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Longitudinal examination of the stability and variability of two common measures of absence

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This study, conducted amongst 121 employees in two hospitals, examines sources of variability in two common measures of absence: *frequency* and *time-lost*. Time series analyses over a five-year span suggest substantial differences by month, season and year. More specifically, the analysis of variance of the frequency measure reveals significant differences between seasons and years and a significant season by year interaction. Peak frequencies are systematically recorded during the winter season, while the lowest occur in summer. These trends are less prominent with the time-lost measure, with only the seasonal differences remaining significant. The paper concludes with a discussion of the implications of these findings for the study and measurement of absenteeism.

easures of absence are plagued with methodological problems. Many question the ychometric properties of the various measures of absence with regards to reliability lackett & Guion, 1985; Hammer & Landau, 1981). In fact, wide discrepancies garding reliability coefficients are reported in the literature. One particular gap seems to the very low test–retest coefficients indicative of instability in measures of absence hadwick-Jones, Brown, Nicholson & Sheppard, 1971; Chadwick-Jones, Nicholson & own, 1982; Hackett & Guion, 1985; Hammer & Landau, 1981; Landy, Vasey & ıith, 1984; Latham & Pursell, 1977; Muchinsky, 1977; Smulders, 1980). None-eless, because reported reliability over time varies considerably between studies and easures, attempts have been made to account for this instability so as to identify erational measures with better psychometric properties than others.

Although over 41 different measures of absence have been used in organizational earch (Gaudet, 1963), it is suggested that 'frequency' and 'time-lost' are the most nmonly used due to their relative conceptual and operational clarity (Atkins & odman, 1984; Chadwick-Jones *et al.*, 1971). Nonetheless, there seems to be dis-eement amongst authors as to which of the two measures is the most stable. For many,

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measures of frequency seem to be more stable than measures of time-lost (Breaugh, 1981; Chadwick-Jones *et al.*, 1971, 1982; Hammer & Landau, 1981; Muchinsky, 1977). On the other hand, Hackett & Guion (1985) using a meta-analysis approach, point out that the mean reliability coefficient for time-lost measures obtained from several recently published studies, tended to be slightly higher than those based on frequency. In both cases, however, the reliability coefficients of the two measures are very low.

While many researchers attribute the sources of instability to data collection problems, and to individual differences (Hackett & Guion, 1985; Landy *et al.*, 1984; Steers & Rhodes, 1984), very few have concentrated on extraneous sources of instability over time. For example, Côté-Desbiolles (1985) found that absence rates vary according to seasons; Dansereau, Alutto & Markham (1978) and Markham, Dansereau & Alutto (1983) report on variation of absence rate according to years, seasons and days of the week; and finally, Behrend (1953), Crowther (1957) and Markham (1985) attributed variation of absence behaviour to the economic cycles.

This study is a partial replication of Dansereau *et al.* (1978) and Markham *et al.* (1983), and aims to examine the possible source of variation that can be attributed to regular and irregular temporal movements. More specifically, this study has two objectives: first, it aims at identifying regular temporal movements within an employee group over a period of five years and estimating their relative contribution to total variance; second, the authors compare the relative stability and variability of the two measures of absence, frequency and time-lost, in order to identify some advantages and disadvantages in their use.

Method

A sample of 121 permanent full-time employees was drawn from two Montreal hospitals. A diversity of job categories was represented as is normally found in hospitals. Ages averaged between 35 and 39 and the mean number of years of schooling was 15. There was a higher proportion of women (84 per cent) as expected in this type of organization. Marital status was distributed as follows: 51.3 per cent married, 34 per cent single, 11.8 per cent separated or divorced and 2.5 per cent widowed.

For the purpose of this study, two types of absence measures were used: (*a*) the monthly frequency irrespective of duration; and (*b*) the monthly time-lost (i.e. the total number of absent days per month). The following inclusion criteria were applied: absences of a half-day or more due to illness or work injury, and absences without pay, authorized or not. Absences of 120 consecutive days or more were excluded to minimize the effect of extreme data on means.

It is worth noting that all hospital employees are governed by a collective agreement, and are subject to the same rights with regard to absence. In fact, if an employee has not exhausted his sick days stipulated by the collective agreement, he/she gets monetary compensation at the end of the year. This policy has not changed over the entire period of our study.

