Discrepancies in Physical and Psychological Recovery After Injury in Elite Youth Football Players

Thomas Klunder

s5257638

Department of Psychology, University of Groningen

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Group number: 06

Supervisor: M.Sc. Niklas Neumann

Second evaluator: Dr. Ben Gutzkow

In collaboration with: Aaron Connemann, Lucas Reijnhoudt, Minsoe Veenstra, Sietse Witteveen and Tim van der Kooi

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Abstract

Research has shown that injury negatively impacts mood and self-efficacy. Research seems to suggest a possible discrepancy between the psychological recovery of mood and self-efficacy when compared to physical recovery (return to play). This study focused on the effects of a time-loss injury on mood and self-efficacy. The goal was to assess a possible discrepancy between physical -and psychological recovery. To test whether the ´ergodicity problem´ occurred, group results were compared to two individual players, to discern if the results were generalizable. Time-series data (single item self-reports) was collected daily from 29 elite male youth football (soccer) players, playing in their highest respective age division in the Netherlands across two seasons. The number of days until return to play were counted and then compared to the amount of days it took for the psychological variable to return to the pre-injury average. Almost every player dropped significantly in mood and self-efficacy during the complete injury process. Only two-third of the players dropped significantly in mood and self-efficacy on the first day of injury. The t-test for the group analysis was not significant $p > 0.05$ for both mood and self-efficacy. Even when adding a robustness measure the t-test remained insignificant. The individual players did drop significantly and showed longer psychological recovery than physical recovery, leading to a non-generalizable group result. Future research should do a second analysis where players without a drop on the first day are excluded.

Keywords: Injury, Football, Nonergodicity, Psychological Recovery, Mood, Time-Series, Self-Efficacy.

Discrepancies in Physical and Psychological Recovery After an Injury in Young Elite Football Players

Elite athletes operate within high-performance contexts where intense physical demands, competitive pressures, and sport-specific demands place considerable strain on the body and significantly increase the risk of injury. A striking example of this is Liverpool defender Virgil van Dijk, who sustained an injury during a match against Everton, where he ruptured the ACL ligament in his knee. As a result of this injury, he was sidelined for 255 days (Transfermarkt, 2025). In an interview on the Liverpool FC Youtube channel van Dijk talked extensively about the effects of the injury on his mind and body (Liverpool FC, 2021). Here van Dijk spoke about the challenges involved with getting injured for such an amount of time, challenges such as alternating good and bad days, learning how to walk again due to the knee injury, setbacks, being lonely during recovery and also returning to sport after such a long time. After physical recovery, the time of returning to sport is also filled with lots of emotions like the relief of getting there and pride of coming back, but then a new challenge opens up: getting back to the old performance level (Liverpool FC). Something that helped van Dijk during this long recovery period and the following return to sport was focusing on his own ability to aid his own recovery and successive return to sport, although this belief wasn't unwavering due to the nature of an injury's recovery trend (Liverpool FC). This focus on his own ability to aid recovery and a successive return is a part of self-efficacy as formulated by Bandura (1978).

The example of van Dijk is illustrative of the sports psychology literature and supports the assumption that psychological processes such as mood and self-efficacy are affected as a result of injury. Hence it is important to explain how injuries are viewed and defined in the sports psychology literature. The assumption regarding the fickle nature of injury occurrences is supported by van Beijsterveldt et al. (2014), who found that 60% of their sample of Dutch

amateur soccer players sustained at least one injury during any season. Elite football players sustain about two injuries on average per year (Ivarrson et al., 2017). Injuries in the sports literature are described as time-loss injuries due to a review from Fuller et al. (2006) regarding injuries in football players. These time-loss injuries are defined as any physical complaint sustained by the athlete that causes the player to be unable to take full part in either training or a match due to the injury (Fuller et al., 2006). The majority of injuries last for a period of up to four weeks, as was found in a review by Ekstrand et al. (2020). Next to this, Fuller et al. defined injury severity as the number of days that have passed from the moment of injury and the moment at which the player is fully available for practice and matches. This is seen as returning to play, because there might still be some physical discomfort or pain (Fuller et al., 2006). Given the inherent risk of injury in elite sports, Virgil van Dijk's case illustrates the importance of psychological recovery next to physical rehabilitation.

As explained by the literature regarding injuries and the illustrative example of van Dijk it can be seen that injuries seem to affect the psychological processes of mood and self-efficacy. This leads to the scope of the present study where these effects of injury will be assessed to see if there is a discrepancy between physical recovery and the recovery of psychological variables.

To begin with, the illustrative example of Virgil van Dijk displays how removal from sport and challenges during rehabilitation can lead to a negative impact on mood. Mood can be defined as a temporary feeling or state of emotion (Ardern et al., 2013). This assumption of the effect of injuries is supported by a great body of research on the topic of mood and/or emotions in injured athletes. This body of research found that injured athletes still might have present physical pain which in turn affect mood, have greater mood disturbances, are more anxious than before, fears of reinjury, report more negative emotions, decreases in self-esteem, report more fear and report more frustration (Ardern et al., 2012; Brewer, 2017;

Clement et al., 2015; Gennarelli et al., 2020; Johnston and Carroll, 1998; Podlog and Eklund, 2005).

A pattern has been observed in these responses of mood following injury. In this pattern negative influences on mood are the highest immediately after the injury, drop afterwards and negative affect increases upon returning to sport. This results in a u-shaped emotional pattern to be observable (Ardern et al., 2012; Morrey et al., 1999). The first part of this u-shaped pattern, namely an immediate reaction to injury seems plausible, due to for example physical pain and removal from sport. While this is important to acknowledge, it falls outside the primary focus of this study. Within the focus of this research however is the psychological response of returning to sport and the recovery of psychological variables. The second part of the u-shaped pattern can be explained by Ardern et al. (2012) who found that negative psychological responses can occur upon receiving medical clearance to return to sport participation and is supported by Ardern et al. (2013) who found that competitive athletes tend to show greater mood disturbances upon returning to sport.

Additionally, injury severity seems to affect mood, lead to greater state anxiety, longer and more negative psychological responses, lengthened psychological distress and bigger mood disturbances (Ardern et al., 2012; Johnston and Carroll,1998; Roh and Perna, 2000; Quinn and Fallon, 1999; Quan and Chen, 2025). Building upon the research already presented, this is also supported by Ardern et al. (2012), who found that negative psychological responses may carry over upon returning to sport. Several studies have shown that athletes commonly experience reinjury anxiety or fear of reinjury (Clement et al. , 2015; Morrey et al., 1999; Podlog and Eklund, 2005, 2007; Principe and Kerr, 2025; Thomeé et al., 2007; Wadey et al., 2014). These findings support the idea that mood disturbances may persist even after the return to play. Next to that, fear in general also seems to be a prominent emotion upon the return to sport (Ardern et al., 2012; Podlog and Eklund, 2005, 2007; Morrey

et al., 1999; Thomeé et al., 2007; Truong et al., 2020). This further supports the idea that mood might be affected for a lengthened period of time, leading to a discrepancy between physical recovery and the psychological recovery of mood. This leads to the first hypothesis: A time-loss injury significantly impacts mood and recovering psychologically takes longer than physical recovery (H1). Here, physical recovery is seen as returning to play. If true, this research might help guide sport psychologists to focus interventions at injured athletes returning to sport.

