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# Cohesion and Adherence within New Members in Outpatient Heart Groups – A Longitudinal Study

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**Abstract**

Background: Although positive health effects of regular and long-term participation in outpatient heart groups are well known, studies on adherence show low participation rates and high dropout rates. In the exercise setting, group cohesion has been shown to be an important factor for adherence behaviour. However, in the specific context of cardiac exercise programs, studies on cohesion are rare and show inconsistent results. Therefore, the aim of the present study was, to investigate the dynamics of group cohesion, and the predictive relationship between group cohesion and adherence in new members of outpatient heart groups over a one year period.
Methods: 39 new members (25% female) of various outpatient heart groups aged 50-75 years participated in the study. A German-language version of the Physical Activity Group Environment Questionnaire, assessed group cohesion at three measurement points. Adherence was measured by percentage at three participation time points.
Results: Multilevel analyses showed a positive development of group cohesion. The analyses revealed no significant correlation between group cohesion and adherence.
Conclusions: Our results provide empirical evidence for the theoretically hypothesized dynamic development of group cohesion in outpatient heart groups. However, other factors than cohesion appear to influence adherence of new members in outpatient heart groups.

**Keywords**: group cohesion, group dynamic, long term adherence, cardiac rehabilitation, physical activity

## 1. Introduction

There is no doubt that a healthy lifestyle that includes exercise can reduce all-cause mortality, cardiac mortality, and the risk of recurrent cardiac events in patients with coronary artery diseases (Pedersen & Saltin, 2006; Piepoli et al., 2004; Taylor et al., 2004). Therefore, to be maximally effective, physical activity should overcome a certain threshold (Bjarnason-Wehrens et al., 2009; Dietz & Rauch, 2003). Unfortunately, many patients with coronary heart diseases do not adhere to these physical activity recommendations (Conraads et al., 2012; Willich et al., 2001; Zhao et al., 2008). Therefore, interventions to increase physical activity in patients with chronic heart diseases are offered in cardiac rehabilitation programs (CRP) that include – among other interventions –outpatient heart groups.Outpatient heart groups are supervised structured long- term programs consisting of individualized and adapted physical exercise as well as psychosocial and educative contents (Bjarnason-Wehrens et al., 2009). Despite the well documented evidence of the benefits from cardiac rehabilitation programs (CRP) and specifically outpatient heart groups(Jolliffe et al., 2001), research addressing adherence in such programs has found low participation rates(Daly et al., 2002) and high dropout rates (Bjarnason-Wehrens et al., 2006; Carlson et al., 2000; Dohnke et al., 2007; Karoff et al., 2007; Scane et al., 2012; Völler et al., 2000).

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Many dropouts often occur within the first six months (Bjarnason-Wehrens et al., 1998; Keck & Budde, 1999) after joining an outpatient heart group. However, for effective treatment, it is important that patients adhere to the exercise prescription and thus participate in outpatient heart groupsover the long term(Bethell, 1999; Ornish et al., 1990; Ornish, 1998; van der Wal et al., 2005).

Existing studies adressing predicting factors for exercise in cardiac rehabilitation in general analyze various influences. Studies have identified the influence of personal factors like self-efficacy (Dohnke et al., 2007; Luszczynska & Sutton, 2006; Woodgate & Brawley, 2008), psychosocial factors such as social support from important others (Little & Lewis, 2006)and the quality of the relationship to the interventionist (Bray et al., 2013; Russell & Bray, 2010; Woodgate et al., 2007). However, exercise in cardiac rehabilitation programs is often provided in groups such as outpatient heart groups (Karoff et al., 2007), which introduces additional variables.

There is much theoretical (Abrams & Hogg, 1990; Baumeister & Leary, 1995; Jetten et al., 2017; Rees et al., 2015) and empirical evidence (Beauchamp et al., 2018; Farrance et al., 2016) that groups and group processes influence individual cognitions, motivations and behavior. In the scope of behavioral medicine, the use of groups and more precisely group dynamic principles to influence individual physical activity behavior has received much attention (Estabrooks et al., 2014). In this context, group cohesion has to been found an important factor (Estabrooks et al., 2012). Exercising in so-called 'true groups' in which group dynamics principles have been used to increase cohesion shows to be very effective in influencing adherence (Burke et al., 2008). Remarkably, little research is done addressing cohesion in cardiac rehabilitation particularly in outpatient heart groups. To address this gap, this study aims to examine group cohesion in outpatient heart groups andmoreoverthe relationship between group cohesion and attendance behavior from a longitudinal perspective.

### 1.1. Group cohesion

In recent years, many academic disciplines have addressed the phenomenon of group cohesion(Burke et al., 2008; Dion, 2000; Fonseca et al., 2018), resulting in a plethora of definitions and measurements and to some extent "confusion about what the term cohesion is supposed to represent"(Hornsey et al., 2012, p. 80). Nevertheless, the definition and conceptualization of Carron and colleagues (1998)has gained in sport and exercise psychology. They define group cohesion as "... a dynamic process which is reflected in the tendency for a group to stick together and remain united in the pursuit of its instrumental objectives and/or for the satisfaction of member affective needs" (Carron et al., 1998, p. 213).

