Going Hard or going Home?

The influence of psychological factors on pain levels among Circus Arts students.

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Abstract

Background/context: The daily training load of circus artists is associated with maximum stress, which may lead to higher injury-risk. A better understanding of the causes of injuries can have a positive impact on the artists' health.

Objective: Examine the association between pain and the independent variables personality factors, stress, coping resources, and previous injuries.

Design: Prospective cohort design.

Methods: Circus Arts students from Codarts Rotterdam were followed three months. At baseline, participants completed the International Personality Item Pool, the Athletic Coping Skills Inventory – 28 and questions about previous injuries. Additionally, participants completed the Subjective Units of Distress and the Self-Estimated Functional Inability because of Pain bi-weekly. One-way Spearman correlations between personality, stress, coping and pain were calculated. Regression analyses were conducted on stress and pain. Difference in pain levels between students with and without previous injuries was calculated by a Mann-Whitney test.

Results: 33 participants ranging in age from 17 to 27 years (M = 22.4) indicated a mean pain score of 4.2. 81.8% sustained an injury during previous academic year. Furthermore, pain was significantly associated with stress and coping resources. Stress could predict 28.2% of the variance in pain. Non-significant results were found between personality (extraversion, neuroticism, conscientiousness and openness to experience), previous injuries and pain.

Conclusions: It can be concluded that the burden of injuries and pain is high in circus students. Recommendations are made to lower stress levels and raise coping resources of the students.

Further research is needed to better unravel the association between psychological factors and pain. These studies should focus on the causality and causes of stress and pain.

KEY WORDS: PAIN, PSYCHOLOGICAL FACTORS, PERSONALITY, STRESS, COPING, PREVIOUS INJURIES, CIRCUS ARTS.

Inhoud

Introduction

The modern version of human circus, also known as Circus Arts, is a rising star in the art industry. Famous productions like Cirque du Soleil are entertaining people all over the world. According to the European Federation of Professional Circus Schools (FEDEC; http://www.fedec.eu/en) there are 680 Circus Arts training facilities in 52 different countries (Munro, 2014). The FEDEC is a network of 41 professional Circus schools and 14 Circus Arts organizations from 24 different countries, including the Netherlands.

Circus Arts combines acrobatic elements on the floor and/or in the air with dance, theatre and comedy. It is a discipline that is not only physically but also mentally very challenging for the artists. The artists perform activities that require a high level of strength, power, fearlessness and agility. The workload is very high, with lots of performances and little time to recover. This makes the artists prone to injuries. These injuries can be highly disadvantageous for professional circus artists and circus students, because they can lead to physical discomfort, medical treatment and absence from rehearsals, performances and classes.

A better understanding of the causes of injuries can have a significant positive impact on the artists' health and associated care costs (Shrier & Hallé, 2010). However, very little research has been conducted regarding injuries in this specific physical discipline. To our knowledge, only a few studies have focused on the epidemiology of injuries in circus artists. A study on injuries within Cirque du Soleil showed that the overall injury rate was 9.7 (95% confidence interval, 9.4-10.00) for 1.376 artists who sustained a total of 18.336 show- or training-related injuries over a period of five years (Shrier et al., 2009). Furthermore, two studies investigated the incidence and characteristics of injuries amongst circus students (Munro, 2014; Wanke, McCormack, Koch, Wanke, & Groneberg, 2012). However, there is no consistency between the results of these studies. Munro (2014) showed that a total of 351 injuries resulting in 1.948 treatments occurred in 63 students during a full academic year. While Wanke and colleagues (2012) investigated the injury risk within the Berlin State Accident Insurance as well as a State Artist Educational School (n=169) for 17 years and stated that the injury risk seemed to be relatively low (0.3 injuries/1000h). The injury patterns vary depending on the activity and the discipline.

Injuries and Circus Arts

To prevent physical complaints, more insight into the prevalence, nature and risk factors of injuries is needed. The daily training load of a slightly younger population within Circus Arts students is associated with maximum physical and psychological stress (Wanke et al., 2012) which may increase the risk for sustaining an injury. The training is characterized by extreme forced postures and

movements and the high physical stress takes places in a period of changes in adolescents subject to the age of puberty (Wanke et al., 2012).

Only one study investigated the association between psychological factors and injuries in circus artists (Shrier & Hallé, 2010). Their results showed that emotional exhaustion, low level of self-efficacy and fatigue were associated with an increase in injury risk.

In addition, the 'Stress and Injury Model' (figure 1) of Williams and Andersen (1998) proposes that other psychological factors may also lead to an increase in injury risk within sports. This model states that the reaction of the athlete to a potentially stressful athletic situation is crucial in determining whether injuries will appear. The 'stress response' depends either directly or indirectly on a series of psychological factors, including personality, history of stressors and coping resources.

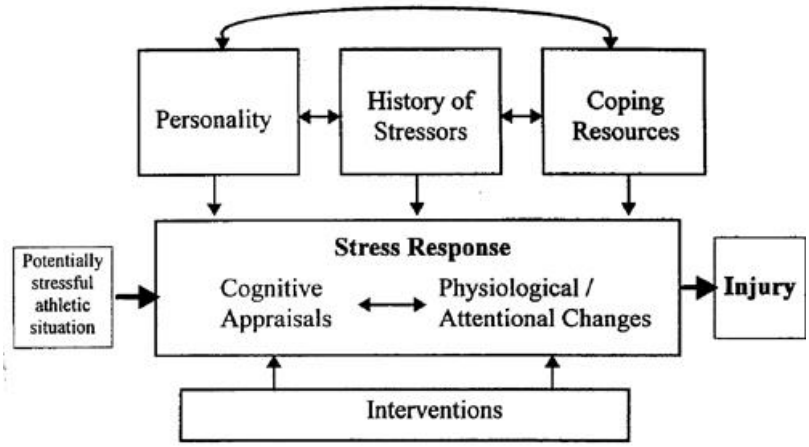

Figure 1: Stress and Injury Model of Williams and Andersen (1998).

Personality

Different studies within sports have shown that some athletes have a particular predisposition toward being injured, based on their personality traits. They possess a certain 'readiness to take risks', a lack of caution and/or an adventurous spirit (Junge, 2000). Previous research showed that personality types with a low level of conscientiousness, combined with a high level of extraversion and/or a high level of neuroticism indicates high risk takers (Castanier, Scanff, & Woodman, 2010). They have a greater desire to enhance bodily sensation and focus on satisfying immediate needs for stimulation, regardless of future consequences. This can divert their attention from their ill-being and problems (Cooper, Agocha, & Sheldon, 2000), which can result in ignoring signs of overload and not taking enough rest. This may lead to injuries.

Extraversion

Extraverted behavior was indicated as risk-factor for sustaining an injury within non-elite Australian Football (McManus et al., 2004). Possessing a high level of extraversion and a low level of

conscientiousness can often lead to less awareness of your own (physical) limits, which can result in exceeding of limitations sooner, and in not paying attention to all consequences (Castanier et al, 2010). These consequences of exceeding your limits can result in pain and injuries.
Literature shows that extraversion was also found to be a valid and generalizable predictor of traffic accidents (Clarke & Robertson, 2005). Injuries can happen by accidents during training and performing as well.

Neuroticism

Neuroticism, the tendency to experience psychological stress, leads to higher amount of reported medical symptoms. Neuroticists tend to exaggerate their interpretations of somatic sensations (Watson & Pennebaker, 1989), because neuroticism lowers the threshold at which pain is perceived as threatening (Goubert, Crombez, & van Damme, 2004). They also tend to see themselves more susceptible to injuries (Stephan, Deroche, Brewer, Caudroit, & Le Scanff, 2009).

Conscientiousness

Tok (2011) showed that risky sport participants have significantly lower levels of conscientiousness. As stated above, a low level of conscientiousness can often lead to less awareness of your own limits. Conscientiousness has a health-protective effect according to Castanier and colleagues (2010), which could be explained by its characteristics of tenacity, persistence, and effort to improve quality of life.
Low levels of conscientiousness can be related to carelessness (Clarke, & Robertson, 2005). Carelessness can be of a contributing influence on injuries as well (Chamarro & Fernández-Castro, 2009).

Openness to experience

Previous research showed that there is a positive relationship between openness to experience and risk-taking (Clarke & Robertson, 2005; Tok, 2011). And as mentioned before, athletes can have a particular predisposition toward being injured, which is based on risk taking (Junge, 2000).

