

The third-quarter phenomenon in Antarctic personnel

Literature Review

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Abstract

The third-quarter phenomenon refers to a period of discomfort reported to occur during the third-quarter of fixed term situations of isolation and stress (Bechtel and Berning, 1990). In the present review Bechtel and Berning's (1990) original definition of the third-quarter phenomenon is explained and subsequent research is discussed with conclusions examining the extent to which the third-quarter phenomenon can be considered apparent in Antarctic personnel. It is proposed here that the third-quarter phenomenon may be less specific than initially thought, specifically that a period of discomfort often occurs during the second half of the stay, this drop is usually confined to the third-quarter of the stay, but may persist into the final quarter. Recommendations for future research are discussed.

The third-quarter phenomenon in Antarctic personnel

The third-quarter phenomenon refers to a period of discomfort reported to occur during the third-quarter of fixed term situations of isolation and stress (Bechtel and Berning, 1990). Human operations in Antarctica, and to some extent in the Arctic, provide a natural laboratory for the study of such phenomena as these operations involve isolation and stress being imposed by the environment. The existence of a third-quarter phenomenon has implications for personnel management at Antarctic bases as it suggests that there is a predictable period when personnel will likely find it more difficult to cope. However, studies examining the third-quarter phenomenon have in many cases failed to find conclusive support for the phenomenon and there is little agreement about the universality or magnitude of third-quarter effects. The current review aims to identify the extent to which the presence of the third-quarter phenomenon is observed in Antarctic personnel. The proposed mechanisms that underlie the phenomenon are beyond the scope of the present review, rather the focus is on examining the prevalence and universality of the third-quarter phenomenon in Antarctic personnel.

Bechtel and Berning (1990) initially proposed the third-quarter phenomenon based on unpublished anecdotal findings of a study on habitability in cold environments conducted by Bechtel and Ledbetter (1976). The anecdotal findings suggested that in cold climates the most challenging part of winter seemed to occur just after the midpoint of winter had passed, during this time chaplains predicted that they dealt with more marital complaints, police remembered more accidents, and base commanders considered there to be more absenteeism. Upon reviewing the literature on psychological changes in finite term stressful situations, Bechtel and Berning (1990) exposed similar findings showing that mood and morale often reached a low point between half-way and three-quarter duration (Connors, Harrison, & Akins, 1985; Palmai, 1963).

This low point was observed to occur during the third-quarter of the stay, regardless of the length of the stay. Bechtel and Berning (1990) defined this third-quarter phenomenon broadly as being a period of discomfort that occurs during the third-quarter of fixed term situations of isolation and stress. Bechtel and Berning (1990) went on to propose various theoretical mechanisms that could underlie the third-quarter phenomenon, but also acknowledged that their review was not sufficient to establish the existence or universality of such a phenomenon.

Given Bechtel and Berning's (1990) proposition that the third-quarter phenomenon is apparent in fixed term situations of isolation and stress, scientific and exploratory missions to polar environments provided a perfect opportunity to explore the existence and magnitude of such a phenomenon. Steel (1991) explored the third-quarter phenomenon using a quasi-experimental research design, analysing dairies and psychometric tests completed by five participants during a seven week stay at a high Arctic weather station during the boreal summer. Although this research was conducted in the Arctic, the conditions are similar to those encountered in the Antarctic, and the study provides a useful examination of the third quarter phenomenon outside of an Antarctic context. Participants completed a modified version of the Russell Mood Scale (Russell, 1980) each evening to provide daily measures of arousal and pleasure over the duration of their stay. Individual arousal and pleasure scores were aggregated as a group and averaged over each week to provide weekly measures of group arousal and pleasure. These aggregated measures remained very stable across the seven weeks, though pleasure did show a slight increase in the third quarter when scores were aggregated over quarters as opposed to weeks. Once significant events (e.g. supply deliveries) were accounted for the results suggested that pleasure scores varied as a function of these events rather than as a result of length or quarter of isolation.