Accordingly, group cohesion is multidimensional in nature and consists of social and task elements (Carron et al., 1998). In addition, the literature emphasizes the need to distinguish the individual perspective and the group perspective of cohesion (Cartwright & Zander, 1968; Hogg, 1992). Carron and Brawley(2012)refer to the individual perspective as Individual Attractions to the Group (ATG).This perspective "reflect[s] the individual's personal motivations to remain in the group, as well as his or her personal feelings about the group" (Carron & Brawley, 2012, p. 727). The group perspective labeled as Group Integration (GI) refers to the individual perceptions about the group as a totality (Carron & Brawley, 2012). This perspective "reflect[s] the individual's perceptions about what the group believes about its closeness, similarity, and bonding as a whole and the degree of unification of the group field."(Carron & Brawley, 2012, p. 727). In line with this conceptual idea, Carron and colleagues (Carron et al., 1998) propose that group cohesion consists of four distinct dimensions: individual attraction to the group – social (ATG-S), individual attraction to the group – task (ATG-T), group integration – social (GI-S), and group integration – task (GI-T).

Derived from the concept, they propose a measurement encompasses these four dimensions (Carron & Brawley, 2000; Estabrooks & Carron, 2000). Although many other academic disciplines consider cohesion as a multidimensional construct, not all agree to operationalize it as such (Hornsey et al., 2012). One cited criticism in the therapeutic context stems from measurement instruments being too long, cognitively demanding, and challenging for some populations (Hornsey et al., 2012). In addition, cohesion is considered "… too vague and amorphous to be useful as a unitary construct …" (Hornsey et al., 2007, p. 567). Despite these criticisms in the context of sport and exercise psychology, the concept and operationalization of group cohesion proposed by Carron and Colleagues is very common and widely used.

### 1.2. Group cohesion and adherence to exercise in outpatient heart groups

Research addressing the relationship between cohesion and adherence to exercise in non-clinical setting show that cohesion can predict adherence (for an overview, see Burke et al., 2008 and Eys & Brawley, 2018). In contrast, research examining the relationship between cohesion and adherence to exercise in the clinical setting is unsatisfactory.

To date, only three studies have been conducted. In general, the results suggest a positive relationship between cohesion and adherence. However, two studies show a general unconditional significant positive relationship between cohesion and adherence (Fraser & Spink, 2002; Shahsavari et al., 2012), while one study showed a positive relationship only for members with a long duration of membership (Chermette et al., 2019).

The different findings in the clinical setting could have resulted due to different properties of the examined groups. Regardingthe duration of membership, Chermette et al. ((2019); 6.5 years of membership in average) and Shahsavari et al. ((2012); one up to three years) studied groups consisting of patients with rather long membership, whereas Fraser and Spink(2002)studied groups with rather short membership (12 weeks). Regarding group formation, Chermette et al. (2019) and Shahsavari et al. (2012)examined existing groups, while Fraser and Spink (2002)examined newly formed groups.Different identification processes within these groups due to different group properties may explain when there is an unconditional or a conditional positive relationship between group cohesion and adherence(Chermette et al., 2019).

Although researchers studying cohesion within exercise groups support the theoretical assumption that cohesion is a dynamic process that initially takes time to develop and, once formed, "continues to change over time" (Carron & Brawley, 2000, p. 95),little research has been done to prove this empirically(Chermette et al., 2019; Sontoro et al., 2015). One of the few studies that examined the dynamic nature of exercise class cohesion is the study by Dunlop and colleagues (2012). The authors showed for group-based exercise programs (yoga, pilates and strength & conditioning) that mean levels of social cohesion significantly changed over time across the duration of the group (eight weeks). However, mean levels of task dimension did not change. One possible explanation for these results is that social cohesion changes over time as members get to know each other, but task cohesion stays constant because the tasks being performed within the group remain the same. This study presents empirical evidence that cohesion is dynamic, but that the dynamic appear to differ between the dimensions of cohesion. Further research needs to be conducted to support these findings (Eys & Brawley, 2018; Sontoro et al., 2015).

In summary: Studies that examined the relationship between cohesion and adherence in newly formed groups found an unconditional significant positive relationship(Fraser & Spink, 2002). Studies that looked at existing groups and rather long membership duration found conditional positive relationships between cohesion and adherence (Chermette et al., 2019). The relationship between cohesion and adherence for new members joining existing outpatient heart groups has not yet been previously studied. Derived from this, the research questions of the present study were as follows:

(1) How does cohesion of new members of existing outpatient heart groups develop over time?
(2) What is the relationship between cohesion and adherence of new members of existing outpatient heart groups?

According to the aforementioned findings on the dynamics of cohesion, we hypothesized (H1) for our first question that task cohesion tends to be rather stable and the social dimension of cohesion changes over time. No empirical data are available for our second research question, so no hypothesis was derived.

## 2. Method

### 2.1. Participants

Participants were recruited from outpatient heart groups offered by a rehabilitation association in Leverkusen, North Rhine Westphalia, Germany. Participants were invited to participate in the study if they met the following inclusion criteria: (a) existing heart disease, (b) brand new member in an outpatient heart group and (c) proficiency in the German language. A total of 42 new members of outpatient heart groups were contacted, 39 (93% response rate) agreed to take part in the present study and 29 patients remaineduntil the end of the study. A Dropout of 10 persons occurred due to termination, unknown absence or missing consent for further participation.

The participants were nested into 18 different outpatient heart groups. There were one to six new members in each group. At the start of data collection, the age range was from 52 to 76 years, with an average of 63.3 (SD = 7.9). 85.7% of the participants were married or lived with a partner. Most of them were male (77%). The average Body Mass Index (BMI) was 27.3 (SD = 6.3) which is comparable to outpatient heart groups (Graf et al., 2004). Almost half of the participants reported a myocardial infarct (48.7%), and 69% had a stent insert (for further characteristics, see Table 1).

