# Exploring the complex relationships between coping strategies, locus of control and self-esteem with psychopathology: structural equation modeling with a special focus on clinical high-risk of psychosis

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*Shortened title:* Coping strategies, locus of control and self-esteem: structural equation modeling of their relationships with psychopathology and psychosis risk.

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**Abstract**

**Background:** Coping strategies, competence, and locus of control (LOC) beliefs are important predictors of mental health (MH). However, research into their complex interactions has produced mixed results. Our study investigated them further in the previously unexplored context of clinical high-risk (CHR) of psychosis.

**Methods:** We tested six alternative structural equation models in a community sample (N=523), hypothesizing a mediating role of coping and treating CHR-symptoms as (i) an additional mediator or (ii) a specific outcome. Our measurement model included two latent factors of MH: (1) psychopathology (PP), consisting of presence of mental disorders, global and psychosocial functioning, and (2) self-rated health (SRH) status.

**Results:** In the model with the best Akaike Information Criterion and the latent factors as outcome variables, maladaptive coping completely mediated the impact of maladaptive LOC on PP and SRH. Additionally, CHR-symptoms partially mediated the effect of maladaptive coping on PP and SRH in the community sample, as long as sex was not entered into the



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model. In the clinical sample (N=371), the model did not support a mediation role of CHR-symptoms, despite significant pathways with both coping and MH outcomes; further, competence beliefs directly impacted on SRH.

**Conclusions:** Coping strategies are an important intervention target for MH promotion, especially in the community. In clinical populations, interventions focusing on coping strategies may improve CHR-symptoms, with improvement of CHR-symptoms supporting better MH, especially SRH. Additionally, due to their mostly cascading effects on MH, improving competence and LOC beliefs may also promote psychological wellbeing.

**Key words:** clinical high risk for psychosis, coping, locus of control, competence beliefs, mental health promotion



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## 1. Introduction

Psychotic disorders are among the most frequent causes of disability-adjusted life years in adults [1] and adolescents [2], and rate second in resulting costs [3]. Psychotic episodes are mostly preceded by a prodromal phase, in which the onset of clinical high-risk (CHR) symptoms, other mental health (MH) problems and deficits in psychosocial functioning often leads to help-seeking [4–6]. Longer duration of an inadequately treated prodromal phase is associated with negative outcomes of first-episode psychosis (FEP) [2,7–9]. Therefore, this phase offers a unique point of intervention for an indicated prevention, aimed at reducing CHR-symptoms and distress, thereby postponing or preventing manifest psychosis [10]. Despite direct associations of CHR-symptoms with distress and an increased risk for psychosis [10–13], relative declines in transition rates, and high rates of onset and persistence of non-psychotic disorders in CHR populations have been observed [11,14–16]. This has generated debate regarding diagnostic specificity of CHR in predicting psychosis, with suggestions that it might be pluripotential, indicating risk for developing a range of different psychiatric conditions [17,18]. Consequently, it was proposed that the CHR state be redefined as a transdiagnostic at-risk mental state (e.g., Clinical At-Risk Mental State; CHARMS [19]), allowing for the identification of early signs of multiple severe mental disorders. However, other studies [20–23] support the diagnostic specificity of CHR-symptoms, indicating that only emergent psychotic disorders significantly differentiate between CHR patients and non-CHR help-seeking controls [21], and that the onset and persistence of nonpsychotic disorders occur at a similar frequency in both groups, suggesting that a CHR status does not specifically represent a risk factor for nonpsychotic disorders [21,22].

Therefore, while the question of the diagnostic specificity of CHR status remains open, the clinical significance of CHR – e.g. psychological burden, independent of conversion to a full-



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blown mental disorder, and negative impact on functioning – is undisputed [10–12,19,20,23], and the inclusion of Attenuated Psychosis Syndrome in Section III in the DSM-5 supports its diagnostic and psychopathological relevance [24], highlighting the need to focus on offering CHR patients effective interventions. Moreover, irrespective of the debate regarding pluripotentiality of the CHR state, evidence indicates some transdiagnostic relevance of the CHR state (or symptoms) in terms of (at least) comorbidity with other psychiatric disorders and syndromes [25–27]**.** This is reflected in new broader transdiagnostic and dimensional psychiatric taxonomies wherein efforts are currently being made to determine the most appropriate way to map CHR for psychosis into these models [28].

Relatedly, other relevant intervention targets for this population include transdiagnostic factors of core beliefs – consisting of locus of control (LOC) and competence beliefs – and coping, demonstrating dysfunctional patterns in CHR [29], FEP [29,30] and schizophrenia patients alike [31,32], and are regarded as possible predictors of psychosis [29]. That is, the hypothesis that typical psychotic symptoms, e.g. delusions and hallucinations, result from the use of dysfunctional coping and core beliefs in response to basic symptoms (BS; self-experienced subclinical disturbances in thinking, speech and perception) [33], and stressful stimuli [34].

Beyond their role in CHR, coping and core beliefs are also relevant for general MH quality [35–37], as reflected by multiple outcomes, including psychopathology, psychosocial functioning, and self-assessment of one's own health status [38]. Coping is an especially important predictor of MH quality [35,39,40], particularly regarding stress [36], and representing either a risk (maladaptive coping, including avoidant and emotion-oriented strategies [41–43]) or protective factor (adaptive coping, including problem-focused and active strategies [44,45]). LOC is another predictor for MH [31,46]: internal LOC (attributing positive events to internal causes and negative ones to external factors such as chance or



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others), is linked to better MH outcomes and greater resilience [47], while external LOC (the opposite tendency) is associated with psychiatric disorders including depression and schizophrenia, as well as generally poorer functioning [31,46,47]. Thus, they can be conceptualized as adaptive and maladaptive, respectively. Finally, competence beliefs, including self-efficacy and self-esteem [48,49], are strongly associated with MH quality [37,50], with higher competence beliefs being related to better psychosocial functioning [37,51].

Investigation of the interactions between coping, core beliefs and MH, involving mainly community samples, but also including a minority of clinical samples, has led to contradictory findings in both populations, indicating a mediating role of coping [52–54], or of core beliefs [49,55,56]. A recent meta-analysis [36], also mostly - but not exclusively - using community samples, supported a mediation by coping on the influence of core beliefs on MH. Specifically, maladaptive coping mediated the relationship between maladaptive LOC and MH problems. Moreover, both adaptive and maladaptive LOC showed a direct influence on MH problems, independent of coping.

In the present study, we extended the meta-analytical and mediation model [36] that had mixed community and clinical samples by first exploring alternative structural equation models (SEM) in a community sample and then examining their validity in a clinical sample. In addition to general psychopathology, we focused on CHR-symptoms, in virtue of their association with MH quality [10–12] as well as coping and core beliefs [29]. The aims of the present study were:

1. To explore the association between core beliefs and MH outcomes, in both a community and clinical sample, assuming a mediation by coping. Specifically, based on the metanalytical model [36], we anticipated that the effect of competence beliefs



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and adaptive LOC on MH outcomes would be mediated by adaptive coping, and that the effect of maladaptive LOC would be mediated by maladaptive coping.

2. To investigate the specific placement of CHR-symptoms in these interactions.

Based on the metanalytical model [36], we did not expect relationships between competence beliefs and adaptive LOC, and maladaptive coping or between maladaptive LOC and adaptive coping, and therefore we did not include these relationships in the models.

## 2. Methods

### 2.1. Participants and recruitment procedure

Cross-sectional data from a community and a clinical sample were used in the current study. The former comprised 523 participants in the first follow-up assessment of the 'Bern Epidemiological At-Risk' (BEAR) study [57,58], whose core beliefs and coping strategies were evaluated in an add-on study (eFigure 1, eText 1). Inclusion criteria were absence of a psychotic disorder and fluency in German.

The second sample included 378 patients of the Bern Early Recognition and Intervention Centre for mental crisis (FETZ Bern), assessed between 11/2009 and 07/2022. Inclusion criteria were informed consent to the use of the collected data for scientific purposes, age above 13 years (to allow for assessment of all BS) and sufficient German language skills. For more information regarding recruitment and assessment procedures in the BEAR study [57] or the FETZ Bern [59], see eTexts 1-4.

### 2.2. Assessments

#### *2.2.1. Mental disorders*



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The Mini-International Neuropsychiatric Interview (MINI) [60] was used to assess current presence of axis-I mental disorders according to the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) [61]. Presence of each disorder was indicated by a score of 1 in the corresponding scale; their sum score (0-36) was used in analyses.

*2.2.2. CHR-symptoms*

Two approaches are used for the assessment of CHR states: (i) ultra-high risk (UHR) criteria and (ii) BS criteria (eTable 1). The Structured Interview for Psychosis-Risk Syndromes (SIPS) [62] was used to assess presence of UHR-symptoms (attenuated (APS) or brief intermittent psychotic symptoms (BIPS). For each of the positive items (P1 to P5; eTable1), participants received a score of 1 if they presented symptoms rated between 3 and 5 (APS) or equal to 6 (BIPS) – irrespective of whether or not the APS/BIPS in question met requirements for onset/worsening and frequency of the UHR criteria that are very infrequent in the general population [57,62]. Scores were then added in a sum score (0-5).

