Hopeful struggling for health - Experiences of participating in computerized cognitive training and aerobic training for persons with stress-related exhaustion disorder

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INTRODUCTION

Stress-related ill-health has increased dramatically in recent years in Sweden, and among these, exhaustion disorder (ED) is a common cause of sick leave (Swedish Social Insurance Agency, 2017). ED (F43.8A, ICD-10-SE) (National Board of Health and Welfare, 2003) is a criteria-based diagnosis and used in Swedish clinical practice as a clinical manifestation of burnout (Grossi, Perski, Osika, & Savic, 2015; Wallensten, Asberg, Wiklander, & Nager, 2019). ED is characterized by psychological and physical exhaustion as a consequence of identified stressors (work- or non-work-related), present for at least six months (National Board of Health and Welfare, 2003). Different symptoms are also included in the diagnostic criteria, and one of the most prominent symptoms is cognitive impairments (Grossi et al., 2015).

Rehabilitation for persons with ED and clinical burnout has usually included cognitive behavioural interventions or multimodal interventions, but with no effect on symptoms or return to work compared with control groups (Grossi et al., 2015; Wallensten et al., 2019). The recovery time may be long with remaining symptoms and reduced work ability (Malmberg Gavelin et al., 2018; Stenlund, Nordin, & Slunga Järholm, 2012) and symptoms of exhaustion are persistent (Glise, Ahlborg Jr, & Jonsdottir, 2012). Cognitive impairments have also been shown to be long-lasting despite treatment with cognitive behavioural therapy (CBT) (Eskildsen, Andersen, Pedersen, & Andersen, 2016; Jonsdottir et al., 2017) and work related activities (Oosterholt, Maes, Van der Linden, Verbraak, & Kompier, 2016; Österberg, Skogsliden, & Karlsson, 2014). The most common cognitive impairments

are reported in executive functions, attention, episodic and working memory (Grossi et al., 2015; Malmberg Gavelin, Boraxbekk, Stenlund, Slunga Järholm, & Stigsdotter Neely, 2015). In addition, people with stress-related exhaustion experience that their cognitive abilities in everyday life are impaired for a long period of time (Eskildsen et al., 2016; Oosterholt et al., 2016).

We have recently evaluated two different interventions specifically directed to improving cognitive functioning in addition to a multimodal rehabilitation programme (MMR) for persons with ED. A 12-week intervention with computerized cognitive training improved performance on the executive function updating and episodic memory (Malmberg Gavelin et al., 2015) whereas aerobic training at a moderate-vigorous intensity during 12 weeks improved performance in episodic memory (Eskilsson, Slunga Järholm, Malmberg Gavelin, Stigsdotter Neely, & Boraxbekk, 2017). The computerized cognitive training also demonstrated cognitive improvements at long-term follow-up (Malmberg Gavelin et al., 2018).

However, in order to implement cognitive and aerobic training in rehabilitation, it is important to understand how people with ED perceive these interventions. Thus, the overall aim of this study was to explore experiences from persons with ED after participating in a 12-week intervention of either computerized cognitive training or aerobic training. . Specific aims were to investigate what was perceived to be advantages/disadvantages of the intervention and if there were any facilitators/barriers to achieve the goal of the training. **METHODS**

Participants and study design

The current study is part of the Rehabilitation for Improved Cognition (RECO) - study, which was a randomized controlled trial, conducted at the Stress Rehabilitation Clinic at the University Hospital in Umeå, Sweden. The overall aim of the RECO-study was to investigate whether the addition of a 12-week period of computerized cognitive training or aerobic training could further enhance cognitive function in patients with ED participating in an MMR program. The RECO-study has previously been described in detail (Eskilsson et al., 2017; Malmberg Gavelin et al., 2015). Inclusion criteria in the study were: confirmed ED according to criteria established by the Swedish National Board of Health and Welfare, 18-60 years of

