


Coping with Antarctic demands: Psychological implications of isolation and confinement

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Abstract

Working in extreme environments requires a wide range of cognitive, psychological and social competences. Antarctica represents one of the most challenging habitats to work in due to its aridity, extremely cold weather, and isolated conditions. This study aimed to assess mood variations and coping strategies, as well as their possible modulation by group dynamics in a crew at the Belgrano II Argentine Antarctic Station throughout 1 year of confinement. Thirteen members of the Argentine Army completed emotional, coping and social dynamics questionnaires bimonthly in March, May, July, September and November. Results showed a significant decline in social dynamics scales, evidenced by decreases in perceived peer and hierarchical support. Additionally, coping strategies displayed a drop in mature defence throughout the expedition. A positive correlation was found between social support and recovery from stress. Our results highlight the importance of interpersonal relationships in psychological adjustment to isolation and extreme environments.

KEYWORDS

coping strategies, extreme environment, group dynamics, mood, stress

1 | INTRODUCTION

Antarctica is considered one of the most interesting natural settings to study the effects of extreme context characteristics on behaviour. It represents a challenging environment to learn about humans' ability to adapt to demanding conditions such as cold temperature—which can reach -43°C during winter—as well as its remoteness and extreme photoperiod. Studies in Antarctica on circadian rhythms (Arendt & Middleton, 2018), emotional aspects (Palinkas, 2003) and performance (Tortello et al., 2020) provide meaningful contributions towards the improvement of health, safety and work conditions. Furthermore, research in Antarctica expands and enhances knowledge essential for space exploration planning (Suedfeld & Weiss, 2000) and provides the opportunity to explore some of the variables implicated in prolonged confinement situations, such as the one resulting from COVID-19 outbreak (Ozamiz-Etxebarria, Dosil-Santamaria, Picaza-Gorrochategui, & Idoiaga-Mondragon, 2020). By focusing on psychological adjustment, Antarctica represents a unique opportunity to approach the study of psychological adjustment, by exploring the impact of weather conditions, confinement, isolation and absence of daylight on mood variations, stress and group dynamics.

Mental health is strongly influenced by weather and isolation conditions (Graham, White, Cotton, & McManus, 2019; Wang et al., 2017). The environmental harshness of Antarctica showed a positive correlation with negative mood (Chen, Wu, Li, Zhang, & Xu, 2016) and decreased interpersonal rapport as well as professional and personal life satisfaction (Bhargava, Mukerji, & Sachdeva, 2000). The amount of time spent in isolation also impacted negatively on positive emotional states and affective processes throughout Antarctic expeditions (Ehmann, Altbäcker, & Balázs, 2018; Peri, Scarlata, & Barbarito, 2000), evidenced by an increase in depressed mood (Palinkas, Johnson, & Boster, 2004) and negative emotions (Wang & Wu, 2015).

Stress and coping strategies (cognitive and behavioural resources to deal with stressful situations [Folkman & Moskowitz, 2004]) are frequently studied in Antarctic research yet no consensus has been reached. Some studies observed increased stress towards the end of an annual expedition (Nicolas & Gushin, 2015). Others found that coping strategies decreased during the midwinter period, as opposed to the established view in favor of the use of more active strategies under chronic stress conditions (Sandal, van de Vijver, & Smith, 2018). Coping strategies have been related to defence mechanisms, indicating that both are involved in psychological adaptation processes to the environment (Nicolas, Sandal, Weiss, & Yusupova, 2013). Adaptive coping strategies were associated with mature defence mechanisms, while less adaptive coping strategies were linked to symptoms of depression (Nicolas et al., 2013). Accordingly, immature defence mechanisms were positively correlated with total stress and perceived stress during a prolonged confinement period (Nicolas & Gushin, 2015).

Group dynamics involve interpersonal interactions among crewmembers (Wang & Wu, 2015), which are essential to accomplish a mission (Wu, Ma, Xiong, XU, & Li, 2020), representing a key factor in psychological adaptation to isolated and confined environments. Several studies have found that long periods of isolation can increase

social tension (Leon, Sandal, & Larsen, 2011; Palinkas et al., 2008) and deteriorate social support (Palinkas et al., 2004), resulting in reduced professional performance (Nicolas, Bishop, & Weiss, 2016). Conflict and tension between crewmembers induced by extreme and isolated contexts (Leon et al., 2011) appear to be a consequence of reduced privacy, boredom, monotony (Suedfeld, 2001) and highly demanding tasks (Ellis & Pearsall, 2011). In this respect, crew leaders play a central role in teamwork performance, reducing stress and tension among individuals (Nicolas et al., 2016).

