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# Vacation, Collective Restoration, and Mental Health in a Population

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**Abstract**

Vacations enable people to help one another, spend time together in pleasant contexts, and renew relational resources. Reasoning that these shared activities spread social and psychological benefits through social networks, we hypothesized that increase in the number of vacationing workers engenders nonlinear decline in psychological distress at the population level. We applied time-series methods to aggregate data on monthly dispensation of antidepressants to the Swedish population for the 147 months starting January 1993. We obtained the data from the pharmacy corporation allied with the national health care system and from governmental sources. Dispensation of antidepressants declined logarithmically with increase in the number of vacationing workers, for men and women alike. The associations held among people beyond retirement age as well as people of working age, further evidence that vacation benefits spread beyond vacationing workers. The results bear on the social regulation of time for restoration as a general determinant of population health.

**Keywords**

caregiving, depression, families, gender, psychosocial resources

Most adults face persistent demands from paid work. In meeting those demands, they deplete resources such as physical energy and the capacity to concentrate. Without sufficient time for recovery of the depleted resources, workers may eventually suffer impaired cognitive function, emotional distress, accidents, illness, and other adverse outcomes (e.g., Dembe et al. 2005; Sparks et al. 1997; Van der Hulst 2003; Virtanen et al. 2009). The costs of insufficient restoration are not only borne by individual workers; poor performance, accidents, and sickness absence also impose costs on other people, employers, and societies (e.g., European Agency for Safety and Health at Work 2002).

Employers, labor unions, legislative bodies, and other actors have sought to mitigate such problems by providing for the restoration needs of workers. Some of the provisions target the temporal parameters for paid work; they specify the number and length of breaks during the work day, the number of hours in the work day, the number of days in the work week, the amount of annual vacation time, and the disposition of vacation time over the year. The variety of provisions reflects the variety in forms of resource depletion

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incurred with work. Different forms of depletion or fatigue impose different duration and periodicity requirements on recovery time (Sluiter et al. 2003).

The present study focuses on annual vacation as a temporal provision for restoration. With greater length than other provisions, vacation can enable more complete recovery of a greater variety of resources depleted through paid work. Many countries have legislation that directs employers to provide vacation time, and in wealthy countries that do not have a national vacation law, such as the United States, organizations commonly include vacation time in a package of employee benefits, even when not directly pressured to do so by labor unions (e.g., Altonji and Oldham 2003; Aronsson and Gustafsson 2005; Richards 1999). In seeming contrast to the widespread affirmation of the value of vacation, and yet perhaps because of it, little research has examined whether vacations actually do affect health and well-being. Of particular concern here, it appears that research has not yet considered whether the benefits of vacationing spread among individuals, an ecological effect that would become evident in population health. We address this gap in the literature by assessing the covariation between vacationing and psychological distress in the population of Sweden over a period of more than 12 years.

The extant evidence largely conforms to the expectation that individual workers benefit from vacation. Quasi-experiments have found that a vacation alleviates feelings of exhaustion, reduces health complaints, and enhances life satisfaction, although effects seen during the vacation appear to fade out within two to four weeks after the vacation (for a review, see De Bloom et al. 2009). Prospective studies have found that more frequent vacationing over multiple years of follow-up predicts lower risk of adverse outcomes such as acute myocardial infarction (Eaker, Pinsky, and Castelli 1992; Gump and Matthews 2000; Vaillant 1978).

We assume, however, that vacationing contributes more to population health than the sum of benefits to individual workers. A worker on vacation does not enter a social void; he or she ordinarily spends vacation time with others. Vacation therefore has implications for the availability of resources held within social networks. Given that the availability of social resources has general benefits for health (Berkman et al. 2000; House, Landis, and Umberson 1988), positive effects of vacation on the availability of social resources should entail general health benefits for a population.

Vacation can improve the availability of social resources in several ways. One follows from the fact that the depletion of individual resources has social consequences. A person suffering from chronic stress or cognitive fatigue may fail to attend to the needs of others, and a person lacking energy may fail to give effective support (Lepore and Evans 1996). Restoration of individual resources therefore has implications beyond those for individual effectiveness and well-being; it sustains the ability to provide support.

Vacation can also relax constraints that otherwise restrict the ability of a worker to provide support, and it can relax the demands that a worker imposes on others. These consequences can together ease the strain on relationships that occurs when a person must contend with work demands that make it difficult to meet demands in the family domain. By providing a respite from work demands, vacations can help workers better manage family demands and so alleviate work-family conflict (Etzion and Westman 2001; Glass and Estes 1997).

Vacation can also bolster relations through which members of families and social networks share support. During leisure time, individuals commonly seek the company of others who can join them in enjoyable activities that help to satisfy restoration and other needs (Auld and Case 1997; Baumeister and Leary 1995). Research on outdoor recreation has long described patterns of shared participation (Knopf 1987). Much advertising for vacation travel has a family togetherness theme (Löfgren 1999), and a majority of family vacationers appear to believe that their vacation travel serves the health and well-being of the family (Travel Industry Association of America, as cited in Lehto et al. 2009). As they renew their individual resources, those gathered during vacation may also renew relational resources they hold in common, such as mutual trust, mutual regard, bonds of affection, and pools of shared memories.[1] In geographically dispersed, 24-hour economies, many people find it difficult to regularly spend time together, and this may erode relational resources (Strazdins et al. 2006). Vacation provides them with opportunities to renew those resources, and it may have particular value for doing so with family and friends who live at distant locations.

In these and other ways, then, vacationing can engender an ecological effect on population health, with benefits spreading from individual workers within and across families, social networks, and still broader collectives. Common to the "mechanisms" we have mentioned is their relevance for the availability of social resources. Vacation can restore the capacity to provide support, ease restrictions on the provision of support, remove some demands for support, and help to maintain relationships that precondition the provision of support.