age, currently employed, considered by physician and psychologist as suitable for MMR in group, no need of other treatment or rehabilitation, no known abuse of alcohol or drugs and no participation in other intervention studies. Twenty-three eligible patients with ED that most recently completed the RCT study and the interventions were asked to participate in individual interviews. We used purposive sampling to provide a variation in age, education, occupation, and representing participants from the computerized cognitive training and aerobic training interventions as well as dropouts. Ten persons declined to participate where the most common cause was lack of time due to work rehabilitation. In total 13 remaining persons (11 women and two men) accepted, gave informed consent and were interviewed. The characteristics of the participants were; 30-56 years of age; 11 with university education; 10 married or cohabiting, and 10 worked with people (for example nurse, teacher) and three with data (for example secretary, computer operator) (Kohn & Schooler, 1983). Moreover, five participants were on full-time sick leave, and eight were on part-time sick leave before the intervention. After the intervention four participants were on full-time sick leave including vocational training, five were on part-time sick leave and four participants reported no sick-leave.

The individual interviews were analyzed with Qualitative Content Analysis (QCA) (Graneheim, Lindgren, & Lundman, 2017; Graneheim & Lundman, 2004). QCA is a useful systematic method of analyzing written or verbal communication, often used in analyses of experiences and reflections of people (Downe-Wamboldt, 1992; Hsieh & Shannon, 2005). QCA focuses on differences between and similarities within codes and categories. The method allows both manifest and latent interpretations of the content, but the interpretations vary in depth and level of abstraction (Graneheim et al., 2017; Graneheim & Lundman, 2004).

Context

The participants took part in a 24-week MMR programme, consisting of group-based CBT, individual physical activity on prescription, and vocational measures. Each CBT group consisted of eight participants who met once a week in 22 three-hour sessions. The purpose of the group sessions was to change the participants' behaviour patterns in order to promote better health, function and work capacity.

96 Therefore, two individual meetings were performed to set individual targets for
 97 behavioural change. Each CBT group-session started with relaxation, followed by
 98 specific themes: stress and recovery; sleep; and coping with emotions.

99 **Intervention**

100 After 12 weeks of MMR, a randomization by CBT group was conducted to either
 101 continue MMR with an addition of computerized cognitive training or continued
 102 MMR with an addition of aerobic training. The additional training was performed
 103 three times per week for 12 weeks. The computerized cognitive training was
 104 performed at home by a web-based program and lasted approximately 15-20 minutes
 105 per session. The aerobic training was performed as group indoor cycling
 106 (“spinning”), at a training center conveniently located for the participant. Each
 107 training session was 40 minutes long, and the participants’ exercised at a moderate to
 108 vigorous intensity. These additional training programs have previously been
 109 described in detail (Eskilsson et al., 2017; Malmberg Gavelin et al., 2015).

110 **Data collection**

111 The interviews were conducted after completion of the MMR programme and the
 112 additional training programmes. Interview data were collected from five participants
 113 from the computerized cognitive training programme, and five participants from the
 114 aerobic training programme. Moreover, three drop outs; one from the cognitive
 115 training and two from the aerobic training were interviewed (Figure 1).

116 [Insert Figure 1 about here]

117 Written and verbal information about the study were given to all participants, along
 118 with a written informed consent. The study was approved by the Regional Ethical
 119 Review Board in Umeå, Sweden (Approval No. 2012-357-32, 2010-53-31). All
 120 interviews were performed at the Stress Rehabilitation Clinic at the University
 121 Hospital in Umeå, Sweden, where the MMR programme was conducted. A
 122 physiotherapist (TE) and a social scientist interviewed the participants. The
 123 interviewers had never met the participants before the interviews. The interviews
 124 were performed with the help of an interview guide with semi-structured questions
 125 regarding participating in respective intervention; computerized cognitive training or

126 aerobic training. Example of questions for this paper was: Please tell me about
 127 barriers/facilitators to achieve the goal of the training, What have you done in order
 128 to overcome the barriers? Did you experience advantages/disadvantages with the
 129 training? If yes, which? What made you succeed/not succeed in your training? Minor
 130 adjustments were made to the questions between interviews so that information
 131 provided in one interview could be taken into consideration in a subsequent
 132 interview. The interviews lasted between 20-60 minutes and were audio-recorded
 133 and transcribed verbatim by a professional transcriber.