Table 1. Patients' characteristics

| | Total patients ($N$ = 39, 30M, 7F[1]) | | Persistent patients ($N$ = 29, 24M, 5F) | | Dropout patients ($n$ = 7, 4M, 1F[1]) |
|---|---|---|---|---|---|
| | *M (SD)* | | *M (SD)* | | *M (SD)* |
| Age (years) | 63.3 (7.9) | | 63.0 (7.3) | | 57.7 (7.1) |
| Marital status/ living with partner | 85.7% | | 79.3% | | 57.1% |
| | | | | | |
| Anthropometry | | | | | |
| Height (m) | 1.72 (0.20) | | 1.75 (0.95) | | 1.72 (0.91) |
| Weight (kg) | 86.3 (16.3) | | 87.2 (15.4) | | 78.0 (14.1) |
| Body mass index (kg/m²) | 27.3 (6.3) | | 28.3 (4.5) | | 26.6 (4.7) |
| History of Heart Diseases | | | | | |
| myocardial infarction | 48.7% | | 48.3% | | 28.6% |
| PCTA[2] | 41.0% | | 37.9% | | 57.1% |
| stent insert | 69.2% | | 72.4% | | 57.1% |
| bypass surgery | 20.5% | | 20.7% | | 14.3% |
| cardiac valve surgery | 2.6% | | 3.4% | | 0% |
| myocardial insufficiency | 20.5% | | 20.7% | | 14.3% |

Note. Data are given as mean and standard deviation (in parentheses) or in %. Characteristics of persistant patients and dropout were not significantly different from each other, as shown by Mann-Whitney-U-tests and chi-square-tests.

[1]Lower sum due to missing data.

[2]Percutaneoustransluminal.

2.2. Design

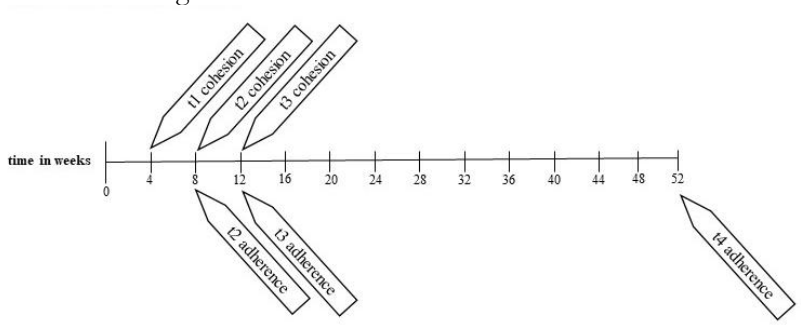
The present study was conducted with a longitudinal approach. Data was assessed within four measure points (see figure 1). Cohesion was assessed after week four (t1), eight (t2) and twelve (t3) of first participation in outpatient heart groups. Additionally, at t1, socio-demographic variables were assessed. Adherence was assessed after week eight (t2), after week twelve (t3) and after week 46 (t4).

2.3. Measures

2.3.1. Cohesion

Perceived cohesion was assessed using the questionnaire KohäsionIm Team – Freizeit und Gesundheitssport (KIT-FG), a validated German version(Kleinknecht et al., 2014) of the Physical Activity Group Environment Questionnaire (PAGEQ; (Estabrooks & Carron, 2000)). Following the conceptual model of group cohesion (Carron et al., 1998), the KIT-FG consists of 21 items depicting the four dimensions of cohesion: ATG-T – attraction to the group task (e.g., 'Other members of this group provide me with the opportunity to pursue the goals that are important for me'; α = .88 - .90), ATG-S – attraction to the group social (e.g. 'This physical activity group is an important social unit for me'; α = .93 - .96), GI-T – group integration task (e.g. 'Our group is untied in its beliefs about the benefits of the physical activities offered in this program'; α = .68 – .79) and GI-S – group integration social (e.g. 'Members of our group sometimes socialize together outside of activity time'; α = .86 - .90). The instruction of the ATG items asked participants to assess their feelings about their personal involvement within their outpatient heart group. Prior to completing the GI items, participants were instructed to assess their feelings about their physical activity group as a whole. The participants indicated their level of agreement with response options scored on a 9-point Likert scale ranging from 1 (very strongly disagree) via 5 (neither agree nor disagree) to 9 (very strongly agree). Each subscale (AGT-T, ATG-S, GI-T, GI-S) was evaluated separately (mean of the respective items), with higher scores indicating higher perception of cohesion.

Figure 1Time course of measurement




*Note.* week 0 = first participation in outpatient heart group

2.3.2. Adherence

Adherence was operationalized as the percentage of sessions attended for the three different periods following the procedure described by Oldridge(1991) and Fraser &Spink(2002).According to the assessment of cohesion, the first period compromises the adherence rate of the four weeks following the first assessment of cohesion (t2). The second period comprises the adherence rate of the four weeks following the second assessment of cohesion (t3). Finally, the third period assessed the adherence rate of the 46 weeks following the last assessment of cohesion (t4). The group instructor assessed adherence. Group exercise took place once or twice a week for the different time frames (see figure 1). Because the heart groups had a different baseline number of meetings (e.g., due to illness of the instructor or due to official holidays), we calculated the percentage of adherence.