This is the first study to assess multiple psychological variables simultaneously on a single crew in Antarctica throughout 1 year. Mood variations, coping strategies and group dynamics have already been described in different Antarctic expeditions. However, previous studies only assessed these variables separately, ignoring the dialectic relationships between psychological factors that may boost or hinder their effect. Furthermore, most of the studies focus on short periods of time, neglecting the potential long-term impact of isolation and confinement variables. In addition, Antarctic stations usually have very specific geographical characteristics (altitude, distance to the pole and degree of isolation), which, added to the unique cultural characteristics of their crews, pose a need to expand studies of this type. Accordingly, this study aimed to assess mood variations and coping strategies, and their potential modulation by group dynamics in a crew at the Belgrano II Argentine Antarctic Station throughout one year of confinement. We hypothesized that the polar night and isolation conditions deteriorate psychological adaptation, with social relationships being one of the main factors that impact affective parameters.

2 | METHODS

2.1 | Subjects and design

This is an observational, analytical and longitudinal study conducted at Belgrano II Argentine Antarctic Station. Psychological variables were assessed every other month throughout a full-year campaign in March, May, July, September and November. Participants left Buenos Aires at the beginning of January and returned to the mainland on February of the following year. Although they spent an entire year at Belgrano II, January was not incorporated in the study in order to avoid any external influences caused by the journey, which takes about a month.

Belgrano II is located at sea level on the mainland (Nunatak Bertrab; $77^{\circ} 51'S$ and $34^{\circ} 33'W$), 1300 km away from the South Pole. It is known as one of the most isolated, driest and coldest territories in the world, with temperatures ranging from -43°C during winter to 5°C during summer. Due to its Southern position, Belgrano II has 4 months of constant light (polar day) and 4 months of constant darkness (polar night). Every year a crew of 15–20 men arrive at Belgrano II to spend 1 year living and working together in isolation. Crewmembers work 5 days a week, 8 h per day (9 AM–6 PM, with fixed hours for breakfast, lunch and dinner).

From a crew of 18 members, 13 healthy men from the Argentine Army with a mean age of 34 ± 1 year and similar anthropometric

characteristics (Body Mass Index: 26 ± 1 kg/m²) participated voluntarily in the study, giving written consent after being informed about the aim and nature of this research. The other five members of the crew (three civilians and two air crew members) were not included in the sample as they had different working schedule that could have acted as cofounders. These included night shift work (air force personnel) or living in a different building (civilians). The study was approved by the Ethics Committee from Universidad Nacional de Quilmes, Argentina, and was conducted according to the Declaration of Helsinki and its amendments.

2.2 | Affective questionnaires

2.2.1 | Beck Depression Inventory-II

The Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996; Argentine version [Brenlla & Rodríguez, 2006]) is a widely used scale to evaluate depression symptoms. It consists of a 21-item self-report questionnaire with a 4-point Likert scale ranging from 0 (not at all) to 3 (severely). The inventory classifies symptom severity in four categories: minimal (0–13 pts), mild (14–19 pts), moderate (20–28 pts) or severe (29–63 pts) depression based on the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV; American Psychiatric Association, 1996).

2.2.2 | Beck Anxiety Inventory

Beck Anxiety Inventory (BAI; Beck, Epstein, Brown, & Steer, 1988, Spanish version [Magan, Sanz, & Garcia-Vera, 2008]) is a screening measure of anxiety, which focuses on somatic symptoms related to panic disorder criteria according to the DSM-IV; It is a self-report questionnaire with 21 items describing anxiety symptoms with a 4-point Likert scale ranging from 0 (not at all) to 3 (severely) to inform symptom frequency and intensity.

2.3 | Coping questionnaires

2.3.1 | COPE

The short version of the COPE scale was administered to assess how participants deal with stress (Carver, 1997; Spanish version [Moran, Landero, & González, 2010]). Coping is defined as a repertoire of cognitive and behavioural strategies to manage stress (Folkman & Moskowitz, 2004) which can be grouped into two major styles: problem-focused and emotional-focused (Folkman & Lazarus, 1980, 1985). While the former refers to dealing with the source of stress, the latter alludes attempting to handle thoughts and feelings associated with the stressor (Litman, 2006).

The scale consists of 28 items describing ways of responding to stress to which subjects have to answer using a 7-point Likert scale

ranging from 0 (never) to 6 (always; Nicolas et al., 2016; Skinner, Edge, Altman, & Sherwood, 2003). Answers are grouped into two coping dimensions (Carver, Scheier, & Weintraub, 1989): task-oriented coping (TOC), which involves dealing with the source of stress; and disengagement-oriented coping (DOC), which represents approach and avoidance in combination with engagement and disengagement (Laborde, You, Dosseville, & Salinas, 2011). TOC includes active coping, planning and positive reappraisal, and DOC is constituted by behavioural disengagement, self-blame, and denial.

