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### Home alone

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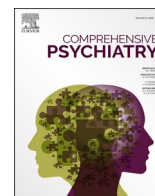
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## Home alone: Social functioning as a transdiagnostic marker of mental health in youth, exploring retrospective and daily life measurements

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### ABSTRACT

**Purpose:** Early detection and intervention of mental health problems in youth are topical given that mental disorders often start early in life. Young people with emerging mental disorders however, often present with non-specific, fluctuating symptoms. Recent reports indicate a decline in social functioning (SF) as an early sign of specific emerging mental disorders such as depression or anxiety, making SF a favorable transdiagnostic approach for earlier detection and intervention. Our aim was to investigate the value of SF in relation to transdiagnostic symptoms, and as a predictor of psychopathology over time, while exploring traditional retrospective versus innovative daily diary measurements of SF in youth.

**Method:** Participants ( $N = 75$ ) were 16–25 years of age and presented early stage psychiatric symptomatology. Psychiatric symptoms, including anxiety and depression, as well as SF -both in retrospect and in daily life- were assessed at two time points and analyzed cross-sectionally and longitudinally.

**Results:** A significant and negative association between SF and all psychiatric symptoms was found, and SF was a significant predictor of change in general psychiatric symptoms over time. Results were only significant when SF was measured traditionally retrospective.

**Conclusion:** This study confirms a distinct relation between SF and transdiagnostic psychiatric symptoms in youth, even in a (sub)clinical population, and points towards SF as a predictor of transdiagnostic psychiatric symptoms. Further research is needed to learn more about the added value of daily life versus retrospective measurements.

### 1. Background

Three out of four mental disorders emerge before the age of 25 [1]. Treatment delays of mental disorders at a young age increase the risk of mental, social and vocational problems later in life [2,3]. Consequently, the mental healthcare sector is increasingly shifting attention to early

detection and intervention programs and hence searching for novel ways to improve identification of individuals who are at risk for developing mental disorders [4,5].

Since sub-clinical symptoms are one of the main risk factors for developing a full-blown disorder as defined by the Diagnostic and Statistical Manual of mental disorders [6], studies on early detection of

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mental disorders often focus on its sub-clinical symptoms to detect an emerging disorder before its actual onset [5,7,8]. In youth, however, several symptoms including, low mood and anxiety often co-occur, sometimes with fluctuating severity [9], making it hard to detect a specific mental disorder early, according to current diagnostic criteria.

Therefore, there is a need for transdiagnostic approaches and corresponding outcome measurements, particularly in youth [10,11] to enable early intervention in this population. Social functioning (SF), could be such a transdiagnostic factor [12] facilitating working across diagnostic silos. SF is affected in several mental disorders; it has been shown to be impaired in people with established mental disorder and decreased SF is related to more severe psychopathology and worse treatment response [13,14]. Even in at risk populations, it has been suggested that SF is impaired in people with subclinical psychiatric symptoms, and therefore may be an early sign of the disorder [15]. Indeed, studies in youth at clinical high risk of psychosis show that their SF is worse compared to healthy controls and at a similar level as those with a first episode of psychosis [16] or recurrent psychotic episodes [17], with higher risk of developing a psychotic episode in people with poorer social or general functioning [18,19]. More importantly, the relation between SF and psychiatric symptoms does not seem to be limited to disorder specific symptoms. When mood and anxiety were assessed in a sample of youth at clinical high risk of psychosis, lower SF was associated with more depressive and social anxiety symptoms [16]. This relation between SF and transdiagnostic (sub)clinical psychiatric symptoms argues for the potential value of SF for identifying individuals at risk. Therefore, in the context of early-detection tools, focusing on SF instead of diagnosis-specific symptoms may be a useful approach, but more knowledge is needed about SF in relation to transdiagnostic sub-clinical psychiatric symptoms in youth. In addition, insight in the predictive validity of SF for symptoms change over time would give the opportunity to target specifically those youngsters with the highest risk of developing a mental disorder and thus most in need of early intervention. Traditionally, SF is defined as the ability to fulfil a societal role, including engagement in vocational as well as social relationships [20,21] and assessed with retrospective questionnaires, such as the Social Functioning Scale (SFS) [22]. However, these assessments have several disadvantages of which the recall bias might be most noteworthy [23]. In addition, when assessing a three-month period retrospectively, recent incidents may influence the overall score disproportionately. These obstacles might be mitigated in daily diary techniques such as the Experience Sampling Method (ESM) [24–28]. With ESM, it is possible to measure SF in daily life, by for example asking individuals several times a day what they are doing (providing information with regard to the ability to fulfil a societal role) and who they are with (presenting information with regard to engagement in relationships). By providing the possibility to collect multiple measurements over a period of time, and measuring someone's current thoughts and emotions in a real world rather than laboratory environment, ESM gets around some of the common biases of traditional measurements [29]. However, ESM has several disadvantages, as participants may experience answering the same questionnaire multiple times burdensome [30] or intrusive, and because of the repeated infiltration in participants daily life, ESM may influence behavior and thereby study results [31].