Steel (1991) did not find any evidence of the third-quarter phenomenon in his study, if anything, pleasure may have increased over the third quarter. There are however several limitations to Steel's (1991) study. The sample size ($n=5$) is an obvious consideration as it is likely that such a small sample would be influenced by individual differences between participants. This is a common feature of research conducted within naturally occurring isolated and confined environments (ICEs) as groups in these environments are typically too small to provide a normally distributed sample, or to provide enough statistical power to yield significant results. It should however be noted that Steel's (1991) study was exploratory in nature, and although his findings provide no evidence to support a third-quarter phenomenon, they also provide little reason to doubt Bechtel and Berning's (1990) prior suggestion of a third-quarter phenomenon.

For a considerable time during the 1990s the third-quarter phenomenon was noticeably absent from published research, during this time there was also an absence of studies of ICEs with enough data resolution to allow quarterly inferences of any kind to be made. However, in 2000 as part of a special edition of *Aviation, Space, and Environmental Medicine* focused on analogies between psychological performance on long term space flight and life in Antarctica, several studies specifically examining the third-quarter phenomenon were published (Palinkas, Gunderson, Johnson, & Holland, 2000; Sandal, 2000; Stuster, Bachelard, & Suedfeld, 2000). These studies are often cited as providing key evidence for the existence of a third-quarter phenomenon in Antarctic personnel (Palinkas & Suedfeld, 2007), each of these studies is considered here.

Stuster et al. (2000) reported finding "substantial evidence of a third-quarter phenomenon" (p. 17) based on content analysis of nine personal journals kept by leaders and

physicians at French stations in Antarctica between 1993 and 1994. Content from the dairies was coded by tone (neutral, positive or negative) to provide a data set detailing the frequency and magnitude of reported events. Net Positivity/Negativity (NPN) ratings by quarter were calculated by subtracting the proportion of negative entries from the proportion of positive entries for each quarter. This revealed a pattern whereby NPN fell steadily over the first half of the stay to a low point in the third-quarter and then improved over the remaining quarter.

It is important to keep the makeup of Stuster et al.'s (2000) sample in mind when interpreting their results. As with Steel (1991) a large number of measures were created from a small number of participants without testing for normality within the sample, meaning that individual differences among the participants may have influenced the results. It should also be noted that the participants consisted of only leaders and physicians, so the study can only be considered representative of people in these roles. It is possible that the status and nature of leaders and physicians means that people in these roles exhibit a different pattern of mood compared with team members in other positions. The strength of Stuster et al.'s (2000) sampling method is that the nine participants were each involved in different visits of varying duration over multiple seasons. Using data from personnel on different visits suggests that the data is free of visit-specific influences that may have had a systematic effect on NPN scores for that group. Using data collected from stays of differing lengths suggests that effects relating to relative duration are indeed being examined, rather than effects related to total duration.

Another consideration for Stuster et al.'s (2000) findings is the use of content analysis, which provides a sound method for extracting situational information, but may have led to recollection and reporting biases. For example, certain significant events may not have been considered noteworthy by the author (reporting bias), and some events may not have been

recalled at the time of writing (recollection bias). Such errors would likely be uniform across each author's journal, however inter-author differences could have affected the validity of the results. Keeping in mind the weaknesses of the reporting method and the small sample size Stuster et al.'s (2000) results are suggestive of a third-quarter phenomenon characterised by lessening mood over the first three-quarters of a stay, and then recovering toward the end of the stay.

Sandal (2000) recorded the psychological reactions of 18 Scandinavian scientific personnel during a three month stay at an Antarctic research base over the austral summer. A questionnaire developed specifically for measuring psychological adaption to polar environments, The Revised Antarctic Questionnaire (Ursin, Etienne, & Collet, 1990), was used to measure stress and coping. This questionnaire was completed by participants at their deployment and at the end of each quarter during their stay. At the three-quarter duration of the stay, statistically significant decreases in well-being and optimism were observed along with an increase in aggression. The increase in aggression was maintained into the fourth-quarter, whereas well-being and optimism recovered to values similar to those observed for the initial two quarters.

Although Sandal's (2000) findings are consistent with Bechtel and Berning's (1990) proposition of a third-quarter phenomenon, it should be noted that six of the 18 participants in Sandal's (2000) study performed a traverse of an ice plateau during the middle phase of their stay, and that their return coincided with the third-quarter data collection. Sandal (2000) did not separate these two groups (the six that completed the traverse and the 12 that spent the entire stay at the base). The separation was likely avoided so as to retain the statistical power of the larger group, but does bring into question the possible effect that returning from the traverse had on the

third-quarter measurements. It is possible that the observed third quarter-phenomenon was associated with a breakdown in inter-group relations as a result of the return of the traverse group.