Presence of the BS criteria, cognitive disturbances (COGDIS) and cognitive-perceptive basic symptoms (COPER), was assessed with the Schizophrenia Proneness Instrument, Adult [63] and Child and Youth [64] versions. Irrespective of frequency and novelty requirements for BS criteria that are also infrequent in the community [33], presence of each criteria-relevant BS (eTable1) was indicated by a score of 1, and a sum score (0-14) was obtained.

*2.2.3. Self-rated health*

Self-rated health was evaluated via the EuroQoL-5D, 3 level version (EQ-5D-3L) [65], assessing 3 degrees of severity across 5 dimensions of health, from which we obtained a sum score (0-100) [66,67]. Participants' self-rating of their current health state on the EQ-5D-3 L



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analogue scale (0-100, ‘worst’ to ‘best imaginable health state’) was also included in our models.

*2.2.4. Global, social, and occupational functioning*

Functioning was assessed with both the Global Assessment of Functioning (GAF) scale, in which psychiatric symptoms are considered, and the Social and Occupational Functioning Assessment Scale (SOFAS) for the evaluation of functioning independently from symptoms [61].

*2.2.5. Core beliefs*

The German Competence and Control Beliefs Questionnaire (FKK) [68] was used to evaluate these constructs by means of Self-Concept (FKK-SK; 8 items), Internality (FKK-I; 8 items), and Externality scales (FKK-PC; 16 items). These were conceptualized in our models as competence beliefs (FKK-SK; as recommended in [68], see also [69]), adaptive (FKK-I), and maladaptive LOC (FKK-PC; ‘internality’ and ‘externality’ are synonyms for internal, i.e. adaptive, and external, i.e. maladaptive, LOC, respectively [31,70]). Analyses were conducted with the normative T-values of each scale’s sum score, obtained from ratings in their respective items on a bipolar 6-level scale.

*2.2.6. Coping strategies*

Positive and negative coping were assessed via the German Stress-Coping-Questionnaire, adult (SVF-120) [71] and children/adolescents (SVF-KJ) [72] versions. In each item, the frequency of use of different coping strategies can be rated on a 0-4 Likert scale (“not at all”-“in any case”). In our analyses we used the relative normative T-values to the sum scores of



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the global scales Positive and Negative Coping Strategies, to represent adaptive and maladaptive coping, respectively.

*2.2.7. Sociodemographic variables*

Age, level of education, and sex were included in the models as possible confounding variables, the latter only at a later stage during a sensitivity analysis.

Further details regarding instruments can be found in eText 5.

**2.3. Statistical analyses**

Data analyses were performed in RStudio version 4.1.1., using the lavaan package for preliminary exploratory and confirmatory factor analyses (EFA, CFA) and to test alternative SEM, and the sempower package for power analysis. The community sample served as the model generation, the clinical sample as model validation sample.

First, an EFA was conducted using variables pertaining to participants' MH (presence of Axis-I mental disorders and self-rated health), based on Spearman correlation matrices and using Oblimin rotation, allowing intercorrelation of factors. Pairwise deletion was applied, excluding one participant who was missing 20% of the data. Based on EFA results, we proceeded with a two-factor CFA.

Finally, six alternative SEM were computed, using the maximum likelihood estimator [73]. After a pairwise deletion of five observations with missing data, the analysis was conducted on 518 participants from the community sample. Along with the EFA/CFA-factors, variables included: age, education, standard t-values for competence beliefs (FKK-SK), maladaptive LOC (FKK-PC), adaptive LOC (FKK-I), adaptive and maladaptive coping, presence of BS and APS/BIPS, or alternatively, presence of either, i.e., of CHR-symptoms. A Tucker-Lewis



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index (TLI)>=0.90, a comparative fit index (CFI)>=0.95, a standardized root mean square residual (SRMR)<=0.08, a root-mean-square error of approximation (RMSEA)<=0.06, as well as a 90%-confidence interval (CI) not containing 0.08 indicate excellent model fit [74]. As the $\chi^2$ test is sensitive to sample size and often results in model rejection when working with large samples [75], we focused on the aforementioned indices in evaluating model fit. After comparing the models' Akaike Information Criterion (AIC) [76] and Bayesian Information Criterion (BIC) [77], one model was selected as fitting the data best; this was validated in the clinical sample.

The clinical sample (N = 371) presented higher amounts of missing data (9.58%). After applying listwise deletion to 51 participants missing more than 50% [78] of their data, we used a multiple imputation method on data missing from the remaining 327 subjects [79].

To control for sex differences, we conducted a sensitivity analysis by including sex in the chosen model and testing it again in both samples. Here, introduction of a categorical variable in the model required the use of the weighted least squares and variance adjusted estimator [73]. We chose this procedure instead of directly including sex in the 6 alternative SEM because using this estimator would not have allowed a statistically valid selection of one best fitting model. Finally, in all samples, we tested all possible mediation pathways indicated in the selected model for significance, and calculated their respective 95% bias-corrected bootstrap CIs.

## 3. Results

### 3.1. Sample characteristics

The two samples differed in sex (more males in the clinical sample), age, and highest educational level (both lower in the clinical sample), as well as in clinical and functional



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variables, with lower functioning and more severe psychopathology in the clinical sample (Table 1).

-Table 1-

### 3.2. EFA and CFA in the community sample

Results of the EFA (eTable 2) indicated two correlated latent factors (factor correlation: 0.34): (i) psychopathology (PP), and (ii) self-rated health (SRH). The model's fit to the community sample data was excellent overall (RMSR=0.01 TLI=0.98, RMSEA=0.059). The CFA (N=522) confirmed the two-factor structure (eTable 3), showing very good model fit (CFI=0.996, TLI=0.990, RMSEA=0.062, SRMR=0.032).

### 3.3. SEM models in the community sample

The resulting latent factors were included in six alternative SEM models (eText 6). In all models, positive and negative coping strategies mediated the effect of competence beliefs, adaptive and maladaptive LOC on the latent MH factors PP and SRH.

Fit indices and power ranged from acceptable to excellent, except for the TLI, which was equally poor for all models (eTable 4). Comparison of their AIC and BIC indices, with emphasis on AIC, indicated model 1.2. (Figure 1, Table 2, eTable 5) as best fitting the BEAR-data (CFI=0.923, TLI=0.863, RMSEA=0.086, 90%CIs=0.075, 0.098, SRMR=0.055, power>0.999 AIC=39484.669, BIC=39684.418), although model 3.2., with CHR-symptoms as an outcome of SHR and PP, had lower BIC (BIC=39677,074, AIC=39485,825). Though the two models had a similarly good fit to the data, AIC was emphasized in model selection, being more relevant to our testing of a complex system of interactions with unknown underlying structure [80], and since BIC can lead to underfitting when working with large samples, non-nested models and data not following a multivariate normal distribution [81].

- Figure 1, Table 2, Table 3 -



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In the community sample, maladaptive coping completely mediated the effect of maladaptive LOC on PP, SRH, and CHR-symptoms (Table 3); and adaptive coping mediated the impact of competence beliefs, but not of adaptive LOC, on PP. Additionally, CHR-symptoms partially mediated the effect of maladaptive coping on PP and SRH. No significant direct effects of competence beliefs and LOC on PP or SRH were detected.

In the sensitivity analysis, introducing sex as an exogenous variable in model 1.2. (eFigure 8, eTable 6), fit to the community sample data and power were excellent across all indices (CFI=0.989, TLI=0.982, RMSEA=0.04, 90%CIs=0.027, 0.045, SRMR=0.045, power>0.999). Direct paths between the variables remained unaltered but all mediation effects were insignificant. competence beliefs newly showed a direct effect on PP.

### 3.4. SEM model 1.2. in the clinical sample

Next, we tested model 1.2. in the clinical sample (Figure 2). Compared to the community sample, model fit decreased, with CFI (0.865) and TLI (0.761) indicating poor fit, while RMSEA (0.099; 90%CIs=0.085, 0.114) remained acceptable and SRMR (0.073) and power (0.986) excellent (Table 2, eTable 5).

-Figure 2-

Maladaptive and adaptive coping no longer impacted SRH or PP directly, and neither adaptive nor maladaptive LOC significantly affected the MH outcome variables. competence beliefs, however, newly directly impacted SRH, which, compared to the community sample model, was more strongly associated with CHR-symptoms. Mediation analyses (Table 3), however, revealed no significant mediation by CHR-symptoms in the effect of both adaptive and maladaptive coping on SRH and PP. Furthermore, no significant mediation of coping in the relationship of competence beliefs and LOC, and CHR-symptoms was found.



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The sensitivity analysis (eFigure 9, eTable 7) led to an increase in goodness of fit and power after including sex in the model. All indices but TLI (0.898) showed values ranging from good to excellent (CFI=0.942, RMSEA=0.068, 90%CIs=0.053, 0.083, SRMR=0.068; power=0.994).

Results did not vary, except for a newly significant direct effect of competence beliefs on PP and a significant covariation between adaptive and maladaptive coping (s=-0.136, p <0.001). No mediation effect was significant.