Even though both ESM and retrospective questionnaires come with certain (dis)advantages, how they relate to each other (i.e., the ecological validity of the SFS) in the context of SF has rarely been investigated. Schneider et al. [32] were the first to make this comparison, combining SFS and ESM data in non-affective first episode psychosis patients and healthy controls, showing associations between SFS scores and ESM measures in the interpersonal domain in both groups. SFS scores and ESM measures, however, were inconsistent when examining the social activity domain, showing a ceiling effect in SFS scores in the healthy control group, which could signify that the SFS is less suitable for detecting more subtle differences in SF than ESM, which is what would be of interest from an early-detection point of view.

In sum, detection of individuals at risk for developing mental disorders is important for prevention of these disorders and subsequent reduction of both the individual and the societal burden of mental disorders [5]. The current study aimed to firmer establish SF as a useful early detection marker by cross-sectionally investigating the relation between SF and transdiagnostic psychiatric symptoms in youngsters reporting sub-clinical psychiatric symptoms. In addition, SF as a predictor of symptoms change over time was examined longitudinally, using both retrospective SFS scores as well as daily life assessments with ESM.

We hypothesized higher SF scores in youngsters with fewer psychiatric symptoms and lower SF at baseline to predict an increase of psychiatric symptoms over time. The comparison between SFS scores and the ESM measure with regard to their relation with psychiatric symptoms had an exploratory nature.

## 2. Methods

### 2.1. Participants

Data were collected as part of a large randomized controlled trial investigating the effect of a psychological intervention on subclinical psychopathology in emerging adults, not in clinical care [inclusion period: September 2013–January 2017] [33,34].

All participants were 16–25 years of age and were recruited by advertisements in public places and on social media. In the present study, only those participants were included who had a score of >123 (norm group II general population) [35] corresponding with above average psychiatric symptomatology using the Symptom Checklist (SCL-90) [36]. The study was approved by the Medical Ethical Committee of Maastricht University Medical Centre (Dutch Trial Register nr.: NTR3808). All participants signed informed consent before the study onset after the procedure had been fully explained to them. For participants under the age of 18, additional consent was given by their parents.

### 2.2. Procedures and measures

Potential participants received information about the study protocol followed by a first screening by phone and two measurement meetings (T1 and T2, see Fig. 1).

#### 2.2.1. Psychiatric symptoms

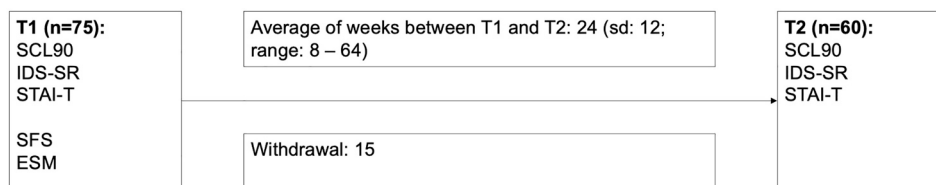
Anxiety, depressive and general psychiatric symptoms were assessed using, respectively, the State-Trait Anxiety Inventory, Trait (STAI-T) [37], the Inventory of Depressive Symptomatology, Self-report (IDS-SR) [38] and the SCL-90. All three measures were assessed both at T1 and T2.

