	0.106 (−0.308, 0.520)	0.447** (0.013, 0.882)	0.583 (−0.429, 1.595)	0.084 (−0.335, 0.503)	0.419† (−0.019, −0.857)	0.562 (−0.474, 1.597)
Caregiver received paid vacation or sick days	−0.149 (−0.637, −0.339)	0.184 (−0.324, 0.693)	0.00438 (−1.153, 1.162)	−0.0621 (−0.552, 0.428)	0.271 (−0.244, 0.786)	0.315 (−0.883, 1.514)	−0.122 (−0.618, 0.375)	0.22 (−0.298, 0.739)	0.189 (−1.037, 1.415)
Caregiver in labor force	0.410† (−0.067, −0.887)	0.2 (−0.297, 0.697)	0.838 (−0.293, 1.970)	0.363 (−0.118, 0.844)	0.135 (−0.369, 0.640)	0.622 (−0.553, 1.797)	0.282 (−0.198, 0.761)	0.0839 (−0.417, 0.585)	0.402 (−0.782, 1.586)
Received employer-based insurance	0.354 (−0.148, 0.856)	−0.127 (−0.649, 0.396)	−1.272** (−2.463, −0.082)	0.241 (−0.277, 0.759)	−0.185 (−0.729, 0.360)	−1.530** (−2.797, −0.264)	0.427 (−0.082, 0.936)	−0.0625 (−0.594, 0.469)	−1.039 (−2.297, 0.218)
Days since diagnosis (ln)	0.00924 (−0.188, 0.207)	0.0959 (−0.110, 0.302)	0.532** (0.064, 1.000)	−0.0173 (−0.217, 0.182)	0.0744 (−0.135, 0.284)	0.450† (−0.038, 0.939)	−0.0106 (−0.211, 0.190)	0.0785 (−0.131, 0.288)	0.469† (−0.026, 0.964)
Female	0.0883 (−0.337, 0.514)	0.205 (−0.239, 0.648)	0.913† (−0.097, 1.922)	0.065 (−0.365, 0.495)	0.167 (−0.285, 0.618)	0.789 (−0.263, 1.840)	0.0211 (−0.409, 0.451)	0.141 (−0.308, 0.591)	0.662 (−0.400, 1.725)
White	−0.693† (−1.394, 0.007)	−0.756** (−1.486, −0.026)	−0.55 (−2.212, 1.113)	−0.735** (−1.443, −0.026)	−0.799** (−1.543, −0.055)	−0.703 (−2.436, 1.029)	−0.792** (−1.503, −0.080)	−0.840** (−1.583, −0.096)	−0.846 (−2.603, 0.912)
Age	−0.0123 (−0.115, 0.091)	0.0472 (−0.060, 0.155)	−0.0266 (−0.271, 0.218)	−0.0309 (−0.135, 0.073)	0.0309 (−0.078, 0.140)	−0.0872 (−0.341, 0.167)	−0.0227 (−0.127, 0.082)	0.0371 (−0.072, 0.146)	−0.0678 (−0.326, 0.190)
Age^2	0.00008 (−0.000, −0.001)	−0.0005 (−0.002, 0.001)	0.0002 (−0.002, −0.003)	0.0003 (−0.001, −0.001)	−0.0003 (−0.001, 0.001)	0.0009 (−0.002, 0.003)	0.0002 (−0.001, −0.001)	−0.0004 (−0.001, 0.001)	0.0007 (−0.002, 0.003)
Married	−0.297 (−0.768, 0.175)	−0.36 (−0.851, 0.131)	0.497 (−0.620, 1.614)	−0.289 (−0.766, 0.188)	−0.359 (−0.860, 0.141)	0.506 (−0.660, 1.672)	−0.402 (−0.884, 0.080)	−0.444† (−0.948, 0.060)	0.232 (−0.959, 1.423)

Table 6 (continued)

	Regression using FB1			Regression using FB2			Regression using FB3		
	Health (1 = very poor, 7 = excellent)	Quality of life (1 = very poor, 7 = excellent)	Perceived stress (0 = often, 16 = never)	Health (1 = very poor, 7 = excellent)	Quality of life (1 = very poor, 7 = excellent)	Perceived stress (0 = often, 16 = never)	Health (1 = very poor, 7 = excellent)	Quality of life (1 = very poor, 7 = excellent)	Perceived stress (0 = often, 16 = never)
Allogeneous BMT	−0.311 (−0.690, −0.069)	−0.417** (−0.812, −0.022)	0.11 (−0.790, 1.009)	−0.262 (−0.649, 0.126)	−0.394* (−0.800, 0.013)	0.216 (−0.730, 1.162)	−0.299 (−0.686, 0.087)	−0.412** (−0.816, −0.009)	0.0992 (−0.856, 1.054)
At Dana Farber	0.596*** (0.145, 1.047)	0.510** (0.040, 0.980)	0.756 (−0.313, 1.826)	0.625*** (0.168, 1.082)	0.526** (0.046, 1.006)	0.826 (−0.292, 1.943)	0.602** (0.143, 1.060)	0.513** (0.034, 0.992)	0.759 (−0.374, 1.891)
Managerial occupation	−0.141 (−0.684, 0.402)	−0.343 (−0.909, 0.223)	−1.002 (−2.290, 0.286)	−0.192 (−0.743, 0.358)	−0.375 (−0.953, 0.203)	−1.135† (−2.481, 0.212)	−0.101 (−0.653, 0.452)	−0.311 (−0.888, 0.266)	−0.902 (−2.266, 0.463)
Professional occupation	−0.789*** (−1.357, −0.221)	−0.700** (−1.292, −0.108)	−0.689 (−2.037, 0.658)	−0.784*** (−1.360, −0.208)	−0.675** (−1.280, −0.071)	−0.618 (−2.025, 0.789)	−0.660** (−1.237, −0.084)	−0.590† (−1.192, 0.012)	−0.301 (−1.725, 1.122)
Construction, production, transportation occupation	−0.0954 (−0.785, 0.594)	−0.22 (−0.939, 0.498)	0.017 (−1.619, 1.653)	−0.142 (−0.843, −0.559)	−0.234 (−0.970, 0.502)	−0.0629 (−1.776, 1.650)	−0.0655 (−0.766, 0.635)	−0.189 (−0.921, 0.543)	0.154 (−1.577, 1.885)
Years of education	0.0311 (−0.052, 0.114)	0.0325 (−0.054, 0.119)	0.0753 (−0.122, 0.272)	0.0201 (−0.065, 0.105)	0.0278 (−0.061, 0.117)	0.0528 (−0.155, 0.260)	0.0162 (−0.070, 0.102)	0.0223 (−0.068, 0.112)	0.0508 (−0.162, 0.263)
Is low income	0.0475 (−0.488, 0.583)	0.107 (−0.451, 0.665)	−1.026 (−2.296, 0.244)	−0.0148 (−0.553, 0.523)	−0.00125 (−0.567, 0.564)	−1.374** (−2.690, −0.058)	−0.0454 (−0.585, 0.494)	0.00156 (−0.562, 0.565)	−1.518** (−2.851, −0.185)
Observations	171	171	171	171	171	171	171	171	171
R^2	0.19	0.18	0.254	0.169	0.146	0.188	0.162	0.147	0.164

95% CIs in parentheses

*** $p < 0.01$, ** $p < 0.05$, † $p < 0.1$

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