Secondly, self-efficacy seems to be affected by injury as well. Perceived self-efficacy is defined as a judgement of one's perceived ability or confidence to perform on or carry out a task (Bandura, 1978). There is a substantial body of evidence supporting that injury can negatively impact self-efficacy (Ardern et al., 2013; Clement et al., 2015; de la Vega et al., 2017; Gennarelli et al., 2020; Masten et al., 2014; Quinn and Fallon, 1999; Thoméé et al., 2007; Wiese Bjornstal et al., 1998). Therefore, it can be concluded that self-efficacy might be affected as a result of injury. The effects of time-loss of injury on self-efficacy are supported further by literature (Ardern et al., 2012; Brewer, 2017; de la Vega et al., 2017; Johnston and Carroll, 1998; Podlog and Eklund, 2005; Truong et al., 2020). They found that confidence and/or self-esteem were affected as a result of injury, which might influence self-efficacy beliefs as well. Additionally, Ardern et al. (2012) found that negative psychological responses might carry over into the return to sport. Based on the aforementioned literature, it is hypothesized that self-efficacy is affected due to injury and takes longer to recover than physical recovery just as mood (H2). As per the effect of injury on mood, if self-efficacy is found to be affected for a prolonged period of time following injury, it might help guide sport psychologists in the right direction to guide interventions.

Lastly, every individual player's psyche is different and therefore nonergodic. This has been shown in research regarding football players (Hill et al., 2018; Neumann et al., 2022,

2024; Wiese-Bjornstal et al., 1998). In their research they found that group results could not be generalized to individual players. This process is called nonergodicity. Nonergodicity has become a new subject in psychological research in general after Molenaar (2004)'s influential paper. This nonergodicity of psychological processes means that these processes have immense individual differences and are therefore not ergodic (Fisher et al., 2017; Molenaar, 2004; Van der Gaag, 2023). Due to these individual differences, group results cannot be generalized because almost no individual follows this ergodic group average (Fisher et al., 2017; Molenaar, 2004; Van der Gaag, 2023). This is due to the heterogeneity of individuals that violates the homogeneity assumption of ergodic processes (Fisher et al., 2017; Molenaar, 2004; Van der Gaag, 2023). This gives an explanation as to why almost no individual follows the exact average trend over time (Fisher et al., 2017; Molenaar, 2004; Van der Gaag, 2023). These results show that nonergodicity is found across multiple fields of psychology as well. This brings us the third hypothesis which states that the group results of injury on mood as well as self-efficacy do not generalize to players on an individual basis (H3). If true, this will be an important consideration for sports psychologists to tailor interventions more to the individual player instead of the group.

To conclude, this study contributes to the growing body of research on the impact of injury on mood and self-efficacy, all the while offering insights into the duration and a possible discrepancy between psychological recovery when compared to physical recovery or return to play. Unlike much of the existing research that mostly focuses on concussions or ACL injuries, this study broadens the scope to other types of physical injuries, thereby enhancing the relevance of psychological recovery for practitioners. Identifying a discrepancy between psychological and physical recovery could help practitioners recognize the importance of addressing psychological factors and tailor possible interventions accordingly

Methods

Subjects

The subjects in this study are 96 male players from the Under-16, Under-18 and Under-21 teams of an elite first division (Eredivisie) football club in the Netherlands. 29 players were included in the sample after inclusion criteria were applied (more details under Data Pre-Processing). These players performed in the first division possible in their age category. Their data was collected as part of ongoing monitoring at the football club itself. Informed consent was obtained from the players to be able to use their data in this research. The players in the dataset generally participated in six to eight training sessions per week consisting 60 to 90 minutes, with matches on the weekend.

Design, Measures and Procedure

The present study was conducted according to the requirements of the Declaration of Helsinki and was approved by the ethics committee of the Faculty of Behavioural and Social Sciences of the University of Groningen (research code: PSY-2425-S-0016). The data used in this study is data from two full seasons (2020-2022). This data consisted of psychological (i.e., self-efficacy and mood) as well as data on time-loss injuries (Fuller et al., 2006). To protect the participants' identities their exact age and for example playing position are not provided. It is needed to point out that there is a distinction made between days and measurement days in the data. This means that although a season might take 365 days, not every day is measured and therefore a measurement day is one datapoint.

Daily monitoring is an integral part of the club’s philosophy and therefore part of their approach to development. This way players became familiar with this type of monitoring from age 15 onwards. At multiple points during the season coaches emphasized the practice of monitoring to help guide development, reduce the likelihood of injuries and enhance performance of the players. Hence it is reasonable to expect that common limitations of self-report questions, for example socially desirable responses or compliance issues are prevented

(Nederhof, 1985). This is due to players knowing that honestly and fully participating is in their best interest for aiding their development.

The self-report questions that were used on a daily basis consisted of single-item questions are shown in Table 1. These sort of single-item questions are shown to have good predictive validity if questions are specific enough (Song et al., 2023; Saw et al., 2017). Questions were answered individually up to 30 minutes before the first training session. This was done on a tablet near the locker room without other players or staff in the vicinity and therefore might help prevent socially desirable answers.

Table 1

Questions used for data collection

	Question	Scale	References
Self-Efficacy	How confident are you that you can perform maximally today?	[a]VAS from 0 (not confident) to 100 (very confident)	(e.g. Bandura, 2006; Wiese-Bjornstal, 2019;)
Mood	How much are you in the mood to train/play the match today?	[a]VAS from 0 (not at all in the mood) to 100 (very much in the mood)	(e.g.Cohen et al., 2006; Kleinert, 2007)

Note. Questions regarding injury were true or false questions. [a]VAS stands for visual analogue scale.