As the assumed ecological effect stems from policies oriented toward restoration needs, and in significant ways it involves the renewal of resources within collectives, we refer to this phenomenon as *collective restoration*. We reason that given restoration needs, the extent of collective restoration varies with the number of people free to restore, the time available to do so, and the qualities of the contexts accessible during that time. Having more people free from paid work increases the number and variety of social constellations that can form in those places within reach during the time available. Having more time allows people to travel farther, reach more places and other people, and restore a broader range of depleted resources to a greater degree. Having accessible contexts of companionship, engaging activity, and aesthetic pleasure can enable faster, more complete restoration of individual and relational resources (Hartig 2007; Staats, van Gemerden, and Hartig 2010); restoration cannot proceed as well with movement into contexts characterized by conflict, monotony, or other demands. With regard to vacation, then, absent other constraints, the more people free from paid work (i.e., the greater the concentration) and days granted (assuming an eventual return to work), the more options for convergence with others in more restorative contexts for durations sufficient to satisfy a broader range of individual and relational restoration needs. Even rather brief national holidays initiate travel, gathering with others, and efforts to attain more pleasant environmental contexts on a massive scale (e.g., Bureau of Transportation Statistics 2003).

## THE PRESENT STUDY

Because it assumes that the restorative options of any one person have implications for the well-being of others, our theory leads us to expect that each additional worker on vacation during a given period will engender a successively larger increment in collective benefit.[2] We therefore test the hypothesis that aggregate psychological distress declines logarithmically with increase in the number of vacationing workers. To further test the assumption that benefits spread, we use the number of vacationing workers to explain aggregate distress in people past retirement age as well as in working-age adults. Retired people typically would not have paid work from which to take a vacation, but they could benefit from vacation taken by others, such as adult children whose work demands constrain the time available to spend with a parent. With aggregate data for each broad age group, we can better attribute variation in distress to the influence of vacation-taking as distributed through families, social networks, and broader collectives. In using such data from Sweden, we treat Swedish society as a collective comprising numerous interconnected families and social networks.

Sweden offers important advantages for this study. The evolution of its vacation legislation reflects widely shared beliefs about not only the time needed for restoration, but also the environmental conditions suitable for restoration (Andra Lagutskottet 1953). Since 1977, the legislation provides for five weeks of paid annual vacation, and workers can take four consecutive vacation weeks during the summer, when warm weather and long days make outdoor settings more attractive (Ericson and Gustafsson 1977). We therefore could expect widely varying levels of vacation concentration over the months of our test period, with distinct summer peaks. Knowing that these peaks in the number of vacationing workers would correspond with a greater amount of vacation time and preferred environmental conditions for restoration, we could address their covariation in our analyses.

To gauge psychological distress, we use the total amount of selective serotonin reuptake inhibitors (SSRIs) dispensed each month to the Swedish population. SSRIs have become a pharmaceutical mainstay of the treatment of depression (Henriksson et al. 2003), an illness that warrants attention because of its high prevalence, debilitating character, and great cost for the individuals involved and society as a whole (Sobocki et al. 2007). Dispensation implies that a person has sought help, received a prescription for SSRIs, and then had that prescription filled.

Triggers or exacerbators of depression include chronic role strain; events like job loss, divorce, and bereavement (Hammen 2005); loneliness (Heinrich and Gullone 2006); and restriction of routine activities by illness or age (Williamson 2000; Zeiss et al. 1996). These have in common the loss or persistent inadequacy of individual and relational resources. One's own and/or others' annual vacation can plausibly mitigate such causes. Time spent in pleasant contexts, alone or with others, may promote resource renewal (Hartig 2007; Staats et al. 2010), reducing the risk of depression in some vulnerable persons and drawing some already suffering out of persistent rumination (Jacobson, Martell, and Dimidjian 2001). Vacation may also enable workers to provide more companionship and support to vulnerable or suffering others, like elderly relatives, without increasing their own vulnerability. By helping vulnerable people to avoid initiating treatment with SSRIs, and by helping some already taking SSRIs to reduce dosing and perhaps discontinue treatment, we think that vacationing can reduce dispensation of SSRIs as measured on the population level.

Depression occurs more often among women (Kuehner 2003). Explanations include more frequent encounters with daily stressors (Almeida and Kessler 1998), possibly following from greater responsibility for domestic work, including care of children (Lundberg 1996) and elderly relatives (Hirst 2005). Annual vacation may thus more strongly reduce vulnerability to or the burden of depression for women. To address this possibility, we analyze dispensation to men and women separately.

## DATA AND METHODS

### *Data Sources and Variables*

We used the compounds included in category N06AB of the World Health Organization's (WHO) Anatomical Therapeutic Classification system (http://www.whocc.no/atcddd/) to define our dependent variable. The N06AB category includes only SSRIs. We obtained data from Apoteket AB for defined daily doses (DDDs) of SSRIs per 1,000 adult Swedes per month. The WHO Collaborating Center for Drug Statistics Methodology defines the DDD as the assumed average maintenance dose per day for a drug used for its main indication in adults (http://www.whocc.no/). The Collaborating Center established this now widely used standard dose concept to aid comparisons of prescription data over time (Merlo, Wessling, and Melander 1996).

A state-owned corporation allied with the national health care program, Apoteket had a monopoly on the dispensation of prescription drugs in Sweden during the period of the study. Because Apoteket provided drugs at subsidized prices, people registered with the national health service had little incentive to buy them elsewhere. Its data therefore offer comprehensive coverage of legal dispensation of drugs to the Swedish population.

For the first years of the series, Apoteket estimated monthly dispensation from a sample (4 percent) of all prescriptions filled by its affiliated pharmacies. After 1995, Apoteket provided the actual amounts dispensed in total. Apoteket could not provide data for time periods less than one month. We requested the data separated by gender because, as noted earlier, men and women may differentially benefit from vacation.