Palinkas et al. (2000) conducted an analysis of 20 women and 63 men who spent the austral winter at the US Amundsen-Scott station between March and October, over multiple seasons from 1991 to 1994. The Profile of Mood States Scale (McNair, Lorr, & Droppleman, 1992) was completed monthly to provide a measure of Total Mood Disturbance over time. By combining measurements taken over multiple seasons Palinkas et al. (2000) were able to overcome some of the problems associated with small sample sizes in naturally occurring ICE groups, resulting in a statistically powerful dataset. Results showed a significant increase in Total Mood Disturbance scores for the second half of winter compared with the first half.

Palinkas et al. (2000) reported that “The increase in total mood disturbance scores after the mid-point of winter isolation found in the (...) data set suggest the existence of a third-quarter phenomenon” (p. 31-32). This proposition raises the question of whether the third-quarter phenomenon extends beyond the third-quarter. Palinkas et al.’s (2000) definition clearly encompasses effects observed in the third-quarter that are also persistent into the fourth-quarter, whereas earlier studies typically report the third-quarter phenomenon as relating to a change in variables present only during the third-quarter and showing recovery in the fourth-quarter. Despite claiming consistency with the third-quarter phenomenon Palinkas et al.’s (2000) findings can be considered to represent a second-half phenomenon, whereby a deterioration in mood occurs around the halfway point of the stay and persists throughout the remainder of the isolation period.

In another study conducted over the austral winter Bhargava, Mukerji and Sachdeva (2000) examined changes in psycho-social measures for 25 male scientists at an Indian Antarctic base over a period of 15 months from 1991 to 1993. A unique set of measures were developed specifically for this study based on observations reported in previous research, all assessments were carried out by the group's leader. Unlike previous studies which focused on the total duration of isolation (i.e. total stay in the isolated environment) Bhargava et al. (2000) focused on the period of extreme isolation between March and January when summer staff had left the base and the 25 participants (and their leader) were all who remained. Data were collected at the beginning of this period of extreme isolation in March, at the middle of the austral winter in June, in September, December, and at the end of the period of extreme isolation in January. A measure of Satisfaction with Work and Life Situation reached its lowest point at the December measurement, nine-tenths of the way through the period of extreme isolation. This measure can be considered roughly approximate to the well-being measure employed by Stuster et al. (2000), the results of both studies are similar; both showing a steady decline over the first half of the stay to a low point near the end of the isolation period which recovers before the end of the isolation period. It is however unclear exactly when this low point occurs; if Bhargava et al.'s (2000) results are considered in the context of the total duration of the expedition, the low December reading would have been at the four-fifths duration of the expedition. This is still outside the third-quarter, but may be indicative of a mood effect specific to the second half of the stay similar to the observations of Palinkas et al. (2000).

A more recent study by Decamps and Rosnet (2005) provided some insight into the relative importance of total isolation period and the extreme isolation period. Similar to Bhargava et al. (2000), Decamps and Rosnet (2005) monitored the stress reactions of Antarctic

personnel over an entire year, part of which was completed in the company of summer personnel (December to March) and part of which can be considered a period of extreme isolation (April to December) when the participants were on their own. Participants were 27 personnel at the French Dumont d'Urville Antarctic Base between December 1997 and December 1998. Data were collected by the base doctor who recorded weekly stress reactions (based on 59 predefined items identified in previous studies of ICEs) for each of the participants. Total numbers of stress reactions were averaged over 10 week periods. Results were similar to those of Sandal et al. (2000) and Stuster (2000), showing increasing frequency of stress reactions over the first three-quarters of the stay, with a recovery toward the end of the total isolation period. Decamps and Rosnet (2005) go on to look at the interplay of other variables within the extreme isolation period in comparison to the total isolation period, however it seems the pattern of overall stress reactions (somewhat comparable to well-being measures) varies on the scale of the entire period of isolation, with the greatest frequency of stress reactions being observed around the third-quarter.

