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Research Article

Anxiety and Mood among Ballet Dancers: A Pilot Study on Effects of a Medical Approach Involving Periodic Intervention

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Abstract

Ballet dancers' risk of injury is high if their state anxiety is high before a public performance. This research investigated the relationship between psychological factors and a medical approach to injury prevention for adolescent ballet dancers in Japan.

Participants were 44 elite adolescent ballet dancers (41 females, 3 males, age range 18.0-21.2 years) who were administered the State-Trait Anxiety Inventory (STAI), Brunel Mood Scale (BRUMS) once every two weeks for approximately one year. We divided the year into three terms according to performance competitions. The first term included the first half of the intervention, the second term followed an interruption for summer vacation and included the second half of the intervention, and the third term represented the interruption of the intervention. Data from 21 females were divided into High (H), Medium (M), and Low (L) state and trait anxiety groups and compared and examined.

The measure of feeling according to trait group did not change significantly across the entire period, but there were significant differences in tension and confusion between H and L State groups at times of important events. Before a public performance during the intervention interruption term, the Trait and State groups were significantly different on all mood scales. The total number of injuries also decreased. Therefore, a medical approach with the periodical possible relation is useful in order to manage performance anxiety and prevent injury.

INTRODUCTION

A systematic approach to performing arts medicine has developed in Western (American and European) countries [1,2]. A comparable medical support system does not presently exist in Japan, although recognition is growing that this is becoming necessary as the audience for the performing arts grows. Ballet demands special training for many years, and from childhood on, dancers often suffer acute injury, from which chronic injury can arise. Nevertheless, these performers are expected to continue to exhibit grace and beauty and to keep dancing in spite of injury.

Injury is a major problem for other athletic performers and there is now substantial evidence that psychological interventions can reduce injury in sports. When planning intervention programs designed to help reduce injuries to dancers, researchers and physicians should identify the major psychosocial factors that are associated with the risk of injury. But sports medicine recognizes the specific problems faced by each performer require an interdisciplinary approach, not only a psychological approach but medical treatment as well.

Anxiety, Pain, and Injury in Ballet

In ballet, if state anxiety is high before a public performance, the risk of injury is also high [3]. The negative emotional state

that accompanies feelings of nervousness includes worry and apprehension, along with activation or arousal of the body. Substantial imbalances between demand and response capability occur with failure to meet demand and have important consequences.

Professional dancers have a 90% risk of injury during their careers [4] and overuse accounts for the majority of all dance injuries (60-76%) [4-6]. Pain that results from injury is a complicated process in which the nervous system communicates important information. Pain warns dancers to pay attention to their bodies. In this investigation, we defined acute injury and chronic pain as follows: Acute injury typically demands immediate attention; for example, when a dancer comes down from a leap incorrectly and sprains her ankle. Chronic pain can be more challenging to define and to discriminate from soreness, especially for dancers, as they appear to have a higher pain tolerance than much of the general population.

When a dancer's physical balance fails, a mental stress reaction is triggered. But stress is also a consequence of the environment in which dancers practice ballet every day, which is a world of "No pain, no gain" that is characterized by perfectionism and competition. Despite constant uneasiness, dancers must accept their situation and constantly try to improve. But the factors that result in a stress reaction differ with the individual, and the outcome of the stress reaction may be different actions, understanding, and judgments about coping ability.

The Williams and Andersen model of stress and athletic injury (1998) [7] identified several psychosocial variables that may place sport players at risk of injury. For example, competitive anxiety, major life events, and coping resources have been examined in relation to injury outcome. Athletes with high competitive anxiety, many life events, and low coping resources may, when placed in stressful situations (e.g., practice, competition), exhibit substantial stress responses (e.g., generalized muscle tension, attention disruptions) that place them at higher risk of injury than athletes with opposite profiles. The number of injuries seemed to be the cleanest and most suitable variable measured in accordance with Andersen and the Williams model.