Data Pre-Processing

The following inclusion criteria were applied to include players for analysis. Firstly, each player needed to have one injury occurrence between the first and last seven measurements. This was done to make sure a baseline prior to the injury could be created and possible fluctuations could be observable following injury. This criterion was also used as a minimum, so that each player had a minimum amount of time following the physical recovery

to recover psychologically. Secondly, each player needed to have at least 100 measurement days entered during data collection. This was done to ensure players were familiar with data collection procedures and to get a representative sample of players. Lastly, each player needed to have more than 70% of possible measurements per factor and did not miss more than three days in a row (Weed et al., 2022). Here 70% and 3 days were chosen for this study based on the research of Weed et al. (2022), who found that too much missing data in total or missing in a row would influence the reliability of linear interpolation. These inclusion criteria resulted in a final sample size of 29 players, where an average of 135 observations per player (range 32-412) was observed. This average and range were after deleting measurements if re-injury occurred and imputing missing values using linear interpolation to maintain data continuity (Jarno, 2025). Of these 29 players, 27 were used for the statistical analysis because there were two significant outliers. Of which one player who did not recover and one who did not drop significantly compared to baseline, but had a long injury (100+ days) Nevertheless, these two players will be mentioned due to their relevance to the practitioner in real-life situations.

Statistical Analysis

After data pre-processing, Excel was used to calculate averages of the psychological variables for each player before the injury. Excel was chosen for its convenience. This average was made to determine a baseline. Using the standard deviation per player, an assessment was made to determine if a significant drop in self-efficacy and mood scores occurred on the day following the injury. This criterion is based on the research of Saw et al. (2017), who found that a drop of one more standard deviation was significant. Furthermore, exploratory research was done to see whether a drop occurred during the whole injury phase.

Following this, an assessment was made of the amount of days it took before the psychological variable (i.e. self-efficacy and mood) returned to baseline following the injury.

Returning to baseline is formulated in this study as: bouncing back. This needs to occur at least once in regard to the baseline average or above and is formulated as psychological recovery. Since the initial bouncing back could be due to factors like accidental entry or a positive life event, the second bounce-back was also calculated. This also served as a way to assess notable differences and a robustness-check. If a player did not have a significant drop on the first injury day, the first and second bounce-back measures were counted as 0 days. Following this the amount of the days it took before a player returned to play were counted and is named physical recovery. To assess whether there was a significant difference between physical and psychological recovery time, a paired samples t-test was done using SPSS.

After assessing the group results, the results of two random individual players were analyzed to check for nonergodicity. These players were chosen at random using excel to see whether the group results can be generalized to the players or not. Also, the individual trajectories of mood and self-efficacy were plotted to see whether a pattern could be observed in the individual data.

Results

Descriptive Statistics

Firstly, the results of whether at least a 1 standard deviation (SD) drop in mood and/or self-efficacy occurred are shown in Table 1. These results support the literature where self-efficacy and mood are significantly affected as a result of the injury. Here, roughly two-third of the players experience a drop directly on the first day of injury itself. Next to that, almost every player experienced a drop at least once during the injury itself. Next to this there were some players where a drop did not occur. This did not change when assessing the whole duration of the injury.

Table 2

Frequencies of one standard deviation drop following injury or during injury.

	Yes	No
SD drop mood on first day of injury	21	8
SD drop self-efficacy on first day of injury	20	9
SD drop mood during injury	28	1
SD drop self-efficacy during injury	26	3

Note. During injury means that a drop did or did not occur during the full duration of the injury and SD = standard deviation.

As described in Data Pre-processing, 27 players were included in the descriptive statistics. There was a high variation in the pre-injury averages of mood and self-efficacy between the players as seen in the ranges in table 3.

Further, looking at the averages of physical and psychological recovery, the psychological recovery averages for the first bounce-back are lower than the physical recovery. On the other hand, the averages for the second bounce-back were higher than the physical recovery average. These results do not match the first and second hypotheses that psychological recovery of both mood and self-efficacy takes longer than physical recovery.

Table 3

Averages, ranges and 95% confidence intervals of the group for physical recovery and psychological recovery(bouncing-back) days.

	Mean	Range	95% CI [a]	
			LB	UB

Pre-injury mood	79.716	[56.48 - 98.08]	76.51	83.291
Pre-injury self-efficacy	76.773	[61.53 - 89.55]	74.26	80.33
Physical recovery	13.26*	3 - 42	9.66	24.41
First bounce-back mood	11.19	0 - 39	-234.7	95.25
Second bounce-back mood	16.63	0 - 42	-230.04	100.73
First bounce-back self-efficacy	9.41	0 - 34	-236.22	93.46
Second bounce-back self-efficacy	13.63	0 - 49	-232.62	97.73

Note. The bounce-back variables are the psychological recovery variables. Here the bounce-back is seen as the first return to the pre-injury average or above and is formulated in days. Means of mood and self-efficacy averages are on the VAS-scale.

[a] CI is an abbreviation for confidence interval.

Assumption Checks

There were two outliers which if not deleted, would have influenced the data significantly. The normality test (Shapiro-Wilk) with $p = < .05$ confirmed this. The first player did not psychologically bounce back to his pre-injury average, the second player did not drop significantly while sustaining a long injury and causing a high difference score. After removing these outliers no assumptions for a paired-samples-t-test were violated and the QQ plots looked normal (see figures 1 through 4 in Appendix). These assumptions include normality and continuous numerical variables, where the variables looked normal and were continuous.

Group Analysis

Following the analysis of the descriptives, a paired samples t-test was conducted to assess whether psychological recovery takes longer than physical recovery. As shown in Table 3, no significant differences were found for the psychological recovery of mood and self-efficacy when compared to physical recovery, with $p = > 0.05$ for both. This leads to rejecting the hypotheses regarding a longer duration of psychological recovery for both mood and self-efficacy. Interestingly, the negative values of the difference variables for the first bounce-back suggest that the direction could be the other way around, namely that the psychological recovery could precede physical recovery. However, this is not the case for the second bounce-back variables.

Table 4

Paired samples t-test results with t and p-values.

	Difference	95% CI difference	*t (p)*
Psychological recovery self-efficacy first bounce-back	-3.852	[-9.166 - 1.462]	-1.49 (.074)
Psychological recovery self-efficacy second bounce-back	.370	[-6.442 - 7.183]	.112 (.456)
Psychological recovery mood first bounce-back	-2.074	[-7.347 - 3.199]	-.808 (.213)
Psychological recovery mood second bounce-back	3.370	[-2.596 - 9.337]	1.161 (.128)

Note. The psychological recovery variables were all paired with physical recovery. The first bounceback means first bounce-back and second means the second bounce-back.

Individual Player Analysis

In this section, the results from two random players (see statistical analysis on how) are highlighted to see whether the group results can be applied to the individual level. This relates to H3 regarding non-ergodicity.

Table 4 presents the pre-injury averages, standard deviations, physical -and psychological recovery for both players. Both experienced a drop of 1 SD or more on both mood and self-efficacy on the day their injury occurred. Next to that, we can see some individual differences in answering and responding to injury as well. Thus, adding to the nonergodic nature of these psychological processes.