The study covered a period of five years (1980 to 1984 inclusive), and was based on daily absence records. Qualitative analyses of temporal movements used two time series plots: the monthly frequency and the monthly time-lost. Seasonal patterns were analysed by averaging monthly values on a seasonal basis. Peaks and troughs in the plots were used to determine seasons' boundaries.

Quantitative analysis of temporal fluctuations was by a factorial analysis of variance conducted on the mean yearly and seasonal frequency as well as time-lost (Armitage, 1971). The year factor had five levels and the season factor four. For all computations, the year was counted from January to December. Similar techniques have been used by Dansereau *et al.* (1978) and Markham *et al.* (1983). In both cases, an ANOVA was considered to be the proper technique as it is a sufficiently robust procedure for the analysis of non-normal distributions (Armitage, 1971).

Moreover, due to the non-normal distribution of the measures, parallel analysis was continued after log-transformation of data. As the results were very similar in both analyses, only ANOVAs on the original scales are reported.

Results

ialitative analysis

gure 1 displays the monthly frequencies from 1980 to 1984 inclusive. Annual ferences are clearly visible. There is a notable drop in monthly frequencies between 80 and 1981 and a smaller decrease from 1981 to 1982. The frequencies remain stable 1982 and 1983 with a slight increase between 1983 and 1984. Although there seems to a cyclical trend, the period of observation is too short for firm conclusions to be drawn. In order to enhance the visibility of the seasonal component, mean seasonal frequencies ve been superimposed for the five years (Fig. 2). A seasonal movement is clearly

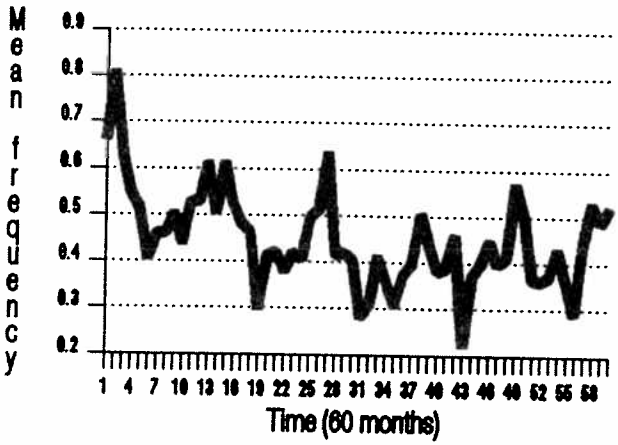

Figure 1. Monthly mean frequencies of absences (N = 121) 1980 to 1984.

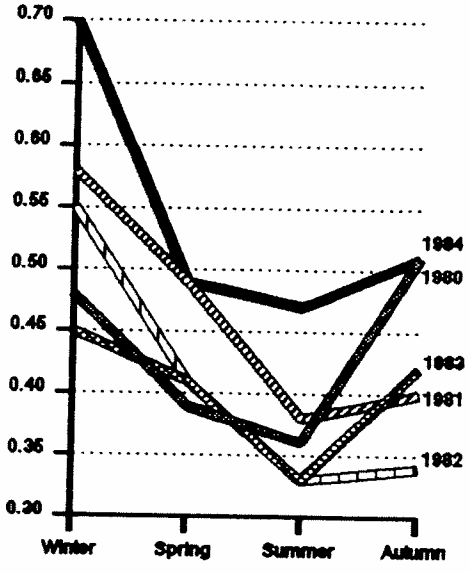

Figure 2. Seasonal cycles, mean frequency.