SSRIs have come to serve as a mainstay of the treatment of depression in Sweden as elsewhere, and SSRI dispensation now stands as a reasonable proxy for treated depression or depressive symptoms in the Swedish population (Henriksson et al. 2003; Loosbrock et al. 2002). The SSRI data have missing age-specific values and exhibit much variability in the early 1990s as regulators increased the indications for which physicians could prescribe the then-new drugs. We therefore started our tests in January of 1993, when indications for SSRI use stabilized and data for all our age and gender groups became complete. Note that the distinct upward trends in the data (see Figure 1A-B) reflect in part the increasing preference for SSRIs over the drugs they progressively came to replace and in part an increase in treated depression given new drugs thought to be better than the old ones (cf. Henriksson et al. 2006).

We transformed the DDD series to their natural logarithms because our theory of collective restoration assumes that the salutary effects of vacation increasingly spread beyond workers as the number of workers on vacation increases. The logarithm transform improved the ability of our test to detect a circumstance in which the amount of decline in SSRI dispensing associated with an additional vacationing worker increased as the number of workers on vacation increased.

For our focal independent variable, we acquired estimates, based on national household

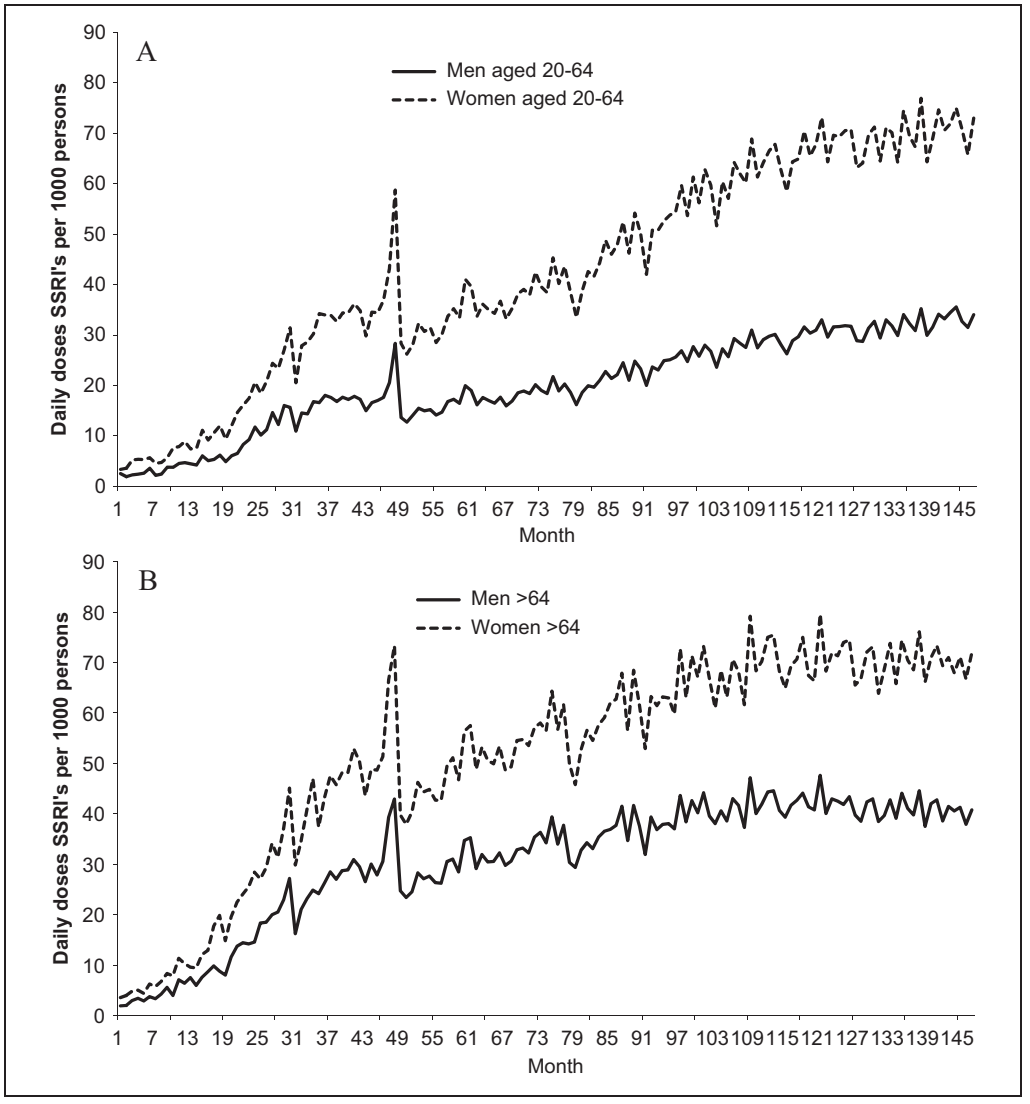


**Figure 1.** (A) Defined daily doses of selective serotonin reuptake inhibitors (SSRIs) dispensed monthly from January 1993 through March 2005 per 1,000 Swedes aged 20 through 64. (B) Defined daily doses of SSRIs dispensed monthly from January 1993 through March 2005 per 1,000 Swedes aged 65 and older.

surveys, of the monthly number (in hundreds) of employed Swedish men and women aged 16 to 64 not working due to vacation (Statistiska centralbyrån 2002). The relevant survey question concerns reasons for not working the ordinary number of hours during a reference week, with vacation among the possible responses. Survey procedures changed in April 2005 to make the Swedish data collection effort consistent with others in the European Union (Statistiska centralbyrån 2006). The changes make pre- and post-April 2005 comparisons uncertain. Our test period, therefore, ended in March 2005. To avoid over-truncation of parameter estimates, we converted the vacation data from hundreds to ten thousands. We present the data in Figure 2. The prominent spikes show the concentration of vacationing during the summer months, especially July, and, to a smaller degree, in connection with the Jul (Christmas) holiday in December.

