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Effects of Interactive Musical Activities on the Well-being of Children with Urogenital Anomalies during Hospitalization for Surgery

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Abstract
Background: Hospitalizations and surgeries are stressful situations mainly for children. It is extremely important to search for strategies that can help to reduce suffering and stress in children during medical treatments, contributing then to the process of humanization in health care. Due to the therapeutic potential of music, we believe that it could be an alternative to help children to cope better with the situation of anxiety and stress arising from a hospitalization. This research intended to evaluate the effect of interactive musical activities in reducing stress in children hospitalized for urological surgery. *Methods*: Fifty-four children were invited for the study of which 40 participated. Twenty-two of those were part of the experimental group and 18 of the control group. The experimental group participated in 15 to 30 minutes daily sessions of playful interactive musical activities during hospitalization (~5 days), except on the day of surgery. The Child Stress Scale - ESI, the drawing-and-story procedure for analysis of the feelings towards surgery and salivary cortisol at 8:00 AM and 4:00 PM were used to evaluate the degree of stress in these children. *Results*: The stress score obtained before and after surgery significantly decreased in both groups, mainly in the experimental group. There was no significant difference in positive and negative feelings towards the surgery in both groups. Salivary cortisol levels between the 2 groups were also similar. *Conclusion*: A positive effect of musical activities in children's stress reduction during the hospitalization period was observed, indicating that these procedures can contribute to the well-being of these patients.
Keywords: Hospitalized child, Music, Stress, Music therapy, Urogenital abnormalities/surgery

1. Introduction

Despite the name, hospitals tend to be inhospitable. The architecture, the predominance of white walls and clothes of professionals, the presence of noisy equipment and the use of technical language are all factors that might be overwhelming for children (Ferreira et al., 2006). Treatments that require prolonged hospitalization and surgical procedures are even more stressful for them (Trinca, 2013). Many initiatives have been taken to alleviate this suffering, such as fruit flavored medicines, televisions in the hallways, and walls in soft tones decorated with children's themes. However, hospital environments still look very threatening for children (Nigro, 2004). It is very important to search for strategies that can help to reduce suffering and stress in children during medical treatments, contributing then to the process of humanization in health care.

In recent years, music has been increasingly used as a therapeutic tool in the treatment of different diseases (Trappe, 2012, McDermott et al., 2014, Robb et al., 2014). The therapeutic potential of music has been an alternative to help children cope better with anxiety and stress due to hospitalization (Nilsson, 2008, Nilsson et al., 2005, Trappe, 2012).

Just like in adults, children stress is characterized by physical and psychological factors, and excessive stress may cause serious health problems (Lemes et al., 2003).

Additionally, stress reduction can reflect in greater cooperation of the child towards the treatment and in reducing the risk of a negative influence in their overall development, since the child's loss of control over their own body or the environment facilitates the occurrence of traumas (Jarred, 2003).

It's necessary to consider not only the disease, but also the hospitalization as a factor that may cause painful emotions and feelings (Ferreira et al., 2006, Nigro, 2004). Hospitalization takes children away from their family environment and subjugates them to a series of procedures over which they have no control. These experiences can help raise levels of fear, anxiety and uncertainty and may disrupt their social and academic development. The younger the child, the lower their ability to understand the situation and the greater the impact of hospitalization in their development (Wolfe and Waldon, 2009). It is important that health professionals be