To begin, we classified ballet's special risk factors into three categories: training, organizational and psychosocial factors, and environmental factors [8]. Research work had shown that little psychological stress was experienced by actors before and during rehearsals, compared with during performances [9-11]The goal of our research was to develop a medical / mental approach for injury prevention and avoiding the 'Athlete's Triad'[12-14].We conducted a prospective study of psychological factors and injury, based on the stress-injury model in sports. Participants were 44 elite adolescent ballet dancers. We examined their injuries and administered psychological questionnaires once every two weeks for about one year in order to investigate the inter-relationships among psychological states and trait anxiety, stress, and ballet performance anxiety. To investigate the psychological correlates of dance injuries and psychological stress, we used the State-Trait Anxiety Inventory (STAI; Spielberger CD) [15,16], Brunel Mood Scale (BRUMS; Terry PC, et al.) [17,18].

BRUMS 6-factor model

A preliminary Japanese version of the Brunel Mood Scale (BRUMS)for adults was used for this research [19,20]. The BRUMS 6-factor model is a standardization of the original questionnaire about simple feelings for adolescents and adults. This BRUMS includes six 24-item measures. The positive scale is vigour and the negative scales are Tension, Depression, Anger, Fatigue, and Confusion.

This appraisal method consists of a questionnaire that asks "How are you feeling right now?" with responses made on a scale ranging from 0 (*not to all*) to 4 (*extremely*). This questionnaire can be completed in 5-10 minutes. The original BRUMS used an initial 42-item version, with a 24-item revision. To validate the Japanese Preliminary Version of the BRUMS, we used 7 items for each of the six scales, for a total of 42 items.

STAI test

The State-Trait Anxiety inventory (STAI) has demonstrated acceptable reliability and validity in student populations [15,16]. We used the Japanese version of STAI (Mizuguchi, et al.) [21]. Participants were told:"A number of statements which people have used to describe themselves are given below. Please indicate how you generally feel." They rated how often they generally experienced each of the ten items on a scale ranging from 1 (*almost never*) to 4 (*almost always*). Cronbach's α exceeded 0.90.

MATERIALS AND METHODS

Participation and procedure

This study was a single group assignment, non-randomized, time series designed trial. This study was conducted over one year (Table 1). Dance training sessions begin in April in Japan, and in the first two months of the period (April-May), only prior anamnesis was conducted. During the intervention terms, a total of 12 measurement days were scheduled once every two weeks for six months, except for the interruption periods.

Participants were 44 elite adolescent dancers (41 females; mean 18.6±0.6 years, and 3 males; mean 19.7±1.5 years) who attended the same training sessions throughout the year and were preparing to perform as a group in three major ballet competitions in August (:1), December (:2), and February (:3). As a result of screening for risk, most were identified as having injury-risk profiles. Their heights(females 159.3 ± 4.4cm, males 172.8 ± 2.8cm), weights(females 48.9 ± 5.4kg, males 62.7 ± 5.2kg), and length of ballet career (females 13.8 ± 2.0years, male 14.3 ± 3.1years) were recorded.

Ethical consideration

All participants were volunteers and provided written consent. This research was approved by means of St. Marianna University School of Medicine Clinical Test Examination (No.1282 and No. 1531).

Measures and Study protocol

The investigation procedure was as follows. Once every two weeks for 6 months (from TIME 1 to 16; see Table 1), we

Table 1: Time Schedule.

TIME No.	OUTLINE	MEDICAL CHECKUP
1	Medical Check, Usual Practice	Baseline
2	Cast Decision	
3	Increase in practice	Intervention 1
4	↓	
5	<Competition 1>	
6	Summer Vacation	Interruption 1
7	↓	
8	Usual Practice	
9	↓	
10	↓	
11	Cast Decision	Intervention 2
12	Increase in practice	
13	Increase in practice more 2-3h/day	
14	(Special Lecturer)	
15	<Competition 2>	
16	<Competition 3>	Interruption 2

Table 2: Number of cases of adolescent elite dancers with the most common ballet injuries (total).

Achilles tendonitis and Shin splints	9	(6.1%)
Ankle sprain	10	(6.7%)
Low back disorders	17	(11.4%)
Stress fracture	1	(0.6%)
Patellofemoral syndrome	0	(0.0%)
Anterior shoulder impingement (subluxation)	2	(1.4%)
Others (including Pain, Jumper's knee)	110	(73.8%)
Total	149	(cases)

administered the feelings questionnaire and the BRUMS test, and a medical questionnaire about the dancer's condition (acute/chronic injury). At the times of the three competitions , we also administered the STAI test.