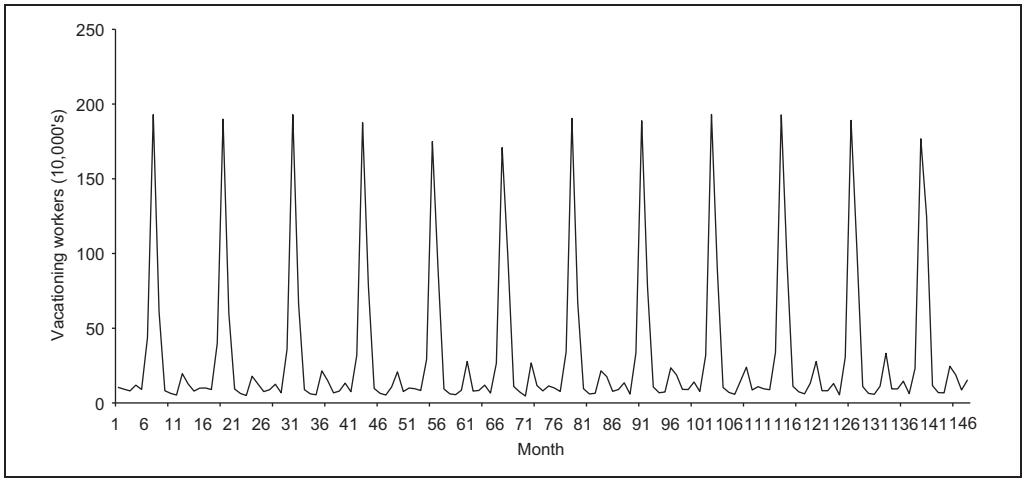


**Figure 2.** The number of vacationing Swedish workers (in ten thousands) over the 147 months from January 1993 through March 2005.

We included monthly mean temperatures (in Celsius) among our additional test variables. Over the year, temperature corresponds with the amount of daylight, which is thought to have implications for depression (Kronfeld-Schor and Einat 2012). Also, population surveys indicate that in Sweden, levels of outdoor activity vary across the year, with more activity during the warmer summer months (e.g., Statistiska centralbyrån 2004). Lack of access to rewarding outdoor activity options may provoke or prolong depression (Hartig, Catalano, and Ong 2007). The monthly means were the mean of daily means. Daily means were in turn the mean of high and low temperatures for the day as well as readings taken at 7 a.m., 1 p.m., and 7 p.m. at 19 weather stations located near population centers. Distributed from the south to the north, these population centers lie outside the relatively cool and sparsely populated mountainous area near the Norwegian border. The monthly temperature means for the stations included in our index do vary with latitude, but for the various pairs of stations the monthly means correlate over the years; for example, relatively cold summer months in southern Sweden ordinarily accompany relatively cold summer months in northern Sweden. The Swedish Meteorological and Hydrological Institute (SMHI) provided these data.

Our theory implies that vacationing will have a salutary effect on mental health over and above any "good summer weather" effect. We therefore included three variables separately measuring the average temperature for June, July, and August in our tests. We scored months other than June, July, or August as 0 in each of these month-specific temperature variables. We included these variables in addition to temperature for all months because the coefficient for the latter would reflect months in which weather has relatively little effect on either depression or vacationing. Although a good estimate of overall association of weather with SSRI dispensing, the coefficient for all months may not capture the importance of good (or poor) weather in the summer (Hartig et al. 2007).

The fact that most Swedish workers vacation in July could induce false rejection of the null hypothesis if dispensing of SSRIs dropped in July for reasons other than the number on vacation, such as the relatively large amount of vacation time commonly taken then. The July-only temperature variable tests for a dose response in SSRI dispensing and would not control for a general low July effect. We therefore added a binary variable scored 1 for all Julys and 0 otherwise to our test equations.

We also specified variables that measure changes in the financing of prescription drug use in Sweden. The government increased "co-payments" or the fraction of prescription costs paid by patients during our test period. These changes took effect in July 1995 and January 1997 (months 31 and 49 in Figure 1). Citing

a "stocking-up" effect in which physicians acted to shelter patients from these increases, researchers have reported that dispensed DDDs increased in the 2 months before the co-payments rose (i.e., stocking up), dropped in the month of the co-payment increases, and then returned to near pre-reform levels (Ong, Catalano, and Hartig 2003). We therefore added three binary variables for each co-payment reform to our test equations to control for stocking up, short-term drops, and long-term adjustment in dispensing.

## Design

We tested our theory separately among men and women of working age (20-64) and those aged 65 and above. Our test turns on whether the observed dispensation of SSRIs differed, as predicted by our theory, from statistically expected values in the same months that vacationing differed from its statistically expected values. Researchers commonly assume that the expected value of the dependent and independent variables are the means of the observed values of each variable; however, vacationing and monthly dispensation of defined daily doses of SSRIs exhibit autocorrelation, including trends, cycles, and the tendency to remain elevated or depressed after high or low values. Autocorrelation complicates hypothesis testing because the expected value of an autocorrelated series is not its mean (Catalano and Serxner 1987). We used routines described in the following to identify autocorrelation and express it as an effect of "history" in the form of earlier values of SSRI dispensation and vacationing.

Removing autocorrelation from our SSRI dispensation and vacationing variables before testing also reduced the likelihood of a type I error; the routines we used preclude spurious associations due to third variables that exhibit similar trends, seasonality, or other patterns.

## Analyses

We tested our hypotheses separately among men and women of working age (20-64) as well as those aged 65 and above. These four tests proceeded through the following steps.