Stress

According to Williams and Andersen (1998), stress is an important factor in determining whether injuries will appear. Psychological stress occurs when a person experiences that the environmental demands exceed their abilities to cope with the demands of specific events or experiences and when the situation is important to them (Cohen, Kessler, & Gordon, 1995). According to the Stress and Injury model (Williams & Andersen, 1998), stress results from a person's cognitive appraisal(s) of a potentially stressful situation and the physiological and attentional aspects (figure 1). The cognitive appraisal includes a primary appraisal ('Is this important to me?') and a secondary appraisal ('Do I have the abilities to perform well?'). The physiological and attentional aspects include for example

heart rate, muscle tension and peripheral attention focus. Williams and Andersen (1998) stated that stress has a large influence on pain and injuries. Stress influences the interpretation of a situation and the reaction on a potential stressful situation, which may lead to a decreased peripheral ability which increases injury-risk. Shrier and Hallé (2010) also specified that fatigue and emotional exhaustion are associated with an increase in injury risk by circus artists in a historical cohort study. Stress is a strong predictor for both fatigue and emotional exhaustion (Michielsen, Willemsen, Croon, de Vries, & van Heck, 2004).

Coping

The third psychological factor associated with injury risk according to the Stress and Injury model, is coping. Coping resources indicate how a person handles stress and problems. The model stated that there is an influence of coping directly on pain, and also a moderating influence on stress. A potential stressful situation is the provocation for the stress response that can lead to injury. More coping resources may buffer individuals from stress and injuries by helping them to perceive fewer situations and events as stressful.

Research among Korean ballet dancers has shown that a broad-based coping skills training (including autogenetic training, imagery, and self-talk) was effective for enhancing targeted coping skills and reducing injury occurrence (Noh, Morris, & Andersen, 2007).

History of stressors

The category ‘history of stressors’ of the Stress and Injury model refers for instance to previous injuries (Williams & Andersen, 1998). Previous injuries have been mentioned as risk factor for sustaining a new injury within sport literature by multiple studies; see for example the review of Emery (2003) or Murphy, Connolly and Beynnon (2003).

Previous injuries can be a risk factor for new injuries due to the fact that students are not completely recovered physically and/or mentally. Due to lack of muscular strength, altered kinematics, diminished proprioception, reduced range of motion and scar tissue students can be physically not ready to perform the same movements as before the injury (Waldén, Hägglund, & Ekstrand, 2006). When someone is not mentally prepared to return there is also a higher risk for sustaining an injury through different principles. The competence, autonomy and relatedness (self-determination theory) of the students may be of importance during the return period of the students (Podlog & Eklund, 2007). Competency based matters indicated that students can experience fear of movement/re-injury. This can lead to lack of focus and decreased confidence during rehabilitation (Walker, 2009) and a reduced sense of self-efficacy (Podlog & Eklund, 2007). This can increase the potential for a re-injury and may affect the way students return to their training and performing (Walker, 2009). When looked at the relatedness and autonomy issues of students during their recovery period they may be return too quickly, due to feelings of isolation and/or external pressures (including teachers and classmates;

Podlog & Eklund, 2007). The type of motivation to return to sport may have a significant impact upon athletes' psychological return outcomes (Podlog & Eklund, 2005). For example, the transition from rehabilitation to full participation in collective training can result in overloading, especially when they feel the need to prove themselves to teachers (external motivation; Waldén et al., 2006).

The aim of this study is to explore the association between the above mentioned psychological factors (i.e. personality, stress and coping), previous injuries and pain by students of the Bachelor education Circus Arts of Codarts Rotterdam. Pain can be seen as the wide definition of injury: "*a recordable incident is any physical or psychological complaint resulting from relevant sports participation regardless of its consequences*" (Clarsen & Bahr, 2014). This is the most common consensus-recommended surveillance definition. The collected pain data should give a good representation of the total burden of injuries.

Based on the above mentioned studies, the following hypotheses were drawn up;

1a. Higher scores on extraversion are associated with a higher degree of pain complaints.
1b. Higher scores on neuroticism are associated with a higher degree of pain complaints.
1c. Lower scores on conscientiousness are associated with a higher degree of pain complaints.
1d. Higher scores on openness to experience are associated with a higher degree of pain complaints.
2. High levels of stress are associated with a high degree of pain complaints.
3. High levels of stress are associated with a high degree of pain complaints over time.
4. Lower scores on coping resources are associated with a higher degree of pain complaints.
5. Coping has a moderating effect on the relation between subjective stress levels and pain complaints.
6. Previous long term injuries are associated with a higher degree of pain complaints.

All hypotheses are stated in a specific direction, based on the above mentioned literature.

Methods

A prospective cohort study was conducted from 11 March 2015 until 11 June 2015 (13 weeks) to study the association between personality characteristics, stress, coping, previous injuries and pain.

Subjects

The participants were first and second-year students of the Bachelor education Circus Arts of Codarts Rotterdam, the Netherlands (n=34). The students are following a 4-year training program, resulting in a Bachelor of Arts, which consists of 40 hours of training per week. They study a wide range of circus disciplines, ranging from juggling to acrobatics, and choose a specialization in their first year in which they wish to excel. Codarts school of Circus Arts is an international school in which students from more than sixteen different nationalities are enrolled.

All data collected were handled strictly confidential and were coded so that students remained anonymous. Ethical approval for the study was obtained from the Faculty Ethics Review Board of the faculty Social and Behavioral Sciences of the University of Amsterdam. Students were verbally and by letter informed of the purpose and procedures of the study. In addition students provided written informed consent.

Questionnaires

All questionnaires used are included in attachment A. Personality and coping resources were documented once during the data collection period. Personality was measured by using the International Personality Item Pool (IPIP; Goldberg, 1999) based on the NEO-PI-R. The IPIP is a 100 item self-reporting inventory of five subscales (Big Five): extraversion, agreeableness, conscientiousness, neuroticism (or emotional stability) and intellect (or openness to experience). We focus on only four of the five subscales, agreeableness was excluded. Participants were requested to rate how well they believed it described them on a 5-point scale (1 = very inaccurate, 2 = moderately inaccurate, 3 = neither accurate nor inaccurate, 4 moderately accurate, 5 = very accurate). All subscales were analyzed separately and the scores ranges from 20 (does not apply to me) to 100 (does apply to me very well) on each subscale. The internal consistency for the subscales is good (Cronbach α ranges from .88 to .91) and the average correlation with the Big-Five factor markers is .70 (Goldberg, 1999; Goldberg, 2006).

The Athletic Coping Skills Inventory – 28 (ACSI-28; Smith, Schultz, Smoll, & Ptacek, 1995) was used to measure coping resources. The questionnaire was adjusted for the students of Circus Arts. ‘Coach or manager’ was replaced by ‘teacher’, ‘competition’ by ‘performance’ and ‘sports’ by ‘perform’. The ACSI is a 28 item inventory of seven subscales: coping with adversity, coachability, concentration, confidence and achievement motivation, goal setting and mental preparation, peaking

under pressure and freedom from worry. Respondents indicate how often they experience situations on a four-point Likert scale (0 = almost never, 1 = sometimes, 2 = often, 3 = almost always). The subscales were analyzed in total and separately. Scores range from 0 to 12 on each subscale, with higher scores indicating greater strengths on that subscale. The total score ranges from 0 to 84.

Epidemiological information on previous injuries (e.g. type, location and duration) during the academic year 2013-2014 was documented as well. Previous, long term injuries were defined as "*any physical complaint resulting in a full time loss of activity (participation in a class, rehearsal, or performance) for a week beyond the day of onset"*, specified for performing arts and based on consensus recommendations for several sports, including cricket (Orchard, Newman, Stretch, Frost, Mansingh, & Leipus, 2005), soccer (Fuller et al., 2006, Van Beijsterveldt et al., 2012), rugby union (Fuller et al., 2007), tennis (Pluim et al., 2009), thoroughbred horse racing (Turner et al., 2012) and athletics (Timpka et al., 2014). Previous injuries are asked in retrospect for a whole academic year.