134 **Data analysis**

135 The interviews were analyzed using QCA according to Graneheim & Lundman
 136 (Graneheim et al., 2017; Graneheim & Lundman, 2004). Each transcript was read
 137 repeatedly as a whole and in parts during the data analysis. The text was divided into
 138 meaning units and sentences, and phrases relevant to the qualitative aim of the study
 139 were identified and sorted into condensed meaning units and labelled with codes. To
 140 find similarities and differences, the codes were compared and interpreted
 141 repeatedly. Codes, sub-categories and categories were analyzed on a manifest level
 142 (close to the text), while the overarching theme included interpretations that
 143 corresponded to the meaning of the material.

144 Each interview was read and coded by four researchers in the research group (AFW,
 145 EEM, MN, TE). Three were not involved in the RCT study (AFW, EEM, MN) and
 146 one was the project coordinator (TE). AFW, EEM and TE are physiotherapists and
 147 MN is a behavioural scientist. AFW, MN and TE have experience from research in
 148 stress-related health, qualitative studies, occupational health and rehabilitation and
 149 teaching in stress-related health.

150 During all steps of the analysis each of the researchers mentioned above,
 151 independently made the coding, followed by a mutual comparison of the result and a
 152 final negotiated outcome. The results were also presented and discussed, in a peer
 153 debriefing (Lincoln & Guba, 1985), with staff at the Stress Rehabilitation Clinic. The
 154 staff recognised the results as consistent with what they perceived that the
 155 participants expressed. The results are presented with quotes from the interviews,
 156 sub-categories, categories and a theme.

157 **RESULTS**

158 **Hopeful struggling for health – the theme**

159 The theme hopeful struggling for health reflects the participants' struggle with
 160 changing from who they were to who they wanted to become and as a participant
 161 mentioned "*it was an interesting before and after experience*". Despite the struggle,
 162 the participants express hope and wishes for a healthy and sound future. Recovery
 163 from ED requires hard work, but "*the longer they worked in the programme the*
 164 *better they became*". The theme constitutes three categories, support, motivation and
 165 sensations since the participants reported these to be the most important parts for
 166 keeping on struggling and for success.

167 Despite being asked to reflect on participating in computerized cognitive training or
 168 aerobic training, the participants' interviews entail to a large extent, experiences
 169 from recovering from ED and participating in the MMR programme. However, the
 170 results indicate that experiences of participating in computerized cognitive training
 171 or aerobic training contributed to a hopeful struggle for health.

172 [Insert Table 1 about here]

173 **Support**

174 Support served as a basis for the whole recovery process and the category support
 175 contained three sub-categories: assistance from others, technological support, and
 176 planning and routine.

177 Assistance from others

178 To be loved and accepted, despite not functioning as before was essential for the
 179 recovery process.

180 "My sister came with me to the aerobic training, it was good that she could
 181 position the saddle and be there as a support when everything was new"
 182 (Participant 11)

183 “My family has been very involved in this (process) and they have taken part
184 in my computer *exercises and we have discussed it*” (Participant 5)

185 Family and close relatives were a concrete support for the participants during the
186 training. The meetings in the MMR programme were highly appreciated. In fact,
187 these meetings were what encouraged the participants the most and gave them hope
188 that their persistence would lead them to recovery one day.

189 “/.../ *to meet the group, to meet peers in the same situation and get tips and*
190 *ideas and even support... That's what's made me stronger*” (Participant 5)

191 The recognition from others with the same diagnosis contributed to larger insights
192 about ED, which was reported as a relief, and the feeling of not being alone was
193 accentuated.

194 The participants reported that they had wished that the computerized cognitive
195 training and aerobic training had been better adapted to their situation, and for
196 instance being performed together with the MMR group.

197 “What if we had gone (aerobic training) *the whole group ... and had classes*
198 *together A little bit more adapted /.../ a little calmer ... a bit lower music*
199 *... and with the support of the others*” (Participant 11)

200 “It would have been better if the cognitive training had been part of the MMR
201 group. Since it triggered my performance anxiety and took energy, I would
202 have needed support in this” (*Participant 6*)

203 In summary, to be able to conduct the exercises included in the computerized
204 cognitive training or aerobic training, support from the family and from others in the
205 same situation was crucial.