#### 2.2.2. Social functioning

SF was assessed both in retrospect, using the SFS, and prospectively in daily life, using ESM.

**SFS.** The SFS is a self-report questionnaire, measuring SF over the last three months and in general. The SFS contains 7 subscales, including Withdrawal (waking time, time spend alone), Interpersonal behavior (having a partner, number of friends, the ability to engage in social conversations) and Pro-social activities (visiting family, museum and attend church activities). Subscales differ in their number of items, ranging from 4 to 22 items per subscale. All raw subscale scores were transformed into scaled scores [39], and a total SFS score was computed per person by calculating the mean of these standardized subscale scores [22].

**ESM.** ESM requires individuals to carry a device (PsyMate, [www.psymate.eu](http://www.psymate.eu)) that beeps 10 times a day at semi random moments (within blocks of 90 min), inviting them to fill out a short questionnaire on their context, behavior and mood at that specific moment.



**Fig. 1.** Measurements per measure moment, average amount of weeks between the two measure moments, with standard deviation and range, and number of participants that dropped out of the study after the first measurement. SCL-90: Symptom Checklist. IDS-SR: Inventory of Depressive Symptomatology, Self-report. STAI-T: State-Trait Anxiety Inventory, Trait. SFS: Social Functioning Scale. ESM-SF: Experience Sampling Method Social Functioning measure.

Participants were asked to use the PsyMate for 7 to 15 days in a row, depending on the specific protocol of the larger study. The ESM questionnaire contained an item questioning the current location; “Where am I?” (answer categories: at home, at family/friends, at work/school, public place, place for hobby/leisure activities, on the way, somewhere else), and an item addressing social situation; “Whom am I with?” (answer categories: partner, family, household members, out-home family, friends, colleagues/classmates, counsellors, acquaintances, strangers/others, nobody). Reflecting the earlier mentioned definition of SF [20,21], ESM-SF was based on a combination of these two items, namely; lower levels of going out, defined as reports of being at home (tapping into the ability to fulfil a societal role), together with limited social contact, defined as reports of being alone (tapping into the ability to engage in relationships), resulting into a measure indicating the percentage of beeps participants reported being home-alone.

### 2.3. Statistical analysis

Analyses were done using Stata/SE version 13.1. All models included age, sex and educational level as covariates. Multiple linear regression analyses were performed to, cross-sectionally, investigate the associations between both traditional (SFS) as well as daily life (ESM-SF) measurements of SF and psychiatric symptoms, measured with the IDS-SR, SCL-90 and STAI-T. In order to examine whether change of symptoms over time could be predicted by either SFS or ESM-SF scores, another set of multiple linear regression analyses was performed using SFS and ESM-SF scores at T1 in interaction with the number of days between T1 and T2 as predictors, and psychiatric symptoms at T2 as the outcome variable, controlling for T1 symptom scores. Results were considered significant at a  $p < .05$  level. Sensitivity analyses were performed, using  $t$ -tests and logistic regressions, to examine whether the results were influenced by the specific protocols within the larger study (i.e., different lengths of ESM data collection and assigned condition), and to examine whether characteristics (age, gender, symptoms, etc.) differed between participants who dropped out between T1 and T2 versus those who completed the study.

## 3. Results

### 3.1. Demographics

A total of 75 youngsters were included (Table 1). 87% of all participants were students, of whom 78% bachelor students (either at university or applied science level), 8% master students, 11% high school students, and 3% was engaged in another form of education.

ESM-SF data of 7 participants were excluded from analyses because they did not fill in a minimum of 33% of all beeps. The average number of days participants used the PsyMate was 14 days (range: 4–25 days). The mean compliance rate, meaning the percentage of answered beeps while using the ESM application, was 61.14% (calculated as the percentage of filled in beeps during the days that participants actually used the PsyMate). For 1 participant the SFS score was missing at T1.

**Table 1**

Demographic variables.