Subsequently, stress and pain questionnaire was administered on a bi-weekly basis for a period of three months (seven times). The Self-Estimated Functional Inability because of Pain (SEFIP) questionnaire (Ramel, 1999) was used to measure pain complaints. A self-reported health questionnaire can be a quick, inexpensive and easy way in defining the pain status in certain body regions (Ramel, 1999). Respondents indicated their pain for fourteen different body regions (neck, upper back, elbows, lower back, hips, thighs (back), shoulders, wrists/hands, thighs (front), knees, shins, calves, ankles/feet and toes). A sum score (range 0-56) was calculated. For every region the score ranged from 0 (no pain) to 4 (maximal pain; so severe they are unable to work). Everything above zero is regarded as a positive finding, which means that there is a physical complaint. The SEFIP is validated against a constructed 'gold standard', a test battery of commonly used tests to measure joint motion, muscular capacity, and coordination for different body regions chosen by an 'expert group' consisting of paramedics. The mean sensitivity for all regions was 78% and the average specificity 89%. Mean agreement between the test battery and the SEFIP varies between 78% (hip) and 96% (neck) with an average of 88% (Ramel, 1999). Test-retest reliability is not acquainted.
A visual analogous scale (Subjective Units of Distress, SUDS) was used to measure stress. This method is used worldwide on large-scale (Ponce et al, 2008). Students can indicate their stress on a scale from zero (not stressed at all) to hundred (very stressed).

Data were collected every Wednesday morning during the physical preparation lessons (if possible). When students were absent the researcher came back later that week. All forms were distributed on paper and in English. English is not the native language of most students, but the education they follow is in English as well, so a decent knowledge of English could be assumed.

Statistical analyses

All data were processed using Excel 2010 (Microsoft Corp, Redmond, Washington, USA) and SPSS 20 (IBM Corp, Chicago, Illinois, USA). The statistical tests are all tested one way, because the hypotheses were also drawn up in one specific direction. The following statistical tests were used: Shapiro-Wilk test to check data on normality and a repeated measures ANOVA with Bonferroni correction to check if pain and stress scores differed over time. Spearman correlation analyses were used to test the association between personality characteristics and the total pain score and for the relation between coping resources and the total pain score. Spearman correlation and regression analyses were used to investigate the relation between all pain and stress scores (over time). For the influence of coping resources on the relation between stress level and pain a moderation analysis was used. For every time point a regression analysis of coping was conducted on the association between stress and pain. Furthermore, regarding previous injuries the participants were divided in two groups (with or without previous injuries). A Mann-Whitney test was used to test if there was a difference in pain scores between the two groups. Significance was accepted at $p<0.05$.

Results

Descriptive statistics

A total of 34 first and second year students were included in this study. One participant was excluded from the analyses due to drop out from school. The remaining 33 participant completed all questionnaires. Therefore, there was no missing data.

Of the included 33 participants, 18 were male (54.5%) and 15 were female (45.5%). The mean age was 22.39 years (SD=2.50) 17 students were freshmen and 16 were second year students. The students specializations within Circus Arts, varied from juggling (6 students), aerials (10 students), acrobatics (11 students), cyr wheel (2 students), Chinese pole (1 student), handstand (1 student), tight wire (1 student) and contortion (1 student).

The assumptions of parametric analyses were not satisfied for the present data set. Non-parametric analyses were used for that cause.

The dependent variable 'pain' was measured bi-weekly over a period of three months. Table 1 shows the means, standard deviations, minimums and maximums. A repeated measures ANOVA with Bonferroni correction showed that pain scores did not significantly differ over time, they vary from 3.48 until 5.30. The mean pain score over the total period is 4.21 on a scale from 0 to 64.

Table 1: Descriptive statistics of the dependent variable pain for every week, including the mean value.

	Pain 1	**Pain 2**	**Pain3**	**Pain 4**	**Pain 5**	**Pain 6**	**Pain 7**	**Mean Pain**
Mean	5.30	4.97	3.48	4.12	4.55	3.42	3.61	4.21
Std. Deviation	3.21	3.51	4.15	2.55	2.95	2.74	2.62	2.56
Minimum	0	0	0	0	0	0	0	.57
Maximum	12	13	17	11	14	10	12	11.14

Personality

Table 2 shows the means, standard deviations, minimum and maximum for the personality variables. The scores on the personality scales indicated that the participants as group have moderate intensities of the personality scales. The large standard deviations indicate large inter-individual differences.

The Spearman correlation analysis showed no significant correlation between any of the personality scales and the mean pain scores. The correlation coefficients are also shown in Table 2.

Table 2: Descriptive statistics of the independent variables of personality score.

	Extraversion	**Conscientiousness**	**Neuroticism**	**Openness to Experience**
Mean	67.30	68.39	65.70	75.15
Std. Deviation	12.68	10.52	11.64	9.00
Minimum	38	40	44	57
Maximum	89	91	90	94
Correlation coefficient with mean pain score	.13 (p=.24)	.03 (p=.44)	-.21 (p=.12)	.21 (p=.12)

Personality consists of five subscales, only four were used: extraversion, agreeableness, conscientiousness, neuroticism and openness to experience. Correlation coefficients and significance level for Spearman correlation between the personality scores and the mean pain are given as well.

Stress

Table 3 shows the means, standard deviations, minimum and maximum for the stress scores for every measurement. A repeated measure ANOVA with Bonferroni correction showed that stress scores did not significantly differ over time, they vary from 26.12 until 40.18. The mean stress score over the total period is 34.14 on a scale from 0 to 100. The large standard deviations indicate large inter-individual differences.

The mean stress and the mean pain scores showed a significant moderate correlation ($r = .56$, $p<.000$). The correlation coefficients of the different weeks are also shown in Table 3. Only in week 5 stress and pain scores were not significant correlated. Correlations between the other stress and pain measures were all of a low/moderate level.

Regression analyses showed that stress could predict a significant part of the variance within the pain levels. 28.2% of the variance in mean pain levels could be predicted by the mean stress score. The declared variance (R square) and F values of the different weeks are also shown in Table 3. Only in week 2 and week 5 stress could not predict significance variance in the pain scores. Week 2 did show a trend towards significance.

Table 3: Descriptive statistics of the independent variable stress.

	Stress 1	Stress 2	Stress 3	Stress 4	Stress 5	Stress 6	Stress 7	Mean Stress
Mean	32.85	34.97	26.12	40.18	34.06	36.00	34.79	34.14
Std. Deviation	19.25	21.90	25.00	21.96	24.31	23.30	22.29	15.58
Minimum	0	0	0	0	0	1	0	.86
Maximum	67	78	83	84	90	75	74	71.43
Correlation coefficient with pain scores	.42*	.30*	.30*	.30*	.23 (p=.099)	.53**	.46*	.56***
R square with pain scores	.118	.097	.155	.133	.060	.207	.212	.282
F value ANOVA with pain scores	4.16*	3.33 (p=.078)	5.67*	4.75*	2.00 (p=.17)	8.09*	8.33*	12.16**

Correlation coefficients for Spearman correlation between the stress and pain scores for every measurement, including the mean scores, are given, as well as the R square (declared variance) and the F value of stress on pain levels.
* p<.05. ** p<.001. ***p<.000.

Table 4 shows the correlation coefficients of stress and pain levels over time. Only stress levels in week 1 were correlated with pain levels in week 2 and stress levels in week 5 with pain levels in week 6. No other significant association was found for stress and pain over time.

Table 4: Correlation coefficients between stress and pain over time.

	Stress 1 – Pain 2	Stress 2 – Pain 3	Stress 3 – Pain 4	Stress 4 – Pain 5	Stress 5 – Pain 6	Stress 6 – Pain 7
Correlation coefficient	.31*	.01 (p=.48)	.27 (p=.067)	.17 (p=.18)	.39*	.26 (p=.069)

* p<.05.

Coping

Table 5 shows the means, standard deviations, minimum and maximum for the coping resources. The scores on the coping scales indicated moderate to high strengths on the coping variables for the group as a whole (range 0-12).

The total coping score and the mean pain scores showed a significant, moderate and negative correlation (r = -.34, p<.05). The Spearman correlation analysis showed that there is a significant correlation between the subscale ‘concentration’ and pain, and between the subscale ‘freedom from

worry' and pain. For the variable 'coachability' a trend toward significance is detected (p = .054). No other significant association was found for coping resources and stress.

Correlation analyses on coping resources and stress levels were performed to investigate the moderation effect of coping resources on the association between stress and pain levels. A Pearson correlation has been used because both variables (i.e. coping and stress) have normal distributions. Again, the total coping score and the subscales concentration and freedom from worry are significantly associated with pain (see Table 5). 'Coping with adversity' and 'peaking under pressure' were also significant correlated with stress, but not with pain.

Moderation analyses (centralized regression analyses) showed no significant influence of coping resources on the association between stress and pain. The total model of coping, stress and the interaction effect is significant (F = 4.06, p<.05), but not when we only look into the interaction effect. The coefficients for the interaction variable mean stress and total coping score are B = -.002, Beta = -.079, t = -.41 and p = .64. Nevertheless, for freedom from worry there is a trend toward significance detected (p = .058).