2.4. Procedure

The study was conducted at a rehabilitation association, located in Leverkusen, North Rhine Westphalia, Germany. Association heads and group instructors were informed about the study purpose and procedure and gave their approval for the study realization. Among others, the association offers outpatient heart groups within the scope of cardiac rehabilitation program phase three. The outpatient heart groups are provided to cardiac patients who had completed phase one (acute rehabilitation phase) and phase two (early rehabilitation) of a cardiac rehabilitation program. Participation requires an initial medical examination and prescription. These outpatient heart groups are carried out by specifically trained instructors which are offering diverse physical activities, as well as relaxation and information about a healthy lifestyle appropriate for cardiac outpatients (for a detailed overview of the cardiac rehabilitation in Germany see Karoff et al., 2007). The outpatient heart group is additionally accompanied and supervised by a physician, which is required by German law. Cardiac patients usually get a prescription of 90 units in which on average last 60 minutes once or twice a week. After completion of these 90 units (usually after two years), physicians can renew the prescription or the participant can bear the costs for participation himself/herself. Participants register in one outpatient heart group so that there is a clear membership to one outpatient cardiac rehabilitation group. As the groups are open for new members to drop in at any time, slight changes of the group composition are possible over time and do not exceed twenty participants.
All new outpatient heart group members are invited for a first meeting informing them about the cardiac rehabilitation programme phase three. Between October 2017 and October 2018, all new members (on average, there was one new member per month per group) were told about the study and a possible participation was offered. Interested new members were asked to fill in a consent form. After week four (t1), eight (t2) and twelve (t3) of participation, questionnaires were distributed by the instructor assessing cohesion with the KIT-FG (see figure 1). Additionally, at t1, socio-demographic variables were assessed. Outpatient heart group members were instructed to complete the questionnaires at home. To ensure that questionnaire data remained anonymous, participants were instructed to return the questionnaire in a blank envelope at the reception of the training facility. An anonymous and unique identifier was generated for each patient. Starting with the distribution of the questionnaires, attendance was assessed by the instructor for 12 months using a coded anonymous list.

The study was approved by the Ethics Committee of the German Sport University Cologne. All procedures were in accordance with ethical standards by the responsible institutional and national committees on human research and with the Declaration of Helsinki. Informed consent was obtained from all study participants prior to participation. Participants did not receive any compensation for taking part in the survey.

### 2.5. Data Analysis

All analyses were conducted using IBM SPSS for Windows (Version 26). Data were examined according to the standards described by Tabachnick and Fidell(2014). For all time points (t1, t2, t3, t4) patterns of missing group cohesion data were analysed with the respective factor scores (i.e., ATG-S, ATG-T, GI-S, GI-T). According to Little's MCAR-Test, all data were missing completely at random ($\chi^2$ (30) = 36.02, p = .207). Missing data were not imputed, as this would skew the direction of cohesion dynamics towards the existing tendency, and thus overstate the results for both research questions. Adherence data were complete (except for dropouts, of course) as they were reported by the group instructors.

Data analysis, firstly, comprised general descriptive statistics. Secondly, data were specifically analyzed for hypothesis (1) and research question (2). With regard to hypothesis (1) multi-level analyses were run to identify dynamics of perception of cohesion, taking into account the nested nature of the data. In order to identify the basic model, initially four (one for each factor of cohesion) three-level (level 1: repeated measures; level 2: individual cardiac rehabilitation group members; level 3: cardiac rehabilitation exercise groups) unconditional means models were tested. For all factors, this model was found to be inappropriate because of the lack of variance at level 3 (ICC for ATG-S: level 3: < .01, level 2: .81; ATG-T: level 3: < .01, level 2: .34; GI-S: level 3: < .01, level 2: .32; GI-T: level 3: < .01, level 2: .51). For this reason, level 3 was excluded from further analyses. For each cohesion factor, further multilevel analyses computed (1) a two-level unconditional means model, (2) a random intercept model, and (3) a random intercept and random slope model. The results are shown in Table 2. The model comparisons show that the random intercept model is most appropriate for all factors of cohesion. This is indicated by the chi-square-based likelihood ratio test comparing the -2LL values of (2) the random intercept model and (3) the random intercept and random slope model. This test shows nonsignificant differences between these models (ATG-S: $\chi^2(1) < 0.01$, p> .05; ATG-T: $\chi^2(1) = 0.91$, p> .05; GI-S: $\chi^2(1) = 0.24$, p> .05; GI-T: $\chi^2(1) = 2.95$, p> .05;), indicating that the more parsimonious model (i.e., the random intercept model) is more appropriate. Furthermore, the AIC- and BIC-values of (2) the random intercept model were predominantly smaller than the AIC- and BIC-values of (1) the unconditional means model, and (3) the random slope and random intercept model. In addition to multi-level analyses, repeated comparisons were run to identify differences in perception of cohesion between t1, t2 and t3. This is appropriate given that there was no variance on level 3 between groups.