2.3.2 | defence Style Questionnaire

The defence Style Questionnaire (DSQ40; Andrews, Singh, & Bond, 1993) was implemented to study defence mechanisms, which are defined as coping styles that are orientated to inner conflicts and dispositions and, therefore, are supposed to be consistent across situations and time (Nicholas & Jebrane, 2009). The DSQ40 was designed to identify how people deal with internal conflicts (Halim & Sabri, 2013). We used the Spanish version published by Chávez-León, Muñoz, and OntiverosUribe (2006), which established the scale's validity and reliability on a sample of 261 participants. Each item is ranked with a 7-point Likert scale ranging from 0 (strongly disagree) to 6 (strongly agree), depending on how accurately each statement represents to the participant's perception. defence mechanisms are grouped into two greater dimensions (see Bonsack, Despland, & Spagnoli, 1998): Mature defence, which includes problem-solving behaviours, and Immature defence, which exhibits withdrawal behaviours.

2.3.3 | RESTQ

Recovery and Stress questionnaire (RESTQ) is an adaptation of the RESTQ-Sport, a questionnaire originally designed for athletes (Kellmann & Kallus, 2001; Spanish version [González-Boto, Salguero, Tuero, & Márquez, 2009]) aimed at addressing perceived measures of stress and recovery from stress. It consists of 12 dimensions composed by seven stress scales—five of them related to recovery from stress. Higher stress dimension scores represent higher subjective tension, whilst greater scores on the recovery components show adequate recovery from stress. The Stress-Recovery Index is calculated by subtracting the total recovery score from the total stress score.

2.4 | Social and occupational questionnaires

2.4.1 | Intervention Group Environment Scale (IGES)

The Intervention Group Environment Scale (IGES; Wilson et al., 2008) is a shortened version of Moos's 90-item Group Environment Scale (Moos, 1994), which describes perceived social climate of group settings. We implemented a Spanish version translated by an expert

taking into account the other Moos's questionnaires that were previously validated (García-Saisó, Ortega-Andeane, & Reyes-Lagunes, 2014; Prado Delgado, Ramirez Mahecha, & Ortiz Clavijo, 2010). It consists of 14 items grouped into three categories: Cohesiveness (five items centred on group support), Implementation and Preparedness (five items related to planning and organization) and Counterproductive Activity (four items focused on unfavorable and negative group activity).

2.4.2 | Job Content Questionnaire

Participants completed the 18-item Job Content Questionnaire (JCQ) to assess social and psychological characteristics of work environment previously implemented by Nicolas (Nicolas et al., 2016; Spanish version [Escribá-Agüir, Pons, & Reus, 2001]). The JCQ includes four dimensions: Decision Latitude (five items related to work-related decision making, creativity and the ability to use and improve skills), Psychological Job Demands (five items about the amount of time and cognitive effort required to fulfill work requirements), Peer Support (four items focused on either material or affective resources provided by partners) and Hierarchical Support (four items tapping leadership quality).

2.5 | Data analysis and statistics

All analyses were performed with GraphPad Prism 7. Figure values represent mean and the standard error of the mean (SEM). Statistical comparisons of obtained scores on affective questionnaires and social and occupational questionnaires were performed using repeated-measures one-way analysis of variance (ANOVA) (month) with Bonferroni's post hoc comparisons. Statistical comparisons of obtained scores on the two dimensions of each coping questionnaire were performed using repeated-measures two-way ANOVA (month, dimension, interaction effect between month effect x dimension effect) with Bonferroni's post-hoc comparisons. In all cases, *p*-values were corrected to account for multiple comparisons controlling the family wise error rate. Pearson's correlation coefficient *r* were performed among the annual averages of the Stress-Recovery Index, Mature and Immature defence, TOC and DOC coping styles, and Job Content dimensions. Benjamini-Hochberg false discovery rate correction at $q = 0.2$ was applied to multiple correction *p*-values in order to adjust for family wise error rate. Significance and confidence levels were set at an alpha level of 0.05.

3 | RESULTS

3.1 | Affective questionnaires

The severity of depression and anxiety symptoms remained below the threshold for mental disorder criteria at every measurement

point (March, May, July, September and November). Neither BDI-II nor BAI showed significant variations during the year, evidencing mood stability throughout the expedition (Table 1).