206 Technological support

207 Technological support was an important factor to manage the exercises. In the
208 aerobic training, some participants had previously over-trained.

209 *“The pulse watch was great, then I knew that, aha – this is enough! And also,*
 210 *it was so much fun! (Participant 11)*

211 The pulse watch was an appreciated tool to keep them from overdoing the exercises
 212 and to help them listen and learn bodily signals. The pulse watch was also a support
 213 in limiting themselves not being enticed to increase the workout by other stimuli
 214 such as music or pepping from the session leader. At the same time, it felt unfamiliar
 215 to adapt the training to a lower intensity. Some described that they had continued to
 216 use the pulse watch in their training after the intervention had ended.

217 The technology was essential for the computerized memory training. When it failed,
 218 the training could not be completed with frustration as a consequent reaction. In one
 219 case, failing of the participant’s own Internet connection, was the reason for drop-
 220 out.

221 *“... also, my Internet connection failed and I was thrown out all the time.*
 222 */.../ That was an additional stressor and sometimes I had to do the tasks three*
 223 *times before they got registered. This became very hard and in the end, I*
 224 *didn’t manage. / ... / I fell behind and it became a burden, so I decided to*
 225 *drop out” (Participant 1)*

226 For other participants in the computerized cognitive training, the technology was
 227 perceived as smooth and without problem.

228 Planning and routine

229 Planning and development of routines in the training were important sources of
 230 support. Permission to exercise during working hours, distributing the training over
 231 several days, or dividing it into smaller parts, facilitated the computerized cognitive
 232 training.

233 *“So I have to divide it (the cognitive training) up in chunks and take micro*
 234 *pauses all the time. Even if I think it feels okay, I have to take these micro*
 235 *pauses as a preventive measure” (Participant 5)*

236 Some participants showed awareness of their own needs and stopped the training,
237 even if it felt they could go on, to save energy for the rest of the day or week.

238 “It (cognitive training) took a lot of energy from the day, about a fourth of
239 my energy. When I got a routine for the practice, it took much less energy”
240 (Participant 6)

241 For some participants it was difficult to get started with aerobic training, but when it
242 became mandatory by participating in the project with a clear framework, the
243 participants enjoyed it. However, lack of exercise groups that suited the participant’s
244 schedule, or living in areas far from training centres, were obstacles to creating
245 lasting routines of aerobic training.

246 “... *and every other week, when I have had the kids, I thought I can exercise*
247 *during lunch hour, but there (at the gym) weren’t that many lunch training*
248 *sessions and then it became difficult to make it happen” (Participant 12)*

249 To conclude, it was important to plan and create routines for the cognitive training so
250 that it did not consume too much of the available energy. Clear routines provided
251 support also for conducting the aerobic training, however, they became more
252 difficult to uphold if the accessibility to training was limited.

253 **Motivation**

254 Motivation was an important part for conducting both the computerized cognitive
255 training and the aerobic training. The category motivation comprised of three sub-
256 categories: balance and timing, feedback and pleasure.

257 **Balance and timing**

258 Balancing and timing of activity, i.e. matching the extra activities to the
259 rehabilitation process and work- and family life, were discussed among all
260 participants. The participants expressed it to be hard to make ends meet combining
261 the MMR programme, the extra exercises that the aerobic and cognitive conditions
262 required, work, family and life itself. Both the computerized cognitive training and

263 aerobic training were thus put aside to prioritize children, family or work during the
264 intervention.

265 *“/.../ twice a week would have been enough for me. /.../ It can feel like a*
266 *failure when you don't succeed in working out three times a week as*
267 *proposed” (Participant 10)*

268 *”...there must also be time for it (the computer training). You have more*
269 *working hours and there is no time to sit down and (do the training) no*
270 *energy ... you consume so much energy at work” (Participant 5)*

271 However, it was possible to prioritize both training and the family when work was in
272 balance. The participants also prioritized themselves more after having gone through
273 the MMR programme and the additional interventions.