aware that the disease affects the child as a whole, compromising their integrity and their emotional development (Chiattone, 2003). Hospitalized children need support and encouragement (Lathom, 2002).
Several factors affect how the child deals with the situation of hospitalization: age, cognitive development, relationship with parents, previous experience, temperament and individual coping strategies (Robb, 1999). Also, stress in hospitalized children is related to fear of medical procedures and misconceptions about the disease and its treatment (Robb, 1999).
During the period of hospitalization, pediatric patients are faced with many idle hours during the day, which may extend until late at night in the case of teens, that can be filled with anxiety (Hannan, 2008). Music requires an engagement of the individual at the time of its execution and has the ability to change the perception of time, providing distraction: for a moment the person is able to forget reality and their concerns (Gousie).
In the process of humanization, music is very important and is used mainly in childcare (Corrêa and Guedelha, 2009). In hospital environments the communication of emotions involves additional aspects, such as the presence of pain, fear of death and stress from long hospitalization. Music can help patients cope better with this situation by offering them opportunities for self-expression, and bringing positive experiences (Stanczyk, 2011).
In a previous study, the use of music for stress reduction was more effective in surgical patients than in patients undergoing less invasive medical procedures (Kemper and Danhauer, 2005).
Other studies suggested that music can be a good adjunct in the reduction of stress, improvement of the mood of patients, reduction in the dosage of sedatives during medical procedures, improvement of the quality of life of people undergoing cancer treatment, and in providing comfort to patients (Awikunprasert et al., 2012, Cassileth et al., 2003, Koelsch et al., 2011, Kulkarni et al., 2012, Silva and Sales, 2013).
However for the use of music, previous planning is needed, and the characteristics of the target audience should be taken into account (Hatem et al., 2006). The music therapy can be active (interactive), when people play instruments, sing, and directly participate in the process of making music; or receptive, when the work is based on the listening. In a stress reduction survey with children, they showed dissatisfaction when required to remain seated and listening to unfamiliar music, possibly indicating that they prefer more active ways of coping with stress (Kemper et al., 2008). One of the advantages of interactive music therapy with music played "live" is that it allows a more personalized way of musical expression (Barrera et al., 2002). It enables changes and improvisation, such as adapting the songs to the child's needs at each moment. In addition, children at this age benefit from opportunities to make choices and be able to play imaginatively, a fact that makes the importance of interactivity in music sessions even more evident (Robb, 1999).
Many studies have connected music with stress reduction; however the effect of interactive musical interventions in children with urogenital anomalies in the age group 7-14 years has not been described yet.
This research intended to evaluate the effect of interactive musical activities in reducing stress in children hospitalized for urological surgery.

2. Subjects and Methods

2.1 Subjects

The study included 40 children, aged 6-14 years who were hospitalized for urological surgery in the Endocrinology and Uropediatrics wards of Clinical Hospital of the University of São Paulo, Medical School (HCFMUSP). A total of 54 children were invited, out of which 14 were excluded: 3 due to lack of data, 5 for cancellation of surgeries, 2 for early discharge, 2 for not understanding the proposal and two teenagers who were not interested in participating in the research.
These 40 children were divided into two groups: the experimental group, participant in the interactive music sessions, and the control group, which was not exposed to musical activities.
For all children in the control group, after the last data collection a music session was offered.

2.2 Measurements

To measure the stress in the pre and postoperative periods, the Child Scale of Stress (ESI) and the drawing-and-story procedure (DE) were always used, before the music sessions. Samples were also collected for determination of salivary cortisol levels. Cortisol is also known as the stress hormone, it consists of a biomarker that allows us to objectively measure this phenomenon that involves psychological and physiological factors. This is a painless and non-invasive test, very appropriated for children studies. The collection times were chosen based on the circadian rhythm of cortisol, avoiding the midnight sample collection. In the postoperative period, after the last music session, questionnaires were administered to children and parents who were participating in the experimental group, for evaluating musical interventions.

2.3 Protocol

This was a randomized study, alternating a child for each group, experimental (with music) and control (no music). When two children shared the same room, both were included in the same group.

All participants, children and their guardians signed an informed consent. This study was approved by the Ethics Committee for Analysis of Research Projects (CAPPesq), being approved on 05/08/2013 under protocol number 266 631.

The Child Stress Scale - ESI, Lipp & Lucarelli (Lipp and Lucarelli, 1998) was used on the first day of hospitalization and at the most on the fifth day after surgery. This test can be applied in children aged 6-14 years. It has 35 items in Likert scale from 0 to 4 points, grouped into four factors: physical reactions, items 2, 6, 12, 15, 17, 19, 21, 24 and 34; psychological reactions, items 4, 5, 7, 8, 10, 11, 26, 30 and 31; psychological reactions with depressive component, items 13, 14, 20, 22, 25, 28, 29, 32 and 35 and psychophysiological reactions, items 1, 3, 9, 16, 18, 23, 27 and 33. The counting is done as follows: starting from zero points when the child leaves the circle blank, 1 point when a quarter circle is painted, and so on, up to 4 points for the fully painted circle. This scale is based on the quadriphasic model of stress, and through a quantitative analysis it is possible to classify which stress stage the child is in: alert, resistance, near-exhaustion and exhaustion.

Alarm stage: score ≥ 10 in the physical reactions factor or;
≥ 15 in the psychological reactions factor or;
≥ 9 in the psychological reactions factor with depressive component or;
≥ 11 in the psychological reactions factor or;
total score between 39 e 59 points.