In another study tracking mood of Antarctic base personnel over an entire year Steel (2001) found moderate support for a rise in anger and depression during the third-quarter of the entire stay. Nine participants completed the Profile of Mood States Scale (as used by Palinkas et al, 2000) during each month of their stay at the New Zealand Scott Base Antarctic Research Station. Anger and depression were observed at their high points during the third-quarter of the stay. In agreement with the results of Palinkas et al. (2000) Total Mood Disturbance scores appeared higher over the second half of the stay compared with the first half. Steel's (2001) results are only suggestive of trends as the small sample size lacks statistical power. The findings suggest mood changes in terms of halves rather than quarters and also support the proposition

that psychological changes occur relative to the total period of isolation rather than the period of extreme isolation.

When comparing results from the above studies and making generalisations about the third-quarter phenomenon there are several factors that must be taken into account. Much of the research has been influenced heavily in its design by Bechtel and Berning's (1990) suggestion of a change apparent over the third-quarter, with studies focusing on measures averaged over quarters. Given the limited basis for Bechtel and Berning's (1990) separation by quarters, it may be more beneficial for research to examine psychological variations over shorter intervals rather than working within the constrained paradigm of quarterly averages. This raises issues about the level of data resolution required to track psychological changes across time in ICEs as collecting and analysing data in quarters may lead to the masking of other relevant observations that occur on a shorter scale. Given the limited evidence available to suggest that effects are separated by quarters it would seem more appropriate to monitor and analyse data using the shortest intervals practical.

An important distinction also exists in terms of the data collection methodology, most of the above studies report either averaged measurements collected over a quarter, or measurements collected at the end of each quarter. These two approaches are in fact measuring different time periods. Measurements averaged over a quarter report the average mood during the particular quarter, thus masking possible effects within the quarter and possibly promoting the appearance of between-quarter effects. Whereas measurements collected at the end of each quarter are representative only of that point in time. The use of these different approaches in different studies draws the accuracy of comparison between studies into question and, more importantly, makes the observance of quarterly effects more likely.

Studies examining the third-quarter phenomenon in Antarctic personnel have been conducted sporadically over the last two decades. During this time conditions at Antarctic bases have undoubtedly changed. For example, communication with people outside the isolation area has become more frequent, living conditions have become more comfortable, and sex ratios of personnel have changed. These changes have probably reduced the feeling of isolation and confinement, and through this may have altered the nature of the psychological changes that are experienced. A possibility for quantifying this change in future research would be to develop a reliable measure of the experience of isolation and confinement.

Bechtel and Berning (1990) initially proposed that discomfort was experienced during the third-quarter, most of the subsequent studies have attempted to quantify this discomfort using existing measures of mood and well-being, though there is no consensus as to the most relevant scale to use. Of the seven studies presented above, only two employ the same measure of mood and thus only two can be considered directly comparable. Future research using standard measures across settings would confirm the cross-setting comparability of existing results and provide many advantages in terms of the potential for direct comparison and collation of data.

Taking the above studies and considerations into account it appears that the third-quarter phenomenon proposed by Bechtel and Berning (1990) may be less specific than initially thought. Based on the available literature it appears that in situations of fixed term isolation and stress a period of discomfort often occurs during the second half of the stay, this drop is usually confined to the third-quarter of the stay, but may persist into the final quarter. As Bechtel and Berning (1990) suggested, it appears that the timing of the phenomenon is not dependant on the total length of the isolation period. Referring to a “third-quarter phenomenon” may be too limiting in

its description when there is significant evidence to suggest that psychological changes may reveal themselves in terms of halves rather than quarters (Palinkas et al., 2000; Steel, 2001).

In order to broaden our understanding of time dependant psychological effects in ICEs it is important that future research moves beyond the almost arbitrary division by quarters and instead focuses on tracking psychological change over time with as much data resolution as is practical. The development of reliable and comparable measures of isolation and confinement would be of significant benefit to research in this area, as would the use of standardised measures of mood applied across repeated studies. Improvement of ICE environments over time, particularly the improvement of conditions at Antarctic bases represents a challenge for the study of effects such as the third-quarter phenomenon, though it is hoped that research in these areas will be able to quantify and then contribute towards the mitigation of such effects.

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