## 4. Discussion

### 4.1. Association between core beliefs and MH outcomes

Our first hypothesis of a mediation by coping in the association between core beliefs and MH was partially supported by findings in the community sample. Aligning with the metanalytical model mostly generated on community samples [36], maladaptive coping completely mediated the effect of maladaptive LOC on CHR-symptoms, PP and SRH, while adaptive coping only mediated the association between competence beliefs and PP. While this suggests that treating maladaptive LOC and coping may promote MH in the community, the lack of mediation effects in the sensitivity model, i.e., after the inclusion of sex, calls for more research into the role of sex in these associations.

Unexpectedly, but aligning with conflicting results in the two clinical samples of the metanalytical model [36], coping did not mediate the impact of core beliefs on MH in the clinical sample. Rather, adaptive and maladaptive beliefs were associated with their coping counterparts. Coping had direct effects on CHR-symptoms, which were directly associated with MH outcomes. Newly, the total effects of maladaptive LOC and competence beliefs on CHR-symptoms became significant, and competence beliefs were directly linked to SRH. A possible reason is that in clinical populations, both adaptive and maladaptive coping might



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specifically focus on CHR-symptoms, rather than overall MH quality, as our results in the community sample suggest with lower rates of CHR-symptoms. Therefore, treatment targeting coping strategies in these populations might help manage and reduce CHR-symptoms, preventing maladaptive coping from acting as a trigger for CHR-symptoms, exacerbating them, or worsening their outcome [82]. Further, in light of our findings indicating a direct effect of competence beliefs on SRH, and of competence beliefs and LOC on coping, challenging maladaptive core beliefs may also have a positive impact on MH quality. In contrast to the metanalytical model [36], we found no direct effects of LOC on MH outcomes. Possible explanations relate to differences in our study, including added complexity of our model with three MH variables, and differing conceptualizations of MH (e.g., including measures of functioning in our study).

Results indicate the need for more group-dependent research on the impact of the severity of psychopathology – and possibly type and operationalization of psychopathology – on the association and potential mediation effects of core beliefs and coping strategies with MH, as different levels of engagement with the mental health care system might act as an additional mediator or moderator. Such future studies will shed light on the most relevant targets for promoting MH, i.e., core beliefs, coping, or both.

### 4.2. Role of CHR-symptoms

To our knowledge, the present study was the first to explore CHR-symptoms in the context of the interactions between core beliefs, coping, and MH, in both a community and clinical sample. In the model selected as the best fit for the data, CHR-symptoms were included as a contributor of MH outcome. However, the alternative model with CHR-symptoms as an outcome of PP and SRH performed similarly well, indicating a strong association (albeit, with unclear direction/placement) between MH variables and CHR in both samples, even after



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controlling for sex differences. Significant mediation effects of CHR-symptoms in the relationship between coping, and PP and SHR were found only in the community sample model disregarding sex, but in no other model, possibly related to the cross-sectional nature of our study, preventing the drawing of definitive causal conclusions. Further factors that might help explain the difference between the community and the clinical sample are (i) the differences in prevalence of CHR symptoms in the two samples, which may influence their role in relation to the other variables in our model as well as the results of our analyses; (ii) the impact of the additional burden of higher psychopathology and more severe functioning deficits in the clinical sample, which is generally more unwell compared to the community sample. Regardless, findings support some transdiagnostic relevance of CHR (regarding broader psychopathology and in relation to transdiagnostic factors), while simultaneously highlighting the challenge of accurately mapping CHR into broader psychopathological systems.

Aligning with earlier research on patients meeting UHR criteria [82,83], maladaptive coping was more strongly and frequently significantly associated with CHR symptoms compared to adaptive coping. Whereas adaptive coping styles were stable in UHR patients, maladaptive coping more likely changed over time and was related to corresponding changes in UHR-symptoms in a UHR sample [82] and, in a community sample, was bi-directionally related over time to psychotic-like experiences [84], which, however, are only a poor estimate of clinician-assessed CHR-symptoms [85]. With maladaptive coping also negatively impacting functioning and likely other clinical factors such as severity of symptomatology including depression or personality traits, interventions that challenge coping strategies – and core beliefs – might be most appropriate for populations in early stages of mental disorders or with subclinical MH problems [83].



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### 4.3. Strengths and limitations

The large size of both the community and clinical sample in this study and their separate analysis provide a comprehensive view of CHR-symptoms and their associations with important transdiagnostic factors related to MH and some important first insight in potential differences between community and clinical. Further, the assessment of MH variables in clinical interviews conducted by highly trained psychologists, and the comprehensive definition of CHR-symptoms not only by UHR-symptoms but also BS, adds to data validity. The lack of control for ongoing psychotherapeutic treatment, which might have affected several variables, may be regarded as a limitation that our study shares with most comparable studies [36]. Moreover, despite growing evidence regarding their impact on CHR outcomes, especially on psychosocial functioning [86–88], we did not include negative CHR symptoms in our models, as they were only assessed in the clinical sample and therefore, a meaningful comparison with the community sample would not have been possible. The role of psychotherapy and negative symptoms should be explored in future research. Additionally, for reasons of sample size and power, we opted against recommendations [89] to only impute on variables missing less than 5% of data but applied multiple imputation to the missing data to the SVF 120/KJ and EQ-5D-3L in the clinical sample as well; potentially constituting a statistical limitation. Furthermore, especially for the low number of participants meeting CHR criteria in the community sample (4.97%), we could not perform sensitivity analyses in CHR persons, limiting comparability with studies on CHR samples [82,83]. Lastly, as only the model with the lowest AIC – an index that penalizes models less for free parameters and favors more saturated models compared to BIC – was further processed, other possible relevant mediations, in particular of PP and SRH in model 3.2 with the lowest BIC, remained unexplored.



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### 4.4. Future directions and conclusion

Our findings support evidence of community studies of a mediation role of coping in the relationship of MH variables with core beliefs, although this role might differ between sexes and may decrease with increasing MH problems. Results in the clinical sample suggest a more complex interplay of the examined variables compared to the community sample, thus indicating the need for more group-specific analyses in future studies. Considering this and the higher severity of psychopathology and functioning deficits, treatment in this population may need to be more comprehensive and tailored to target multiple factors influencing MH outcomes, including coping strategies and core beliefs, to address the specific challenges faced by help-seeking individuals. Regarding CHR-symptoms, a clear association with PP and, especially, SRH became evident in all models, with inconclusive results about their constellation. Future prospective studies should further examine the transdiagnostic factors coping and core beliefs, their relationship with CHR-symptoms, and their emergence of manifest mental disorders. Overall, our results contribute to existing evidence that coping strategies, competence beliefs and LOC represent worthwhile targets for the promotion of MH and shed further light on their complex interactions.



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**Conflicts of Interest**

Drs Kaess, Kindler, Michel and Schultze-Lutter, Ms Rinaldi (MSc), and Mr Osman (MSc) have declared that they have no conflicts of interest in relation to the subject of this study. Dr Schimmelmann has been a consultant and/or advisor to, or has received honoraria from AstraZeneca, Bristol-Myers Squibb, Eli Lilly, Janssen, Novartis, and Shire.

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**Supplementary Material**

For supplementary material accompanying this paper, visit cambridge.org/EPA.

## Figure legends

**Figure 1:** Model 1.2. in the community sample. *Note*: rectangles represent observed variables, ovals represent unobserved latent variables; black lines with double-ended arrows represent covariances; black lines with single-ended arrows represent significant paths; dashed gray lines with double- or single-ended arrows represent non-significant covariances or regression paths, respectively; numbers next to the lines indicate coefficients of significant standardized regressions and covariances, or factor loadings; the coefficients of non-significant covariances and regressions are not reported here to facilitate the figure's interpretation, please see Table 2 and eTable 5 for further details. CHR-symptoms: Clinical High-Risk symptoms; EQ-5 (100): score on the 0-100 analogue scale of the EuroQoL-5D, 3 level version (EQ-5D-3L); EQ-5 (sum): sum score on the EQ-5D-3L – see eText 5 for details; SOFAS score: Social and Occupational Functioning Scale score; GAF score: Global Assessment of Functioning score; MINI: Mini-International Neuropsychiatric Interview.