Table 5

Descriptive statistics for the individual players that are analyzed

	Player 1	Player 2
Pre-injury average mood	80.25	86.84
Post-injury average mood	64.32	83.23
Pre-injury average self-efficacy	78.35	67.31
Post-injury average self-efficacy	68.3	63.44
Physical recovery	25	4
First bounce-back mood	21	12
Second bounce-back mood	39	19
First bounce-back self-efficacy	29	12
Second bounce-back self-efficacy	39	18

Note. The psychological and physical recovery variables (including bounce-back variables) are formulated in amount of days.

Player 1

Player 1 shows a sizable drop in both mood and self-efficacy immediately following injury. Table 4 also shows that the first bounce-back of self-efficacy is higher than the physical recovery (29>25). This is not the case for mood, which recovers prior to physical recovery. Although this changes when looking at the second bounce-back, where both mood and self-efficacy recover for the second time, 14 days after the player returns to play. This is a

significant difference when compared to the first bounce-back. In contrast to the group analysis, these results support the first and second hypothesis, that a time-loss injury significantly affects mood and self-efficacy and that it might have lasting effects beyond the physical recovery itself, at least on the individual level. These results also support the third hypothesis, because the group results were insignificant for the second bounce-back as well. This is also supported by the number of physical recovery days being outside of the 95% confidence interval for the group analysis.

Looking at the trajectory of mood and self-efficacy in Figure 1, we can see that Player 1 experiences a drop in mood and self-efficacy some time prior to the injury occurring. Suggesting a possible life event. Further, the trajectory of mood and self-efficacy does seem to be less stable after the injury, than prior to the injury. Next to that, it can be observed that Player 1 self-reported higher mood and self-efficacy in the first one-third of the data collection than in the second one-third. This might affect the pre-injury average.

Player 2

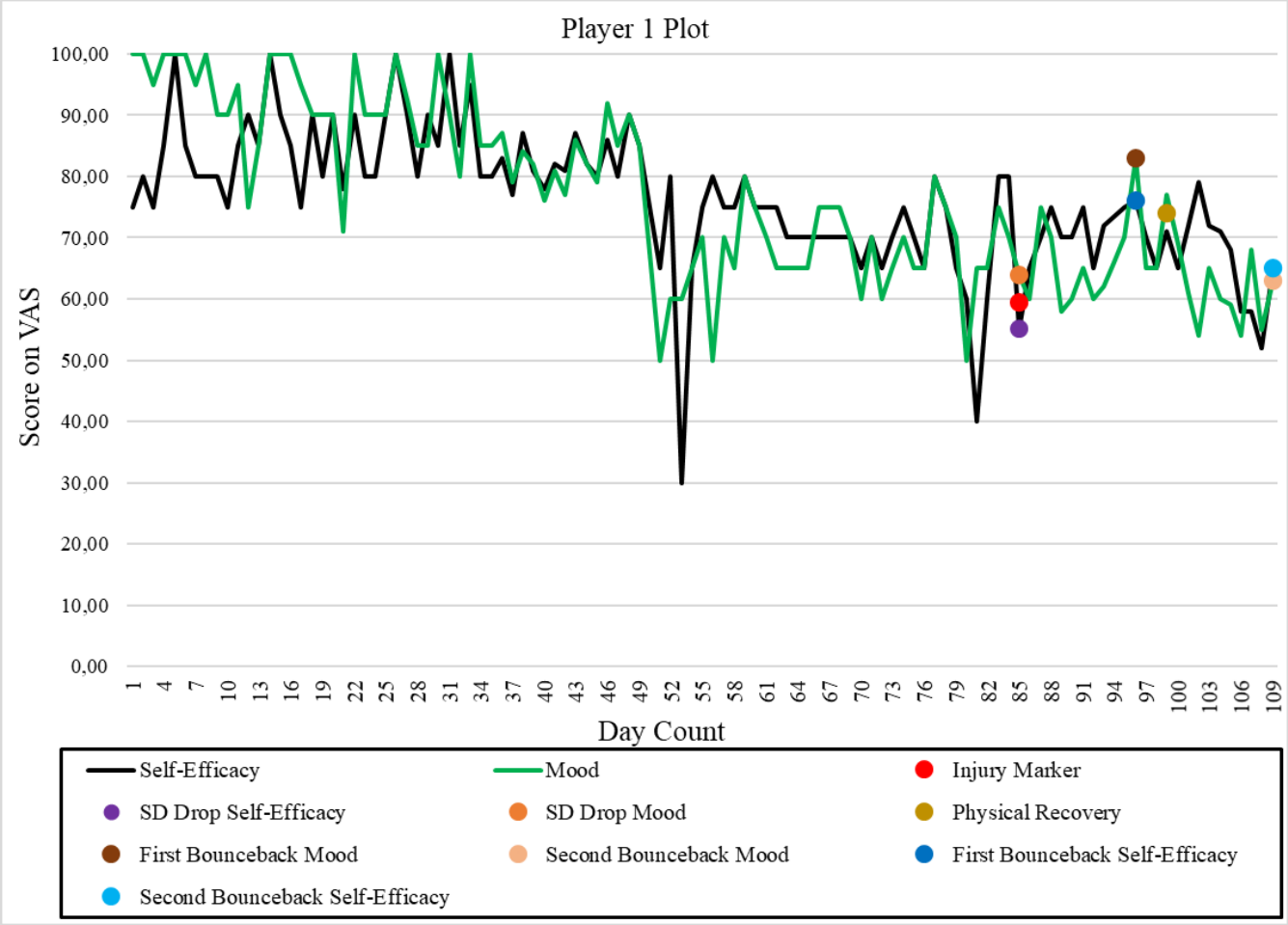
Although the injury was short (four days), player 2 took three times as long to bounce back at least once (twelve days) for both psychological variables. This difference increased to eighteen days for self-efficacy and nineteen for mood when looking at the second bounce-back. Next to this, player two falls outside of all the 95% confidence intervals of the group analysis for the pre-injury averages. His physical recovery is also lower than the lower bound of the 95% confidence interval of the group analysis for physical recovery. These results support the third hypothesis of non-ergodicity. Since the group results saw no significant difference between psychological recovery and physical recovery, a significant difference (visually) can be observed for player two.

Looking at player two's trajectory, a drop in mood and self-efficacy can clearly be observed. Just as the longer recovery time is visible. When compared to player one, player

two's trajectory seems more stable prior to injury. It is not possible to compare the stability after the second bounce-back due to the fact that player 1 got reinjured. Although for player two, his trajectory seems to stabilize after the second bounce-back.