Resistance stage is characterized when the score is ≥ 16 in the physical reactions factor, or;
≥ 22 in the psychological reactions factor or;
≥ 15 in the psychological reactions factor with depressive component or;
≥ 16 in the psychophysiological reactions factor or;
total score > 59 until 79.

Near-exhaustion stage is identified when:
total score is ≥ 22 in the physical reactions factor or;
≥ 29 in the psychological reactions factor or;
≥ 21 in the psychological reactions factor with depressive component or;
≥ 21 in the psychophysiological reactions factor or;
total score ≥79 until 99 or;
completely filled circles appear in ≥7 items of the scale.

Exhaustion stage: total score > 99, regardless of the score in the other criteria for the different stress factors.

We also used the drawing-and-story procedure (DE), in which each child is asked to draw and then tell a story while looking at the picture. This is a free drawing activity, in which 12 colored pencils, 1 black pencil and a sheet of A4 paper are used. The use of the eraser is discouraged in order not to lose the value of psychological features.

The DE fairly common abridged version was used. For these drawings a theme is established by the context in which the child belongs (Trinca, 2013). It is requested that the child form a story from their picture, rather than about their picture. Thus free associations are triggered in the form of stories. After the child has told the story, the professional moves on to the investigation phase, in which more information about the patient is gathered. The application of DE was performed at the beginning of the hospitalization period and no later than the fifth day after surgery. Drawing-and-story procedures were interpreted, being subsequently categorized, allowing a quantitative analysis made by the psychologist of the team, who was unaware of which group the children belonged to.

Two samples of saliva were collected for cortisol measurement - the first at 8:00 AM and the second at 4:00 PM. The samples were taken from the first day of hospitalization (pre-surgical) until at least the first postoperative day. This procedure was performed, at most, until the fifth postoperative day. On the day of surgery there was no collection of salivary cortisol. The measurements of salivary cortisol were made in duplicate by radioimmunoassay using commercial kits, Salivette®, from Siemens, Sarstedt, Germany.

Two questionnaires were used with the experimental group: one for the child and another for their parent. Those were satisfaction questionnaires about the music sessions with two closed questions and one open question, based on Barrera interviews, which were taken at the time of patient discharge (Barrera et al., 2002).

The musical sessions took place in the patient's room in both the pre and postoperative periods, however in the postoperative period the patient was often in bed, at rest. In this case, the researcher acted beside the bed. The participation of children for the purpose of research was at least 1 meeting in the preoperative period and 1 in the postoperative period. The sessions had a playful character, consisting of four types of musical activities: listening to music, singing, playing and improvising.

These activities were as follows:
- listen to and interact with music;
- sing and play small percussion instruments;
- play melodic instruments (xylophone and / or keyboard);

- improvise.

The duration of musical sessions was at least 15 minutes and no more than 30 minutes long, consisting of musical activities in which the child was invited to participate actively. The materials used were the following: instruments (ganza shaker, sleigh bell, triangle, two tone wood agogo, guiro, xylophone, drum and keyboard), IPod with amplifier, books and puppets. The IPod was always adjusted to medium volume by the researcher.

2.4 Statistical Analysis

Data were presented as mean and standard deviation for numerical variables with normal distribution, and median and range for variables with non-normal distribution. To assess the pattern of distribution of the variables the Kolmogorov-Smirvov test was used. The comparison of numerical variables between groups was made by using the t Student's test or Mann Whitney, when appropriate. To test the association between categorical variables we used the Fisher exact test or chi-square test. Correlations between numeric variables were tested by Pearson's correlation coefficient, or Spearman's when appropriate. Statistical significance was set at $p<0.05$. For statistical analysis, we used the SigmaSat 3.5 for Windows.

3. Results

There was no significant difference between the values of initial stress in the control group *versus* the experimental group (28.3 ±13.1 *versus* 34.2 ±15.4 $p > 0.05$) in the ESI. A statistically significant difference in the reduction of stress level in both groups was observed when comparing the stress scores before and after surgery within the same group. The experimental group showed greater reduction (34.2 ±15.4 *versus* 23.1 ±12.0, $p < 0.001$) than the control group (28.3 ±13.1 *versus* 24.8 ±14.9, $p= 0.048$) (Table 1). The difference in the decrease of stress (Δ stress score) between the control *versus* the experimental group (-3.5 ±7.1 vs. -11.1 ±13.6) was statistically significant with a greater decrease in the experimental group ($p=0.04$) (Figure 1).