274 The motivation was declining when the participants had to struggle with managing
275 their own performance anxiety.

276 *“... it was a performance thing ... it was hard to do it (the cognitive training)*
277 *because you wanted to perform better than last time and at the same time it*
278 *was harder since you levelled up” (Participant 6)*

279 This was especially true for the computerized cognitive training, where the exercises
280 increased in difficulty when the participants passed a certain level.

281 Feedback

282 Objective feedback from heart rate curves in the aerobic training and measures of
283 physical fitness level from professionals was appreciated. This, in combination with
284 getting support from the physiotherapist in customizing the aerobic training provided
285 a sense of security.

286 *“... I exercised too much ... so the exercise became less frequent (when*
287 *entering the intervention), but controlled ... and that was valuable. I needed*
288 *someone who steered me in all aspects of reality” (Participant 2)*

289 Customized training consisted of both graded activity and learning to set boundaries.

290 Participants in the computerized cognitive training wished for feedback on measures
291 of cognitive function.

292 “... *then when I walked out of there (the cognitive testing) ... I was ...*
293 *personally I was really sad /.../ Because it was like a proof that ... how far it*
294 *had gone /.../ I mean, how shall I be able to function ...to do a job? ”*
295 *(Participant 9)*

296 Not receiving feedback on measures of cognitive function meant that participants
297 were left with concerns about not being restored again. They also wished for
298 feedback on results from the cognitive training.

299 *...these computer exercises...well, ok there is no feed-back from the*
300 *(computer) programme” (Participant 4)*

301 Because the cognitive training was adaptive and always challenging, there was a
302 great need to get feedback on the training results.

303 Pleasure

304 Joy was an important factor. The participants reported it to be difficult to get started
305 with the aerobic training, but those who went on perceived the exercise to be
306 enjoyable as confidence increased to cope with it. Training in a group, to music at
307 their own pace worked well.

308 “... The group leader was positive and the music was peppering. I thought it
309 was great fun /.../ You feel good... you become happier ... you become calmer
310 somehow” *(Participant 9)*

311 However, some participants could feel that the music was too loud and would have
312 preferred to exercise in a calmer environment.

313 On the contrary, the computerized cognitive training was initially very fun and
314 inspirational but turned out to become more stressful and therefore difficult to
315 prompt at the end of the intervention. In fact, the cognitive training ended up as

316 being perceived as boring and the participants expressed a wish to renew the training
317 program to make it more fun.

318 Honestly, I was bored with the practices at the end. I have tested other types
319 of memory exercises on the Internet and they are much more varied and more
320 fun. Almost like playing a game even though you practice memory.
321 (Participant 4)

322 Thus, pleasure was an important part of motivating oneself to training, where
323 environment, group leaders and music were some important motivators. Cognitive
324 training could be improved and made more fun with more game-like elements.

325 **Sensations**

326 Participants from both the computerized cognitive training and aerobic training
327 reported various sensations. These were mostly positive, at least in retrospect, and
328 included a sense of improved and sustained memory, clearer head, energy, better
329 self-efficacy, increased self-esteem and better understanding of themselves. These
330 were sub-categorised into memory, strength and faith.

331 **Memory**

332 The participants experienced that their memory gradually improved.

333 “It (the computer training) gave some effect. I had more acuity, I got better
334 structure at work, I could structure the job a little better... better structure of
335 things,...it did not get messy when I was to perform certain tasks, easier to
336 keep up with and be able to hold discussions in conversation, find words a
337 little better ” (Participant 4)

338 The improved memory increased the participants' ability to work and facilitated
339 conversations.

340 For some it was difficult to single out what had been the most active ingredient in
341 the rehabilitation in improvement of memory.

342 “If it (cognitive improvement) was due to only memory training or if it was
343 *due to giving it time to heal, I don't know*” (Participant 5)

344 Time itself could be part of the improvement but also the specific training. It was
 345 also clear to some of the participants that the improved memory was noticeable in
 346 daily life.