Table 2 Results of the multi-level analysis for dynamics of cohesion

| | ATG-S | | |
|---|---|---|---|
| | Model 1 | Model 2 | Model 3 |
| Fixed effects | | | |
| Intercept | 5.63*** (0.30) | 5.68*** (0.30) | 5.68*** (0.30) |
| Time (weeks) | | 0.08** (0.02) | 0.08** (0.02) |
| Random effects | | | |
| Residual | 0.70*** (0.13) | 0.60*** (0.11) | 0.60*** (0.11) |
| Level 1 (time) | | | < 0.01 (< 0.01) |
| Level 2 (subject) | 3.02*** (0.77) | 3.01*** (0.76) | 3.01*** (0.76) |
| Goodness of fit | | | |
| -2LL | 329.64 | 319.68 | 319.68 |
| AIC | 335.64 | 327.68 | 329.68 |
| BIC | 343.34 | 337.94 | 342.51 |
| | ATG-T | | |
| | Model 1 | Model 2 | Model 3 |
| Fixed effects | | | |
| Intercept | 6.35*** (0.23) | 6.40*** (0.23) | 6.39*** (0.23) |
| Time (weeks) | | 0.09** (0.03) | 0.09** (0.03)) |
| Random effects | | | |
| Residual | 0.81*** (0.15) | 0.67*** (0.12) | 0.54*** (0.15) |
| Level 1 (time) | | | < 0.01 (< 0.01) |
| Level 2 (subject) | 1.60*** (0.45) | 1.66*** (0.45) | 1.70*** (0.45) |
| Goodness of fit | | | |
| -2LL | 318.39 | 307.18 | 306.27 |
| AIC | 324.39 | 315.18 | 316.27 |
| BIC | 332.08 | 325.44 | 329.09 |
| | GI-S | | |
| | Model 1 | Model 2 | Model 3 |
| Fixed effects | | | |
| Intercept | 4.85*** (0.25) | 4.88*** (0.25) | 4.88*** (0.25) |
| Time (weeks) | | 0.06* (0.03) | 0.06* (0.03) |
| Random effects | | | |
| Residual | 0.91*** (0.17) | 0.85*** (0.16) | 0.77*** (0.21) |
| Level 1 (time) | | | 0.01 (0.01) |
| Level 2 (subject) | 1.93*** (0.54) | 1.95*** (0.54) | 1.97*** (0.54) |
| Goodness of fit | | | |
| -2LL | 325.47 | 321.08 | 320.84 |
| AIC | 331.47 | 329.08 | 330.84 |
| BIC | 339.10 | 339.25 | 343.56 |
| | GI-T | | |
| | Model 1 | Model 2 | Model 3 |
| Fixed effects | | | |
| Intercept | 7.11*** (0.19) | 7.15*** (0.19) | 7.16*** (0.19) |
| Time (weeks) | | 0.10** (0.03) | 0.11** (0.03) |
| Random effects | | | |
| Residual | 0.92*** (0.17) | 0.75*** (0.14) | 0.50*** (0.14) |
| Level 1 (time) | | | 0.02 (0.01) |
| Level 2 (subject) | 0.89** (0.30) | 0.94** (0.30) | 1.04** (0.30) |
| Goodness of fit | | | |
| -2LL | 303.67 | 292.17 | 289.22 |
| AIC | 309.67 | 300.17 | 299.22 |
| BIC | 317.30 | 310.34 | 311.93 |

Note. Standard errors are in parentheses. All p values in this table are two-tailed. Model 1 is an unconditional means model, model 2 is a random intercept model, and model 3 is a random intercept and random slope model.

*p< .05, **p< .01, ***p< .001.

In terms of research question (2), again, multi-level analyses were considered. In order to identify the basic model initially a three-level (level 1: repeated measures; level 2: individual outpatient heart group members; level 3: cardiac rehabilitation exercise groups) unconditional means model was tested. This model was found to be inappropriate due to missing variance on level 3 (ICC for level 3: < .01, level 2: .11). For this reason, level 3 was excluded, but also a two-level model revealed a general lack of variance in data, leading to the conclusion that multi-level analyses on the relationship between perception of cohesion and adherence were impossible and inappropriate (see Table 3).

For this reason, bivariate correlation analyses were calculated. Because adherence was operationalized as the percentage of sessions (with bounded data from 0 to 1), the analyses related to research question (2) were counterchecked with logit-transformed adherence data (Warton & Hui, 2011).

The results did not change (e.g., inappropriateness of level 3 due to ICC for level 3: < .01, level 2: .02). See Table 3 for more data of comparing the original and transformed data results).

Table 3
Results of the multi-level analysis for adherence

| | Unconditional means model | |
|---|---|---|
| | original values | logit-transformed values |
| Fixed effects | | |
| Intercept | 0.58*** (0.03) | 0.12 (0.12) |
| Random effects | | |
| Residual | 0.06*** (0.01) | 1.13*** (0.22) |
| Level 2 (subject) | 0.01 (0.01) | 0.02 (0.15) |
| Goodness of fit | | |
| -2LL | 9.66 | 249.73 |
| AIC | 15.66 | 255.73 |
| BIC | 23.32 | 266.03 |

Note. Standard errors are in parentheses. All p values in this table are two-tailed.
***p< .001.

## 2. Results

### 3.1. Characteristics of cohesion and adherence

Descriptive statistics for cohesion and adherence are shown in Table 4. On the descriptive level, perception of cohesion was moderate to high on average with moderate standard deviations. Furthermore, the adherence rate from new outpatient heart group members diminished from 71.3% - week four to eight after the start of participation, to 59.2% - week eight to week twelve after the start of participation, to 41% after one year of participation.

Table 4
Descriptive statistics and Cronbach's Alpha for the subscales of cohesion for the total sample.

| | *N* | *M* | *SD* | *Min* | *Max* | α |
|---|---|---|---|---|---|---|
| ATG-S t1 | 37 | 5.30 | 1.78 | 1.50 | 8.50 | .93 |
| ATG-T t1 | 37 | 5.94 | 1.64 | 1.67 | 9.00 | .88 |
| GI-S t1 | 35 | 4.52 | 1.66 | 1.50 | 8.25 | .79 |
| GI-T t1 | 35 | 6.58 | 1.69 | 1.80 | 9.00 | .88 |
| Adherence rate 1 (t2) | 33 | 71.3% | 23.0% | 25% | 100% | |
| ATG-S t2 | 30 | 5.73 | 2.17 | 1.33 | 9.00 | .96 |
| ATG-T t2 | 30 | 6.37 | 1.62 | 2.00 | 9.00 | .90 |
| GI-S t2 | 30 | 5.06 | 1.70 | 2.00 | 9.00 | .68 |
| GI-T t2 | 30 | 7.23 | 1.16 | 4.00 | 9.00 | .86 |
| Adherence rate 2 (t3) | 30 | 59.2% | 27.5% | 13% | 100% | |
| ATG-S t3 | 29 | 6.02 | 1.73 | 2.67 | 9.00 | .95 |
| ATG-T t3 | 29 | 6.69 | 1.31 | 4.00 | 9.00 | .88 |
| GI-S t3 | 29 | 4.98 | 1.65 | 1.75 | 9.00 | .78 |
| GI-T t3 | 29 | 7.45 | 1.07 | 5.20 | 9.00 | .90 |
| Adherence rate 3 (t4) | 31 | 41.0% | 21.7% | 2% | 100% | |