3.2 | Coping questionnaires

When analyzing coping styles, TOC prevailed over DOC at every measurement point (Table 2) suggesting that subjects tend to use more adaptive coping strategies independently of seasonality or isolation (Figure 1). Non-significant differences were observed throughout the year for each coping style (Table 2).

Significant variations were observed in participants' defence mechanisms throughout the expedition. Compared to Immature defence, Mature defence exhibited greater values throughout the year, evidenced in significant differences during the beginning and the middle of the expedition (Table 2; Figure 2). Dips in Mature defence were observed during the campaign (Table 2)—May values were significantly higher than November scores. This data indicates receded psychological adjustment decline in the last quarter of the confinement experience. No significant variations were found for Immature defence.

Regarding RESTQ, ANOVA analyses did not show significant changes for the Stress-Recovery Index throughout the year, indicating that the relationship between stress and recovery remained stable during all the campaign (Table 1).

3.3 | Social and occupational questionnaires

Regarding social and occupational scales, IGES dimensions (Cohesiveness, Implementation and Preparedness, Counterproductive Activity) did not vary throughout the campaign, showing no impact of isolation or seasonality (Table 1). However, JCQ did evidence significant changes throughout the year for Social Support, which exhibited a progressive reduction throughout the expedition (Table 1). Both Peer Support (Figure 3a) and Hierarchical Support (Figure 3b) decreased significantly throughout the year (Table 1), demonstrating a decline as isolation time increased. Post hoc analyses for Hierarchical Support exhibited significant variations between March and September (March was higher than September, $p < 0.03$). No significant variations for Psychological Job Demand and Decision Latitude were found (Table 1 and Figure 3c and d).

3.4 | Correlations among questionnaires' annual averages

Correlations were performed among the annual RESTQ, JCQ, DSQ40 and COPE averages in order to elucidate the relationship between occupational and social parameters and participants' ability to deal with stress (Table 3). Decision Latitude was positively correlated with Stress-Recovery Index and TOC (Table 3). Psychological job demand

TABLE 1 Repeated measures one-way ANOVA analyses for BDI-II, BAI, IGES, JCQ and RESTQ questionnaires

Psychological Questionnaire	DF	F (DFn, DFd)	p value
BDI-II	4	0.34 (2.54, 28.04)	ns
BAI	4	1.33 (2.39, 26.34)	ns
IGES			
<i>Cohesiveness</i>	4	0.92 (3.11, 34.29)	ns
<i>Implementation and Preparedness</i>	4	1.29 (2.69, 29.62)	ns
<i>Counterproductive Activity</i>	4	0.32 (2.63, 28.96)	ns
JCQ			
<i>Decision Latitude</i>	4	1.32 (2.37, 26.17)	ns
<i>Psychological Job Demands</i>	4	0.60 (2.8, 31.01)	ns
<i>Peer Support</i>	4	3.24 (3.06, 33.71)	0.03*
<i>Hierarchical Support</i>	4	4.10 (2.49, 32.42)	0.02*
RESTQ	4	2.13 (2.61, 28.72)	ns

Abbreviations: BDI-II, Beck Depression Inventory II; BAI, Beck Anxiety Inventory; IGES, Intervention Group Environmental Scale; JCQ, Job Content Questionnaire; RESTQ, Recovery and Stress questionnaire.

* $p < 0.05$

TABLE 2 Repeated measures two-way ANOVA for COPE and DSQ questionnaires

Psychological Questionnaire		DF	F (DFn, DFd)	p value
COPE	Interaction	4	1.24 (4, 88)	ns
	Month	4	1.02 (4, 88)	ns
	Dimension	1	12.99 (1, 22)	0.001**
DSQ	Interaction	4	1.24 (4, 88)	ns
	Month	4	3.66 (4, 88)	0.008**
	Dimension	1	8.59 (1, 22)	0.007**

Notes: Bonferroni post-hoc analyses for COPE-Dimension TOC > DOC: March $p < 0.02$, May $p < 0.001$, July $p < 0.01$, September: $p < 0.01$, November $p < 0.001$. Bonferroni post-hoc analyses for DSQ - Month: March $p < 0.01$, May $p < 0.01$, July: $p < 0.01$, September $p = ns$, November $p = ns$; - Dimension: Mature May > Nov $p < 0.01$.

Abbreviations: COPE, Multidimensional coping inventory; DOC, disengagement-oriented coping; DSQ, Defence Style Questionnaire; TOC, task-oriented coping.

** $p < 0.01$

also showed a positive correlation with Mature defence (Table 3). Both defence mechanisms, Mature and Immature, were positively correlated with TOC (Table 3). A positive association between Stress-Recovery Index and Peer Support was found (Table 3). The same occurred with Hierarchical Support, which was positively correlated with RESTQ Index ($r = 0.7, p < 0.008$; Table 3). Data suggests that the relationship between social support and the ability to handle stress may play an important role to go through polar night and increased isolation time.