347 *"And that's (the aerobic training) what makes this spring so fantastic. When*
 348 *I wake up and feel fresh and don't have to go back to sleep and can*
 349 *remember six numbers in a row!" (Participant 2)*

350 The memory gradually improved during the rehabilitation, which facilitated work
 351 and everyday life. Strength

352 Participants in the aerobic training expressed that they became stronger mentally and
 353 physically which was felt in different situations in everyday life. Aerobic training
 354 was exhausting but gave a lot of vigour afterwards.

355 *"...of course I was tired from the exercise, but it was a refreshing tiredness*
 356 *... that gave energy and power" (Participant 10)*

357 The participants expressed that the aerobic training gave them a possibility to relax
 358 the thoughts since these stopped for a while. It was described as *"if the oxygen went*
 359 *to the head"* and as *"a pause for the brain and exertion for the body instead"*. This in
 360 turn contributed to a better ability to concentrate and remember.

361 Participants who were working, reported that the cognitive training led to fatigue as
 362 it consumed all their energy on the training days.

363 *"... my brain hurt for a couple of days (after training) ... I was completely*
 364 *beaten. That's why it was so hard to find that strength ... to get the thoughts*
 365 *to land ... really tricky" (Participant 2)*

366 Obviously, the participants in the computerized cognitive training needed to have
 367 enough energy to perform the cognitive training. However, they were strengthened
 368 when they succeeded in the exercises.

369 *"It is mostly my memory I notice...of course your self-confidence is better*
 370 *when you succeed in certain exercises, you feel strengthened."* (Participant
 371 5)

372 In summary, aerobic training provided energy after the training sessions, while
 373 cognitive training gave some of the participants a feeling of fatigue. The cognitive
 374 training was facilitated if there was a balance between activity and recovery in daily
 375 life.

376 Faith

377 Faith was strengthened when participants felt they were able to complete the
 378 training. In the computer training group participants were hopeful through the
 379 computer exercises, despite ups and downs.

380 "Of course I think I got help from this (computer training), I do not doubt it
 381 for a second. In the beginning, then the curve pointed upwards very quickly.
 382 But then ...there was like a deep dip and then after that it became heavier but
 383 of course I think I was helped by it" (Participant 4)

384 One participant in the aerobic training felt that the most valuable part was to
 385 complete the intervention, which she had not thought possible.

386 *"I didn't think that I would succeed with the training ... and that it would feel*
 387 *so positive. Now I have discovered that I can do aerobic exercise if I do it the*
 388 *right way" (Participant 8)*

389 The belief in being physically active meant that some dared to resume previous
 390 activities that they had stopped doing since they became ill in ED.

391 To sum, faith was strengthened in both groups and gave them hope for a healthy
 392 future in work and private life.

393

394 **DISCUSSION**

395 The aim of this study was to explore experiences from persons with ED when
 396 participating in a 12-week intervention of either computerized cognitive training or
 397 aerobic training that was included in an MMR programme. The main findings

showed that it was hard work recovering from ED and the participants struggled with the exercises from the intervention. However, they gradually experienced that the interventions gave confidence and hope for a healthier future. Support – both emotional and instrumental – was described as an important facilitator of the recovery process, including assistance from others, as well as support from technological aids and through finding an appropriate training routine. Motivation was also expressed as a key factor for conducting the training; specifically, the importance of adequate timing, feedback on training progression and training enjoyment were highlighted by the participants as drivers of training motivation.. In addition, both cognitive and aerobic training were perceived as beneficial for improving memory and feeling stronger mentally and physically, leading to increased self-confidence.

To recover and regain energy, basic needs may have to be replenished. Relatedness, competence, and autonomy are basic psychological needs emphasized in the self-determination theory (SDT) (Ryan & Deci, 2000). SDT speaks about how external and internal motivation impact for instance self-regulation. In the present study, it became evident that the pulse watch served as an external motivator for some individuals to start regulating their behaviours. Further, the pulse watch became a tangible tool to learn how to listen to bodily signals and set boundaries for themselves in order to promote health in the recovery process. Setting boundaries to keep balance is key in maintaining a good health (Beckie, 2012). When learning how different pulse levels, i.e. how different activity levels, were perceived bodily the participants could gear themselves towards a healthier activity level. For some, aerobic training was also an intrinsic motivation with feelings of enjoyment.