Table 5: Descriptive statistics of the independent variables of coping:

	Coping with adversity	**Coacha-bility**	**Concen-tration**	**Confidence and achievement motivation**	**Goal setting and Mental preparation**	**Peaking under Pressure**	**Freedom from Worry**	**Total coping score**
Mean	6.79	10.36	7.27	6.79	5.52	5.33	6.82	48.88
Std. Deviation	2.19	1.45	1.65	1.64	2.35	2.33	2.69	8.75
Minimum	3	7	4	3	1	0	1	35
Maximum	11	12	10	10	11	12	12	73
Correlation coefficient with pain scores	-.16 (p=.19)	-.28 (p=.054)	-.29*	-.15 (p=.20)	.08 (p=.32)	-.13 (p=.23)	-.34*	-.34*
Correlation coefficient with stress scores	-.31*	-.11	-.31*	-.20	.08	-.30*	-.40**	-.37*

Coping consists of seven subscales: coping with adversity, coachability, concentration, confidence and achievement motivation, goal setting and mental preparation, peaking under pressure, freedom from worry and total score. Correlation coefficients for Spearman correlation between the coping scores and the mean pain score and correlation coefficients for Pearson correlation between the coping scores and the mean stress score are given as well.

* p<.05. ** p<.001.

Previous Injuries

81.8% of the students sustained an injury during previous academic year (27 of the 33 students).

Students were divided in two groups based on their injuries during study year 2013-2014 (group 1 = yes or group 2 = no). Table 6 shows the amount of students in a group and the means and standard deviations.

A Mann-Whitney test showed no significant difference between the group with and the group without injuries on perceived pain levels ($p = .45$). When correlation analyses were used between the total amount of weeks injured and the mean pain scores there is also a non-significant result ($r = .14$, $p = .23$). However we did find an inclination in mean pain scores between injured and non-injured students, a difference of 1.1 is detected.

Table 6: descriptive statistics of the mean pain scores of the two groups based on their injuries.

	N	Mean pain	SD
Injury (>1)	27	4.40	2.75
No injury (0)	6	3.33	1.15

Discussion

The aim of the study was to examine the associations between pain and the independent variables personality, stress coping resources and previous injuries.

Personality

Firstly, there was no significant association between pain and the independent personality factors 'extraversion', 'conscientiousness', 'neuroticism', and 'openness to experience'. This is not in line with studies that reported a certain "readiness to take risks" as stated in the extensive review of Junge (2000). These studies based their conclusions on different personality factors and sports (football, ballet, physical education and running) than used in this study, which makes it difficult to compare. The researches stated that injured athletes are tough-minded (Jackson et al., 1978), enterprising (Hamilton, Hamilton, Meltzer, Marshall, & Molnar, 1989), have a lack of caution and have emotional lability (Lysens, Vanden Auweele, & Ostyn, 1986), and are adventurous and forthright (Taimela, Kujala, & Osterman, 1990). The link between conscientiousness, extraversion, neuroticism, openness to experience and risk behaviour has been found in previous studies (Castanier et al., 2010; Clarke & Roberson, 2005; Stephan et al., 2009), as well as the link between risk behaviour and injuries (Junge, 2000). However, the association between these specific personality factors and injuries is not found in this study. This association is, to our knowledge, not examined in literature, except for extraversion within Australian Football (McManus et al., 2004). Extraversion was only marginally associated with an increased injury risk (increased risk by 3%). Besides the small effect, the study is difficult to compare with our study. The results of the study done by McManus and colleagues (2004) were collected with telephone interviews within a population of only men and a much wider age range (16-50 years). In addition, Circus Arts is of substantial difference than Australian Football.

The measurement of the personality traits might be valuable for estimating individuals' tendency to participate in adventure/risky sports (Tok, 2011), but not for indicating the risk on experiencing pain and injuries.

The large inter-individual differences indicated by large standard deviations could perhaps also explain the non-significant association between personality and pain. Standard deviations indicate how well the mean fits the data, when the SD is large it signifies that the mean is not an accurate representation of the data (Field, 2009). The correlation coefficient is calculated trough dividing the covariance by the multiplied standard deviations (Field, 2009). Large SD indicates smaller correlation coefficients and thus smaller chances of finding a correlation.

Further, the content of the IPIP could have influences the scores on the questionnaire. Feedback given by the students indicated that they had some difficulties with filling in this particular questionnaire. This can possibly result from the language barrier of the students (English is for most students not

their mother tongue) or from their lack of knowledge about some psychological factors. In this way the answers given by the students could perhaps not be accurate, which could influence a possible association. These influences were attempted to be restricted by the attendance of the researcher.

Stress

Secondly, students with high perceived stress levels also reported high pain levels in general and more specific for time point 1, 2, 3, 4, 6 and 7. This is in agreement with previous research within a variety of college sports (Andersen & Williams, 1999). The Stress and Injury model (Williams & Andersen, 1998) stated that stress influences the interpretation and reaction on a potential stressful situation which may lead to a decreased peripheral ability (high heart rate, peripheral narrowing, increased distractibility and muscle tension) which increases injury-risk. The results derived from the regression analyses also showed that mean stress levels could predict 28.2% of the variance in the mean pain levels.

For time point 5, we did not find a significant correlation between stress and pain. This might be explained by the fact that this measurement was just after a holiday break. The workload of this specific period is quite different from the workloads in the other periods.

In this study we investigated mainly correlations between stress and pain, not causality. Causality indicates that one factor is the cause of the other factor by appearing first and eliminating other possible causes. Correlations indicate that the independent variables could also be dependent variables. The hypotheses of this study stated that stress is the independent variable which influences pain, as mentioned mostly in literature, for instance by the Stress and Injury model (Williams & Andersen, 1998). In general, stress levels could predict a significant part of the variance within pain levels. This also suggests that stress influence pain, and not the reverse. The correlations over time have not confirmed this, which might be explained by the interval between the measurements. Two weeks might be too long to indicate a specific influence of a stress response on pain. The Stress and Injury model (Williams & Andersen, 1998) described a more direct influence of the stress response on a potential stressful athletic situation and injury risk.

On the other hand, there is some evidence that pain also influences stress: absence because of injury is correlated with stress (Adam, Brassington, Steiner, & Matheson, 2004). Further research is needed for this.

Coping

Based on the third factor, coping, two hypotheses were drawn up: one stated that low coping scores are directly associated with high pain levels and one stated that coping has a moderating influence on the relation between stress and pain. More coping resources may buffer individuals from stress and injuries, because fewer situations are perceived as stressful (Williams & Andersen, 1998).

The total score showed direct significant correlations with pain, and the significant main factors of coping were ‘concentration’ and ‘freedom from worry’.
Within junior soccer players, Johnson and Ivarsson (2011) found that increased injury risk was predicted by ineffective coping skills, such as worry. Low scores on freedom from worry indicates that a person puts pressure on himself by worrying about performing poorly or making mistakes and that a person worries about what others will think if he performs poorly. This is related to higher pain scores according to our results, by perceiving more situations as stressful.
Concentration indicates whether a student is easily distracted, and if a student is able to focus on the task at hand in both practice and performance situations, even when adverse or unexpected situations occur. Better concentration skills can result in perceiving fewer situations as stressful because adverse and unexpected events do not distract the focus away from the task. This can result in lower pain levels, as indicated by our results.
The subscale ‘coachability’ showed a trend towards significance. A significant relationship with pain is expected when more participants are included. Coachability indicates if a student is open to and learns from instructions, and accepts constructive criticism without taking it personally and becoming upset. Our results and the study of Johnson, Ekengren, & Andersen (2005) within soccer indicated that when students are more ‘coachable’ this relates to lower pain levels. For instance, coachability can help students perceive fewer situations as stressful by accepting the feedback and instructions given by teachers instead of defending oneself.

A direct connection between coping and stress was found for the same coping resources (total, concentration and freedom from worry). Our results indicate, based on the theory of the Stress and Injury model (Williams & Andersen, 1998), that better handling stress and problems will likely diminish the negative consequences of stress.
A moderating influence of coping on the relationship between stress and pain was not found. This is consistent with the study of Hanson, McCullagh and Tonymon (1992). They indicate that coping resources were a good discriminator for severity and frequency of injuries, but not a moderator between stress and injuries. On the contrary, our results are not in line with the theory of the ‘Stress and Injury model’ (Williams & Andersen, 1998) and the study of Smith, Smoll and Ptacek (1990). Their population consists of a variety of high school athletes, a different sample than used in this study. They showed that for athletes with high stress-low coping resources social support and psychological coping skills operate in a conjunctive manner (need low scores on both) to increase the injury risk of athletes. Both factors separately have not showed correlations with injury. In the present study the moderation influence of social support was not taken into account, which could explain the non-significant moderation influence of coping.