1. We used the strategies attributed to Dickey and Fuller (1979) as well as Box and Jenkins (see Box, Jenkins, and Reinsel 1994) and Ljung and Box (1978) to identify and model autocorrelation in the monthly number of workers vacationing from January 1993 through March 2005. The strategy, auto regressive, integrated, moving average (i.e., ARIMA) modeling, draws from a large family of models available to empirically specify autocorrelation in time series. The residuals of this model exhibit no autocorrelation and gauge the degree to which the observed values differ from statistically expected values.
2. We regressed monthly DDDs of SSRIs per 1,000 men or women for each age group on the co-payment reforms; monthly average temperature; June, July, and August temperatures; and a binary variable scored 1 for all Julys and 0 otherwise.
3. As in step 1, we used the strategies attributed to Dickey and Fuller (1979) as well as Box and Jenkins (see Box et al. 1994) and Ljung and Box (1978) to identify and model autocorrelation in the residuals of the regression estimated in Step 2.
4. We specified our test equations by adding the residuals from the model developed in Step 1 to the equation developed in Step 2. Our test equations, therefore, were as follows:

$$\begin{aligned}\nabla ln\mathrm{Y_t} = \mathrm{C} &+ (\omega+\omega_1\mathrm{B})\nabla\mathrm{X_{1t}} + \omega_2\nabla\mathrm{X_{2t}} \\ &+ \omega_3\nabla\mathrm{X_{3t}} + \omega_4\nabla\mathrm{X_{4t}} + \\ &\omega_5\nabla\mathrm{X_{5t}} + \omega_6\nabla\mathrm{X_{6t}} + \omega_7\nabla\mathrm{X_{7t}} \\ &+ \omega_8\nabla\mathrm{X_{8t}} + \omega_9\nabla\mathrm{X_{9t}} + \omega_{10}\nabla\mathrm{X_{10t}} \\ &+ \omega_{11}\nabla\mathrm{X_{11t}} + (\omega_{12}+\omega_{13}B)\mathrm{X_{12t}} \\ &+ \frac{(1-\theta\mathrm{B^q})}{(1-\varphi\mathrm{B^p})}\mathrm{a_t}\end{aligned}$$

$\nabla$ is the operator that indicates a series was differenced (i.e., values at t subtracted from values at lag t-1) to remove secular trends.

$ln\mathrm{Y_t}$ is the natural logarithm of the monthly number of defined daily doses of SSRIs per 1,000 persons dispensed to one of the four age by gender groups in month t.

C is a constant.

$X_{1t}$ is a binary variable included to control for a stocking-up effect reportedly induced by the co-payment increase of July 1995 (Ong et al. 2003). We scored the variable 1 for May and June 1995 and 0 for all other months.

$X_{2t}$ is a binary variable included to control for the long-term effects, if any, of the July 1995 increase in drug co-payments (Ong et al. 2003). We scored the variable 1 for July 1995 and all subsequent months and 0 for all earlier months.

$X_{3t}$ is a binary variable included to control for the drop in drug dispensing in July 1995 that reportedly (Ong et al. 2003) coincided with the introduction of co-payments. We scored the variable 1 for July 1995 and 0 for all other months.

$X_{4t}$ to $X_{6t}$ are binary variables constructed identically to $X_{1t}$ to $X_{3t}$ except that they describe the stocking up, short-term effects, and dispensing drop associated with the January 1997 co-payment increase (Ong et al. 2003).

$X_{7t}$ is the monthly mean temperature for all months.

$X_{8t}$ to $X_{10t}$ are the monthly mean temperatures for Junes, Julys, or Augusts. Other months were scored 0.

$X_{11t}$ is a binary variable scored 1 for all Julys and 0 otherwise.

$X_{12t}$ is the residual series, derived from Step 1 above, from the best fitting ARIMA model of number of employed Swedes vacationing in month t. We specified the association with the independent and dependent variables measured in the same month as well as with the SSRI dependent variable following the vacationing variable by 1 month. The former specification helps us capture changes in dispensation during the same months that more than expected numbers of employed Swedes took vacation, in keeping with findings from individual-level studies that workers realize benefits during their vacation (De Bloom et al. 2009). The latter specification helps us capture persistent associations; like benefits measured in individual-level studies, ecological benefits on the population level might persist after the vacation period (e.g., two to four weeks; De Bloom et al. 2009). The latter specification also helps us capture associations that are delayed; that is, in contrast to benefits registered in individual-level studies, a potential ecological benefit of vacationing might not appear in the same month as more than expected vacationing occurs, but rather in the following month.

$\omega$ through $\omega_{13}$ are the estimated effect parameters.

$\phi$ is the autoregressive parameter.

$\theta$ is the moving average parameter.

B is the "backshift operator" that yields the value of the series it conditions at time t-1 for predictor variables, t-p for the autoregressive parameter, and t-q for the moving average parameter.

$a_t$ is the error term for month t.

5. We estimated the equation resulting from Step 4 for the months January 1993 through March 2005 and used the methods alluded to in Steps 1 and 3 to ensure that the error terms exhibited no autocorrelation. These methods (Dickey and Fuller 1979; Box et al. 1994) included applying the Ljung-Box (Ljung and Box 1978) test to the autocorrelation and partial autocorrelation functions of the residuals.

## RESULTS

Step 1, in which we identified and modeled autocorrelation in the vacationing variable, yielded the following Box-Jenkins equation:

$$\nabla_{12} Y_t = (1 - .3848B)(1 + .3585B^7)a_t$$

Both coefficients in the equation (for B and $B^7$) exceeded twice their standard errors and the error terms exhibited no autocorrelation. The fact that the series required differencing at the twelfth month demonstrates the extreme seasonality in the vacationing data. The two moving average coefficients imply "memory" in vacationing. The first implies that observed values above (or below) their expected values tend to persist, although diminished, for one month. The second coefficient implies that observed values above (or below) expected at month t will precede an opposite, but diminished, low (or high) value at month t+7. Adjusting for these tendencies ensures that any association we find between SSRI dispensation and unexpected incidence of vacationing cannot arise from a coincidence in autocorrelation between the two series.