4 | DISCUSSION

The present study aimed to investigate psychological and social parameters as well as coping strategies found to be essential in the adaptation to Antarctic expeditions. As we hypothesized, extreme context conditions, such as isolation and confinement, impacted on psychosocial variables, which were evidenced by significant decreases in Peer and Hierarchical Support and Mature defence. Our results exhibit the importance of interpersonal relationships for effective psychological adjustment to extreme environments for prolonged periods of time.

4.1 | Affective questionnaires

Mood variations during Antarctic campaigns have already been described (Palinkas et al., 2008). However, there is no consensus regarding which psychological changes develop in such extreme context (Tortello et al., 2018). Some studies showed that affective disorders developed as a consequence of seasonal variations (Harris et al., 2010), while others found no differences (Khandelwal, Bhatia, & Mishra, 2017) or even improvements in psychological functions (Weiss, Suedfeld, Steel, & Tanaka, 2000). In this regard, previous research reported fewer anxiety symptoms (Steine, Steine, Sandbaek, & Roseth, 2003) and a decline in depressive symptoms (Palinkas, Cravalho, & Browner, 1995), in absence of seasonal affective disorder (mood disorder related to depression) in temporary polar residents (Arendt, 2012). Although our findings—which are in line with prior evidence—showed that extreme environments do not necessarily cause pathogenic consequences (Suedfeld, 2001; Suedfeld & Weiss, 2000), anxiety and depression were only assessed with screening questionnaires developed to examine psychological disorders, and might not be sensitive enough to identify changes in other, milder, emotional patterns. In addition, evaluating emotionality in a military crew with a self-report questionnaire may not be the most accurate tool to study this phenomenon, as participants are in a military work environment where emotions are not likely to be expressed. Indeed, social desirability effects arise frequently even in anonymous questionnaires (Décamps & Rosnet, 2016).

4.2 | Coping questionnaires

Dealing with Antarctic demands means facing a stressful context in which isolation, confinement and risky situations constantly challenge crewmembers. Strategies to cope with these variables are crucial to accomplish a mission. Literature exploring coping strategies during Antarctic expeditions showed that handling this extreme situation improves skills to actively deal with stress (Palinkas et al., 2008; Steine et al., 2003). Consistent with our results, previous research demonstrated a satisfactory use of coping strategies (Barbarito, Baldanza, & Peri, 2001), which is expected from an experienced and highly motivated sample. Although participants are

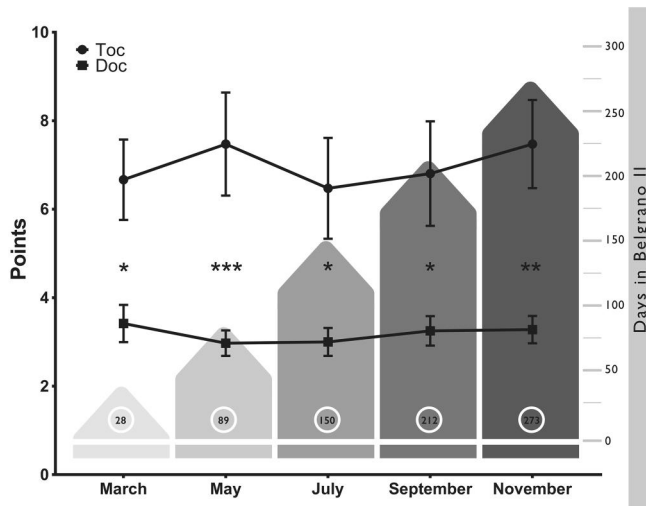


FIGURE 1 Coping styles. task-oriented coping prevailed over disengagement-oriented coping (repeated-measures two-way ANOVA, dimension effect $p < 0.001$), which was evidenced in each measurement point (Bonferroni post hoc analyses for March: $p < 0.02$, for May: $p < 0.001$, for July: $p < 0.01$, for September: $p < 0.01$, for November $p < 0.001$). Right axis and shared bars illustrate the numbers of days at Belgrano II station. The circle inside each month stands for the amount of days the participants remained in isolation