Another possible explanation could be that the moderating effects are not robust enough to be of significance due to our small sample size. One of the coping resources (freedom from worry) already showed a trend towards significance.

Previous injuries

The last factor included in the study was 'previous injuries' sustained during past academic year. The focus was on severe injuries that lasted at least one week to limit the recall bias, because those injuries are easier to reproduce than mild injuries with duration of a couple of days (van Beijsterveldt et al., 2012).

The total burden of injuries sustained during previous academic year is high; higher than for instance reported in university dance (81.8% versus 67-77%; Weigert, 2005), and private dance schools with a slightly younger population (81.8% versus 63%; Kish, Plastino, & Martyn-Stevens, 2003).

There were no significant results found between previous injuries and pain levels. Hamilton, Meeuwisse, Emery, Steele and Shrier (2011) did not find previous injuries to be a causal risk factor for subsequent injuries in Circus Arts as well. They stated that it may still be a causal factor in other studies but that a certain bias away from the null should be kept in mind. When conditioned on all other injury risk factors in the statistical model further studies can take this bias into account, since different individuals have different predispositions toward injury. The results are in contrast to the 'Stress and Injury model' (Williams & Andersen, 1998) and the research within sports (for instance Waldén et al., 2006).

One of the explanations for the non-significant result between previous injuries and pain is the fact that only six students did not sustain an injury during the past year. The power to find significant results was therefore not large enough. However, we did find an inclination in mean pain scores between injured and non-injured students in the direction as expected by the 'Stress and Injury model' (Williams & Andersen, 1998).

Limitations of the study

Although the results from the present study are promising, there are several limitations to consider.

Firstly, only 33 participants were included in the study. Therefore the power was possibly too small to detect some results. It is expected that the results of some copings scales (for instance coachability), the moderating effect of coping (for instance freedom from worry) and previous injuries (when the groups are more equal) will show significant results with a larger sample. Therefore, we recommend repeating the study next academic year (2015-2016) with new students. On the other hand, the practical value of (predictive) factors is limited, if statistically, results can only be used from studies that involve a large sample (Ivarsson & Johnson, 2010). Large samples are sometimes difficult to gather, for instance when injured participants are desired. The results of small samples can be useful as long as the results are significant, coherent and interpretable.

Another point for improvement is to make sure that pain is well-defined for all participants. Feedback from the students indicated that some confusion arose concerning the pain questionnaire (SEFIP) regarding muscle aches. They were not sure if muscle aches are considered as part of 'pain' as well. It is recommended to include muscle ache, since it indicates (some) damage to the muscles (McArdle, Katch, & Katch, 2010). During recovery period, the muscle is vulnerable and therefore increases the chance on injuries. When explaining the questionnaires it can be useful to give some examples, including muscle ache.

This study aims to measure mainly correlations, which results in minimal information about the causality between the measured factors. To learn more about the risk factors and eventually develop interventions it is important to do more research. Experiments in which pain or stress is manipulated, to determine the causality between the factors are limited by ethical factors. In that case, longitudinal designs with structural equation models (SEMs) can provide more information about causality by measuring theoretical causes prior to the effects and by simultaneously modelling the unique effect of several causes (Selig & Little, 2012).

A different approach to gather more information about causality is using interventions with supposed risk factors based on empirical correlation research. When the frequency and/or severity of injuries reduce, a causal link can be identified. Which is, for instance, done by Johnson et al. (2005), Kerr and Goss (1996), Maddison and Prapavessis (2005), Noh et al. (2007) et cetera.

To extend the value of research towards practise, we need to know more about the causes of the reported stress levels. Causes could perhaps be found in the training load, as suggested by Wanke et al. (2012), or possibly within the history of stressors (major life events and daily hassles; Williams & Andersen, 1998) and/or the training history (years, hours per week). Wanke et al. (2012) showed within a slightly younger population of Circus Arts students that the training load and maximum physical and psychological stress were associated, because of the extreme forced postures and movements and the age of puberty. The intense training regimes inherent in the dance profession have also been shown to lead to psychological distress and injury in the absence of sufficient recovery time (Galambos, Terry, Moyle, & Locke, 2005; Grove, Main, & Sharp, 2013).

The undergoing of life events, such as break-ups, vacations and death of loved ones, causes the body to adapt and, therefore, leads to stress on the body and an increased risk for injuries (Williams & Andersen, 1998). The stress from many minor daily problems, irritations or changes may contribute to stress levels and injury risk as well (Williams & Andersen, 1998). A study within professional soccer players also indicated that negative-life-event stress and daily hassle were significant predictors of injuries (Ivarsson, Johnson, & Podlog, 2013). To rule out some of these possible explanations it is useful to take the life events, daily hassles and the hours of training last year/before they enrolled in the Codarts programme, into account as well. A sudden high impact on the body when increasing the training load rapidly can result in overtraining and injuries (McArdle et al., 2010).

In further research it can also be useful to look specifically into risk behaviour instead of (Big Five) personality factors. The connection between risk behaviour and injuries has been seen within sports in a review of Junge (2000) and some empirical studies (Bouter, Knipschild, Feij, & Volovics, 1988; Smith, Ptacek, & Smoll, 1992). However, Junge stated that injured athletes possess a certain readiness to take risks, whereas Bouter et al. and Smith et al. stated that injured athletes scored lower on sensation seeking. Sensation seeking then works as a protective factor against certain forms of life stress. To make sure that this 'readiness to take risks' is the determining factor of personality on stress, and to gather more information about the direction of this association it is recommended to test this relationship separately, preferable with a prospective design.

Practical recommendations

The results showed that pain and injuries occur repeatedly in the students of Circus Arts. The mean pain score was relatively the same as reported in dance: 4.2 versus 4.9 (Miletic, Sekulic, & Ostojic, 2007; Weigert, 2005), and 4.2 versus 3.15 – 4.9 (Miletic & Miletic, 2011). But, the mean score of pain was never zero, which means that there was always at least one student with pain in the classes. Literature showed that pain can increase and ultimately lead to absence and dropouts. It is important, for the students' sake and for the school, to take pain complaints very seriously in order to prevent drop-outs and high health costs. The data on previous injuries also indicate that injures are very frequent within the students of Circus Arts. Sports literature and the trend shown in this study indicated that previous injury is a risk factor for sustaining a new injury. Paying more attention to students with previous injuries is important to avoid re-injury. Monitoring these students can help interfere on time when a student is overloading or not ready to fully participate in classes. Training with pain and injuries may compromise learning (by having to adjust the training every time) and injuries can be the end of a (potential) career as professional artists.

Causality cannot be proven in this study, but based on our results and theory of, for instance, the 'Stress and Injury model' (Williams & Andersen, 1998) it can be expected that the relationship between stress and pain is directed from stress to pain. The stress response is crucial in determining whether injuries will appear.

From psychological point of view it is more reasonable to look into lowering stress levels than lowering pain levels. Lowering pain levels is also possible, by for instance using medication, better preparing the body on the workload or by improving the recovery period due to different treatments, but that goes beyond the scope of this study. As Williams and Andersen (1998) suggested, stress management techniques could be used as interventions aimed at reducing stress responsivity and vulnerability and, consequently, the injury risk. According to Williams and Andersen an intervention should focus either on altering the cognitive appraisal of potentially stressful events or modifying the physiological and attentional aspects of the stress response. Kerr and Goss (1996) introduced a stress

inoculation programme of 16 individual sessions on bi-weekly basis and showed that stress management had effect on reducing stress and appeared to have effect on lowering injury outcome within gymnasts. The program contained thought control, positive self-statements, refocusing, relaxation, imagery, cue plans for skills and routines and more. A different approach based on the same inoculation training (Meichenbaum, 1985) used in the study of Maddison and Prapavessis (2005) within rugby players indicated a reduction in injury risk. They developed a structured Cognitive Behavioural Stress Management (CBSM) approach over six group sessions during a 4-week preseason period. The following factors were included: progressive muscle relaxation, autogenic techniques, imagery, cognitive restructuring, goal setting and event planning.