Figure 1

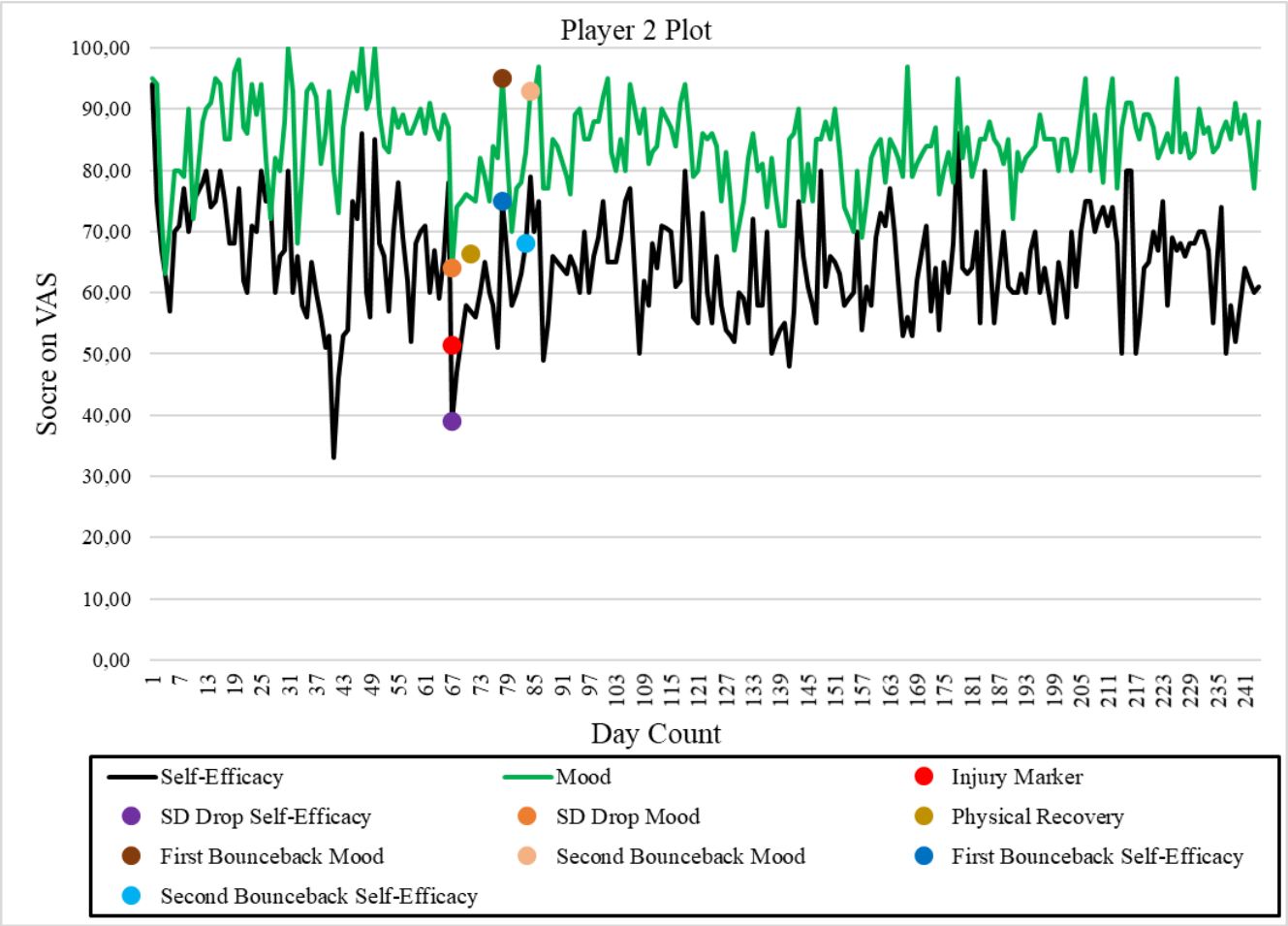
Trajectory of mood and self-efficacy with markers of injury and bouncebacks for Player 1



Note. See figure legend for colors and a short description of the variables.

Figure 2

Trajectory of mood and self-efficacy with markers of injury and bouncebacks for Player 2.



Note. See figure legend for colors and a short description of the variables.

Discussion

This study examined whether a discrepancy exists between the psychological recovery and physical recovery of elite football players after a time-loss injury. To assess this discrepancy, time-series data from 27 players, collected across two competitive seasons was used. This data included the psychological factors of self-efficacy and mood. Next to that, data from injuries was collected to assess physical recovery. In this study physical recovery was formulated as a return to play, that is, the time it takes for a player to return to the field. The present study is one of the first to properly examine a possible discrepancy between physical recovery and the psychological recovery of mood and self-efficacy. Previous research only provided an indication for this possible difference (Ardern et al., 2012; Clement

et al., 2015; Morrey et al., 1999; Podlog and Eklund, 2005, 2007; Principe and Kerr, 2025; Thomeé et al., 2007; Wadey et al., 2014). Based on aforementioned research, it was hypothesized that there would be a significant effect of injury on psychological variables and a significant difference between psychological and physical recovery. This difference is that psychological recovery of both mood and self-efficacy would take longer than the physical recovery. Next to assessing the possible differences between psychological and physical recovery it was checked if the group results could be generalized to individuals. To do this, the individual trajectories of two players were assessed. Based on literature, it was hypothesized that, the group results were not generalizable on an individual basis and lead to an observable nonergodicity of psychological processes (Fisher et al., 2017; Molenaar, 2004; Van der Gaag, 2023).

Firstly, no significant differences between psychological recovery of mood and physical recovery following a time-loss injury were found on the group level, therefore, H1 is rejected. This relationship did not change when adding a robustness check by using the second bounceback. These results may be explained by the fact that one-third of the players did not drop significantly on the first day of injury and being given 0 days for psychological recovery. This may have skewed the results towards the zero. The findings might have changed if these players were excluded in a second analysis; however, this second analysis was not within the scope of this study.

Additionally, the non-significant result might be explained by how an injury is approached by a football club. Generally, high performing teams tend to introduce early discussions and give realistic expectations for the time expected before returning to play (Truong et al., 2020). This might prevent the players suffering from general fear, fear of reinjury, mood disturbances or still present physical pain upon returning to the field (Ardern et al., 2012; Brewer, 2017; Clement et al., 2015; Gennarelli et al., 2020; Johnston and Carroll,

1998; Podlog and Eklund, 2005). Next to that, the role of social support might influence the manner in which mood is affected upon returning to sport (Podlog and Dionigi, 2010). Galli and Vealey (2008) found higher levels of social support tended to increase a player's capability to cope with distressing feelings. This might give an explanation as to why the group analysis was found to not be significant, because some of the players had high levels of social support and were therefore able to cope better with mood influences that were still present (Galli and Vealey, 2008; Podlog and Dionigi, 2010). This might have caused the used measuring instrument (single item self-reports) to miss these nuances.

Another possible explanation for the non-significant results is the influence of athletic trainers on the effects of injury on mood (Yang et al., 2014). Athletic trainers are an integral part of the rehabilitation process of injured athletes (Heaney, 2006; Yang et al., 2014). This causes athletic trainers to develop bonds and for them to receive questions from players on how to deal with the psychological effects (Heaney, 2006; Yang et al., 2014). This bond and subsequent satisfactory social support was shown to decrease possible anxiety when returning to play and giving another possible explanation for the non-significant result (Yang et al., 2014).