Tables 1 and 2 present the coefficients from the final models for our four age by gender groups. Consistent with our hypotheses, increase in the

**Table 1.** Gender-specific coefficients (standard errors) for models of the natural log of selective serotonin reuptake inhibitors (SSRIs) defined daily doses dispensed monthly (January 1993 through March 2005) per 1,000 Swedes aged 20 through 64 years.

| | Men | | Women | |
|---|---|---|---|---|
| Constant | .0049 | (.0065) | .0092** | (.0025) |
| Monthly temperature | –.0014 | (.0012) | –.0016 | (.0013) |
| Two months prior to co-pay 1 | .0405 | (.0670) | .0870** | (.0386) |
| All months after co-pay 1 | –.0307 | (.1034) | .0361 | (.0515) |
| Month of co-pay 1 | –.0922* | (.0487) | –.0808* | (.0463) |
| Two months prior to co-pay 2 | .2581** | (.0372) | .2589** | (.0375) |
| All months after co-pay 2 | –.3681** | (.0651) | –.3271** | (.0471) |
| Month of co-pay 2 | –.0020 | (.0421) | –.0817* | (.0445) |
| June temperature | –.0010 | (.0016) | .0001 | (.0018) |
| July temperature | .0055 | (.0075) | .0096 | (.0090) |
| August temperature | –.0023 | (.0014) | –.0017 | (.0016) |
| July binary | –.2333* | (.1249) | –.3100** | (.1497) |
| Vacationers | –.0030** | (.0007) | –.0028** | (.0008) |
| Vacationers in prior month | .0005 | (.0007) | –.0001 | (.0008) |
| Auto regressive, integrated, moving average (ARIMA) parameters | $\theta B^{21}$ = .3121** | (.1054) | $\theta B$ =.7332** | (.0742) |
| | $\phi B$ = –.5554** | (.0859) | $\theta B^{21}$ = .2809** | (.0981) |
| | $\phi B^{3}$ = .4467** | (.0917) | $\phi B^{3}$ = .3257** | (.0994) |
| | $\phi B^{12}$ = .3918** | (.0637) | $\phi B^{12}$ =.3651** | (.0693) |

*$p < .05$, single-tailed test; **$p < .01$, single-tailed test.

number of vacationing employed Swedes predicts logarithmic declines in DDDs of SSRIs dispensed to men and women of both working and retirement age. The declines occurred in the given vacation month, but not in the following month. The associations have the same sign and similar magnitudes for men and women in the two age groups; this suggests that gender does not moderate the reduction of SSRI dispensation as a collective benefit of vacationing. The negative coefficients for the July binary variable suggest that over and above the number of vacationing workers and temperature, something about that month, possibly the relatively large amount of vacation time typically taken, also contributes to logarithmic decline in dispensation.

The effects of the two co-payment increases clearly appear in the analyses (Tables 1 and 2). Our adjustment for autocorrelation removed seasonal patterns from the dispensing data and thereby apparently "controlled" for much of the general effect of temperature across months. For none of the summer months did linear increase in temperature predict logarithmic decline in dispensation.

Tables 1 and 2 also show the ARIMA parameters needed to remove autocorrelation from our SSRI dispensation variable for each of the age by gender groups. The four groups had quite similar patterns of autocorrelation. All exhibited strong seasonality with the lowest dispensing in summer and the highest in winter. All also showed the tendency to exhibit inverse "echoes" of high or low values 21 months later.

We tested the possibility that extreme outliers in dispensing could have coincided with outliers in vacationing and spuriously induced our results. We used the methods devised by Chang, Tiao, and Chen (1988) to identify and control for outliers in our final estimations. Controlling for outliers did not change the results of our test. We also assessed whether the inclusion of statistically nonsignificant ($p > .05$, single-tailed test) variables in our test equations could have induced a type I error. We deleted all variables with nonsignificant coefficients and estimated the resulting equations. The results remained essentially unchanged. We also tested additional equations that included the number of people employed as an additional predictor of dispensation. These analyses produced results similar to those reported previously.

Finally, we tested the rival explanation that our key findings resulted from people stocking up with medication in the month before they took vacations, thereby reducing the number of dispensed

**Table 2.** Gender-specific coefficients (standard errors) for models of the natural log of selective serotonin reuptake inhibitors (SSRIs) defined daily doses dispensed monthly (January 1993 through March 2005) per 1,000 Swedes aged 65 years and above.

| | Men | | Women | |
|---|---|---|---|---|
| Constant | .0053** | (.0025) | .0049 | (.0030) |
| Monthly temperature | –.0011 | (.0013) | –.0003 | (.0013) |
| Two months prior to co-pay 1 | .1262** | (.0382) | .0432 | (.0416) |
| All months after co-pay 1 | –.0232 | (.0528) | .0214 | (.0521) |
| Month of co-pay 1 | –.0885* | (.0502) | –.0886* | (.0470) |
| Two months prior to co-pay 2 | .2879** | (.0347) | .3102** | (.0364) |
| All months after co-pay 2 | –.2507** | (.0480) | –.2936** | (.0473) |
| Month of co-pay 2 | –.1187** | (.0455) | –.1086** | (.0449) |
| June temperature | .0004 | (.0019) | –.0015 | (.0020) |
| July temperature | .0093 | (.0093) | .0067 | (.0089) |
| August temperature | –.0017 | (.0017) | –.0029 | (.0018) |
| July binary | –.2599* | (.1538) | –.2553* | (.1466) |
| Vacationers | –.0023** | (.0008) | –.0031** | (.0008) |
| Vacationers in prior month | .0003 | (.0008) | .0004 | (.0008) |
| Auto regressive, integrated, moving average (ARIMA) parameters | $\theta B^{21}$ = .3813** | (.0975) | $\theta B^{21}$ = .2728** | (.0988) |
| | $\phi B$ = –.8347** | (.0827) | $\phi B$ = –.7694** | (.0738) |
| | $\phi B^{2}$ = –.5128** | (.0798) | $\phi B^{2}$ = –.6145** | (.0729) |
| | $\phi B^{12}$ = .3679** | (.0611) | $\phi B^{12}$ = .4299** | (.0582) |

*$p < .05$, single-tailed test; **$p < .01$, single-tailed test.