Another recommendation, based on our results and theory derived from literature, is to help students develop coping skills. Stress management and relaxation programs may increase coping skills which result in lower injury risk (Johnson et al., 2005). The intervention program for high injury-risk soccer player used by Johnson and colleagues consisted of training in six mental skills (somatic and cognitive relaxation, stress management skills, goal setting skills, attribution and self-confidence training) over 6-8 sessions during 19 weeks. An intervention program focusing on strategies for improving attention, such as mindfulness, could also decrease injury risk (Johnson, Andersen, Fallby, & Altemyr, 2015). They did not find any significant results, but there was a medium effect size and 67% of the soccer players of the intervention group remained injury free in comparison to 40% in the control group.
A broad-based coping skills intervention, including autogenic training, imagery and self-talk enhanced coping skills and reduced injury duration by ballet dancers (Noh et al., 2007). It was an intensive intervention, three times a week for 12 weeks for 40 minutes each session. The instructions were done in groups, but participants had to practice the interventions individually.
Our results indicate that it can be important for students to learn how to concentrate and focus, despite all kind of distractions. For the subscale freedom from worry it can be important that students do not put pressure on themselves by worrying about bad performances and mistakes. By increasing their self-efficacy through positive and reinforcing feedback, as well as by creating an atmosphere of trust and openness to express their feelings they can decrease the level of worry (Johnson & Ivarsson, 2011).
An intervention about stress management, coping resources, self-efficacy and other mental aspects could be a good suggestion for the curriculum of the students.

Conclusion

Our study showed that that the burden of injuries and pain is high in circus students. Furthermore, high stress levels are associated with high pain levels, while high coping resources (total, concentration and freedom from worry) are correlated with low pain levels. Mean stress levels could predict 28.2% of

the variance in mean pain levels. Non-significant results were found between personality (extraversion, neuroticism, conscientiousness and openness to experience), previous injuries and pain.
Further research is needed to better unravel the association and causality between psychological factors and pain. These studies should include more participants and when measured longitudinal, more information can be gathered about the sequence of the variables. Eventually, studies should focus on the effectives of psychological interventions (i.e. stress management and mental/coping skills training) on the prevention of pain.
The results and theory derived from literature indicate that it can be useful to lower stress levels of the students, for instance, by teaching them stress management skills. It is also recommended to raise the coping resources of the students, for instance, by giving lectures about coping and other mental skills.

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Attachment A: Questionnaires

Questionnaire injury registration Codarts Circus 2014-2015

The students completed this questionnaire in December. The second part of this questionnaire (question 10 and further) has been handed out every three months during the academic year (December, March, June).

I. General questions

1. What is your student number: ……
2. What is your gender?
   - □1 Male
   - □2 Female

3. Date of birth -------- - -------- - --------- (day – month – year)

4. What is your major?
   - □1 Juggling
   - □2 Aerials (trapeze / rope / silk / hoop)
   - □3 Acro (floor / partner / dance)
   - □4 Cyr Wheel
   - □5 Trampoline/ Bascule
   - □6 Chinese pole
   - □7 Other, …….

5. In which study year are you?
   - □1 1st year
   - □2 2nd year
   - □3 3rd year
   - □4 4th year

6. In the last three months, how much time did you spend on circus activities per week? Please fill in the average hours per week:
   - A. Codarts education ……. hours per week
   - B. Study hours in own spare time ……. hours per week
   - C. Work ……. hours per week

II. Health

7. In general, would you say your health is
   - □1 Poor
   - □2 Fair
   - □3 Good
   - □4 Very Good
   - □5 Excellent

8. Did you sustain an injury this past year (study year 2013 – 2014)?
   - □1 Yes -> Please go to question number 9
   - □2 No -> Please go to question number 10

9. What kind of injury/injuries did you sustain this past year (study year 2013 – 2014)?

	Body region	Short description of injury/complaint (diagnosis)	Duration *(weeks)*
1.			
2.			
3.			
4.			
5.			

10. Did you sustain an injury during the past three months (September, October, November)?

An injury is defined as: Any physical complaint resulting in a full time loss of activity (participation in a class, rehearsal, or performance) for one or more days beyond the day of onset.

- □1 Yes -> Please go to question number 11
- □2 No -> Please go to question number 18

The next questions refer to your most serious injury.

11. Date of injury onset: ___ - ___ - 2014

12. Date of injury recovery: ___ - ___ - 2014
    - □1 I am not fully recovered from this injury yet

13. Was it a traumatic or overuse injury?
    - □1 Traumatic injury
    - □2 Overuse injury

14. Was it a new injury or a recurrent injury?
    - □1 New injury
    - □2 Recurrent injury -> Date of recovery previous injury: ___ - ___ - 2014

15. What was the injury location?

    Head and neck:
    - □1 Head / face
    - □2 Neck / cervical spine

    Upper limbs:
    - □3 Shoulder
    - □4 Clavicula
    - □5 Upper arm
    - □6 Elbow
    - □7 Forearm
    - □8 Wrist
    - □9 Hand / finger / thumb

Trunk	□10 Sternum / ribs □11 Upper back □12 Abdomen □13 Lower back / sacrum □14 Pelvis
Lower limbs	□15 Hip □16 Groin □17 Thigh □18 Knee □19 Lower leg □20 Achilles tendon □21 Ankle □22 Foot / toe

16. What was the injury type?

Fractures and bone stress	□1 Fracture □2 Other bone injuries
Joint (non-bone) and ligament	□3 Dislocation / sublocation □4 Sprain / ligament injury □5 Lesion of meniscus or cartilage
Muscle and tendon	□6 Muscle rupture □7 Muscle tear □8 Muscle strain □9 Muscle cramps □10 Tendon injury □11 Tendon rupture □12 Tendinosis □13 Bursitis
Contusions	□14 Haematoma □15 Contusion / bruise
Laceration and skin lesion	□16 Abrasion □17 Laceration
Control / peripheral nervous system	□18 Concussion (with or without consciousness) □19 Nerve injury
Other	□20 Dental injuries □21 Other injuries

17. Did you sustain another injury during the last three months (September, October, November)?

□1 Yes -> Please ask for an extra injury registration form

□2 No

18. Do you have any remarks about this questionnaire?

□1 No

□2 Yes, namely

……

……

Thank you for filling in this first questionnaire!

The 100-Item IPIP Big-Five Factor Markers

How Accurately Can You Describe Yourself?

Describe yourself as you generally are now, not as you wish to be in the future. Describe yourself as you honestly see yourself, in relation to other people you know of the same sex as you are, and roughly your same age. So that you can describe yourself in an honest manner, your responses will be kept in absolute confidence. Indicate for each statement whether it is 1. Very Inaccurate, 2. Moderately Inaccurate, 3. Neither Accurate Nor Inaccurate, 4. Moderately Accurate, or 5. Very Accurate as a description of you.

		Very Inaccurate	Moderately Inaccurate	Neither Accurate Nor Inaccurate	Moderately Accurate	Very Accurate
1.	I'm the life of the party.	**O**	**O**	**O**	**O**	**O**
2.	I insult people.	**O**	**O**	**O**	**O**	**O**
3.	I'm always prepared.	**O**	**O**	**O**	**O**	**O**
4.	I get stressed out easily.	**O**	**O**	**O**	**O**	**O**
5.	I have a rich vocabulary.	**O**	**O**	**O**	**O**	**O**
6.	I often feel uncomfortable around others.	**O**	**O**	**O**	**O**	**O**
7.	I'm interested in people.	**O**	**O**	**O**	**O**	**O**
8.	I leave my belongings around.	**O**	**O**	**O**	**O**	**O**
9.	I'm relaxed most of the time.	**O**	**O**	**O**	**O**	**O**
10.	I have difficulty understanding abstract ideas.	**O**	**O**	**O**	**O**	**O**
11.	I feel comfortable around people.	**O**	**O**	**O**	**O**	**O**
12.	I'm not interested in other people's problems.	**O**	**O**	**O**	**O**	**O**
13.	I pay attention to details.	**O**	**O**	**O**	**O**	**O**
14.	I worry about things.	**O**	**O**	**O**	**O**	**O**
15.	I've a vivid imagination.	**O**	**O**	**O**	**O**	**O**
16.	I keep in the background.	**O**	**O**	**O**	**O**	**O**
17.	I sympathize with others' feelings.	**O**	**O**	**O**	**O**	**O**
18.	I make a mess of things.	**O**	**O**	**O**	**O**	**O**
19.	I seldom feel blue.	**O**	**O**	**O**	**O**	**O**
20.	I'm not interested in abstract ideas.	**O**	**O**	**O**	**O**	**O**
21.	I start conversations.	**O**	**O**	**O**	**O**	**O**
22.	I feel little concern for others.	**O**	**O**	**O**	**O**	**O**
23.	I get chores done right away.	**O**	**O**	**O**	**O**	**O**
24.	I'm easily disturbed.	**O**	**O**	**O**	**O**	**O**
25.	I've excellent ideas.	**O**	**O**	**O**	**O**	**O**
26.	I've little to say.	**O**	**O**	**O**	**O**	**O**
27.	I've a soft heart.	**O**	**O**	**O**	**O**	**O**
28.	I often forget to put things back in their proper place.	**O**	**O**	**O**	**O**	**O**
29.	I'm not easily bothered by things.	**O**	**O**	**O**	**O**	**O**
30.	I do not have a good imagination.	**O**	**O**	**O**	**O**	**O**
31.	I talk to a lot of different people at parties.	**O**	**O**	**O**	**O**	**O**