In this study, feedback from the pulse watch and from professionals were important for motivation. Professional competence and support to work with goal-setting and action plans are examples of tools used to facilitate behavioural change (Abraham & Michie, 2008) which have also been found to be important for persons with long-lasting pain (Andersen, Kohberg, Herborg, Sogaard, & Roessler, 2014). Additionally, a recent study on home-based cognitive training in long-lasting pain described weekly contact between trial personnel and participants as vital for maintaining training engagement (Baker et al., 2018). In our study, participants in the

430 computerized cognitive training reported that the training sometimes was boring and
 431 that the lack of feedback made the participants' motivation to easily fade. Thus,
 432 making training more engaging, e.g., though including game-like elements (Anguera
 433 & Gazzaley, 2015), as well as incorporating more clinician contact could be of value
 434 for motivation.

435 According to SDT, fulfilling relatedness, competence and autonomy needs, such
 436 external motivation can convert into internal motivation that reflects conducting
 437 behaviours due to conviction rather than external pressure. It can be assumed that the
 438 need for relatedness can be satisfied by the confirmation of meeting others with the
 439 same experiences. In line with this, there was a strong wish from the participants that
 440 the computerized cognitive training and aerobic training had been performed
 441 together with the MMR group. Research has shown that persons with ED (Eriksson,
 442 Karlström, Jonsson, & Tham, 2010; Fjellman-Wiklund, Stenlund, Steinholtz, &
 443 Ahlgren, 2010) and sick-listed with long-lasting pain (Andersen et al., 2014) who
 444 participate in a group-based rehabilitation programme tell about the importance of
 445 good encounters with people who understand what they are going through, of being
 446 confirmed and of cohesion in the group. This was confirmed by the participants in
 447 the present study, but in referral to the MMR group meetings. Cognitive and aerobic
 448 training also increased the participants' experience of competence in coping with
 449 their situation. However, in our previous study (Malmberg Gavelin et al., 2018), we
 450 observed that participants from aerobic training did not maintain their maximal
 451 oxygen uptake at one-year follow-up, which indicate that they may have stopped
 452 training, suggesting that the concept of autonomy was not reached. Potentially, there
 453 may be a need for enhanced intrinsic motivation practice to achieve autonomy for
 454 sustained exercise behaviours over time (Teixeira, Carraça, Markland, Silva, &
 455 Ryan, 2012).

456 Support from different sources played an important role in the recovery process.
 457 Family support was a basis for successful participation in the intervention. The
 458 family is considered to be a universal buffer against stress (Cutrona & Russel, 1990).
 459 It can provide support by emotional and confirmatory support, that can ease stress
 460 regardless of stressor (Cutrona & Russel, 1990). Support from the family may thus

461 be something to reflect carefully on and work with when developing interventions
462 for persons with ED.

463 After having completed the intervention, the participants perceived that their
464 cognitive functioning had improved which corroborates the results of the cognitive
465 test battery in our previous studies (Eskilsson et al., 2017; Malmberg Gavelin et al.,
466 2015). It was, however, difficult for the participants to specify whether the perceived
467 improvement in memory was due to training or the time for healing. Notably, the
468 participants expressed that the computerized cognitive training and the aerobic
469 training had been beneficial for memory in everyday situations.

470 The recovery process of cognitive function may further be aggravated by fatigue
471 which is a major symptom in ED. Even if the persons are able to perform
472 complicated tasks, more resources and energy are allocated for the process (Krabbe,
473 Ellbin, Nilsson, Jonsdottir, & Samuelsson, 2017; Malmberg Gavelin et al., 2017;
474 Oosterholt, Maes, Van der Linden, Verbraak, & Kompier, 2014; van Dam, Keijsers,
475 Eling, & Beckers, 2011) than in healthy persons (Krabbe et al., 2017; Oosterholt et
476 al., 2014; van Dam et al., 2011). This excess in energy expenditure may tax on
477 everyday functioning. Participants in the computerized cognitive training described
478 that they needed to have enough energy to perform the cognitive training. Carrying
479 out the aerobic training also took energy, three training sessions per week were
480 difficult to maintain for most of the participants. If interventions such as these are
481 included in treatment, it is important to consider a balance between activity and
482 recovery, and those who are working may require extra attention in balancing the
483 resources and demands. This could be facilitated if planning and clear routines
484 existed for how the training should be organized. The participants also needed
485 appropriate technological support, which for some was a problem during the
486 computerized cognitive training. This is especially important to take into account as
487 persons with ED have impaired cognitive functioning, specifically in domains of
488 relevance for efficient planning and problem solving (Ellbin, Engen, Jonsdottir, &
489 Nordlund, 2017; Eskildsen, Andersen, Pedersen, Vandborg, & Andersen, 2015;
490 Jonsdottir et al., 2013; Öhman, Nordin, Bergdahl, Slunga Birgander, & Stigsdotter
491 Neely, 2007).