DDDs of SSRIs during vacations in a manner not addressed by our adjustments for autocorrelation. We did so by measuring the association between our vacation variable (i.e., $X_{12}$ in the test equation shown previously) and DDDs of SSRIs dispensed 1 and 2 months *earlier*. The stocking up rival predicts significant positive associations for at least one of the months. We found no significant positive (or negative) associations for any of the age by gender groups.

To put our findings into context, consider the benefits of vacationing above expected values. On average, 37,584 "extra" Swedish workers vacationed in each of the 73 months with greater than expected values. Converting this number to tens of thousands (i.e., 3.7584) and multiplying the result by the coefficients for vacationers shown in Tables 1 and 2 suggests that on average, above expected levels of vacationing decreased dispensation of SSRI daily doses per 1,000 persons by 1.128 percent and 1.052 percent among working-age men and women and by 0.864 percent and 1.165 percent among men and women of retirement age during the same month. These seemingly small values acquire practical significance in light of the large size of each age by gender group. For example, at the end of 1992, just before our test period started, the Swedish population included 2,470,968 women aged 20 to 64 (see Statistics Sweden's online database of population statistics; http://www.scb.se). This number had grown to 2,622,756 by the end of 2005. Especially toward the end of our test period, for months with more than expected vacationing, a 1 percent reduction in dispensation would have translated into hundreds fewer DDDs of SSRIs dispensed to this group alone. Bear in mind that a DDD is the assumed average maintenance dose per day for a drug used for its main indication in adults. One DDD in our data thus corresponds roughly to the amount dispensed to one person for each day of the month.

## DISCUSSION

The results fit the theory that concentrated vacationing supports collective restoration that also benefits those who are not themselves on vacation from paid work. By testing the hypothesis with a log-transformed variable measuring aggregate dispensation to working-age adults, we could show that the decline in SSRI dispensing associated with each additional vacationing

worker became larger as the number of vacationing workers increased. This association also held among men and women of retirement age, further indication that the reduction in psychological distress extended beyond those in the paid workforce. The associations describe benefits of vacation net of adverse experiences that may have led some people to start or continue to use SSRIs; we do not assume that all people enjoyed the vacation time they spent with others. The association furthermore describes benefits net of the consequences of reduced access to social resources otherwise available in the workplace when workers are not on vacation. The net benefit may seem small in terms of percentage reduction in dispensation, but given the large number of people involved, the estimate for each age by gender group has practical significance.

In addition to less dispensation in months with more than expected vacationing, we found less dispensation for Julys in particular. Given our adjustments for temperature, the association should reflect on circumstances in July other than the weather. One plausible circumstance is the large amount of vacation time taken. In response to persistent popular demand, Swedish vacation legislation enables workers to concentrate vacation time in the warm summer months. In practice, working Swedes ordinarily take a large part of their vacation during that warmest of months, July. When many workers take much vacation time, it may benefit population mental health over and above the benefit that accrues when more than expected workers take a relatively small amount of vacation time.

We found lower levels of SSRI dispensation in the same month as concentrated vacationing, but not in the subsequent month. One might ask whether dispensation to the population can be responsive to extra vacationing in the same month, as treatment guidelines recommend that patients take the drugs over several months (e.g., Qaseem et al. 2008). From any one month to the next, a change in aggregate dispensation measured in DDDs reflects the combined effect of decisions by a large number of people. Some of those decisions (to initiate treatment, to increase dosing) work to increase aggregate dispensation, while other decisions (to decrease dosing, to discontinue treatment) work to decrease dispensation. Some of those decisions are made by people receiving care in close consultation with a physician as they proceed through different phases of treatment (e.g., gradual increase in dosing during the acute phase, stable dosing during the continuation phase, tapering of dosing in the discontinuation phase). Other decisions are made without consulting a physician; noncompliance with treatment regimens commonly occurs (e.g., Demyttenaere 2003). Against this background, we see two general ways in which aggregate SSRI dispensation can show lower than expected values during the same month as extra vacationing. First, less initiation of SSRIs may occur as concentrated vacationing helps some vulnerable people to avoid treatment altogether by addressing the root causes of depressive episodes. Second, those already taking SSRIs can reduce their consumption. Reduction in dosing of SSRIs for less depressed individuals can be reflected in reduction in aggregate DDDs dispensed, as the DDD is a specified dosage for each SSRI. Individuals who are discontinuing a lengthy SSRI treatment regimen can conclude tapering off and cease consumption of the drugs within a month under supportive circumstances, in agreement with the prescribing doctor (e.g., American Psychiatric Association 2010). Similarly, individuals who are only mildly depressed but taking SSRIs may simply discontinue on their own, without consulting their doctor, perhaps because they are simply feeling better and the work, family, or other circumstances behind their depression have improved (cf. Demyttenaere 2003). In sum, although our aggregate data disallow specification of the degree to which each of these mechanisms has operated, we have good reason to believe that on the aggregate level, SSRI dispensation can capture month-to-month change in population mental health due to variation in levels of vacationing.

Two alternative explanations for our findings refer to variation in supply of SSRIs rather than variation in demand. One alternative assumes that doctors vacation at the same rate and time as other workers; with fewer of them at work, progressively fewer SSRIs get prescribed, so fewer get dispensed. The second alternative refers to the possibility that people would not be able to fill their prescriptions because they would not have access to a pharmacy during their vacation, whether traveling in Sweden or abroad. We doubt the plausibility of both of these rival explanations. During the period covered by this study, units in the Swedish health care system could anticipate staff vacationing and apply compensatory measures, such as hiring temporary staff. For people

receiving continuing care, arrangements for necessary medications should have been made before they and/or their doctors went away during periods of concentrated vacationing. Our adjustments for autocorrelation in dispensation should have captured such a seasonal pattern if it existed. Our direct test of the possibility that people stocked up in the months before vacation affirms this assumption. We completed that test using the SSRI dispensation variable adjusted for autocorrelation, and we found no evidence of stocking up behavior. Our statistical adjustments for autocorrelation render implausible other, eventual rival explanations that refer to phenomena with a seasonal component that corresponds to the seasonality in our vacationing and SSRI dispensation variables.