By analyzing separately the factors which make up the stress level, it was observed that the experimental group showed a significant drop in two factors, psychological and psychophysiological reactions, and the control group showed significant decrease only in psychophysiological reactions factor (Tables 2 and 3).

In the pre surgical period 13 children of the experimental group showed signs of stress (59.1%), 7 of which in advanced stages; in the post surgical period 9 children (40.9%) maintained the signs of stress, but all in the initial stage (Table 4). In the control group, 8 children showed signs of stress in the pre surgical period (44.4%), 3 of which in advanced stages; in the post surgical period these 8 children still showed stress signals, 2 of which in advanced stages (Table 5).

The most extensive surgeries were equally distributed between the two groups, 27.3% in the experimental group and 22.2% in the control group, with no significant statistic difference.

In the analysis of the drawings it was possible to identify which were the most recurrent feelings. Negative feelings that came up the most in both groups were: anxiety and worry, irritability and anger, fear, depressive symptoms, sadness and melancholy, psychological distress, and feelings of powerlessness. Positive feelings that most appeared were: being confident that everything would work out and the ability to face difficulties. In the quantitative analysis there was no significant difference between the two groups.

Mean or median salivary cortisol levels in the 2 periods were similar in both groups ($p > 0.05$; Mann-Whitney).

In the questionnaire for the experimental group, 21 out of 22 children, responded that they felt good participating in musical activities and one said she was indifferent, however in her free comments she stated that she had felt "at home" and had done what she most loved, which was playing. All children said that the activities helped in their well-being during hospitalization and most chose to write comments about the activities. All parents stated that the activities helped their children feel better, decreasing stress and anxiety, and all reported positive feedback.

4. Discussion

Every situation involving illness, doctors, hospitalization, with the possibility of surgery is a potential cause to suffering, by increasing anguish and distress levels, especially when it comes to children (Trinca, 2013).

The search for strategies that can help reduce pain and stress in children during medical treatments, hence providing a more humanized process in the hospital, is of paramount importance. Music, as a non-verbal system of communication, facilitates the externalization of feelings and concerns regarding the health and well-being, thus helping to decrease stress and anxiety levels (Barrera et al., 2002, Lathom, 2002). Stress is a phenomenon that involves cognitive and emotional components, and is closely related to the physiological system.

It is interesting to mention that, although fewer in number, studies using interactive music therapy show better effects when compared to the receptive music therapy (Kain et al., 2004, Tarja et al., 2012). Interactive music therapy is more involving for the child and for that reason was chosen for this study (Barrera et al., 2002). Nonverbal procedures enable children to express their questions indirectly and give them more space to avoid resistance (Trinca, 2013). As music interacts with other areas, the musical experiments also involved talking,

expressive body movements, and stories with the initial goal of attracting the child's attention (Bruscia, 2006, Ruud, 1991).

The experimental group showed a significant drop in psychological and psychophysiological reactions, and the control group showed significant decrease only in psychophysiological reactions factor. This can be attributed to the fact that the psychophysiological reactions raise questions about psychological problems related to physical matter. Since the two groups were attended in the same way through a physical perspective, the stress related to this factor decreased significantly after surgery, because the intervention solved the physical problem. On the other hand, the psychological reactions factor decreased significantly only in the experimental group, which suggests that music interventions had a positive impact on reducing psychological stress in these children, helping them deal better with subjective questions that arise from hospitalization for surgery.

The decrease in the stress score in the group exposed to interactive musical activities and the control group is due to resolutive treatment to which the children were subjected. This is expected, as the patients are likely to be more anxious before the procedure than afterwards (Kulkarni et al., 2012).

The high incidence of stressed children deserves our attention, since stress can cause many diseases related to our contemporary lifestyle. That are many factors that can generate stress, and hospitalization is one of those (Franca and Leal, 2010). It is important to treat the symptoms and the current disease, without neglecting the treatment of the associated stress (Lipp, 2010).

The DE is a very diverse psychological resource when compared with the standardized psychological tests. It is used for a broader exploration of personality, showing the unconscious emotional dynamics. Some advantages of DE are: ease of use, adaptability to the needs of the examinee, low cost. The DE serves as a facilitator between the interviewer and the interviewee, and between the interviewee with him/her own self. It is well accepted by children and is quite appropriate, replacing the direct interview, which could inhibit the interviewee. When the child tells the story, starting from their picture, at the same time they know and do not know that they are talking about themselves. They create expressions of their mental world, in a simplified and disguised form, so they are neither surprised nor frightened by its content (Trinca, 2013).