Measure	N	Mean (sd) / %
Age	75	20.8 (0.26)
Sex		
female	63	84.0%
male	12	16.0%
Vocational		
work	7	9.3%
study	65	86.7%
other	3	4.0%
Living situation		
alone	10	13.3%
student housing	32	42.7%
parents/family	20	26.7%
partner	13	17.3%
ESM-SF	68	33.2 (2.05)
SFS	74	117.5 (0.61)
SCL-90	75	172.2 (4.72)
IDS-SR	75	23.2 (1.20)
STAI-T	75	49.0 (1.20)

Note: Age in years. ESM-SF: the number of participants of whom the home-alone score was calculated (N), the percentage of moments of being at home alone (mean), and the standard deviation (sd). SFS: Social Functioning scale. SCL-90: Symptom Checklist. IDS-SR: Inventory of Depressive Symptomatology, Self-report. STAI-T: State-Trait Anxiety Inventory, Trait. SFS, SCL-90, IDS-SR, STAI-T: scores at baseline.

### 3.2. Social functioning and psychiatric symptoms cross-sectionally

As shown in Table 2, were lower SF scores related to more severe depressive, anxiety and general psychiatric symptomatology at T1, measured with the SCL-90, the IDS-SR and the STAI-T. The percentage of explained variance per model varied between 20 and 24%. Of all covariates, only age showed a significant contribution to the model when analyzing the associations between SFS and STAI-T ( $\beta = 1.08$ ,  $p = .034$ ) and SFS and SCL-90 scores ( $\beta = 4.36$ ,  $p = .030$ ).

The analyses of psychiatric symptoms and SF in daily life showed no significant relations.

**Table 2**

Social functioning and psychiatric symptoms at T1.

Measure	Beta	p-value
SCL-90		
ESM-SF	0.376	0.254
SFS	−3.333	<0.001**
IDS-SR		
ESM-SF	0.105	0.218
SFS	−0.970	<0.001**
STAI-T		
ESM-SF	0.066	0.427
SFS	−0.774	0.001**

Note: ESM-SF being the percentage of being at home alone. SFS: Social Functioning scale. SCL-90: Symptom Checklist. IDS-SR: Inventory of Depressive Symptomatology, Self-report. STAI-T: State-Trait Anxiety Inventory, Trait. \* indicating significance at a  $\alpha < 0.05$  level. \*\* indicating significance at a  $\alpha < 0.01$  level.

### 3.3. Social functioning and psychiatric symptoms over time

Change in general psychiatric symptoms between T1 and T2, measured with the SCL-90, was significantly predicted by the SFS score at T1 ( $\beta = -0.020, p = .047$ ) (Table 3). Participants with lower SF at T1 show a stronger increase in psychiatric symptoms over time, compared to participants with higher SF at T1 and after correcting for T1 psychiatric symptoms. Furthermore, of all added covariates; age, sex, educational level and psychiatric symptoms at T1, only the last one contributed significantly to the model. This was the case for all three psychiatric questionnaires; the SCL-90 ( $\beta = 0.516, p < .001$ ), the IDS-RS ( $\beta = 0.419, p < .001$ ) and the STAI-T ( $\beta = 0.744, p < .001$ ). The relations between SFS at T1 and the IDS-SR and STAI-T at T2 however, were not significant, and neither were the associations between ESM-SF at T1 and SCL-90, IDS-SR and STAI-T scores at T2. These models explained 37–53% of variance.

### 3.4. Sensitivity analyses

A first sensitivity analysis was done to check whether the results differed between participants who were allocated to different conditions within the larger protocol, and no significant differences were found. A second analysis was done to compare study drop-outs to remainders with no significant differences. A third analysis was done on SF and the SCL-90 subscales “anxiety”, “depression” and “paranoid ideation”. No significant results were found.

## 4. Discussion

The aim of the current study was to investigate the value of SF in relation to transdiagnostic (sub)clinical symptoms in youth, cross-sectionally and over time, while using both traditional as well as daily life measurements of SF. Cross sectionally, a transdiagnostic relation between SF and psychiatric symptoms was confirmed, showing that poorer SF relates to more severe psychiatric symptoms, including depressive, anxiety and general psychiatric symptoms in youth, even in a (sub)clinical population. Analysis of the predictive validity of SF showed lower SF at T1 as a predictor of an increase in general psychiatric symptoms over time. These effects were only significant when SF was measured with the traditional SFS.