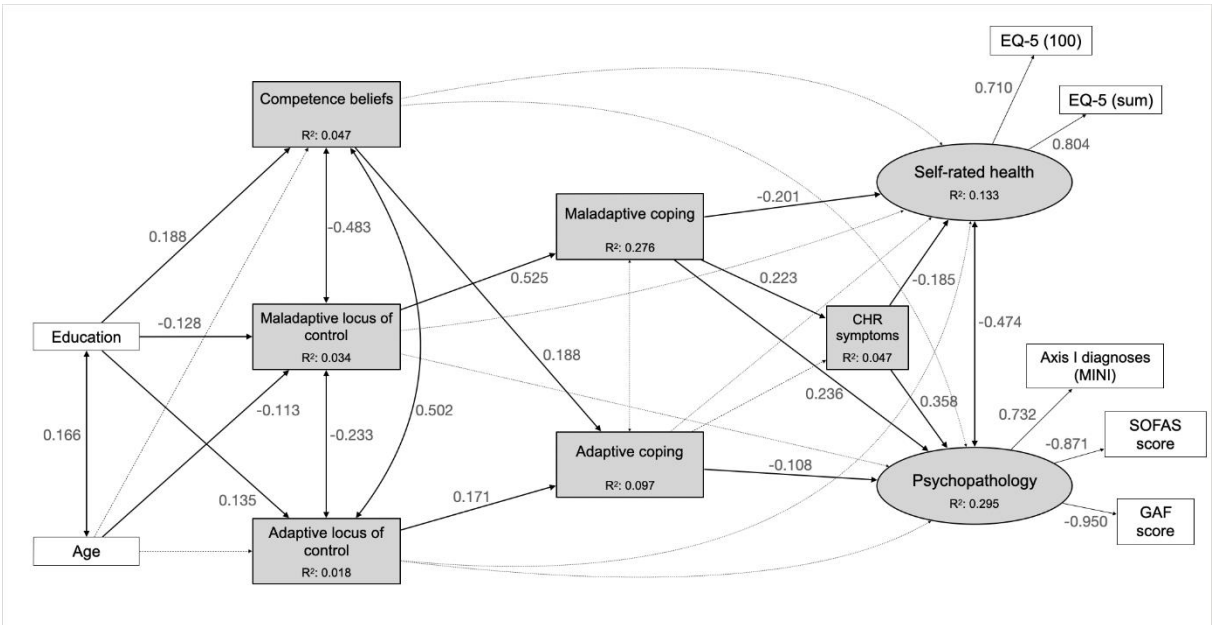




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**Figure 2:** Model 1.2. in the clinical sample. *Note*: rectangles represent observed variables, ovals represent unobserved latent variables; black lines with double-ended arrows represent covariances; black lines with single-ended arrows represent significant paths; gray lines with double- or single-ended dashed arrows represent non-significant covariances or regression paths, respectively; numbers next to the lines indicate coefficients of significant standardized regressions and covariances, or factor loadings; the coefficients of non-significant covariances and regressions are not reported here to facilitate the figure's interpretation, please see Table 2 and eTable 5 for further details. Blue lines indicate differences from results of testing in the community sample. CHR-symptoms: Clinical High-Risk symptoms; EQ-5 (100): score on the 0-100 analogue scale of the EuroQoL-5D, 3 level version (EQ-5D-3L); EQ-5 (sum): sum score on the EQ-5D-3L – see eText 5 for details; SOFAS score: Social and Occupational Functioning Scale score; GAF score: Global Assessment of Functioning score; MINI: Mini-International Neuropsychiatric Interview.

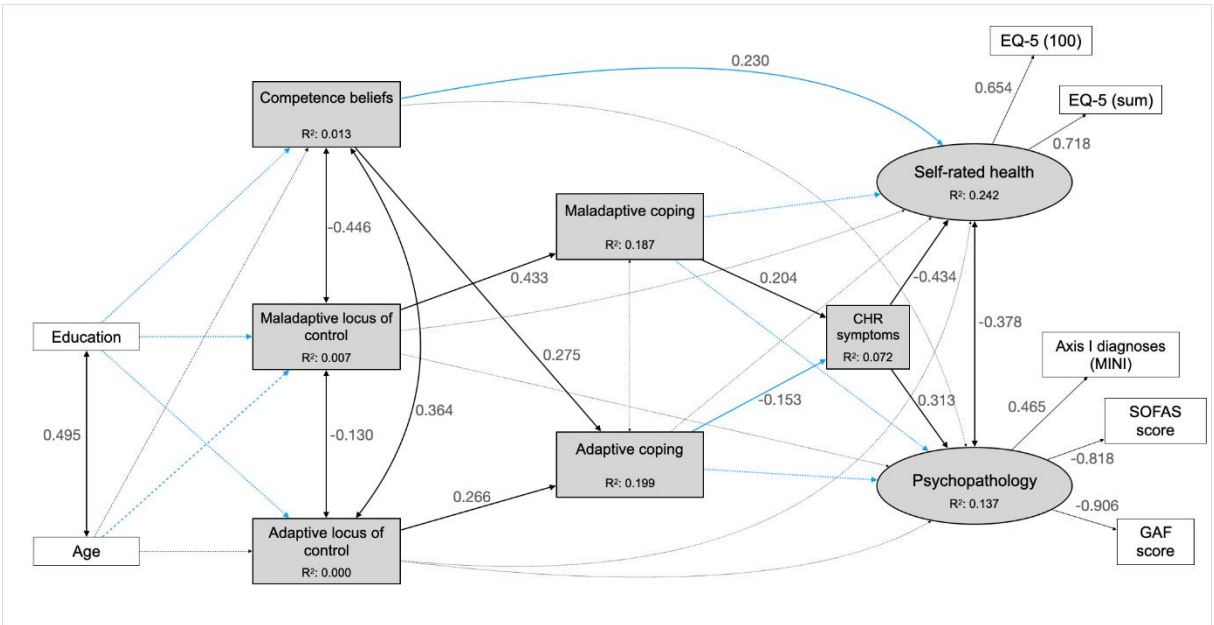




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**Table 1** Sample characteristics and group comparison

| | **Community sample** (N=523) | | **Clinical sample** (N=371) | | **Statistics; effect size** |
|---|---|---|---|---|---|
| | n | % | n | % | |
| **Age (mean±SD, median, range)** | 33.4±7.8, 35.00, 19.00-45.00 | | 18.94± 4.51, 17.44, 12.98-40.30 | | U = 186 426, p < 0.001; r = 0.757 |
| **Sex (male)** | 204 | 39.0 | 179 | 47.4 | $\chi^2$ = 15.956, p < 0.001; V = 11.166 |
| **Highest professional education (ISCED level)**[a] | | | | | U = 142 062, p < 0.001; r = 0.456 |
| Early childhood education (ISCED 0) | 0 | 0 | 4 | 1.1 | |
| Primary school or school for special needs (ISCED 1) | 0 | 0 | 6 | 1.6 | |
| Secondary school (ISCED 2) | 5 | 1.0 | 108 | 28.6 | |
| Highschool (ISCED 3.4) | 8 | 1.5 | 10 | 2.6 | |
| Highschool-level professional education (ISCED 3.5) | 36 | 6.9 | 38 | 11.9 | |
| Post-secondary non-tertiary education (ISCED 4) | 6 | 1.1 | 1 | 0.3 | |
| Short cycle tertiary education (ISCED 5) | 256 | 48.9 | 141 | 37.3 | |
| Master (ISCED 7) | 205 | 39.2 | 45 | 11.9 | |
| Doctoral (ISCED 8) | 7 | 1.3 | 0 | 0 | |
| **SOFAS score (mean±SD, median, range)** [b] | 84.80±6.66, 88, 40.00-100.00 | | 59.35± 12.97, 60, 30.00-95.00 | | U = 174 438, p < 0.001; r = 0.775 |
| **GAF score (mean±SD, median, range)** [c] | 81.70±9.84, 87.0, 36.00-95.00 | | 51.86±12.51, 53, 21.00-90.00 | | U = 176 177, p < 0.001; r = 0.770 |
| **Current axis-I disorders, sum score (mean±SD, median, range)** [d] | 0.21±0.61, 0, 0.00-6.00 | | 1.06± 1.06, 1, 0.00-6.00 | | U = 37 924, p < 0.001; r = 0.483 |
| **Current CHR symptoms, sum score (mean±SD, median, range)** [e] | 0.44±0.61, 0, 0.00-5.00 | | 4.28± 3.29, 3, 0.00-14.00 | | U = 17 212, p < 0.001; r = 0.698 |
| ***Current UHR symptoms, sum score* (mean±SD, median, range)** [f] | 0.15±0.43, 0, 0.00-3.00 | | 1.74± 1.25, 2, 0.00-5.00 | | U = 25 606, p < 0.001; r = 0.687 |



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| | | | |
|---|---|---|---|
| ***Current basic symptoms, sum score*** **(mean±SD, median, range)** [g] | 0.29±0.60, 0, 0.00-4.00 | 2.63± 2.51, 2, 0.00-10.00 | U = 28 810, p < 0.001; r = 0.608 |

*Note:* SOFAS: Social and Occupational Functioning Assessment Scale; CHR: clinical high risk; UHR: ultra-high risk. U: Mann-Whitney-U test, r: Pearson's r; $\chi^2$: Chi square; V: Cramer's V.

[a]In the FETZ-sample, 18 participants (4.8%) were missing data about their education level.

[b]In the FETZ-sample, 30 participants (7.9%) were missing data about their SOFAS score.

[c]In the FETZ-sample, 26 participants (6.9%) were missing data about their GAF score.

[d]In the FETZ-sample, 85 participants (6.9%) were missing data about their current axis-I disorders.

[e]In the FETZ-sample, 46 participants (12.2%) were missing data about their current CHR symptoms.

[f]In the FETZ-sample, 26 participants (6.9%) were missing data about their current UHR symptoms.

[g]In the FETZ-sample, 45 participants (11.9%) were missing data about their current basic symptoms.