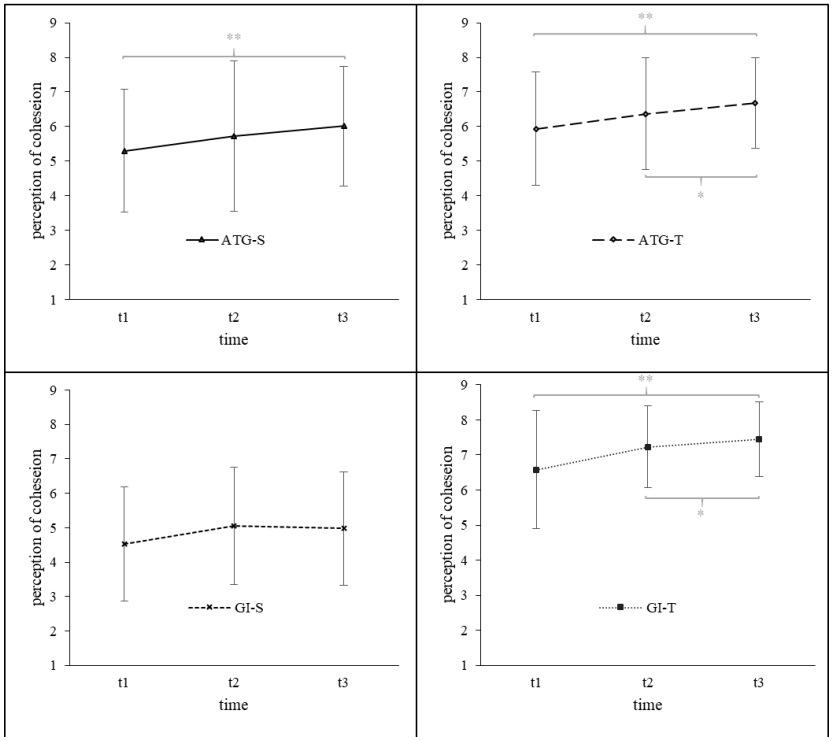
### 3.2. Development of cohesion over time

The random intercept models show that all factors of cohesion constantly increased significantly over time (weeks). The degree of increase varied between 0.06 (GI-S) and 0.10 (GI-T). For all factors of cohesion, there was significant variance between individuals. This means that participating subjects varied in their actual degree of cohesion which could not be explained with the parameters in the model.

In order to further analyze the change of cohesion over time, two blocks of analyses for comparison of measurement points were run. Firstly, a repeated-measures ANOVA for each cohesion factor was run. These ANOVAs included all persons who did not drop out during the study and whose data were complete. Results show significant differences in ATG-S ($F(2, 50) = 2.80$, $p = .019$, $\eta^2 = .15$, $1\text{-}\beta > .99$), ATG-T ($F(2, 50) = 5.02$, $p = .010$, $\eta^2 = .17$, $1\text{-}\beta > .99$), and GI-T ($F(2, 46) = 5.16$, $p = .010$, $\eta^2 = .18$, $1\text{-}\beta > .99$) over time, but not in GI-S ($F(2, 46) = 1.33$, $p = .274$, $\eta^2 = .06$, $1\text{-}\beta = .98$). Specifically, Bonferroni-adjusted post-hoc-analyses revealed a significant increase for both ATG-S and ATG-T from t1 to t3 ($p = .011$ and $p = .028$, respectively). GI-T increased from t1 to t3 ($p = .034$) and from t2 to t3 ($p = .016$).

Second, all measurement points were compared pairwiseusing t-Tests to include as much data as available (e.g., considering persons who dropped out at t3, but provided data for t1 and t2). Results revealed significant differences for ATG-S between t1 and t3 ($t(28) = -3.32$, $p = .002$), for ATG-T between t1 and t3 ($t(28) = -3.37$, $p = .002$) as well as between t2 and t3 ($t(25) = -2.53$, $p = .018$), and for GI-T between t1 and t2 ($t(27) = -2.14$, $p = .042$), t1 and t3 ($t(26) = -2.53$, $p = .018$) as well as between t2 and t3 ($t(25) = -3.29$, $p = .003$). There were no significant differences for GI-S.

Figure 2 Development of perception of cohesion over time – results of pairwise t-tests




Note. * p< .05, two-tailed. ** p< .01, two-tailed; ATG-S = attraction to the group social; ATG-T = attraction to the group task; GI-S = group integration social; GI-T = group integration task. t1 = week four after first participation; t2 = week eight after first participation; t3 = week twelve after participation. 1 (very strongly disagree) via 5 (neither agree nor disagree) to 9 (very strongly agree).

### 3.3. Relationship between cohesion and adherence

Due to general lack of variance in adherence data over time (see Table 3), multi-level analyses were not possible and inappropriate. Bivariate correlations showed no significant associations between perception of cohesion and adherence rate (see Table 5).

Table 5
Intercorrelation between group cohesion and adherence for all three time points.