Furthermore, this does not mean that psychological recovery might still take longer, but it does suggest that the group results for this comparison are not generalizable to every player and are subject to a variety of confounds. Nevertheless, one-third of the players did not experience a drop on the first day and only one player did not experience a drop at all. This partially supports the results of Ardern et al. (2012) and Morrey et al. (2017), who found an immediate effect of the injury experience on a player's mood upon sustaining the injury. However, this study contradicts those results partly, since one-third of the players did not experience a significant drop upon sustaining the injury. This could be explained by the nonergodic nature of psychological processes, leading to not every player being significantly

affected by injury (Fisher et al., 2017; Hill et al., 2018; Molenaar, 2004; Neumann et al., 2022, 2024; Van der Gaag, 2023; Wiese-Bjornstal et al., 1998). Next to these findings, it was found that almost every player significantly dropped at least one time during injury. Therefore, it is reasonable to say that psychological recovery of mood is still of importance to practitioners, although not to the extent that was hypothesized on the group level.

Secondly, we found no significant differences between the psychological recovery of self-efficacy and physical recovery on the group level. This relationship did not change when looking at the second bounceback as a robustness measure. Therefore, H2 was rejected. This could be partly explained by the same reasons used for mood, namely that one-third did not drop on the first injury day, and therefore the average would be dragged down. Thus, the group average might not give a full representation of the effects of injury on mood. Although one-third did not drop significantly in self-efficacy on the first day of injury, almost all players (except 3) dropped at least once during the injury. This supports the literature regarding significant effects of a time-loss injury on self-efficacy (Ardern et al., 2013; Clement et al., 2015; de la Vega et al., 2017; Gennarelli et al., 2020; Masten et al., 2014; Quinn and Fallon, 1999; Thoméé et al., 2007; Wiese Bjornstal et al. 1998). The non-significant result might be explained by self-efficacy beliefs changing as a result of a time-loss injury (Ardern et al., 2012; Brewer, 2017; de la Vega et al., 2017; Johnston and Carroll, 1998; Podlog and Eklund, 2005; Truong et al., 2020).

Additionally, the non-significant result for the duration of psychological recovery of self-efficacy is subject to confounding variables. For example, intrinsic motivation (internal motivation) (Podlog and Eklund, 2005). It was shown that higher intrinsic motivation was associated with increased confidence (Podlog and Eklund, 2005). Intrinsic motivation could therefore influence self-efficacy. This is important, since intrinsic motivation might increase when nearing a return to play. Another explanation might be in the research of de la Vega et

al. (2017). They found that confidence tends to increase as the rehabilitation progresses (de la Vega et al., 2017). This might lead to confidence getting restored to such a level that a return to baseline happens at least once or twice, causing self-efficacy to recover at the same approximate speed as the body. A further explanation could be in the influence of social support on self-efficacy. Research has shown that social support may increase confidence through easing fears, setting realistic expectations and seeing improvements (Ardern et al., 2012). This increase in confidence might increase self-efficacy as well, leading to a quicker recovery of self-efficacy.

Based on this study and aforementioned research, we cannot conclude that psychological recovery of self-efficacy takes longer on average than physical recovery. However, it has been shown the present research supports existing literature regarding the recovery of self-efficacy after an injury is of importance. This is because two-third of the players experienced a significant drop following injury. This further strengthens the research that psychological recovery of self-efficacy should be of importance to practitioners.

Thirdly, group results were not generalizable to the two random players that were analyzed. Thus, H3 was accepted. Looking at their individual trajectories and the group results for psychological recovery we can conclude that for the individual players they did take longer to recover psychologically when compared to their physical recovery. Especially when looking at the second bounce-back to original functioning. Next to that, enormous individual differences in responding to injury were seen as well. This could, however, be explained by the difference in datapoints post-injury. Player 1 got injured close to the ending where Player 2 sustained an injury near the beginning of data collection. This might skew interpretation of results to a small degree, yet this study had strong inclusion criteria and therefore reliability was not influenced. However we saw that Player 2 had a much more stable trajectory of his psychological variables in general when compared to Player 1. This

does support the notion that group results are not generalizable due to individual differences (Molenaar, 2004; Fisher et al., 2017; Van der Gaag, 2023). Further, we saw that for Player 1 the first bounce-back came rather early in respect to the second bounce-back, which suggests that the first bounce-back to original functioning might not be the best tool to check if someone has recovered psychologically. Thus suggesting that the first time bouncing back could occur as a result of a random occurrence like a positive life event. Furthermore, due to both players not following the ergodic process of the group we have found evidence which supports the psychological research regarding nonergodicity (Fisher et al., 2017; Hill et al., 2018; Molenaar, 2004; Neumann et al., 2022, 2024; Van der Gaag, 2023; Wiese-Bjornstal et al., 1998).

Importance and Implications

While the duration of psychological recovery for both mood and self-efficacy have been shown to not extend beyond the return to play for the group, we can stress the importance of psychological recovery for the individual. This means that implementing a way of assessing and monitoring psychological recovery might be of importance in aiding players in their development, but also in aiding their recovery process (Neumann et al., 2024). Implementing such monitoring might not be difficult, since daily monitoring is becoming increasingly more present in professional sports settings (Pekas et al., 2023; Pekgor et al., 2024). The next question to ask moves us in the direction of how to help players recover more quickly. An opportunity might be in giving athletic trainers workshops on how to help players with their psychological recovery as well (Heaney, 2006; Principe and Kerr, 2025; Yang et al., 2014). Due to athletic trainers already being a big part of the physical rehabilitation of the player, they have a good chance to implement proper techniques to help psychologically struggling footballers (Heaney, 2006; Principe and Kerr, 2025; Yang et al., 2014). Next to influences of athletic trainers, mindfulness interventions have been shown to help adaptation

following sports injury (Liu and Noh, 2024). This might help players who, for example, did experience a significant drop. Furthermore, the present research emphasizes the individual approach that needs to be taken when understanding development. This approach is already present in the sports context (MacNamara et al., 2010). This approach is further supported by the nonergodicity of psychological processes as described by (Fisher et al., 2017; Molenaar, 2004; Van der Gaag, 2023). This means practitioners need to focus more on the individual player's parameters and tailor interventions accordingly.