Critics might discount our findings because dispensation of antidepressants does not reflect the true rate of depression in the population. Evidence from Sweden does suggest that antidepressants remain underused (Henriksson et al. 2006). Nonetheless, as mentioned previously, findings by Henriksson et al. (2003) and others (Loosbrock et al. 2002) have affirmed that dispensation of SSRIs stands as a reasonable proxy for treated depression or depressive symptoms in Sweden. The critical issue here is whether variation in dispensation over time reflects variation in demand over time. As discussed previously, we have good reason to believe that month-to-month, change in aggregate dispensation does reflect on change in population mental health.

Critics might also discount our findings because we used aggregate data rather than individual-level data. We assert that our ecological approach suits the research question, which encompasses the restorative influence of vacation-taking on relational resources and the availability of social resources among people, which in turn can engender benefits for multiple members of families, social networks, and broader collectives. Our approach enabled us to address not only the aggregated individuals within the population, but also the large number of relationships among them (cf. Schwartz 1994; Susser 1994).

A related critique of our approach concerns the lack of specific evidence regarding the possible mechanisms through which one person's vacation could ameliorate depression in others. We have mentioned four possible mechanisms that involve the availability of social resources that may counteract depression: Vacation can restore a vacationing worker's capacity to provide support, ease restrictions on the provision of support, set aside some demands for support, and help people maintain relationships that precondition the provision of support. True, our data do not allow us to say just how much any one of these mechanisms contributed to the associations uncovered, but we think that the extant research literature, including work cited in the introduction, more than adequately affirms the plausibility of their involvement.

We do not deny the potential value of individual-level research that could directly address underlying mechanisms, but we also think that individual-level research has limitations of particular significance with regard to the phenomenon of interest here. Variation in health across populations, or within a population across time, as studied here, is not necessarily explainable through reference to individual-level risk factors (Rose 1985; Schwartz 1994; Syme 1967). Also, a focus on mechanisms proximal to the disease can entail neglect of the social conditions that determine the access that individuals have to significant resources, such as social resources, which affect multiple disease outcomes through multiple mechanisms (Cassel 1976; Link and Phelan 1995; Syme 1967, 1996). Capturing an effect of vacation concentration as transmitted through multiple mechanisms across networks of relationships over time will present a significant challenge for individual-level research (see e.g., Koopman and Lynch 1999).

As it stands, individual-level research has yet to address the implications that the vacations of individual workers hold for the health of other individuals, for their families, and for other collectives to which they belong. This research gap has potentially significant practical implications. A lack of evidence regarding the collective benefits of vacationing and vacation concentration allows for the creation of new policies or changes in existing policies that focus too narrowly on the renewal of depleted individual resources needed to perform work, and which thereby neglect needs for the maintenance of relational resources and the sharing of social resources. In geographically dispersed, 24-hour economies, many people find it difficult to regularly spend time together, and this may diminish the relational resources they hold in common as well as their possibilities for providing support to one another (Strazdins et al. 2006). Under such circumstances, individual workers may in fact prioritize renewal of

relational resources and the provision of support to distant others over their personal restoration needs during the time available for vacation. Our results suggest that by enabling more people to spend more time together in more restorative contexts, vacation legislation like that in Sweden supports processes of collective as well as individual restoration.

Benefits of concentrated vacationing need not only accrue to people joined in lasting relationships. A collective restorative benefit may also include contributions from chance positive encounters among people who are little known to each other, as with conviviality at cafés and parks and at the concerts, festivals, and other public events commonly offered to the public in conjunction with periods of concentrated vacationing (cf. Ehrenreich 2007; Etzioni 2000). Such instances of positive emotional contagion or what might be called "mass psychogenic wellness" present an additional challenge to efforts to approach this topic with individual-level data.

Our theorizing and results open a wide field for further research. Future studies can test the robustness of our findings and provide a more complete picture of collective vacation benefits by using other measures of mental health, including indicators of depression other than SSRI dispensation, such as suicide. Future research can also address the social psychological and social ecological processes through which collective restoration may occur during periods of concentrated vacationing. Studies can do so using other kinds of data (e.g., dyadic data from spouses/partners, data reflecting on the regeneration of common pools of memory). Future research can also focus on the striking amounts of travel and place transformation that occur during periods of concentrated vacationing, and it can consider the roles played by place transformations and movements among places in processes of individual and collective restoration (cf. Stokols 1988).

Finally, research can address the collective implications of inequalities in the distribution of time for restoration and access to restorative contexts, as well as policy approaches to addressing such inequalities (cf. Phelan, Link, and Tehranifar 2010; Richards 1999; Strazdins et al. 2011). For example, applied policy research might assess the collective benefits of statutory versus nonstatutory restoration measures applied at different temporal and social scales. A significant question in this regard concerns whether countries with national vacation legislation realize collective restoration to a greater extent than countries that leave vacation policies to individual organizations. National legislation, as in Sweden, may enable a greater concentration of vacationing and more tolerant norms regarding the acceptability of taking vacation (Richards 1999), and so a greater collective benefit.

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## NOTES

1. Although sometimes used synonymously, we distinguish *relational resources* from *social resources*. With the former we refer to the foundations of relationships themselves, such as mutual trust and mutual regard. We treat them as resources because they provide a basis for action by parties to a relationship. We assume that parties to a relationship can deplete those resources and that they might be able to restore them if they have become depleted. By social resources we mean forms of support one person can provide to another. Provision of support is commonly predicated on the existence of some form of more lasting relationship between provider and recipient. We assume that the ability of a person to provide some forms of support to another person can diminish (e.g., due to age or infirmity), even though the relationship between them remains solid. We also assume that the provision of support can sometimes strengthen relational resources and yet sometimes diminish them (e.g., in the face of a lack of reciprocity).
2. We do not mean to imply that all workers should or can take vacation at a given time. Some societal functions require continuous staffing, as with emergency services and health care. We do assume a limit to the increase in collective benefit.

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