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) ATG-S t1 | | .60** | .52** | .42** | .81** | .68** | .52** | .43* | .83** | .69** | .51** | .21 | -.09 | -.16 | .31 |
| (2) ATG-T t1 | .66** | | .74** | .30 | .54** | .68** | .64** | .36 | .57** | .69** | .60** | -.24 | -.27 | -.24 | .20 |
| (3) GI-T t1 | .53** | .74** | | .43** | .33 | .55** | .54** | .33 | .41* | .53** | .55** | .15 | -.23 | -.19 | .05 |
| (4) GI-S t1 | .36 | .30 | .48** | | .28 | .21 | .31 | .61** | .32 | .28 | .32 | .62** | .13 | .01 | .14 |
| (5) ATG-S t2 | .79** | .54** | .28 | .20 | | .74** | .71** | .50** | .90** | .74** | .69** | .32 | .06 | -.05 | .25 |
| (6) ATG-T t2 | .66** | .73** | .56** | .19 | .74** | | .75** | .32 | .76** | .88** | .72** | -.06 | -.23 | -.18 | .16 |
| (7) GI-T t2 | .55** | .63** | .57** | .22 | .78** | .81** | | .54** | .71** | .71** | .83** | .22 | -.19 | -.15 | -.06 |
| (8) GI-S t2 | .45* | .38 | .37 | .64** | .55** | .32 | .53** | | .56** | .47* | .57** | .83** | .29 | .01 | .14 |
| (9) ATG-S t3 | .83** | .57** | .41* | .32 | .90** | .76** | .71** | .56** | | .84** | .63** | .34 | -.03 | -.07 | .17 |
| (10) ATG-T t3 | .69** | .69** | .53** | .28 | .74** | .88** | .71** | .47* | .84** | | .78** | .19 | -.15 | -.12 | .24 |
| (11) GI-T t3 | .51** | .60** | .55** | .32 | .69** | .72** | .83** | .57** | .63** | .78** | | .33 | -.06 | -.06 | .06 |
| (12) GI-S t3 | .21 | .01 | .15 | .62** | .32 | -.06 | .22 | .83** | .34 | .19 | .33 | | .50** | .31 | .12 |
| (13) Adherence rate 1 (t2) | -.23 | -.30 | -.32 | .08 | -.08 | -.34 | -.20 | .32 | -.03 | -.15 | -.06 | .50** | | .40* | -.01 |
| (14) Adherence rate 2 (t3) | -.21 | -.19 | -.20 | .08 | -.10 | -.25 | -.08 | .03 | -.07 | -.12 | -.06 | .31 | .35 | | .23 |
| (15) Adherence rate 3 (t4) | .25 | .21 | .06 | .16 | .24 | .14 | -.03 | .15 | .17 | .24 | .06 | .12 | -.04 | .20 | |

Note. * p< .05, two-tailed. ** p< .01, two-tailed. Adherence rate 1 (t2) = week 4 - 8 after start of participation, Adherence rate 2 (t3) = week 8 - 12 after start of participation; Adherence rate 3 (t4) = week 12 to 54 after start of participation), the intercorrelations from all patients are displayed above and for the persistent patients under the diagonal.

## 4. Discussion

The use of group dynamic principles, particularly group cohesion, to influence individual physical activity behavior has received much attention in the nonclinical setting (Estabrooks & Carron, 2000). In contrast, research in the clinical setting in general and particular in outpatient heart groups in the context of cardiac rehabilitation is scarce. The present study dealt with this gap. The results showed empirical evidence for the dynamic nature of group cohesion. Among new members joining existing outpatient heart groups, social and task cohesion developed positively over a 12-week period. These results suggest that group cohesion develops in new members who join existing groups without a specific intervention.

The fact that all of the members are cardiac patients and share a common identity, as well as the focus of the content of these groups, may be sufficient for the development of group cohesion. Nevertheless, the results further showed that group cohesion is not a significant predictor of adherence among these new members. The properties of the groups could be an explanation for these results and should be more focused in future research and interventions.

Regarding our finding on the dynamic nature of cohesion of new members joining existing outpatient heart groups, several aspects can be discussed. Afirst aspect concerns the diverging degree of cohesion of new group members in the beginning of their group membership. After four weeks of participation in an outpatient heart group, the new members reported inter-individually different levels of perception in all sub-scales of cohesion. One explanation for this finding could be that new members in outpatient heart groups in general need time to evaluate the existing group concerning their individual attraction to the group as well as the group integration regarding the group's task and social aspects. These newcomer evaluations are highly individual processes (Coultas et al., 2014), which are influenced by several factors (Carron & Hausenblas, 1998; Dunlop & Beauchamp, 2011; Moreland & Levine, 1982). Of these factors, the perceived similarity to the other group members seems to be highly important for the perception of group cohesion. The perceived similarity to the other group members comprises surface level similarity (e.g. demographic attributes) and deep level similarity (e.g. attitudes, beliefs, motives; (Dunlop & Beauchamp, 2011; Shapcott et al., 2006)). Heart group participants have one fundamental thing in common: they all have heart disease. This could lead to a shared identity. However, other characteristics such as age, previous experience with physical activity, as well as attitudes, individual motives and goals are different in such groups and for this reason lead to deviating cohesion perceptions of the individual. When forming groups in the context of cardiac rehabilitation, the similarities to other group members should be taken into account to promote the individual development of group cohesion.

Another aspect concerning the dynamic nature of cohesion is that cohesion (ATG-S, ATG-T, GI-T) increased constantly over time. This dynamic of cohesion is in line with theoretical assumptions(Carron & Hausenblas, 1998)and with previous research conducted in this field (Dunlop et al., 2012). From a theoretical point of view, it can be assumed that new members of a group undergo a process of assimilation(Levine et al., 2001). In the process of interaction with the existing group members, the new member learn more about the other members, establishes relationships and his/her role within the group(Mennecke et al., 1992). Hence, the constant increase of cohesion of new members of outpatient heart groups is a sign for positive group integration.