492 Contrary to the computerized cognitive training, participants from the aerobic
 493 training perceived that they gained energy following the physical activity training
 494 sessions. They experienced, that the brain and the mind rested and that the body
 495 worked instead. This is in line with our earlier results (Eskilsson et al., 2017) where
 496 there was a tendency for a larger improvement in heart rate recovery for participants
 497 who improved most in episodic memory. This indicates that aerobic exercise is
 498 related to regulation of the autonomic nervous system and an increased
 499 parasympathetic reactivation after exercise.

500 **Methodological considerations**

501 In order to increase trustworthiness triangulation between researchers (Lincoln &
 502 Guba, 1985) was used. Different research fields such as physiotherapy, cognitive-,
 503 social- and health psychology as well as stress rehabilitation were represented when
 504 conducting the study.

505 For the interviews, we aimed for a variety of participants from both intervention
 506 groups (computerized cognitive training and aerobic training) along with dropouts
 507 from both groups. The perceptions from the dropouts were regarded as important
 508 information to understand how future interventions should be developed. This study
 509 was part of a randomized controlled study evaluating both cognitive training and
 510 aerobic training which may have made the analyses more demanding. However, the
 511 strength of this design is that our results may be applicable in a clinical setting in
 512 treatment of ED. More women participated in both this qualitative study as well as in
 513 the MMR-programme. For future qualitative studies, more men need to be included
 514 as informants to explore if men and women benefit from the same type of treatment
 515 of ED.

516 The participants in this study represent the group of persons diagnosed with ED well
 517 since they were middle-aged, well-educated, have families, work with people and
 518 most of them are women. Thus, the transferability of our results may be made to
 519 similar settings.

520 The strengths of our study are the rich and varied interviews and that researchers
 521 from different research fields participated in the analyses and interpretations. This

522 ensured that several interpretations were discussed and negotiated before reaching a
 523 final result which helps guarding against over-interpretation of the results and
 524 improving trustworthiness. Thus, trustworthiness was ensured through accuracy in
 525 the research design, data collection and analysis. The researchers responsible for the
 526 intervention study did not participate in the analysis and interpretation of the
 527 interviews. However, they were included in discussions of the results and the model,
 528 and a negotiated outcome in the research group was reached after minor adjustments.

529 **CONCLUSIONS**

530 It seems to be advantageous in rehabilitation and recovery from ED to include
 531 support from various sources such as group support from others who are in the same
 532 situation and from family members. Both aerobic and cognitive training were
 533 perceived as beneficial for improving memory and feeling stronger both mentally
 534 and physically. However, it is important to adjust the aerobic training to fit the
 535 patient group by adjusting frequency and, in cases of patients who over-train, to
 536 modify intensity. Moreover, the use of a pulse watch may strengthen the practice of
 537 setting boundaries. The computerized cognitive training may be ameliorated by
 538 including regular feedback and making the exercises more motivating. In addition,
 539 the timing and amount of activities in the rehabilitation for persons with ED should
 540 be considered.

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687 **FIGURE LEGENDS**

688 **Figure 1.** Study design and description of the 12-week intervention of computerized
689 cognitive training and aerobic training.

Theme	Hopeful struggling for health		
Categories	Support	Motivation	Sensations
Sub-categories	Assistance from others Technological support Planning and routine	Balance and timing Feedback Pleasure	Memory Strength Faith

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