We interrupted the intervention between the second and third competitions and administered the medical evaluation questionnaire and other questionnaires. These results were analyzed for associations with each other and for relationships to sports injuries.

Intervention 1: Warning Signs of Injuries

We explained the warning signs of injuries as follows:

1. Pain that gets progressively worse during class, rehearsal, workout, etc.
2. Pain that appears when executing certain movements (e.g. during arabesque or landing a jump).
3. Pain that comes after class, rehearsal, or workout and comes back the next day after less movement is done.
4. No real sense of "pain" but a definite restriction of movement.

Intervention 2: Warning Signs of Injuries &Medical treatment (after coaching about injuries)

Dancers should be concerned about arousal and anxiety because these create muscle tension and coordination difficulties as well as attention and concentration changes. During intervention 2, we devised a method for the injury prevention by summarizing the risk factors for each injury and describing how physicians treat the injuries.

1. We discussed each type of injury and pain.
2. We checked injuries and pain and recommended training guidance and a coping process.
3. We recommended going to the hospital when the injury was severe or the symptoms were acute.
4. We followed up with each person and their director if their psychological factors and mood states changed rapidly.

Statistical analysis

SPSS 21.0J for Windows was used to conduct the statistical analysis. Injury characteristics of the 44 participants were

Table 3: Correlations between BRUMS and STAI.

Pre & Intervention1		
1 BASELINE	Traits Anxiety	States Anxiety
Vigour	*0.529	*0.512
Tension	*0.503	**0.578
Depression	*0.558	*0.498
Confusion	**0.576	*0.570
Anger		*0.496
Fatigue	*0.552	*0.528

Intervention 2 (First)		
10 USUAL	Traits Anxiety	States Anxiety
Vigour		
Tension		
Depression		
Confusion		
Anger		
Fatigue		

Intervention 2 (Latter) & Interruption 3		
13 SPECIAL LECTURER	Traits Anxiety	States Anxiety
Vigour		
Tension	*0.500	*0.681
Depression		**0.669
Confusion		**0.653
Anger	*0.539	*0.503
Fatigue	*0.469	

2 CAST	Traits Anxiety	States Anxiety
Vigour		
Tension	*0.529	**0.675
Depression	*0.499	*0.540
Confusion	*0.530	**0.577
Anger	*0.479	*0.547
Fatigue	**0.554	*0.493

11 CAST	Traits Anxiety	States Anxiety
Vigour		
Tension		
Depression		
Confusion		
Anger		
Fatigue		

15 COMPE2	Traits Anxiety	States Anxiety
Vigour		*0.636
Tension		**0.808
Depression		**0.629
Confusion		**0.742
Anger		
Fatigue		

5 COMPE1	Traits Anxiety	States Anxiety
Vigour		
Tension	*0.534	*0.466
Depression	*0.512	*0.529
Confusion	*0.506	*0.516
Anger	**0.574	*0.463
Fatigue		

12 INCREASE	Traits Anxiety	States Anxiety
Vigour		
Tension	*0.682	
Depression	**0.727	
Confusion	*0.626	
Anger	*0.608	
Fatigue	**0.581	

16 COMPE3	Traits Anxiety	States Anxiety
Vigour		*-0.502
Tension	*0.495	**0.773
Depression		**0.636
Confusion	*0.457	**0.773
Anger	*0.493	**0.588
Fatigue		**0.687

tabulated. For all analyses, a p value less than 0.05 was considered statistically significant.

RESULTS AND DISCUSSION

In the one-year study period, 40 (91%) of the participants were injured, with 18 (12%) having externally caused injuries and 131 (88%) having disorders. We selected data from 21 female participants who reported 78 cases of injury and pain; however, the severity of their symptoms was slight, and all were able to continue their ballet lessons. (Table 2) shows the classification of externally caused injuries and disorders. Many of these instances were not serious, and the dancer was able to continue to attend lessons. Nineteen dancers (41%) were absent from their lessons from one to ten days (average 3 days) during this period.