not specifically trained in coping strategies, military personnel deal with uncertainty and stressful situations on a daily basis, which might have impacted positively on these measurements. Despite the adequate use of coping strategies, a decline of mature defence was observed throughout the expedition, showing that defence mechanisms were modulated by progressively increasing time spent in isolated conditions. It has already been reported that prolonged confinement with a reduced group of people combined with isolation from family and friends have detrimental effects on interpersonal relationships (Nicolas et al., 2016) and psychological adjustment (Palinkas et al., 2004). Although defence mechanisms and coping strategies results were expected to be similar as both concepts reflect adaptive strategies, the observed differences between them are not surprising as they involved different psychological processes. While defence mechanisms refer to an unconscious, unintentional and automatic psychological process, coping is, by definition, evidence a conscious, voluntary and intentional effort (Cramer, 2002; Halim & Sabri, 2013). We hypothesized that environmental modulation would only be observed in defence mechanisms. These are unconscious, deep-rooted processes of the inner self, which are not condition by variables related to duty or work which play a main role in a military sample. Defence mechanisms are more accurate reflection of individuals' psychological changes as opposed to coping styles which are conscious actions and can be affected by external variables which not only include environmental conditions but also social desirability and interpersonal variables. Moreover, coping styles questionnaires measure how individuals think they might behave and not how they

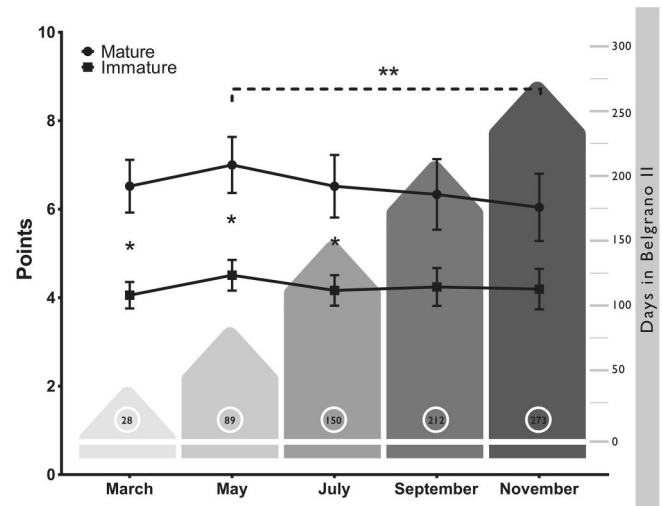


FIGURE 2 Defence mechanisms. Mature defence exhibited greater values than Immature defence along the campaign (repeated-measures two-way ANOVA, Month effect [$p < 0.01$] and Dimension effect [$p < 0.01$]), evidenced in significant differences during the third quarter of the expedition (Bonferroni post-hoc analyses for March: $p < 0.01$, for May: $p < 0.01$, for July: $p < 0.01$, for: September $p = ns$, for November: $p = ns$). Mature defence showed a decay throughout the campaign (Bonferroni post hoc analyses for May vs. November $p < 0.01$). Right axis and shared bars illustrates the numbers of days at Belgrano II station. The circle inside each month stands for the amount of days the participants remained in isolation

actually behaved (Halim & Sabri, 2013; Lazarus & Folkman, 1984). Although previous studies have reported an effect of polar night on coping strategies (Sandal et al., 2018), our findings showed no seasonal variations, supporting the idea that isolation has a greater impact on variables associated to psychological well-being (Bhargava et al., 2000).

4.3 | Social and occupational questionnaires

Isolation and confined environments are well known to influence interpersonal dynamics, which, in turn, are considered to be the main source of stress in Antarctica (Stuster, Bachelard, & Suedfeld, 2000). Many studies in Antarctica and other space analogues have reported significant psychological and interpersonal difficulties on the second half of a mission, also known as the 'third-quarter phenomenon' (Gushin et al., 1997; Kanas et al., 2007; Sandal, 2000). However, others have found no changes in perceived social climate throughout the expeditions, highlighting the decisive role of motivational and social factors in interpersonal relationships (Kanas et al., 2007). Empathy between partners, motivation sparked by special or out of the ordinary events and family support are some of the factors that could lead to better social relationships (Poláčková Šolcová, Šolcová, Stuchlíková, & Mazehóová, 2016; Suedfeld, 2005). The literature supports our findings of decreased rapport (Bhargava et al., 2000) and in the amount of social interaction involved in both asking and