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**Table 2.** Standardized regression coefficients (β) and p values for relevant paths in model 1.2.

| **Model 1.2., community sample** (N=518) | | | **Model 1.2., clinical sample** (N=327) | |
|---|---|---|---|---|
| | **β** | **p** | **β** | **p** |
| **Psychopathology (PP)** | | | | |
| Maladaptive coping | 0.236 | <0.001** | *-0.053* | *0.401* |
| Adaptive coping | -0.108 | 0.009* | *-0.080* | *0.212* |
| CHR symptoms | 0.358 | <0.001** | 0.313 | <0.001** |
| **Maladaptive coping** | | | | |
| Maladaptive LOC | 0.525 | <0.001** | 0.433 | <0.001** |
| **Adaptive coping** | | | | |
| Competence beliefs | 0.188 | <0.001** | 0.275 | <0.001** |
| Adaptive LOC | 0.171 | <0.001** | 0.266 | <0.001** |
| **Self-rated health (SRH)** | | | | |
| Maladaptive coping | -0.201 | 0.001** | *-0.007* | *0.927* |
| CHR symptoms | -0.185 | <0.001** | -0.434 | <0.001** |
| Competence beliefs | *-0.030* | *0.636* | 0.230 | 0.004* |
| **CHR symptoms** | | | | |
| Adaptive coping | *-0.003* | *0.947* | -0.153 | 0.005* |
| Maladaptive coping | 0.223 | <0.001** | 0.204 | <0.001** |
| **Competence beliefs** | | | | |
| ISCED level | 0.188 | <0.001** | *0.101* | *0.113* |
| **Adaptive LOC** | | | | |
| ISCED level | 0.135 | 0.002* | *-0.020* | *0.756* |
| **Maladaptive LOC** | | | | |
| ISCED level | -0.128 | 0.004* | *-0.092* | *0.150* |
| age | -0.133 | 0.010* | *0.063* | *0.323* |

*Note:* ** = p < .001; * = p < .05; *italics*: not significant; significant in the other sample



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**Table 3.** Mediation effect analyses, 95% bias-corrected bootstrap confidence intervals

| | **Model 1.2., community sample** (N=518) | | | **Model 1.2., clinical sample** (N=327) | | |
|---|---|---|---|---|---|---|
| | **Standardized coefficient** | **p** | **95%CI** | **Standardized coefficient** | **p** | **95%CI** |
| **Mediation pathway** | | | | | | |
| ***Competence beliefs – adaptive coping - PP*** | | | | | | |
| Indirect effect | -0.020 | 0.040* | *-0.002, 0.000* | | | |
| *Total effect* | *-0.053* | *0.403* | *-0.009, 0.003* | | | |
| ***Competence beliefs – adaptive coping – CHR symptoms*** | | | | | | |
| Indirect effect | | | | *-0.028* | *0.124* | *-0.024, 0.001* |
| Total effect | | | | -0.224 | 0.002* | -0.131, -0.030 |
| ***Adaptive LOC – adaptive coping – CHR symptoms*** | | | | | | |
| Indirect effect | | | | *-0.027* | *0.107* | *-0.022, 0.001* |
| Total effect | | | | *0.015* | *0.805* | *-0.037, 0.046* |



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| | | | | | | |
|---|---|---|---|---|---|---|
| ***Adaptive LOC – adaptive coping – PP*** | | | | | | |
| *Indirect effect* | *-0.018* | *0.071* | *-0.002, 0.000* | | | |
| *Total effect* | *-0.060* | *0.264* | *-0.008, 0.002* | | | |
| ***Maladaptive LOC – maladaptive coping - SRH*** | | | | | | |
| Indirect effect | -0.106 | 0.026* | -0.200, -0.019 | | | |
| Total effect | -0.181 | 0.011* | -0.339, -0.064 | | | |
| ***Maladaptive LOC – maladaptive coping - PP*** | | | | | | |
| Indirect effect | 0.124 | 0.003* | 0.003, 0.011 | | | |
| Total effect | 0.205 | 0.001** | 0.005, 0.017 | | | |
| ***Maladaptive LOC – maladaptive coping – CHR symptoms*** | | | | | | |
| Indirect effect | 0.111 | <0.001** | 0.005, 0.016 | *0.027* | *0.302* | *-0.007, 0.030* |
| Total effect | 0.133 | 0.003* | 0.005, 0.020 | 0.155 | 0.009* | 0.014, 0.097 |



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| | | | | | | |
|---|---|---|---|---|---|---|
| ***Maladaptive coping – CHR symptoms – SRH*** | | | | | | |
| Indirect effect | -0.039 | 0.047* | -0.090, -0.011 | *-0.026* | *0.304* | *-0.108, 0.022* |
| Total effect | -0.240 | 0.008* | -0.404, -0.061 | *-0.033* | *0.704* | *-0.242, 0.162* |
| ***Maladaptive coping – CHR symptoms – PP*** | | | | | | |
| Indirect effect | 0.076 | 0.004* | 0.001, 0.007 | *0.019* | *0.322* | -0.001, 0.003 |
| Total effect | 0.312 | <0.001** | 0.008, 0.024 | *-0.034* | *0.607* | -0.007, 0.005 |
| ***Adaptive coping – CHR symptoms – SRH*** | | | | | | |
| Indirect effect | | | | *0.043* | *0.101* | *-0.004, 0.125* |
| Total effect | | | | *0.046* | *0.577* | *-0.131, 0.257* |
| ***Adaptive coping – CHR symptoms – PP*** | | | | | | |
| Indirect effect | | | | *-0.031* | *0.101* | *-0.003, 0.000* |
| Total effect | | | | *-0.110* | *0.102* | *-0.012, 0.000* |



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*Note:* ** = p < .001; * = p < .05; *italics*: not significant; value missing: indirect effect was not analysed in the corresponding sample.

**Supplementary Material to:**

**Exploring the complex relationships between coping strategies, locus of control and self-esteem with psychopathology: Structural Equation Modeling with a special focus on clinical high risk of psychosis**

Giulia Rinaldi; Naweed Osman; Michael Kaess; Benno G. Schimmelmann; Jochen Kindler; Frauke Schultze-Lutter; Chantal Michel

**Contents: 6 eTexts, 8 eTables, 9 eFigures**





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## eText 1: The Bern Epidemiological At-Risk (BEAR) study - details on study design

At baseline, a representative sample of the Bernese general population was obtained using a stratified sampling method. Participants were randomly selected from the approximately 310,000 predominantly Caucasian 16 to 40 years old residents of the semi-rural Canton Bern.

The community sample was evaluated during a semi-structured telephone interview. Excellent concordance rates (78-100%) were found for telephone and face-to-face assessment for the used clinical interviews in a feasibility study that was carried out prior to the BEAR-study baseline assessment [1].

Eligibility criteria were inclusion in the selected age range, main residency in Canton Bern (i.e. having a valid address in the Canton and not being abroad during the assessment period), and an available telephone number.

First telephone contact was attempted two weeks after sending eligible participants a one-page information letter, meant to increase response rates, and explaining the study goals and procedure, as well as the incentives for participation.

Participation in the telephone interview after receiving exhaustive information about the study was considered as giving informed consent. Eligible participants that could not be reached after up to 100 calls over several months, at different times and days including Saturdays, were considered as unknown eligible.

Further exclusion criteria were (i) a lifetime diagnosis of psychosis [2] and (ii) insufficient fluency in German, French or English. If respondents met one of these criteria, their interview was interrupted prematurely. On average, the semi-structured interviews lasted 43 minutes (SD: 20 minutes; range: 20–225 minutes).

To ensure an excellent assessment quality, clinical psychologists conducted the telephone interviews after three months of intensive training, and were provided with weekly supervision by F. Schultze-Lutter and C. Michel [2].



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**eText 2: BEAR-study - details on recruitment of sample and representativeness**

*Baseline*

Out of 4,471 eligible participants, 2,857 were interviewed. Due to insufficient language skills, 125 (4.4%) interviews were interrupted prematurely; furthermore, 41 (1.4%) interviews were aborted due to a lifetime diagnosis of psychosis (19 of these were not diagnosed/treated) [2] and 8 (0.3%) participants prematurely terminated the interviews themselves. The 1,350 (29.5%) refusers cited lack of time or interest as the main reason for not taking part in the study.

Completed interviews were 2,683, with a contact rate of 94.8% and a response rate of 63.4%. Compared to the 16- to 40-year-old general population of Bern, the eligible sample was negligibly older, but this difference was mainly based on a higher non-significant number of available telephone numbers (landlines) in 36- to 40-year-olds.

For the 2,683 participants who completed the interview, negligible differences were detected in age distribution, but not gender, nationality or marital status, when compared to the 16- to 40-year-old general population of Bern. They were therefore considered to be a representative sample of their age group [3].

*Follow-up*[4]

In their baseline interview, 659 participants (23.1% of the 2,857 interviewed) reported CHR symptoms or criteria; of these, 97.9% (n=645) gave their consent to be re-contacted for a future assessment, thus constituting the main target group (RISK) for the follow-up. Next, a control group (CONTROL) of 645 persons who didn't report any CHR symptoms or criteria at baseline were selected, after matching them to RISK participants for both (i) gender and (ii) age at baseline. CONTROL subjects that were ineligible or refused to participate were replaced by another match to the respective RISK participant. Including these, 1,263 participants were re-contacted for the follow-up assessment, with a contact rate of 78.8%. In total, 839 interviews were conducted (response rate 66.4%), including 829 non-conversions, 5 conversions to psychosis, and 5 partial interviews.