Strengths and Limitations

However, the present study does have its limitations. Firstly, the type of injury was not assessed. This means that no conclusions could be drawn about the effects of a specific type of injury. Secondly, there was no information collected about the type of emotions or difficulties experienced during the injury. Therefore, this study cannot inform specific interventions to target parts of self-efficacy and/or mood. Thirdly, the group analysis only used the first day of injury as a starting point for psychological recovery. By using the u-shaped effect pattern observed in mood following injury (Ardern et al., 2012; Morrey et al., 1999). This was done to use the same point in time for both physical and psychological recovery, but more information might be obtained when also looking at the first significant drop day in the rehabilitation process as a starting point for psychological recovery. Fourthly, group analysis of psychological recovery might miss important nuances and fluctuations in psychological variables caused by the injury (Hill et al., 2018; Neumann et al., 2022, 2024; Wiese-Bjornstal et al., 1998). Finally, when looking at the nonergodicity of psychological processes only descriptive statistics were used. Therefore, conclusions regarding nonergodicity could only be drawn to a certain extent.

Next to limitations, this study also has its strengths. The first one being that it was one of the first times that time-series data was collected for such an amount of time and therefore

a lot of individual nuances can be found. Secondly, this study was the first to look at whether psychological recovery was significantly longer in duration than physical recovery. Where previous research only looked at what kind of effects might still be present when returning to play, not whether they had a significant impact (Ardern et al., 2012). Thirdly, this study was conducted by utilizing data from daily monitoring, therefore players were unaware we would specifically assess the effect of injury on psychological variables. This most likely reduced response bias and added to the reliability of the findings (Nederhof, 1985).

Future Directions

Future research might focus on the individual variations in psychological variables when reacting to injury. Next to that they could look at the influences a specific injury might have on psychological variables. Further research could also be done to corroborate the present results regarding nonergodicity (Fisher et al., 2017; Molenaar, 2004; van der Gaag, 2023). Other research could also focus on the other limitations of this study like the chosen drop day or the type of emotions and difficulties players experience during the injury. Next to research focusing on limitations of the present study, other research might also focus on which interventions might have the best effect in aiding psychological recovery. For example, interventions targeting athletic trainers (Heaney, 2006; Principe and Kerr, 2025). To conclude, future research should focus on the direction of psychological recovery when compared to physical recovery, because in the present research, no evidence was found for either direction.

Conclusion

The present study has found no evidence to suggest that psychological recovery is of a longer duration than the time to return to play. However, this study does show individual variation in responses to time-loss injuries are of importance. The group results of the duration of psychological recovery were not able to generalized on an individual level. This finding strongly suggests that the response to injury is highly nonergodic and individual

variation will be missed when looking at the group. Future research should do a secondary analysis, to discern if only players with significant drops following injury, do take longer to psychologically recover. Furthermore, practitioners should take an individual approach when a player is or gets injured.

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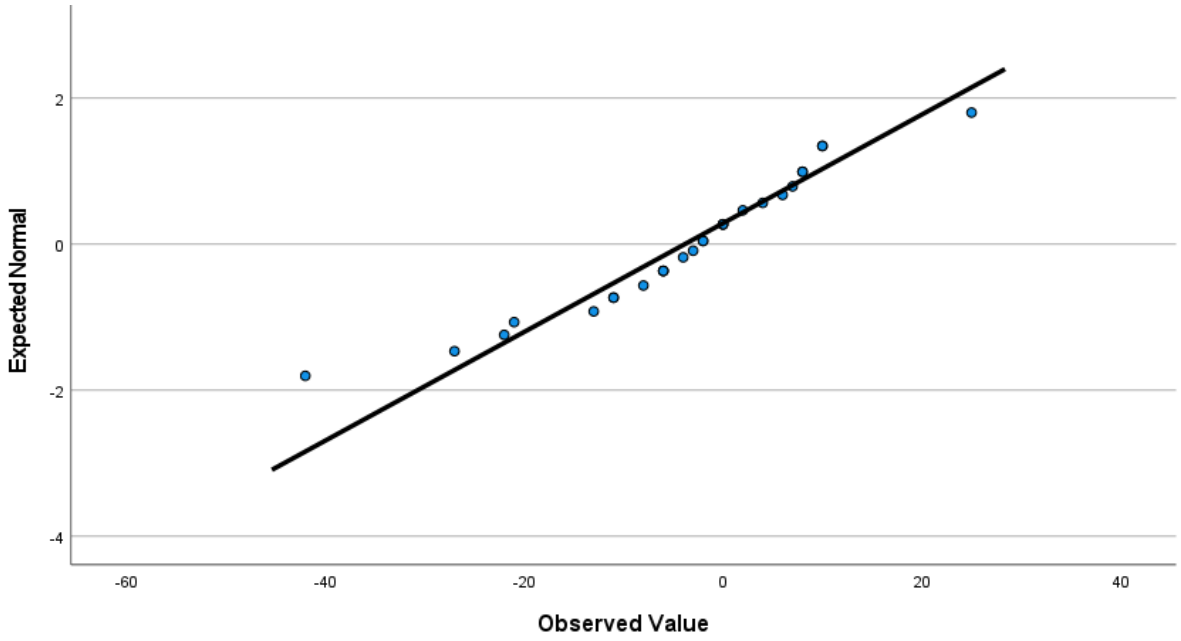
Appendix A

Figure 1

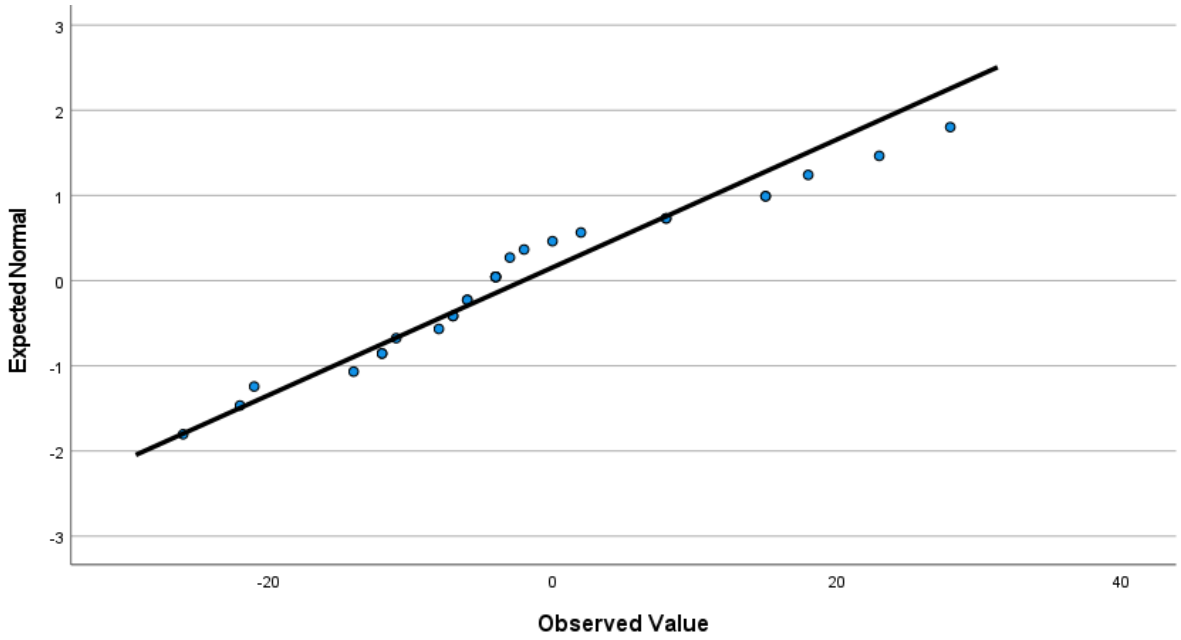
Q-Q plot for the difference between physical recovery and the first bounceback variable of self-efficacy



Note. Y-axis: The number of standard deviations the observation differs from the group average. X-axis: The difference value of the first bounceback of self-efficacy in amount of days minus the amount of days before physical recovery.