Above mentioned results partly matched our expectations. First, it was our hypothesis that SF would correlate with psychiatric symptoms both when measured traditionally as well as in daily life, whereas our results only showed significant effects when SF was assessed traditionally, using a retrospective questionnaire. Second, as hypothesized, our results showed poorer SF as predictor of increased general psychiatric symptoms over time, but this effect was not seen for the depressive and anxiety questionnaires' scores.

**Table 3**

Social functioning at T1 and psychiatric symptoms at T2.

	beta	p-value
SCL-90 (follow-up)		
ESM-SF $\times$ time	0.001	0.727
SFS $\times$ time	-0.020	0.047*
IDS-SR (follow-up)		
ESM-SF $\times$ time	<-0.001	0.642
SFS $\times$ time	-0.003	0.167
STAI-T (follow-up)		
ESM-SF $\times$ time	<-0.001	0.922
SFS $\times$ time	-0.002	0.539

Note: ESM-SF being the percentage of being at home alone. SFS: Social Functioning scale. SCL-90: Symptom Checklist. IDS-SR: Inventory of Depressive Symptomatology, Self-report. STAI-T: State-Trait Anxiety Inventory, Trait. \* indicating significance at a  $\alpha < 0.05$  level. \*\* indicating significance at a  $\alpha < 0.01$  level.

### 4.1. The value of SF

The cross-sectional association between SF and psychiatric symptoms, as confirmed in the present study, is in line with previous research [15,16]. More interestingly is that, instead of focusing on a specific disease [32], the present study allowed for a broad range of psychiatric symptoms below as well as above the diagnostic thresholds. Thereby, this study endorses the value of SF as transdiagnostic marker of (sub) clinical psychopathology in youth, demonstrating the potential of SF in early detection of mental ill health.

An advantage of SF as early indicator of psychiatric disorders might be that SF is easier assessable than diagnosis-specific symptoms, especially for people in the direct environment of youth. In youth psychiatry, there is a paradox in the need for care versus the use of care: the majority of mental disorders starts early in life [1] but adolescents are least likely to seek help due to age specific barriers such as poor access and financial costs [40–42]. As a consequence, a minority of youngsters experiencing mental health problems actually receives professional help [43,44].

Functional decline has received attention also outside the field of (youth) mental health. Dementia research showed promising results for the assessment of functioning, as problems with activities in daily life are often first noticed by the patient and its environment and, in at risk populations, functional decline can be a predictor of the progression to the actual disorder [45,46]. Moreover, the importance of SF for mental health is emphasized by the World Health Organization's (WHO) definition of SF: “mental health is a state of well-being in which an individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and is able to make a contribution to his or her community” [47].

### 4.2. Social functioning and psychiatric symptoms longitudinally

To be able to detect those at risk of developing a mental disorder as early as possible, the predictive validity of SF over time is particularly interesting. Our longitudinal results are promising, showing poorer SF in relation to an increase of psychiatric symptoms over time. Our results did not show a relation between SF and specific depressive and anxiety symptoms, which finding further emphasizes the relation between SF and psychiatric symptoms to be generic rather than disease specific [16], which can be seen as an advantage of SF as transdiagnostic factor, especially in a population of young people where several symptoms often co-occur, sometimes with fluctuating severity [9]. In addition, because of the need for early detection and intervention, the mental health sector tried to learn from other medical fields such as oncology. Following their example, a staging model was developed [48,49] showing prodromal stages with non-specific symptoms and a disease specific presentation appearing later on in the development of a mental disorder. Even in full blown mental disorders, the clinical presentation can be diffuse including transdiagnostic symptoms, which might advocate for a more dimensional view on psychopathology rather than strict categorical diagnoses [50]. In the light of these theoretical developments, focusing on SF would be a useful addition to diagnosis-based symptoms in assessing disease progression. Concerning our results, it must be stated that the predictive relation between SF and psychiatric symptoms over time must be interpreted with some cautiousness, because the significance level is just below the significance threshold. The possibility of a type 1 error must be considered, in which case the null hypothesis was unfairly rejected. Lowering the  $\alpha$  level by strictly controlling for multiple testing, on the other hand, would increase the chance of a type 2 error, i.e. not rejecting an untrue hypothesis.