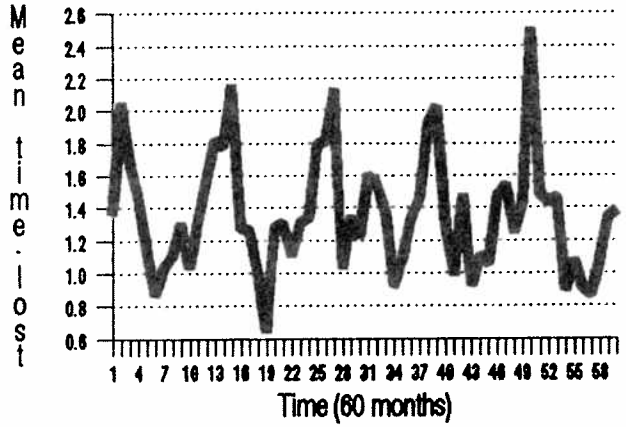

Figure 3. Monthly mean time-lost (N = 121) 1980 to 1984.

observed. The seasonal mean is at a maximum in winter, decreases somewhat in spring, is at its lowest point in summer and starts increasing towards the winter level of the following year in the autumn.

Figure 3 illustrates the monthly time-lost in a similar fashion but there are no apparent annual differences.

Figure 4 displays the superimposed mean seasonal time-lost for the five years. Seasonal differences are again clearly visible. Mean time-lost peaks in winter and is generally lower in summer, except for 1982.

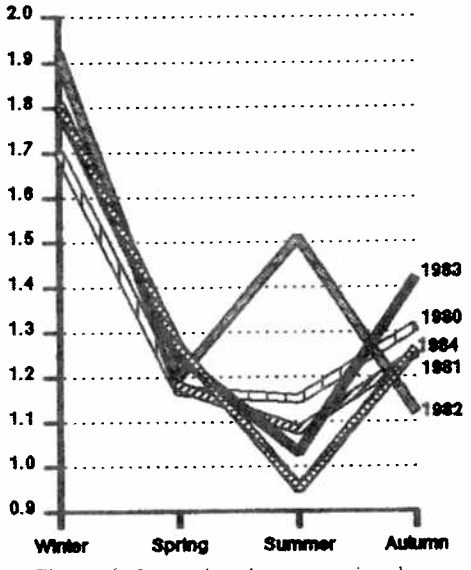

Figure 4. Seasonal cycles, mean time-lost.

'able 1. ANOVA of mean monthly frequencies

ources of variation	SS	d.f.	MS	*F*	*p*
'ear	18.73	4	4.68	11.0	.00
:ason	29.03	3	9.68	22.7	.00
'ear by season	11.19	12	0.93	2.2	.01
esidual	3083.60	7240	.42		
otal	3142.55	7259			

'uantitative analysis

ıble 1 summarizes the analysis of variance of the mean monthly frequencies aggregated / season and year. Significant differences are observed between annual as well as seasonal eans. The seasonal factor is rather more significant ($F = 22.7; p < .0000$) than the year ctor ($F = 11.0; p < .0000$). The interaction term year by season demonstrates that the asonal means vary significantly from year to year ($F = 2.19; p < .01$).

Table 2 shows the same analysis for the time-lost measure. Only the seasonal factor ntributes significantly to total variance ($F = 15.6; p < .0000$). Thus, significant fferences are observed between seasonal means. Contrary to the analysis on monthly 'quencies, the annual time-lost is not statistically different from year to year and the ısonal pattern does not change significantly from year to year (year by seasonal :eraction).

ıble 2. ANOVA of mean monthly time-lost

ırces of variation	SS	d.f.	MS	*F*	*p*
ar	11.86	4	2.97	0.2	.91
ıson	535.23	3	178.41	15.2	.00
ar by season	88.68	12	7.39	0.6	.82
sidual	85 179.31	7240	11.77		
tal	85 855.08	7259			

Discussion

e quantitative analysis of Tables 1 and 2 complements the results obtained by ılitative analysis (see Figs. 1 to 4) and allows the following general observations:

1. Monthly frequency measure is subject to significant seasonal and annual cycles, ile the time-lost measure is subject only to a significant seasonal cycle;

2. Seasonal and annual differences are more prominent and significant on the monthly ıuency than on the monthly time-lost measure;

3. The season by year interaction reinforces the view that seasonal differences tend to change from year to year on the monthly frequency measure.

The results confirm the existence of significant temporal movements in absence behaviour amongst hospital employees. Thus, the monthly frequency measure varies significantly not only on a seasonal and annual basis but both movements interact significantly. Comparable results have been reported by Dansereau *et al.* (1978), Markham *et al.* (1983) with significant differences in their absence rate measure between years, seasons and days of week for employees from an aerospace industry in the mid-north of the USA.