In the drawing-and-story procedure, although the numbers were very similar in the two groups, the positive and negative feelings that came up in this instrument were cited in detail, as this information is very important for the development of new strategies to help children in surgery situations. Based on this information, more specific strategies can be created with a focus on reducing these negative feelings and channeling positive feelings for the well-being of these children.

The variation of cortisol can be objectively measured through saliva, which is a well-known way to measure stress (Thoma et al., 2013). We believed that the lack of a significant drop in salivary cortisol level, in disagreement with the improvement in the stress score, may have been due to the timing of musical intervention that took place after the afternoon saliva collection. It would have been more appropriate for the music sessions to take place at 3:30 PM, preceding the collection of cortisol at 4:00 PM. This is because salivary cortisol reflects the immediate stress of the organism and is subject to changes due to any events that stand between musical sessions and saliva collection. Further studies are necessary with larger trial and musical interventions preceding saliva collection to precisely verify the impact of these activities in the postsurgical of children with urological anomalies.

To conclude, in children with urological anomalies, we observed a positive effect of interactive musical activities in reducing stress during the period of hospitalization for surgery, indicating that these procedures can contribute to the well-being of children, improving tolerance to hospital environment.

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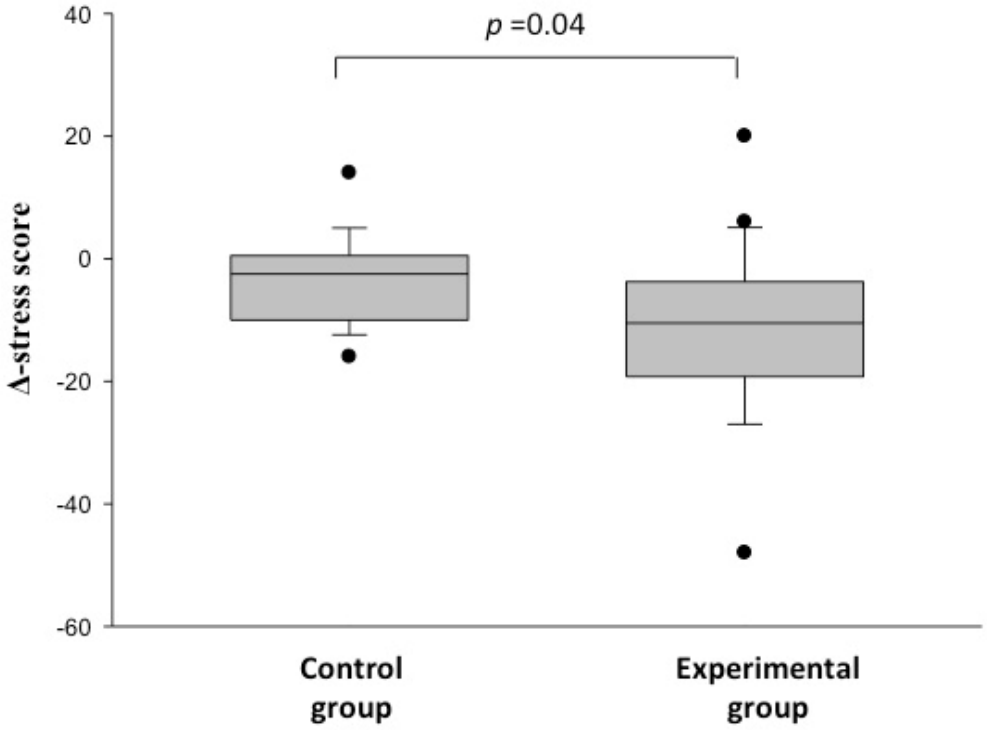

Figure 1. Decrease of Δ-stress score after surgery in children submitted to surgical treatment for urogenital anomalies

Table 1. *Child Stress Scale,* total score in pre and post surgical periods

Groups	N	Period	Mean	SD	*p*
Experimental	22	pre	34.2	15.4	<0.001
	22	post	23.1	12	
Control	18	pre	28.3	13.1	0.048
	18	post	24.8	14.9	

Table 2**.** *Child Stress Scale*, factor scores in 22 children from the experimental group before and after surgical treatment