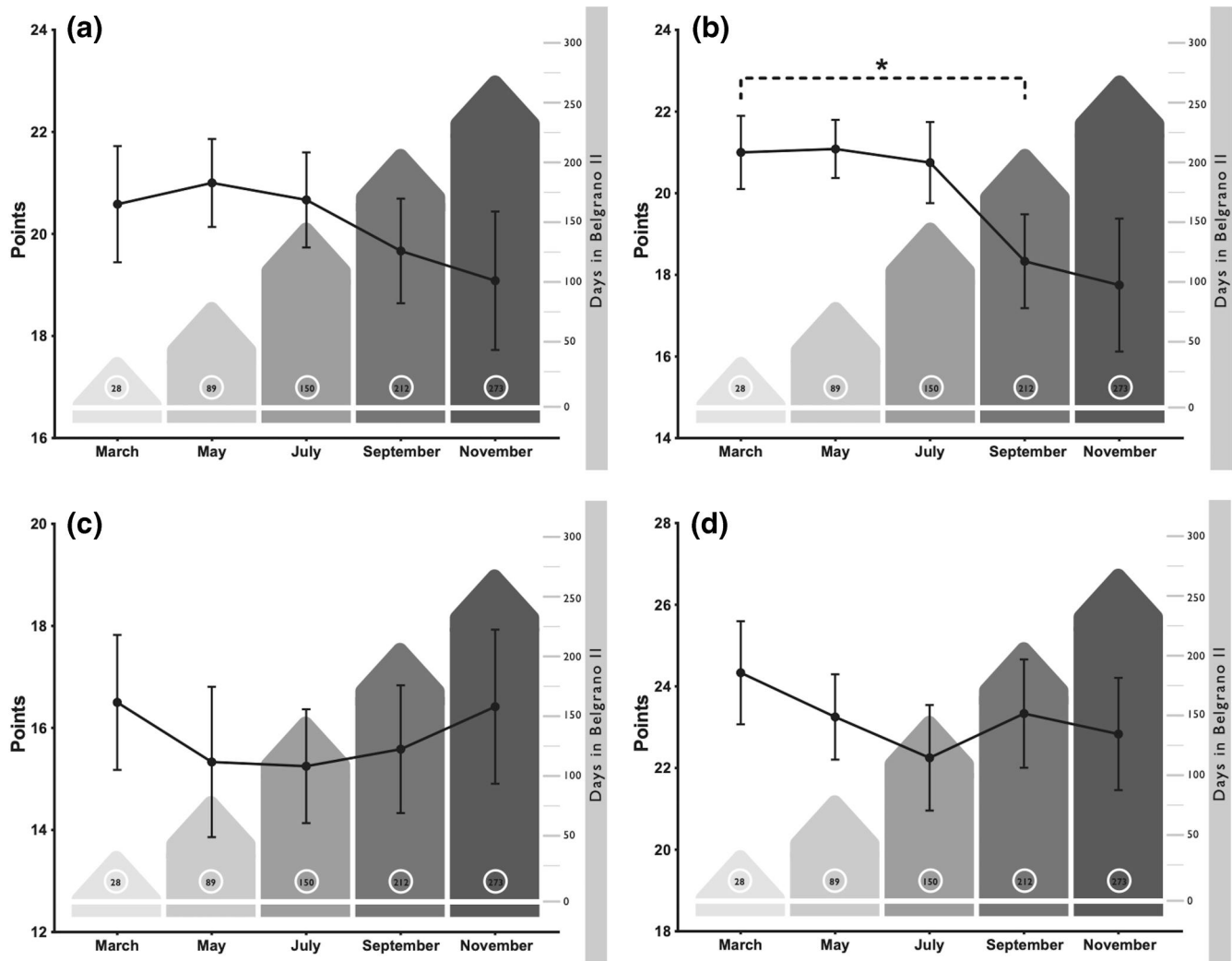


FIGURE 3 Job Content. (a) Peer Support decreased significantly throughout the year (repeated-measures one-way ANOVA $p < 0.03$); (b) Hierarchical Support decay significantly along the campaign (repeated measures one-way ANOVA $p < 0.01$) evidenced in significant differences between March and September (Bonferroni's post-hoc analyses for March vs. September $p < 0.04$); (c) Psychological Job Demand showed no significant variations (repeated-measures one-way ANOVA $p = ns$); (d) Decision Latitude showed no significant variations (repeated-measures one-way ANOVA $p = ns$). Right axis and shaded bars illustrate the numbers of days at Belgrano II station. The circle inside each month stands for the amount of days the participants remained in isolation

providing advice (Palinkas, Gunderson, Johnson, & Holland, 2000). Likewise, seeking social support between peers also evidenced a decline throughout the expedition (Peri et al., 2000). In this regard, occupational and hierarchical differences seemed crucial factors that mediate interpersonal tension and conflicts among crewmembers (Nicolas et al., 2016). Waning of social variables might be attributed to environment monotony, lack of privacy, absence of new people to interact with and little differentiation between work and leisure (Palinkas et al., 2008; Kokun & Bakhmutova, 2020). Perhaps, the willingness to maintain social cohesion is gradually reduced as isolation time increases and as the expedition reaches its conclusion. Surprisingly, seasonality does not seem to play an essential role in social relationships. Winter represents the harshest season on Antarctic expeditions, where less sleep (Folgueira et al., 2019), greater mood fluctuations (Anton-Solanas, O'Neill, Morris, & Dunbar, 2016)

and increased fatigue (Chen et al., 2016) are observed. However, interpersonal dynamics were not affected during this season in our study, which possibly relates to the emotional flatness observed during polar night (Sandal et al., 2018).