### 4.3. SFS versus ESM-SF

Since we did only find significant results when examining SF traditionally, the ESM-SF measure as transdiagnostic marker of SF can be

questioned. In contrast to earlier research examining the relation between the SFS and ESM-SF in a population of non-affective first episode psychosis patients [32], the present study focused on the transdiagnostic role of SF in a (sub)clinical population with a broad range of psychiatric symptoms. Because of the exploratory nature of the comparison between the two SF measures in the current study, no direct conclusions can be drawn, but still, some associations between ESM-SF and psychiatric symptoms might have been expected. A possible explanation for the lack of results using the ESM-SF measure in the present study is that the sample of the present study was quite homogeneous, consisting of mostly female, high educated university students, around the age of 19, with (sub)clinical general psychiatric symptoms. This homogeneity can be stated as a limitation of the present study. Furthermore, almost half of our study population stated to live in student housing, and a quarter lived with their parents or family members, which might lead to a smaller amount of possible time to spend alone while at home than in non-student populations. In this case, being with other people does not necessarily lead to actual social engagement, while on the other hand, young people might be digitally social engaged while being at home alone. Therefore, in retrospect, the ESM-SF measure, defined as the time spend at home while being alone, might be less suitable for this specific population living in a digital world, whereas the SFS might be less influenced by the living situation because this is only a minor part of its broad range of items. Future research could focus on levels of variation in location and company, rather than the time spend at home alone itself. Variability of context may better reflect social engagement. Another explanation, apart from our study population, is that we did not use the most suitable ESM items to tap into social functioning in general. Future studies could aim to examine the use of other ESM items also assessing vocational engagement, current activity or items that tap into impact of social contact on a person, a feeling of connectedness or satisfaction with social contact or being alone. An alternative explanation for our contradictory results regarding the SFS and ESM measures, may lie in the so-called method effect [51]; the choice of measurement methods partly effects the results of a study, with higher correlations between measurements assessed with the same method. This method effect may explain a stronger association between the traditional SFS questionnaire and the psychiatric symptoms questionnaires, than between the ESM-SF measure and the psychiatric symptoms questionnaires in the present study. Therefore, future research might explore the predictive validity of the ESM-SF measure for psychiatric symptoms that are measured with an ESM measure as well, instead of with a questionnaire. This would create the opportunity to not only compare overall ESM-SF with psychiatric symptoms, but to, in addition, examine the relation between ESM-SF and psychiatric symptoms during all beeps. In such a study design, a next possibility is to investigate whether psychiatric symptoms at a certain measure moment can be predicted by previous assessed levels of SF, using time-lagged analyses, or to examine whether change in social functioning can be an early sign of mental problems emerging. When considering the difference in significance between the ESM-SF and SFS measure, also the validity of self-assessment measurements should be discussed. Self-assessment measures are widely used but previous research showed that self-assessed levels of functioning do not always reflect more objective measures of functioning in psychiatric patients, such as performance-based [52], observer ratings [53] and GPS data [54]. The above mentioned possibility of measuring psychiatric symptoms with ESM would provide the ability to compare daily life functioning levels with psychiatric symptoms in daily life, and thereby, a possible biasing effect of self-assessment would be bypassed. In addition, the use of GPS might be an interesting way of lowering the burden for participants because the question regarding their current location could then be dropped.

#### 4.4. Conclusion

To conclude, the findings of the present study confirmed our

hypothesis regarding a cross-sectional association between SF and depressive, anxiety and general psychiatric symptoms. Furthermore, lower SF predicted an increase in general psychiatric symptoms over time. Thereby, this study demonstrates the value of SF as transdiagnostic marker of (sub)clinical psychopathology in youth.

Further research is needed to learn more about the predictive validity of SF and any added value of daily life versus retrospective measurements of SF and psychiatric symptoms, focusing on a broad range of symptoms, in a heterogeneous population of young people with the goal of facilitating prevention, early detection and intervention, even outside a clinical context.

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