The mean monthly frequencies (see Fig. 1 and Table 1) reveal a significant tendency for employees to be less and less absent from 1980 to 1983. Dansereau *et al.* (1978) have observed similar results but on a two-year span (1974–1975). They attributed the decrease in absence behaviour to unstable economic conditions. The same reasoning may be invoked in this study, since the 1980 to 1983 period was characterized by important budget compressions in the hospital sector in Quebec. These constraints lead to numerous lay-offs, long recall lists as well as displacement by seniority ('bumping'). The year of 1983 was marked by a poor industrial relations climate (i.e. volume of strikes and grievances in the hospital sector), concurrent with economic recession in Canada and the Western world. Such conditions heighten employees' anxieties about job security and future opportunities, and encourage an attitude favouring more assiduous attendance (Steers & Rhodes, 1984); hence the steady decrease in the monthly frequencies of absences from 1980 to 1983.

Nonetheless, the seasonal variations observed in this study were not the same as those observed by Dansereau and colleagues. In fact, the peaks and troughs are inverted; their rates were higher in the summer and lower in the winter. In our study, frequency and time-lost both peak during the winter and are lowest during the summer.

The dissimilarity in seasonal variations is not likely to be due to the measures used, which were conceptually similar: they are both general indicators of absence behaviour. Rather, the inverted pattern is more likely to be due to differences in the sample populations (hospital workers/industry vs. high technology workers/industry). Seasonal variations have also been reported by Côté-Desbiolles (1985) where absences for illness, personal or family reasons, for all sectors in the Province of Quebec, reached their maximum during the winter and their minimum in the summer. Such fluctuations can be largely attributed to the Quebec climate, which is more severe in the winter and milder in the summer.

Another important issue is the variability and sensitivity to extreme values of the two measures of absence. Using the season as the time base, frequency varies relatively more (mean = 0.45 ± 0.66) with a coefficient of variation of 68.3 per cent, than time-lost (mean = 1.36 ± 3.44) whose coefficient of variation is 39.7 per cent. Both qualitative and quantitative analyses point to a greater variability of the monthly frequency measure compared to time-lost.

It is noteworthy, on the other hand, that the time-lost measure would record a single 20-day episode of absence as an actual increase of 20 but would count only as one in the monthly frequency measure. Moreover, a prolonged absence precludes the possibility of numerous short ones. Our results show that time-lost is a more invariant indicator of

ence behaviour with regards to yearly and seasonal trends and that monthly frequencies ow more complex but predictable patterns. The outlying time-lost increase observed 982 (see Fig. 4) appears like a typical case of irregular movement that falls out of line n the general seasonal trend of the other four years of observation. However, deeper lysis of the raw data showed that three out of 121 employees were absent for 19 days or e during the 1982 summer season. Recalculation of the means excluding such cases ded monthly time-lost values similar to the ones reported in the four other years. This ws that if time-lost appears more invariant to temporal movements, it is more sensitive xtreme values.

or research as well as practice, the question remains as to what is the most suitable time ıe for absence data. One suggestion stemming from this study is for data collection to ındertaken over a full year, or in corresponding peak seasons, in order to maintain parability.

Conclusions

measures based on frequency shows greater relative variability than time-lost sures, even though the latter are more sensitive to extreme value. The choice of the rvation periods in absence research is also critical in order to draw firm and stable lusions about possible reasons for absence behaviour.

otwithstanding the above arguments, the interaction between year and season poses retical questions as to the comparability of frequencies on a two-year span. In the case tervention for 'controlling absenteeism', for example, in addition to the use of control ps, knowledge of the trends preceding and following the experimental period would ar mandatory. In this way one may adjust for the cyclical components of long ɔdicity (e.g. five years). Thus, it is recommended that future empirical models of ıteeism should include both time series analysis and parametric testing spanned over nimum of three years in order to detect non-linear trends.

n a more practical note, as the 'short term' absence (i.e. frequency measure) may be ıble, it requires personnel managers to use aggregated data over several time periods der to identify potential patterns. This might enhance the understanding of absence viour and help the setting up of more effective intervention and control measures.

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