Correlations between BRUMS and STAI

In ballet, after the cast determination, the practice schedule and practice time are increased in preparation for public performances. Especially during this period, foreign stage leaders instruct the dancers for 2-3 hours. A strong relationship was found between the STAI and the BRUMS on usual practice days before an intervention, the cast determination day in the early stages of the intervention, and the public performances. In the second half of the intervention, although there was no relationship with usual practice days, or cast determination days, there was a strong relationship with characteristic uneasiness on days of extended practice. Strong relationships were seen in state anxiety and mood changes one month before a public performance. From the latter of November (practice increase: TIME 12), participants had to dance for 2-3 hours more with a foreign director, and their state anxieties on the STAI and BRUMS were seen to correlate (Table 3). These correlations were evident at cast decision, and before a performance at the beginning of the intervention, whereas no correlation was found during usual practices.

Differences in Mood States by STAI

Next, participants were classified into three groups (High: H, Medium: M, and Low: L) based on their trait-anxiety and the state-anxiety scores before a public performance. A one-way analysis of variance (ANOVA) was conducted between anxiety level and the three periods (Intervention 1, Intervention 2, and Interruption 2). Results indicated no significant difference in any of the measures of trait-anxiety in the three groups. However, there were significant differences in state anxiety of the three

Table 4: Differences in Mood States (BRUMS by State-Anxiety Groups).

TIME	DATE	Vigour				Tension				Depression			
		H	M	L		H	M	L		H	M	L	
1	BASELINE	11.57	8.67	4.33		13.86	11.33	7.83		15.00	14.00	7.83	
2	CAST	11.00	7.57	8.00		9.14	8.71	4.57		13.14	13.29	6.14	
3	INCREASE	8.57	9.67	14.43		12.00	9.83	3.71		11.71	10.00	2.43	
4	INCREASE	8.29	12.86	15.14		15.14	7.43	3.14		12.00	6.71	1.57	
5	<COMPE 1>	10.00	10.67	10.71		11.57	8.00	4.86		9.00	6.17	1.57	
11	CAST	9.43	9.00	9.75		10.86	9.00	3.75		8.43	8.00	3.50	
13	INCREASE	10.86	9.20	11.43		12.14	7.60	2.43	*	10.86	6.60	2.00	
15	<COMPE 2>	20.00	10.33	12.60		24.50	7.17	5.60	*	13.50	6.83	3.80	
16	<COMPE 3>	10.14	9.86	16.29	*	15.57	8.86	1.86	*	10.57	7.86	0.43	*

TIME	DATE	Confusion				Anger				Fatigue			
		H	M	L		H	M	L		H	M	L	
1	BASELINE	14.29	10.50	6.67		13.14	11.33	6.67		12.43	11.17	5.33	
2	CAST	13.71	9.14	4.14		11.71	10.57	5.29		12.29	9.43	5.14	
3	INCREASE	13.43	10.50	4.86		8.43	8.17	2.14		16.71	16.00	13.43	
4	INCREASE	15.71	7.29	3.86		9.43	5.29	1.00		20.29	11.86	10.71	
5	<COMPE 1>	11.71	7.17	4.00		8.14	5.00	1.43		15.29	9.67	9.86	
11	CAST	11.71	11.33	4.50		7.29	7.33	1.50		15.86	9.67	10.75	
13	INCREASE	12.57	6.20	2.86	*	7.71	5.60	1.14		12.43	10.60	8.29	
15	<COMPE 2>	19.00	7.33	5.60		9.50	7.33	4.80		17.50	11.33	8.00	
16	<COMPE 3>	15.14	8.29	2.14	*	9.14	7.14	0.29	*	18.14	8.29	5.86	*

Abbreviations: CAST; The period of cast decision, COMPE; The period of competition, USUAL; The period of usual practice, INCREASE; The period of increase in practice.
H, M, and L; High, Medium, and Low state anxiety groups. *p< 0.05.

Table 5: Incident Rate Ratio of Injuries in 44 Ballet Dancers.