32.	I'm not really interested in others.	**O**	**O**	**O**	**O**	**O**
33.	I like order.	**O**	**O**	**O**	**O**	**O**
34.	I get upset easily.	**O**	**O**	**O**	**O**	**O**
35.	I'm quick to understand things.	**O**	**O**	**O**	**O**	**O**
36.	I don't like to draw attention to myself.	**O**	**O**	**O**	**O**	**O**
37.	I take time out for others.	**O**	**O**	**O**	**O**	**O**
38.	I shirk my duties.	**O**	**O**	**O**	**O**	**O**
39.	I rarely get irritated.	**O**	**O**	**O**	**O**	**O**
40.	I try to avoid complex people.	**O**	**O**	**O**	**O**	**O**
41.	I don't mind being the center of attention.	**O**	**O**	**O**	**O**	**O**
42.	I'm hard to get to know.	**O**	**O**	**O**	**O**	**O**
43.	I follow a schedule.	**O**	**O**	**O**	**O**	**O**
44.	I change my mood a lot.	**O**	**O**	**O**	**O**	**O**
45.	I use difficult words.	**O**	**O**	**O**	**O**	**O**
46.	I'm quiet around strangers.	**O**	**O**	**O**	**O**	**O**
47.	I feel others' emotions.	**O**	**O**	**O**	**O**	**O**
48.	I neglect my duties.	**O**	**O**	**O**	**O**	**O**
49.	I seldom get mad.	**O**	**O**	**O**	**O**	**O**
50.	I've difficulty imagining things.	**O**	**O**	**O**	**O**	**O**
51.	I make friends easily.	**O**	**O**	**O**	**O**	**O**
52.	I'm indifferent to the feelings of others.	**O**	**O**	**O**	**O**	**O**
53.	I'm exacting in my work.	**O**	**O**	**O**	**O**	**O**
54.	I've frequent mood swings.	**O**	**O**	**O**	**O**	**O**
55.	I spend time reflecting on things.	**O**	**O**	**O**	**O**	**O**
56.	I find it difficult to approach others.	**O**	**O**	**O**	**O**	**O**
57.	I make people feel at ease.	**O**	**O**	**O**	**O**	**O**
58.	I waste my time.	**O**	**O**	**O**	**O**	**O**
59.	I get irritated easily.	**O**	**O**	**O**	**O**	**O**
60.	I avoid difficult reading material.	**O**	**O**	**O**	**O**	**O**
61.	I take charge.	**O**	**O**	**O**	**O**	**O**
62.	I inquire about others' well-being.	**O**	**O**	**O**	**O**	**O**
63.	I do things according to a plan.	**O**	**O**	**O**	**O**	**O**
64.	I often feel blue.	**O**	**O**	**O**	**O**	**O**
65.	I'm full of ideas.	**O**	**O**	**O**	**O**	**O**
66.	I don't talk a lot.	**O**	**O**	**O**	**O**	**O**
67.	I know how to comfort others.	**O**	**O**	**O**	**O**	**O**
68.	I do things in a half-way manner.	**O**	**O**	**O**	**O**	**O**
69.	I get angry easily.	**O**	**O**	**O**	**O**	**O**
70.	I will not probe deeply into a subject.	**O**	**O**	**O**	**O**	**O**
71.	I know how to captivate people.	**O**	**O**	**O**	**O**	**O**
72.	I love children.	**O**	**O**	**O**	**O**	**O**
73.	I continue until everything is perfect.	**O**	**O**	**O**	**O**	**O**
74.	I panic easily.	**O**	**O**	**O**	**O**	**O**
75.	I carry the conversation to a higher level.	**O**	**O**	**O**	**O**	**O**
76.	I bottle up my feelings.	**O**	**O**	**O**	**O**	**O**

77.	I'm on good terms with nearly everyone.	**O**	**O**	**O**	**O**	**O**
78.	I find it difficult to get down to work.	**O**	**O**	**O**	**O**	**O**
79.	I feel threatened easily.	**O**	**O**	**O**	**O**	**O**
80.	I catch on to things quickly.	**O**	**O**	**O**	**O**	**O**
81.	I feel at ease with people.	**O**	**O**	**O**	**O**	**O**
82.	I've a good word for everyone.	**O**	**O**	**O**	**O**	**O**
83.	I make plans and stick to them.	**O**	**O**	**O**	**O**	**O**
84.	I get overwhelmed by emotions.	**O**	**O**	**O**	**O**	**O**
85.	I can handle a lot of information.	**O**	**O**	**O**	**O**	**O**
86.	I'm a very private person.	**O**	**O**	**O**	**O**	**O**
87.	I show my gratitude.	**O**	**O**	**O**	**O**	**O**
88.	I leave a mess in my room.	**O**	**O**	**O**	**O**	**O**
89.	I take offense easily.	**O**	**O**	**O**	**O**	**O**
90.	I'm good at many things.	**O**	**O**	**O**	**O**	**O**
91.	I wait for others to lead the way.	**O**	**O**	**O**	**O**	**O**
92.	I think of others first.	**O**	**O**	**O**	**O**	**O**
93.	I love order and regularity.	**O**	**O**	**O**	**O**	**O**
94.	I get caught up in my problems.	**O**	**O**	**O**	**O**	**O**
95.	I love to read challenging material.	**O**	**O**	**O**	**O**	**O**
96.	I'm skilled in handling social situations.	**O**	**O**	**O**	**O**	**O**
97.	I love to help others.	**O**	**O**	**O**	**O**	**O**
98.	I like to tidy up.	**O**	**O**	**O**	**O**	**O**
99.	I grumble about things.	**O**	**O**	**O**	**O**	**O**
100.	I love to think up new ways of doing things.	**O**	**O**	**O**	**O**	**O**

The ACSI-28: Assessing Your Sport Psychological Skills

The following are statements that athletes/performers have used to describe their experiences. Please read each statement carefully, and then recall as accurately as possible how often you experience the same thing. There are no right or wrong answers. Do not spend too much time on any one statement.

Please circle how often you have these experiences when performing. Please make sure that you fill in every question and that you choose only one answer each time. The questionnaire continues on the next page.

Participant number: …….

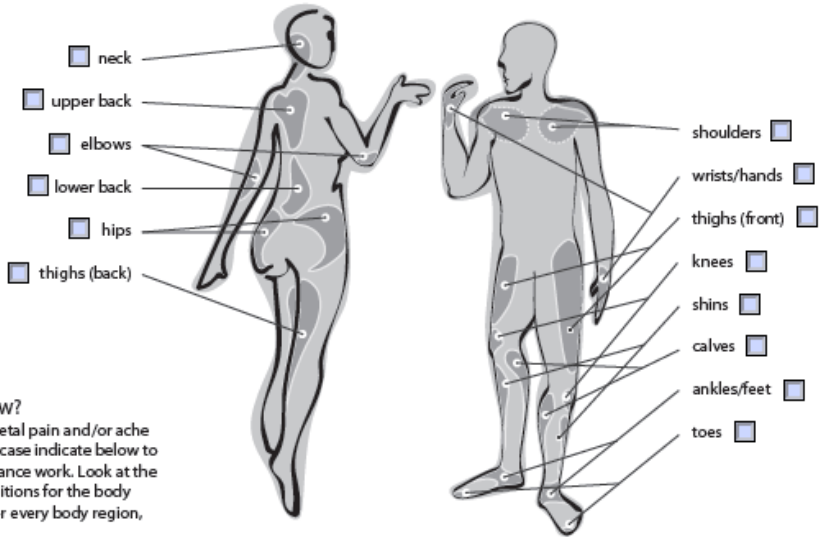
		Almost never	Sometimes	Often	Almost always
1.	On a daily or weekly basis, I set very specific goals for myself that guide what I do.	**O**	**O**	**O**	**O**
2.	I get the most out of my talent and skill.	**O**	**O**	**O**	**O**
3.	When a teacher tells me how to correct a mistake I've made, I tend to take it personally and feel upset.	**O**	**O**	**O**	**O**
4.	When I'm performing, I can focus my attention and block out distractions.	**O**	**O**	**O**	**O**
5.	I remain positive and enthusiastic during performing, no matter how badly things are going.	**O**	**O**	**O**	**O**
6.	I tend to perform better under pressure because I think more clearly.	**O**	**O**	**O**	**O**
7.	I worry quite a bit about what others think of my performance.	**O**	**O**	**O**	**O**
8.	I tend to do lots of planning about how to reach my goals.	**O**	**O**	**O**	**O**
9.	I feel confident that I will perform well.	**O**	**O**	**O**	**O**
10.	When a teacher criticizes me, I become upset rather than feel helped.	**O**	**O**	**O**	**O**
11.	It is easy for me to keep distracting thoughts from interfering with something I am watching or listening to.	**O**	**O**	**O**	**O**
12.	I put a lot of pressure on myself by worrying about how I will perform.	**O**	**O**	**O**	**O**
13.	I set my own performance goals for each class.	**O**	**O**	**O**	**O**
14.	I don't have to be pushed to practice; I give 100%.	**O**	**O**	**O**	**O**
15.	If a teacher criticizes or yells at me, I correct the mistake without getting upset about it.	**O**	**O**	**O**	**O**
16.	I handle unexpected situations in my specialty very well.	**O**	**O**	**O**	**O**
17.	When things are going badly, I tell myself to keep calm, and this works for me.	**O**	**O**	**O**	**O**