*The community sample in the present study*



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A total of 523 participants in the follow up of the BEAR study were included in the community sample included in the present study. Their main sociodemographic characteristics are described in Table 1. The 109 participants who were not eligible for the add-on study or did not provide their consent to complete the questionnaires (see Figure 1 for further details) were mostly male (63.3%), had a median age of 35 (mean age: 32.9 $\pm$ 8) and most (86.2%) had completed at least a short-cycle tertiary education (ISCED level $\geq$ 5). Those who agreed to complete the questionnaires but did not return them by the end of the study (N = 202) were also mostly male (57.9%), had a median age of 35 (mean age: 33.0 $\pm$ 7.6) and most (91.1%) reported a high level of education (ISCED level $\geq$ 5).

See eFigure 1 for a graphic depiction of the composition of the community sample used in the present study.



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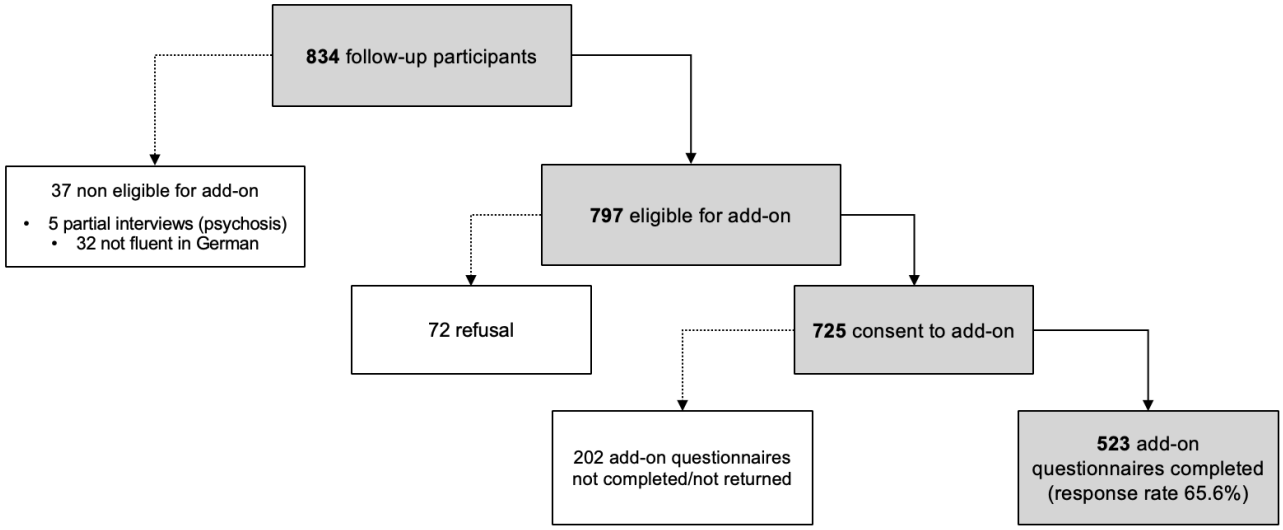
## eFigure 1: Composition of the community sample




Participants in the Bern Epidemiological At Risk (BEAR) study who were included in the community sample used in the present study.



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**eText 3: The Bern Early Recognition and Intervention Centre for mental crisis (FETZ Bern)**

The FETZ Bern [5] (www.upd.ch/fetz) is the only specialized outpatient clinical center for early detection of psychosis in the Canton of Bern, Switzerland, serving an area with 1 million inhabitants. Its target population are help-seeking persons between 8 and 40 years of age with putative psychotic symptoms or CHR symptoms, who are provided with a naturalistic, but close to scientific monitoring of all consecutive referrals. Patients with various psychiatric symptoms are admitted to the FETZ Bern; however, persons with (i) past clinical diagnosis of any psychotic disorder according to DSM and ICD, (ii) diagnosis of delirium, dementia, amnestic or other neurological disorders, and (iii) general medical conditions affecting the central nervous system are excluded from treatment. The diagnostic assessment of CHR symptoms follows the international gold standards for psychosis risk detection [6]. The FETZ Bern works in close cooperation with the outpatient facilities and inpatient units of the University Psychiatry Department Bern (UPD) and the Soteria Bern, allowing for an efficient referral into adequate treatment. The FETZ Bern is also financed by clinical accounting of these institution, along with research funds of the University of Bern.

If there is clinical suspicion of psychotic development, patients can be admitted to the FETZ Bern either of their own initiative or after referral by physicians or psychosocial institutions. Anyone can contact the FETZ Bern via the service phone, email, mail or in person. Before the first appointment, they will then be contacted telephonically by a clinical psychologist for a first assessment of the clinical indication for treatment at the FETZ Bern. This first evaluation covers CHR symptoms, social decline, genetic risk and drug abuse, and, when this indication is not met, it leads to referral into appropriate diagnostics or treatment. Three clinical psychologists, supervised by the clinical head psychologist and board-certified psychiatrists, conduct all assessments. Administrative processes are carried out with the aid of an assistant clinical psychologist and an intern. Patients and, for minors, their legal guardians provide their informed consent for use of their anonymized clinical data in scientific analyses and publications, as per requirement of the local ethics committee (ID PB_2016-01991).



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**eText 4: Details on participants excluded from the clinical sample**

The clinical sample included in the present study consisted of 378 participants. Fifty-one participants were excluded from the analyses due to having more than 50% missing data. They were 50.1% male (N = 26) and had a median age of 17.21 years (mean age: 19.07 ±4.52). Further, 35.3% of them (N = 18) reported a high level of education (ISCED level ≥ 5), while 31.4% (N = 16) were missing this information, 11.8% (N = 6) had completed high school or high school-level professional education (ISCED level: 3.4/3.5), 19.6% (N = 10) secondary school (ISCED level: 2), and one person (1.96%) had finished primary school only (ISCED level: 1).



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**eTable 1: Clinical high-risk symptoms and criteria of first-episode psychosis**

| **Ultra-high risk (UHR) criteria** according to the SIPS |
|---|
| A. 'Brief Intermittent Psychotic Symptoms' (BIPS)<br><br>➲ At least any 1 of the following SIPS P-items scored 6 'severe and psychotic'<br><br>• P1 Unusual Thought Content / Delusional Ideas<br>• P2 Suspiciousness / Persecutory Ideas<br>• P3 Grandiose Ideas<br>• P4 Perceptual Abnormalities / Hallucinations<br>• P5 Disorganized Communication<br>➲ First appearance in the past three months<br><br>➲ Present for at least several minutes per day at a frequency of at least once per month but less than 7 days |
| B. 'Attenuated Positive Symptoms' (APS)<br><br>➲ At least any 1 of the following SIPS P-items scored 3 'moderate' to 5 'severe but not psychotic'<br><br>• P1 Unusual Thought Content / Delusional Ideas<br>• P2 Suspiciousness / Persecutory Ideas<br>• P3 Grandiose Ideas<br>• P4 Perceptual Abnormalities / Hallucinations<br>• P5 Disorganized Communication<br>➲ First appearance within the past year or current rating one or more scale points higher compared to 12 months ago<br><br>➲ Symptoms have occurred at an average frequency of at least once per week in the past month |
| C. 'Genetic Risk and Deterioration' Syndrome<br><br>(1) Patient meets criteria for Schizotypal Personality Disorder according to SIPS<br><br>(2) Patient has 1st degree relative with a psychotic disorder<br><br>(3) Patient has experienced >30% drop in global assessment of functioning (GAF) score over the last month compared to 12 months ago |



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| |
|---|
| ➲ [1 and 3] or [2 and 3] or all are met. |
| **Basic symptom criteria** |
| Risk criterion ‘Cognitive-Perceptive Basic Symptoms’ (COPER)<br><br>➲ At least any 1 of the following basic symptoms with a SPI-A score of ≥3 within the last 3 months:<br><br>• Thought interference<br>• Thought perseveration<br>• Thought pressure<br>• Thought blockages<br>• Disturbance of receptive speech<br>• Decreased ability to discriminate between ideas and perception, fantasy and true memories<br>• Unstable ideas of reference<br>• Derealisation<br>• Visual perception disturbances (excluding hypersensitivity to light or blurred vision)<br>• Acoustic perception disturbances (excluding hypersensitivity to sounds)<br>➲ First occurrence ≥12 months ago |
| High-risk criterion ‘Cognitive Disturbances’ (COGDIS)<br><br>➲ At least any 2 of the following basic symptoms with a SPI-A score of ≥3 within the last 3 months:<br><br>• Inability to divide attention<br>• Thought interference<br>• Thought pressure<br>• Thought blockages<br>• Disturbance of receptive speech<br>• Disturbance of expressive speech<br>• Unstable ideas of reference<br>• Disturbances of abstract thinking<br>• Captivation of attention by details of the visual field |



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**eText 5: Details regarding assessments used in the present study**

*Mini-International Neuropsychiatric Interview* (MINI)

The Mini-International Neuropsychiatric Interview [7] was used to assess current present of following mental disorders according to the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) [8] criteria: anxiety and mood disorders, depressive and (hypo-)manic episodes, obsessive-compulsive disorders, post-traumatic stress disorders, substance dependence/abuse, eating disorders, somatization disorders, hypochondriasis, body dysmorphic and pain disorders.