Reactions	**Period**	**Mean**	**SDS**	***p***
Physical	Pre	6.3	5.6	0.3
	Post	5	4.1	
Psychological	Pre	13*	(4 – 25)**	0.008[#]
	Post	9*	(1 – 21)**	
Psychological with depressive components	Pre	6.4	5.6	0.2
	Post	5	4.1	
Psychophysiological	Pre	8.9	4.5	<0.001
	Post	2.8	2.8	

*median; **range; [#]Mann-Whitney

Table 3. *Child Stress Scale*, factor scores in 18 children from the control group before and after surgical treatment

Reactions	Period	Mean	SDS	*p*
Physical	Pre	5.8	5.1	0.2
	Post	5	6.1	
Psychological	Pre	10	6.2	0.89
	Post	9.8	5.8	
Psychological with depressive components	Pre	2*	(1 - 11)**	0.9#
	Post	2.5*	(0 – 15)**	
Psychophysiological	Pre	8.8	4.5	<0.001
	Post	5.6	3.9	

*median; **range; #Mann-Whitney

Table 4. *Child Stress Scale*, individual detailed scores of children from the experimental group

Child	Reactions								Total		Stress stage	
	Physical		Psychological		Psychological with depressive components		Psychophysiological					
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	6	0	25	12	6	0	6	4	43	16	R	N
2	14	8	16	7	4	0	10	2	44	17	A	N
3	9	6	13	14	4	9	16	9	42	38	NE	A
4	8	4	4	2	11	4	13	7	36	17	A	N
5	7	7	11	11	6	7	10	3	34	28	N	N
6	1	1	4	3	3	0	4	2	12	6	N	N
7	14	7	22	21	12	11	8	4	56	43	R	A
8	5	11	16	16	5	5	13	4	39	36	A	A
9	4	7	15	8	0	10	4	1	23	26	A	A
10	5	5	13	5	2	8	10	2	30	20	N	N
11	13	13	19	15	3	1	8	1	43	38	A	A
12	6	15	8	11	2	11	9	8	25	45	N	A
13	5	5	7	8	5	3	2	1	19	17	N	N
14	8	0	11	12	0	4	6	1	25	17	N	N
15	0	0	7	6	5	1	6	0	18	7	N	N
16	23	2	15	13	18	6	20	7	76	28	NE	N
17	1	2	15	5	17	9	9	6	42	22	R	A
18	6	4	12	12	15	9	12	7	45	32	R	A
19	0	2	4	9	2	0	1	2	7	13	N	N
20	2	6	15	5	15	10	10	7	42	28	R	A
21	3	1	9	4	6	0	6	2	24	7	N	N
22	0	4	15	1	0	2	13	0	28	7	A	N

N = Normal; Stress stages: A = Alert, R = Resistance, NE = Near-exhaustion, E = Exhaustion. Gray squares signalize stress

Table 5. *Child Stress Scale*, individual detailed scores of children from the control group

Child	Reactions								Total		Stress stages	
	Physical		Psychological		Psychological with depressive components		Psychophysiological					
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	2	1	9	7	3	3	6	7	20	18	N	N
2	4	4	14	4	2	2	4	2	24	12	N	N
3	4	3	11	12	11	7	12	5	38	27	A	N
4	3	8	1	7	11	15	5	4	20	34	A	R
5	1	2	2	3	1	0	7	3	11	8	N	N
6	5	2	6	5	2	0	10	6	23	13	N	N
7	2	0	2	3	1	1	10	4	15	8	N	N
8	9	10	9	12	2	1	13	13	33	36	A	A
9	21	24	18	23	2	2	19	12	59	61	NE	NE
10	9	0	5	6	1	11	6	2	21	19	N	A
11	9	4	9	16	9	9	4	1	31	30	A	A
12	1	1	11	16	1	5	10	5	23	27	N	A
13	13	12	25	18	1	9	12	10	51	49	NE	A
14	4	0	19	7	7	6	11	6	35	19	A	N
15	6	4	10	7	2	1	5	4	23	16	N	N
16	2	1	6	6	3	5	4	3	15	15	N	N
17	9	12	10	16	10	1	17	13	46	42	R	A
18	2	2	13	9	2	0	5	1	22	12	N	N

N = Normal; Stress stages: A = Alert, R = Resistance, NE = Near-exhaustion, E = Exhaustion. Gray squares signalize stress