Periods		TIME No.	Attendance	Injured dancers	Non-injured dancers	Total No. of Injuries	Incidence	IRR	95% CI		
									Minimum	Maximum	
Baseline		1	44	43	1	53	3.58	1.00			
Intervention 1		2	42	41	1	53	3.76	1.05	0.72	1.53	
		3	39	37	2	47	3.59	1.00	0.68	1.48	
		4	39	38	1	48	3.66	1.02	0.69	1.51	
	<COMPE 1>	5	-	-	-	-	-	-	-	-	
Interruption 1		6&7	17	15	2	24	4.20	1.17	0.72	1.90	
Intervention 2		8	29	14	15	28	2.87	0.80	0.51	1.27	
		9	22	17	5	31	4.19	1.17	0.75	1.82	
		10	17	10	17	9	1.57	0.44	0.22	0.89	*
		11	22	19	3	18	2.44	0.68	0.40	1.16	
		12	23	20	3	11	1.42	0.40	0.21	0.76	*
		13	34	34	0	9	0.79	0.22	0.11	0.45	*
		14	26	22	4	10	1.14	0.32	0.16	0.63	*
	<COMPE 2>	15	-	-	-	-	-	-	-	-	
Interruption 3	<COMPE 3>	16	-	-	-	-	-	-	-	-	

Abbreviations: Incidence values are the number of injuries per 1000 hours of ballet dance (95% confidence interval).
IRR is incidence rate ratio. 95% CI is 95% confidence interval. *p<0.05.

groups before a public performance ($p<0.05$) (Table 4).The mean trait anxiety in this group was 51.3±9.7 points, whereas the Japanese mean is 34-44 points, and state anxiety was 50.4±9.8 points, whereas the Japanese is 31-41points. In all instances of State Anxiety, there were differences in tension between High- and Low-score groups as measured by STAI. Moreover, the trait and performance anxiety of most participants were high compared to the mean scores of Japanese people. In dancers with high state anxiety before a performance, a significant difference in mood was observed for performances before the interruption of the intervention. In the group with high state anxiety, a significant difference in strain and depression was observed with increased practice time. (Table 4) suggest that participants with particularly high state anxiety before a public performance in the second half of the intervention and before the interruption of the intervention experienced significantly large mood swings. This suggests that medical management and support with periodical interventions should stabilize dancers with high state anxiety. Moreover, mood swings caused by emotional stress reactions should be avoided as a result of such support. The repeated measures ANOVA indicated that the traits scale was not significantly related to any of the other scales. The state scales showed significant differences according to the importance of an event. This could be the reason that traits/state anxiety scores (51.3 ± 9.7 pt. /50.4 ± 9.8pt.; 5/5categories) were higher in all dancers than in the general population. High trait anxiety was also associated with high personal states in Japanese dancers.

Profile of Mood States (BRUMS Total)

A time series graph of the period of the investigation is shown in (Figure 1). The pink time-axis represents a cast determination day. The green time axis represents days before a public performance, and the light blue time axis is the period during the summer vacation, when the intervention was temporarily interrupted. (In addition to this, there were interruptions during the 2nd and the 3rd public performances.) The pink time axis in the early half of the intervention and the second half of the intervention were compared. Cast decision days and intervention periods resulted in significant differences in fatigue, anger, and depression scales. This could have been related to the intensity of performance and practice, and the fatigue scale showed improvement towards the second half of the year. A significant decrease was also observed for measures of depression and anger ($p<0.05$).Time-axis comparison on the days preceding a public performance, before the interruption of the intervention, was conducted for the early stages of the intervention versus the second half of the intervention. There were no particular significant differences for the days before these 3 public performances. There were also no particular significant differences in feelings between the time-axes before a public performance, which is an event day. Repeated measures ANOVA of time × measure conducted for the early stages of the intervention indicated significant differences resulting from time, even before a public performance ($p< 0.05$). Especially compared to normal days, events such as cast determination day, days of