*EuroQoL-5D, 3 level version* (EQ-5D-3L)

The EQ-5D-3 L [9] sum score we used in our analyses was obtained via the following formula by Hinz and colleagues [9] (see also [10]):

(100-(10x [value1+value2+value3+value4+value5-5]))

The 5 values refer to the 5 dimensions of mobility, self-care, usual activities, pain/discomfort, anxiety/depression, self-rated on 3 degrees of severity (from absence of problems to extreme difficulties).

*German Competence and Control Beliefs Questionnaire* (FKK)

In our analyses, we used three scales from the German Competence and Control Beliefs Questionnaire (FKK) [11].

Two were primary scales, each with a sum score obtained from 8 corresponding items. We used the Self-Efficacy primary scale (FKK-SK), referring to the positive self-concept of one's own competencies, to represent competence beliefs, as indicated in the instrument's manual [11].

To indicate adaptive LOC, we used the Internality primary scale (FKK-I), assessing the tendency to a general attribution of control/causality to the self in relation to life events. This is coherent with the conceptualization of adaptive LOC as 'internal LOC', or, alternatively, as 'internality', as originally defined in Rotter's social learning theory [12], on which the FKK is based.

The third was a secondary scale, the Externality scale (FKK-PC), obtained from the aggregation of two primary scales, and evaluating the tendency to a general attribution of control on life events to fatalistic (Fatalistic Externality primary scale, FKK-C) and/or



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social causality (Social Externality primary scale, FKK-P). This scale was used to conceptualize maladaptive LOC, defined as ‘external LOC’, or, alternatively, as ‘externality’, by Rotter [12]. The FKK-PC score is calculated by summing the 16 items that form the FKK-P and FKK-C primary scales. The choice of employing two primary (FKK-I, FKK-SK) and one secondary (FKK-PC) scale to conceptualize core beliefs in our SEM models, instead of scales on the same level of complexity, was meant to reflect the concepts and model structure resulting from the meta-analysis by Groth et al. [13], separating adaptive and maladaptive LOC from competence beliefs.



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## eTable 2: Results of the EFA in the community sample

| EFA results, community sample (N=522) | | |
|---|---|---|
| | **Factor loadings** | **Variance explained** |
| **Psychopathology** | | **68 %** |
| Current axis-I disorders | 0.51 | |
| GAF score | 1.01 | |
| SOFAS score | 0.82 | |
| **Self-rated health** | | 32% |
| EQ-5D summary score | 0.83 | |
| EQ-5D analogue score | 0.44 | |

## eTable 3: Results of the CFA in the community sample

| CFA results, community sample (N=522) | | |
|---|---|---|
| | **Factor loadings** | |
| | **Unstandardized (SD)** | **Standardized** |
| **Psychopathology** | | |
| Current axis-I disorders | 1.00[+] | 0.736 |
| GAF score | -20.66 (0.99) | -0.943 |
| SOFAS score | -13.01 (0.65) | -0.877 |
| **Self-rated health** | | |
| EQ-5D analogue score | 1.00[+] | 0.704 |
| EQ-5D summary score | 0.71 (0.07) | 0.814 |

*Note:* +: fixed parameter



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**eText 6: Description of the six alternative SEM models**

In all 6 alternative SEM models we tested in the present study:

- age and education (ISCED level) are exogenous variables, while all others are endogenous;
- following Groth and colleagues [13], Positive and Negative Coping Strategies (SVF) play a mediating role in the relationship between competence beliefs (FKK-SK), adaptive (FKK-I) and maladaptive LOC (FKK-PC), while mental health outcomes are represented by the latent factors PP and SRH obtained through the preliminary EFA and CFA.

The models can be further described as follows:

- Models 1.1. and 1.2.: presence of any BS symptom and presence of any UHR symptom (1.1.), or presence of any CHR symptom (1.2.) are associated with higher Psychopathology and lower Self-Rated Health (outcome variables), respectively; they are in turn predicted by competence beliefs and locus of control, and this association is mediated by coping.
- Models 2.1. and 2.2.: presence of any BS symptom and presence of any UHR symptom (2.1.), or presence of any CHR symptom (2.2.), respectively, are outcome variables, parallel to Psychopathology and Self-Rated Health.
- Models 3.1. and 3.2.: presence of any BS symptom and presence of any UHR symptom (3.1.), or presence of any CHR symptom (3.2.), respectively, are outcome variables, influenced by Psychopathology and Self-Rated Health.

For graphic representations of the models, see eFigures 1-6.



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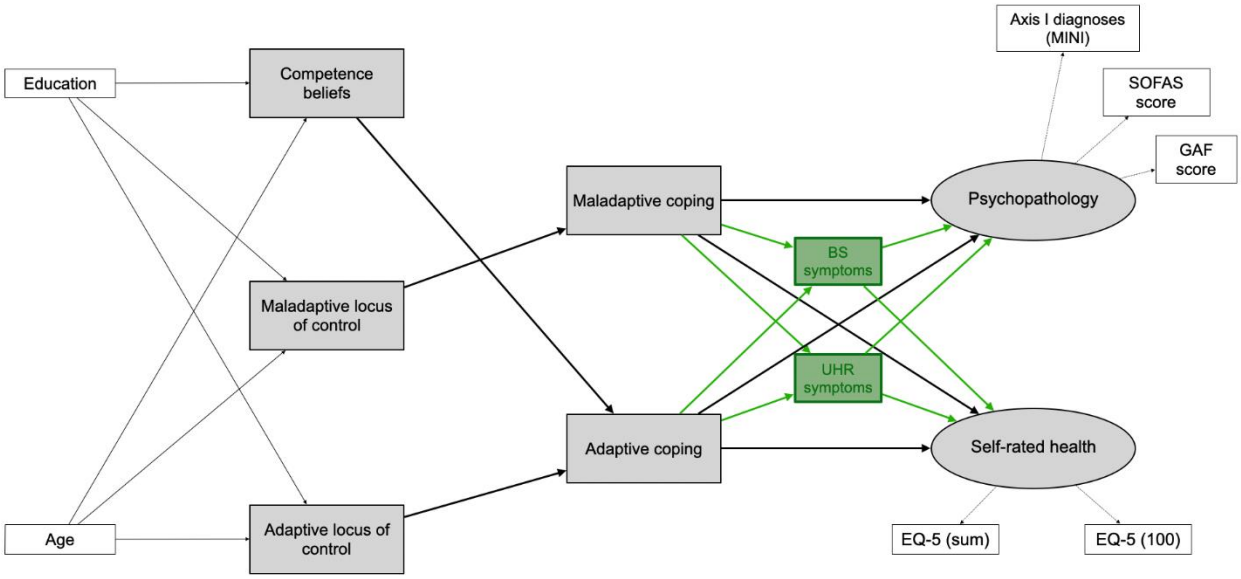
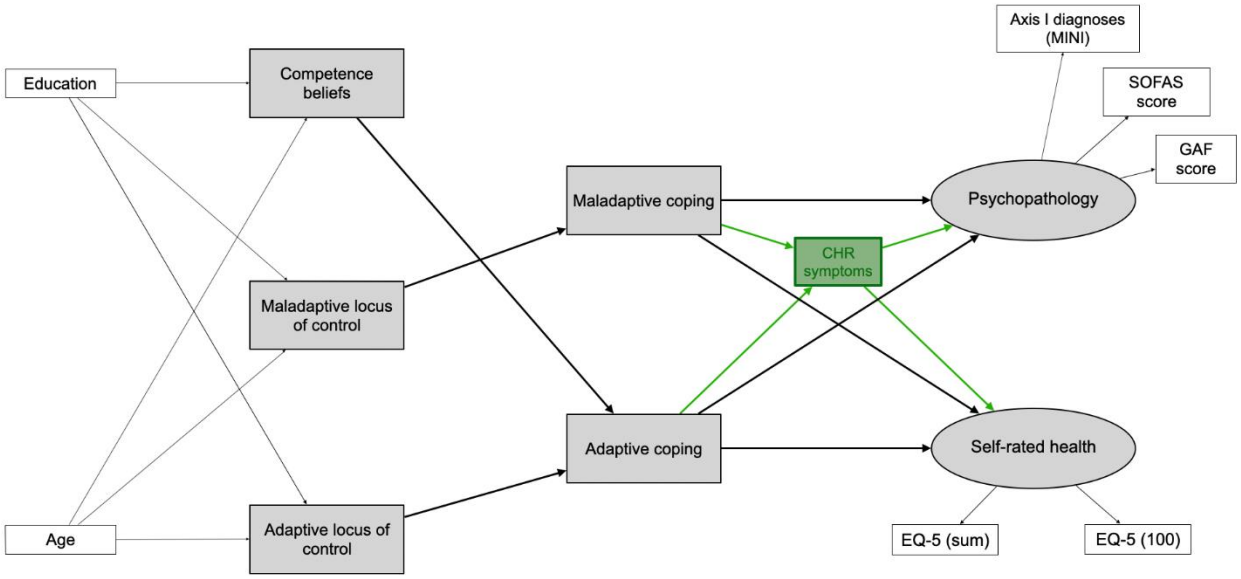
## eFigure 2 – Model 1.1.




*Note:* CHR symptoms: Clinical High-Risk symptoms; EQ-5 (100): score on the 0-100 analogue scale of the EuroQoL-5D, 3 level version (EQ-5D-3L) analogue scale; EQ-5 (sum): sum score on the EQ-5D-3L – see eText 5 for details; SOFAS score: Social and Occupational Functioning Scale score; GAF score: Global Assessment of Functioning score; MINI: Mini-International Neuropsychiatric Interview.