From an empirical view the present findings are consistent with previous research concerning the dynamic development of group cohesion. Dunlop and colleagues (2012) tracked the development of cohesion in group-based exercise programs with healthy adults and found significant changes over time for the social but not for the task cohesion. Accurately described, ATG-S first decreased between the second and the fifth class/week and then increased slightly after the eighth class/week. GI-S increased between the second and the eighth class/week. The authors explained their results with the assumption that in the investigated groups (yoga, pilates and strength & conditioning) the nature of the task being performed within the class remains the same throughout the program and the social cohesion changes as members get to know each other. The findings of the present study concerning the development of cohesion of new members of outpatient heart groups over time showed different results. The social and the task dimension (ATG-T, ATG-S, GI-T, GI-S) increased constantly over a twelve-week period. Apparently the new members in outpatient heart groups needed time to develop social cohesion (e.g., getting to know the other members) and needed time to evaluate the task of the group. The content and type of intervention in outpatient heart groups are manifold and not that obvious as in specialized courses as Yoga or Pilates. However, the content of the proposed physical activity in groups has an impact on the development of task cohesion (Coultas et al., 2014; Estabrooks & Carron, 1999). For example, offering a team sport such as an adapted form of volleyball may influence perception of cohesion differently compared to an offer like a workout on an ergometer. The content clarity of outpatient heart groups could help promote the development of task cohesion. Further research is needed to replicate these findings.

The results of the present study show that there is no significant relationship between cohesion and adherence for new members in existing outpatient heart groups. This is in line with existing research in the rehabilitation setting which found no significant relationship between cohesion and adherence for members within existing groups with short membership duration(Chermette et al., 2019) but in contrast to the findings of (Fraser & Spink, 2002)which found a significant positive relationship between cohesion and adherence in newly formed groups.

The group properties concerning the formation (newly formed group vs. existing groups) and the membership as well as the underlying identification processes could be an explanation for the diverging results (Chermette et al., 2019). Identification processes are typically divided into cognitive (knowledge about belonging to the group), affective (positive emotions about being part of the group) and evaluative (membership is important and influencing) components (Tajfel, 1982). These commitments and feelings in a group are depending on time (Moreland & Levine, 1982).

In regard of the conditional relation between cohesion and adherence in existing groups, it is conceivable that the cognitive and affective components of identification of new members entering this group are high but the evaluative component is not yet. Thus, the group in the beginning of the membership is not that important for the member and does not influence the individual behavior. This influence could increase as the membership lasts(Chermette et al., 2019). In newly formed groups, the evaluative component of identification could emerge faster because every individual is a constituting member of this group. This in turn could have an impact on individual behavior already at the beginning of the group membership. Further studies should examine in which phase of group development in different groups cohesion actually influences adherence and should focus on the underlying mechanism like the identification processes.

For new members entering in existing groups, adherence in in early phases of membership might be influenced by group factors as well as individual factors. An important factor for exercise adherence for new members might be the surface level similarity with other group members. Group members have a general preference to exercise with similar others (Dunlop & Beauchamp, 2011) and thus could influence adherence behavior directly. The individual factors might be task self-efficacy (Woodgate & Brawley, 2008), which seems to help members to overcome the intention action gap in the beginning of exercising in outpatient heart groups. In the later phase of membership self-regulatory efficacy beliefs seems to be more important for adherence than task-efficacy (Quirk et al., 2018; Woodgate et al., 2005). Future interventions in the context of outpatient heart group should consider these group properties. In the beginning of the group membership interventions should rather focus individual factors such as self-efficacy. In the latter phase of the membership, the group could be the focus of the intervention to enhance the adherence behavior of cardiac patients.

## 5. Limitations and strengths

Limitations exist regarding the sample, the content of the cardiac rehabilitation exercise groups and the data collection. The small sample size limits our findings. We have examined only 40 new members of outpatient heart groups which limits the generalizability of the results. Furthermore, the present study was conducted in only one rehabilitation center offering outpatient heart groups. To strengthen the present results further studies need to be realized with larger sample sizes and in other rehabilitation centers offering outpatient heart groups. Another limiting factor is the heterogeneity in the content offered in the cardiac rehabilitation exercise groups. We did not record the exact content of the course. The range of exercises may influence the dynamic of cohesion differently (Estabrooks & Carron, 1999). Finally, it has to be mentioned that we did not collect cohesion from all group members but only for the new member entering the group. For a detailed exploration of the dynamic change of cohesion after a new member enters the group further research should raise data of group cohesion of groups before a new member enters and afterwards.

Despite these limitations, the current study demonstrates some strengths: First, the longitudinal approach of the current study adds information about the dynamic of cohesion to the research gap in the field of cohesion in outpatient heart groups. These findings offers potential for further investigation concerning the dynamic of cohesion as well as the relationship. Second, even if the sample size is relatively small, the distribution of the characteristics such as sex and age as well as disease type are common among outpatient heart groups (Bjarnason-Wehrens et al., 2006). Third, the present study focused on solely new members in outpatient heart groups. This is an important sample according to the high drop outs often occurring within the first six months of participation (Bjarnason-Wehrens et al., 1998; Keck & Budde, 1999).

## 6. Conclusion

In conclusion, the current study found empirical evidence for the dynamic nature of group cohesion in outpatient heart groups. New members entering an existing group with other members having similar diseases develop cohesion without any specific intervention. Moreover, the present study showed that group cohesion is not a significant predictor of adherence for these new members. The properties of the groups might be an explanation for these results and should be more focused in future research and interventions.

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