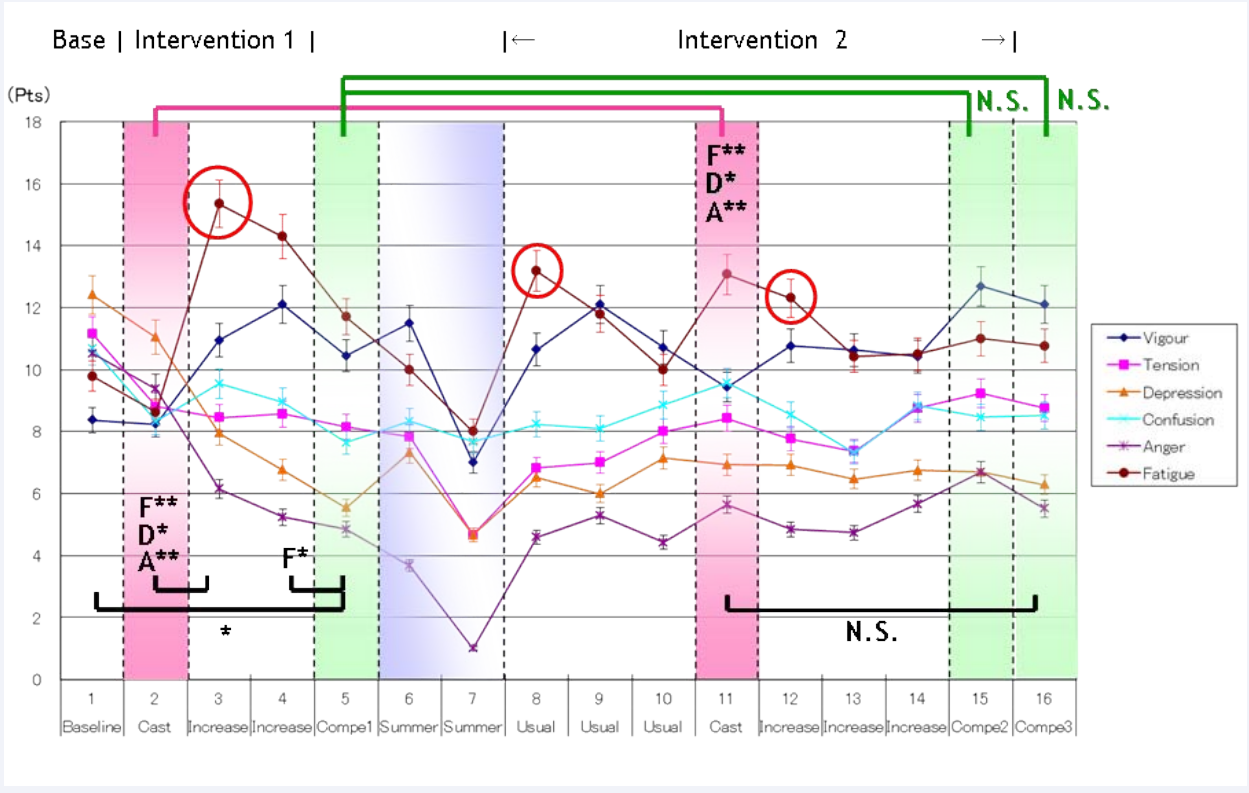

Figure 1 Profile of mood states (BRUMS Total).

increased practice, and the day before a public performance had an effect. However, the ANOVA indicated no significant time × measure differences in the second half of the intervention. Therefore, it was concluded that mood swings decreased in the second half of intervention. The amount of practice increased and the number of performances increased in the latter half of the year. However, anger and depression was lower and the mood states of the participants were steady in the latter half of year. In support of Andersen and Williams' model, high competitive trait anxiety and tension/anxiety were significantly related to the injury rate, while tension/anxiety, anger/hostility, and total negative mood states were significantly related to severity of injury. High competitive trait anxiety also played a significant role in the degree of tension/anxiety, anger/hostility, and total negative mood state assessed by BRUMS.

Injury Recording in Ballet

In the baseline period, we only inquired about the injuries experienced by the participants. After the intervention, we checked on their injuries and pain, and gave guidance for training and coping. We referred participants to a hospital when the injuries were severe or when they had symptoms of anxiety. In accordance with the stress and injury model of Williams and Andersen (1998), ballet dancers who received an intervention in this period had dramatically lower injury rates from the first of baseline (3.58/1000h) to the last of intervention (1.14/1000h) (Table 5). And we hardly examined a sign said to be athlete's triad as stress fractures, anorexia nervosa and Amenorrhea in them.

CONCLUSION

Our approach improved dancers' psychological and physical condition through biweekly interventions for 6 months. Moreover, this psychological and medical approach was effective for injury prevention. These effects were evident in the latter stages of the intervention, especially when dancers' communications with each other improved. After an interruption of two months, there were significant psychological changes in dancers, especially in those with high anxiety. This suggests that it is necessary and useful for dancers to undergo regular medical care. Dancers with high anxiety scores before a competition might be at risk of injury. In the future, psychological coaching and medical management is recommended for amateur Japanese dancers during their tight performance schedule. We intend to build on this study by expanding and continuing the support provided for the participants.

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