4.4 | Correlations among questionnaires' annual averages

Occupational dimensions such as Decision Latitude and Psychological Job Demand trigger stress, which leads individuals to resort to different coping strategies to meet work requirements. Remarkably, results showed that when both variables increased, participants implemented adaptive mechanisms to deal with occupational demands. These observations are supported by other

TABLE 3 Correlations between average scores of JCQ, RESTQ Index, COPE and DSQ

		JCQ				RESTQ	DSQ		COPE	
		Decision latitude	Psychological job demands	Peer support	Hierarchical support	Stress-Recovery Index	Mature	Immature	TOC	DOC
JCQ	Decision latitude	-	-	-	-	-	-	-	-	-
	Psychological job demands	0.46	-	-	-	-	-	-	-	-
	Peer support	0.34	-0.08	-	-	-	-	-	-	-
	Hierarchical support	0.30	-0.33	0.81*	-	-	-	-	-	-
RESTQ	Stress-recovery Index	0.63*	0.22	0.61*	0.65*	-	-	-	-	-
DSQ	Mature	0.43	0.63*	0.21	0.06	0.27	-	-	-	-
	Immature	0.37	0.45	0.21	-0.02	-0.11	0.70*	-	-	-
COPE	TOC	0.72*	0.35	0.46	0.18	0.39	0.67*	0.61*	-	-
	DOC	0.52	0.31	-0.07	-0.20	0.12	0.49	0.31	0.64*	-

Notes: This table shows the Pearson correlation coefficients between the average scores measured throughout the year. *p*-values surviving FDR correction for multiple comparisons are marked in bold.

Abbreviations: COPE, Multidimensional coping inventory; DSQ, defence Style Questionnaire; DOC, disengagement-oriented coping; JCQ, Job Content Questionnaire; RESTQ, Recovery and Stress Questionnaire

**p* < 0.05

studies which showed that professional growth plays a major role in motivation under isolated and confined conditions (Poláčková Šolcová et al., 2016). Therefore, being under work-related pressure might strengthen psychological adjustment. The positive association between TOC and defence mechanisms suggests that the crew actively opted for cognitive-based, problem-oriented responses. This behaviour is not surprising, given the participants' psychological profile and the work environment where measures were taken. However, both mature and immature mechanisms were observed when unconscious, automatic psychological defences were triggered (Halim & Sabri, 2013). As we hypothesized, social support was associated to the ability to recover from stress during overwintering in Antarctica. Social support is known to be one of the major predictors of better health outcomes (Uchino, Cronan, Scott, Landvatter, & Papadakis, 2020), and poor social relationships can lead to pathological problems and deterioration of self-image (Rosnet, Le Scanff, & Sagal, 2000). Under Antarctic conditions, group dynamics between crewmembers become increasingly important as contact with family and friends can turn into a stress source, that is, problems that cannot be solved from a distance (Palinkas et al., 2004). Considering our results, peer and hierarchical support can foster better adjustment to this stressful context. In this regard, social interaction can play an important role in providing emotional and cognitive strategies to manage isolation conditions characteristic of the Antarctic environment (Bakmutova, 2019). Our findings support the importance of promoting healthy relationships among peers and leaders as a mechanism to prevent increased stress.

5 | CONCLUSION

Our findings highlight the importance of social dynamics in isolated, confined, extreme environments and its impact on individual defence mechanisms. The absence of natural light does not seem to influence these psychological variables. The present study represents the first evidence with an integrated perspective of different psychological parameters throughout one year at Belgrano II Antarctic station. Still some limitations must be addressed, such as the reduced sample size (crews of remote Antarctic stations are usually small); the lack of an objective measures to complement the subjective assessment; and the absence of a control group in the mainland. In addition, it would have been useful to incorporate a positive affect assessment such as the PANAS scale (Watson, Clark, & Tellegen, 1988) to complement the negative affect instruments and to explore the interplay between positive emotion and group dynamics. Future studies should include positive affect evaluation, measures other than self-report questionnaires and a non-polar sample as a control group. This work highlights the need to implement effective strategies aimed at improving interpersonal relationships as a means to achieve better adjustment to Antarctic demands.

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CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

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