		Almost never	Sometimes	Often	Almost always
18.	The more pressure there is during a performance, the more I enjoy it.	**O**	**O**	**O**	**O**
19.	While performing, I worry about making mistakes or failing to come through.	**O**	**O**	**O**	**O**
20.	I have my performance worked out in my head long before the show starts.	**O**	**O**	**O**	**O**
21.	When I feel myself getting too tense, I can quickly relax my body and calm myself.	**O**	**O**	**O**	**O**
22.	To me, pressure situations are challenges that I welcome.	**O**	**O**	**O**	**O**
23.	I think about and imagine what will happen if I fail or screw up.	**O**	**O**	**O**	**O**
24.	I maintain emotional control regardless of how things are going for me.	**O**	**O**	**O**	**O**
25.	It is easy for me to direct my attention and focus on a single object or person.	**O**	**O**	**O**	**O**
26.	When I fail to reach my goals, it makes me try even harder.	**O**	**O**	**O**	**O**
27.	I improve my skills by listening carefully to advice and instruction from teachers.	**O**	**O**	**O**	**O**
28.	I make fewer mistakes when the pressure is on because I concentrate better.	**O**	**O**	**O**	**O**

Bi-weekly Pain and Stress questionnaires

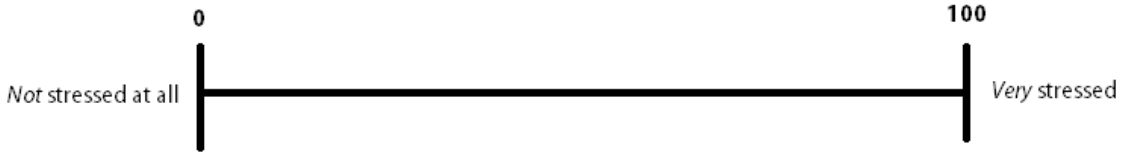
Please fill in the next questions honestly and accurately. There are no right or wrong answers. All the answers will be used **anonymous**. Your details will not be reducible back to you.
On the line at the bottom you can fill in how stressful you are just now. The line is like a thermometer, starting at 0 and going to 100. Put a line/cross how stressed you are at the moment.

Date: …….. Participant number:……



How do you feel just now?
Do you have any musculoskeletal pain and/or ache right now (today), and in that case indicate below to what extent it disturbs your dance work. Look at the picture above to see the definitions for the body regions, and check one box for every body region, please.
Thank you.

Body region:	Estimation					Comments (optional):
	Very well	Some pain but not much problem	Pretty much pain but I can handle it	Much pain, must avoid some movements	Can not work in the production because of pain	
neck	☐	☐	☐	☐	☐	
upper back	☐	☐	☐	☐	☐	
elbows	☐	☐	☐	☐	☐	
lower back	☐	☐	☐	☐	☐	
hips	☐	☐	☐	☐	☐	
thighs (back)	☐	☐	☐	☐	☐	
shoulders	☐	☐	☐	☐	☐	
wrists/hands	☐	☐	☐	☐	☐	
thighs (front)	☐	☐	☐	☐	☐	
knees	☐	☐	☐	☐	☐	
shins	☐	☐	☐	☐	☐	
calves	☐	☐	☐	☐	☐	
ankles/feet	☐	☐	☐	☐	☐	
toes	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	



Attachment B: Participant letter and informed consent

codarts
rotterdam

for you student life by codarts

RESEARCH THESIS: Risk factors for sustaining an injury within Circus Arts
In close collaboration with professorship Performing Arts Medicine and Student Life

March 2015

Dear students,

My name is Diana van Winden and I am a student in a Master degree in Sport-and Performance Psychology at University of Amsterdam. You are invited to take part in this research project which I am conducting as part of the requirements of my degree and is supervised by dr. Janine Stubbe (lector of Performing Arts Medicine at Codarts).

This project aims to investigate the association between psychological factors and pain. I will focus on the relationship between personality traits, previous injuries, coping styles (the way you handle problems and stress), perceived stress level and pain. The purpose of this research is to explore risk factors for sustaining an injury. Codarts will use this information to improve students' health and wellbeing and performance and to prevent injuries among students at Circus Arts.

Codarts Rotterdam attaches great importance to healthy students. Health plays a very important role in allowing students to perform at their maximal capacity for as long as possible.
Injuries can be highly disadvantageous for circus students, since they can lead to physical discomfort, medical treatment and absence from classes, rehearsal and performance. To prevent physical complaints, more insight into the prevalence, nature and risk factors of injuries is needed.

All first and second year students of Circus Arts are invited to participate in this research project. Participation is voluntary and you can withdraw at any time. All the data collected during this project will be handled strictly confidential and will be coded so that you remain anonymous. The key for the coded data will be in possession of the investigators and will not be given to someone else. Teachers or others will not know which answers you gave. I do not anticipate any risks associated with participating in this study. If you decide not to (further) participate in this project, this will not affect your education in any way.

Taking part in this research project requires very little time and effort. Prior to the start of this research, all students complete a baseline questionnaire with items regarding personality, coping and previous injuries. Subsequently, a short stress and pain questionnaire will be administered on a two weekly basis for a period of three months which will take approximately five minutes to complete. You will be given time during the physical preparation lessons to complete the questionnaires. The

questionnaires used in this study will replace questionnaires that some of you already have been completing for Janine Stubbe.

I would like to emphasize that this research is of utmost importance to Codarts and most importantly for your own professional development and future. The results will give more insight in the number, characteristics and risk factors of injuries among Circus Arts students. In the future Codarts will use this information to develop intervention strategies to prevent injuries.
I kindly ask you to please sign the enclosed informed consent form and returning it to me or to Nikolay Pyasta.
If you have any questions or concerns, please do not hesitate to contact me.

Thank you in advance for your participation.

Kind regards,

Diana van Winden
Intern Student Life
E dvanwinden@codarts.nl
T +31 621209911
Codarts Rotterdam
Kruisplein 26, 7th floor
3012 CC Rotterdam
The Netherlands
www.codarts.nl

If you have any questions, complaints or comments for the Ethic Committee please contact:
prof dr Richard Ridderinkhof
University of Amsterdam
Room: A 1013
T 020 - 525 6119
E K.R.Ridderinkhof@uva.nl

Informed Consent

This form is part of the information letter that you received about the research that will be performed among the first and second year students of Circus Arts at Codarts. With signing this form you declare that you've read and understand the participant information. You agree with the procedure of the research as is written in the information letter.
If you want more information about the study you can contact Diana van Winden (dvanwinden@codarts.nl; +31 621209911) or Janine Stubbe (jhstubbe@codarts.nl).

[PARTICIPANT]
"I've read the information and give permission for participation at this research and the use of the received data. I will contain the right to withdrawal this permission without reason and the right to quit with this project when I want."

Date:

……... ……
name participant signature

[RESEARCHER]
"I've given information and an explanation about the study. I declare to be open for questions about the study."

Date:

……... ……
name researcher signature