Figure 2

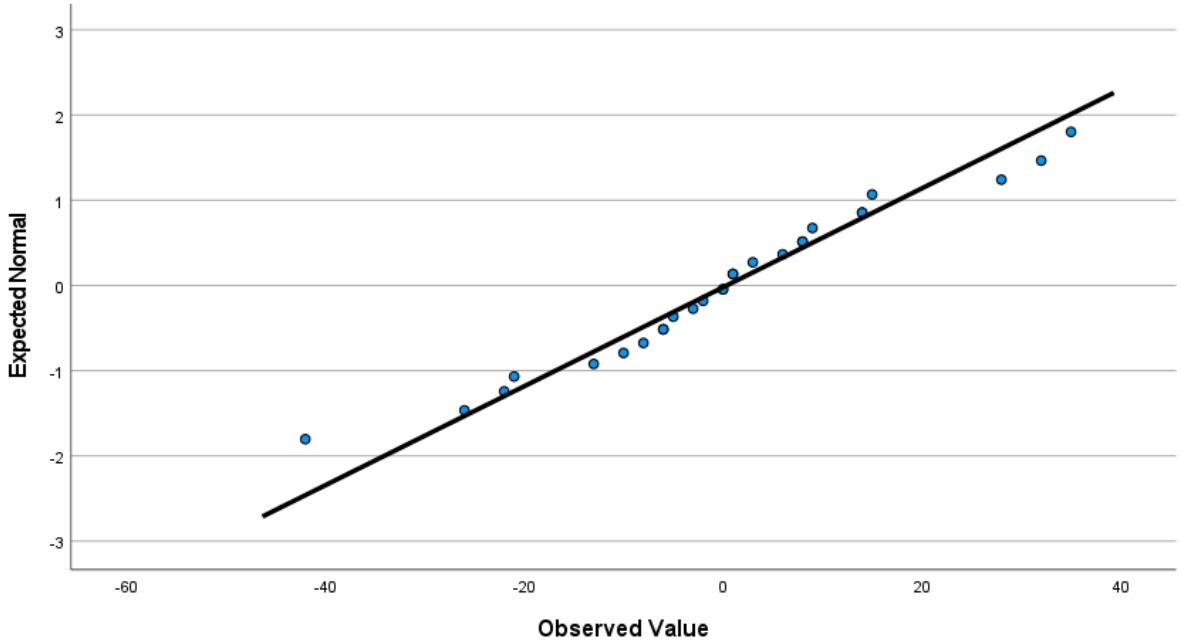
Q-Q plot for the difference between physical recovery and the first bounceback variable of mood



Note. Y-axis: The number of standard deviations the observation differs from the group average. X-axis: The difference value of the first bounceback of mood in amount of days minus the amount of days before physical recovery.

Figure 3

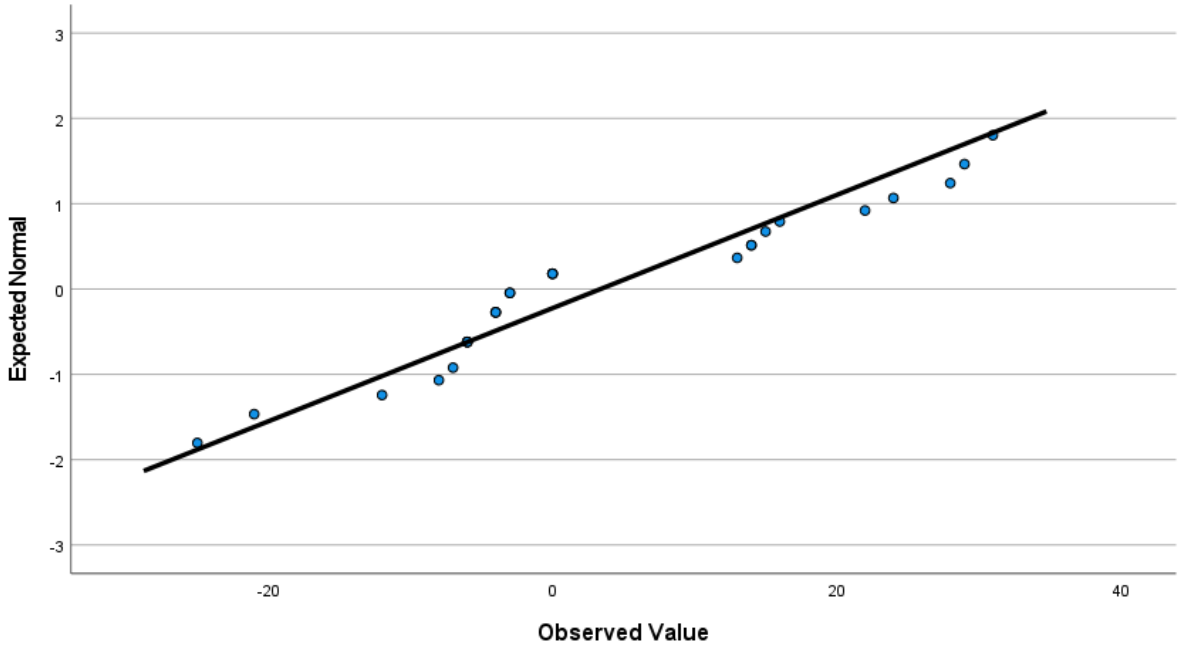
Q-Q plot for the difference between physical recovery and the second bounceback variable of self-efficacy



Note. Y-axis: The number of standard deviations the observation differs from the group average. X-axis: The difference value of the second bounceback of self-efficacy in amount of days minus the amount of days before physical recovery.

Figure 4

Q-Q plot for the difference between physical recovery and the second bounceback variable of mood



Note. Y-axis: The number of standard deviations the observation differs from the group average. X-axis: The difference value of the second bounceback of mood in amount of days minus the amount of days before physical recovery.