## eFigure 3 – Model 1.2. (chosen as best fitting the community sample data)




*Note:* CHR symptoms: Clinical High-Risk symptoms; EQ-5 (100): score on the 0-100 analogue scale of the EuroQoL-5D, 3 level version (EQ-5D-3L) analogue scale; EQ-5 (sum): sum score on the EQ-5D-3L – see eText 5 for details; SOFAS score: Social and



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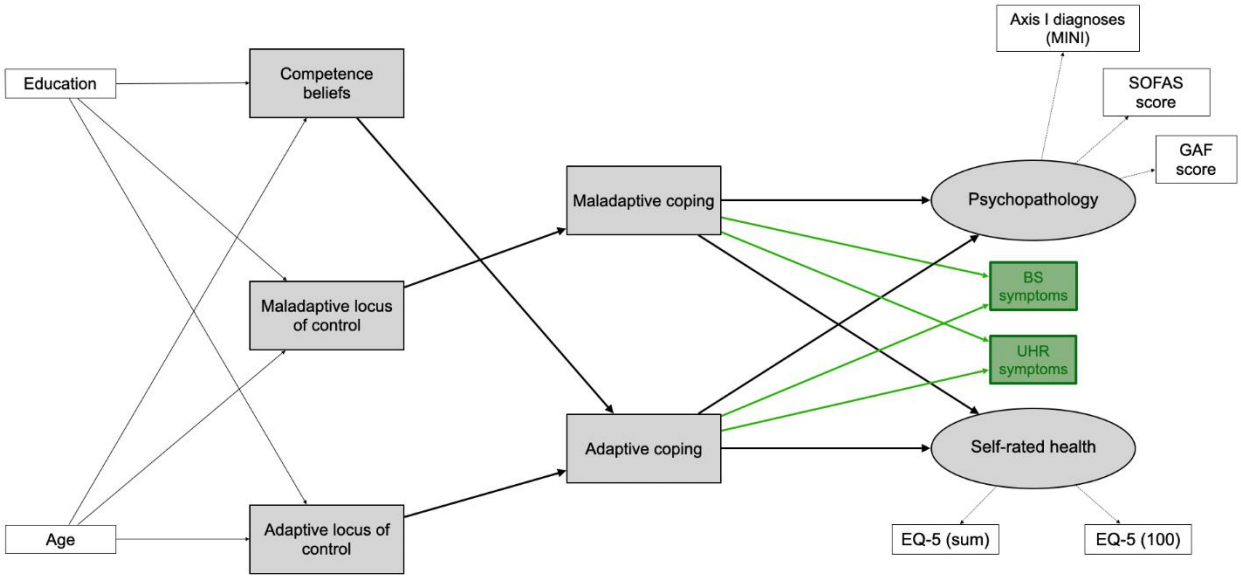
Occupational Functioning Scale score; GAF score: Global Assessment of Functioning score; MINI: Mini-International Neuropsychiatric Interview.

## eFigure 4 – Model 2.1.




*Note:* CHR symptoms: Clinical High-Risk symptoms; EQ-5 (100): score on the 0-100 analogue scale of the EuroQoL-5D, 3 level version (EQ-5D-3L) analogue scale; EQ-5 (sum): sum score on the EQ-5D-3L – see eText 5 for details; SOFAS score: Social and Occupational Functioning Scale score; GAF score: Global Assessment of Functioning score; MINI: Mini-International Neuropsychiatric Interview.



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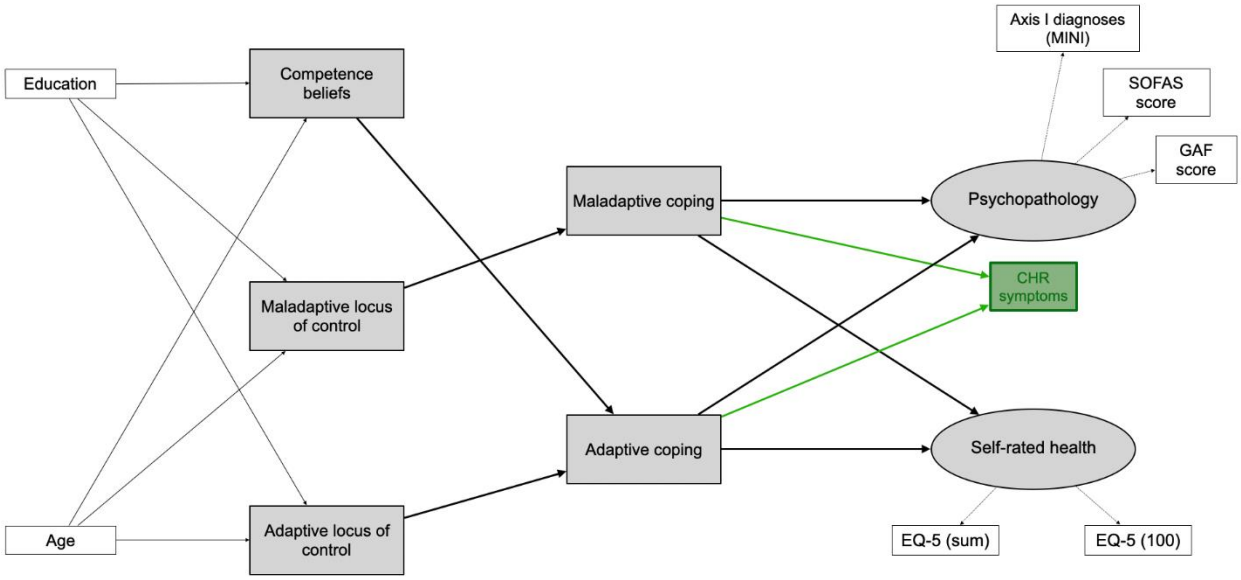
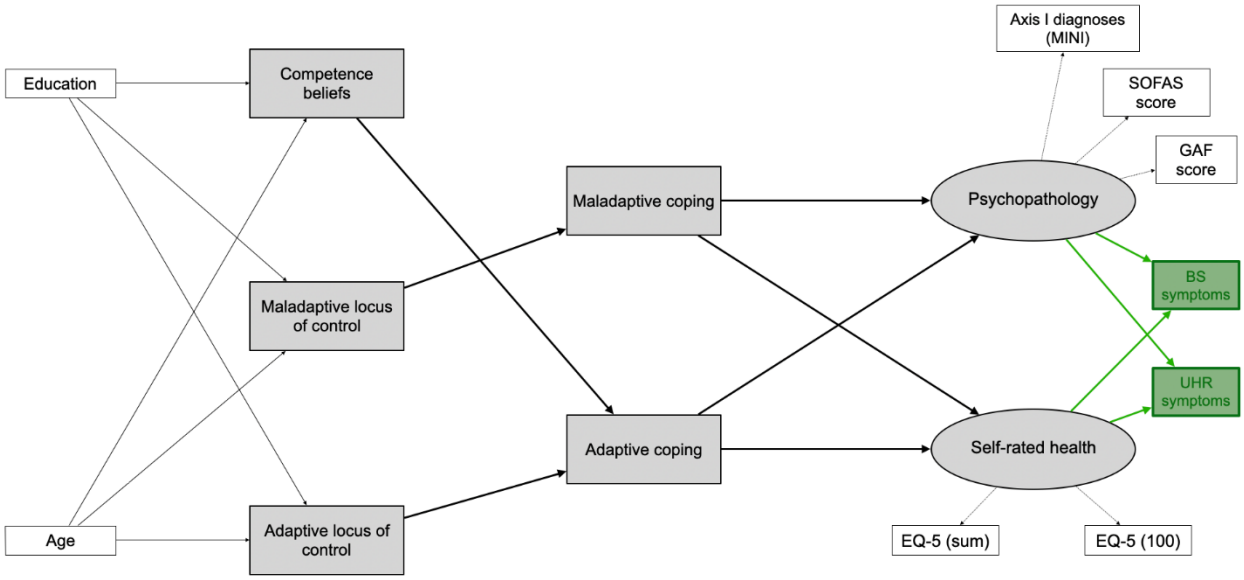
## eFigure 5 – Model 2.2.




*Note:* CHR symptoms: Clinical High-Risk symptoms; EQ-5 (100): score on the 0-100 analogue scale of the EuroQoL-5D, 3 level version (EQ-5D-3L) analogue scale; EQ-5 (sum): sum score on the EQ-5D-3L – see eText 5 for details; SOFAS score: Social and Occupational Functioning Scale score; GAF score: Global Assessment of Functioning score; MINI: Mini-International Neuropsychiatric Interview.

## eFigure 6 – Model 3.1.




*Note:* CHR symptoms: Clinical High-Risk symptoms; EQ-5 (100): score on the 0-100 analogue scale of the EuroQoL-5D, 3 level version (EQ-5D-3L) analogue scale; EQ-5 (sum): sum score on the EQ-5D-3L – see eText 5 for details; SOFAS score: Social and Occupational Functioning Scale score; GAF score: Global Assessment of Functioning score; MINI: Mini-International Neuropsychiatric Interview.



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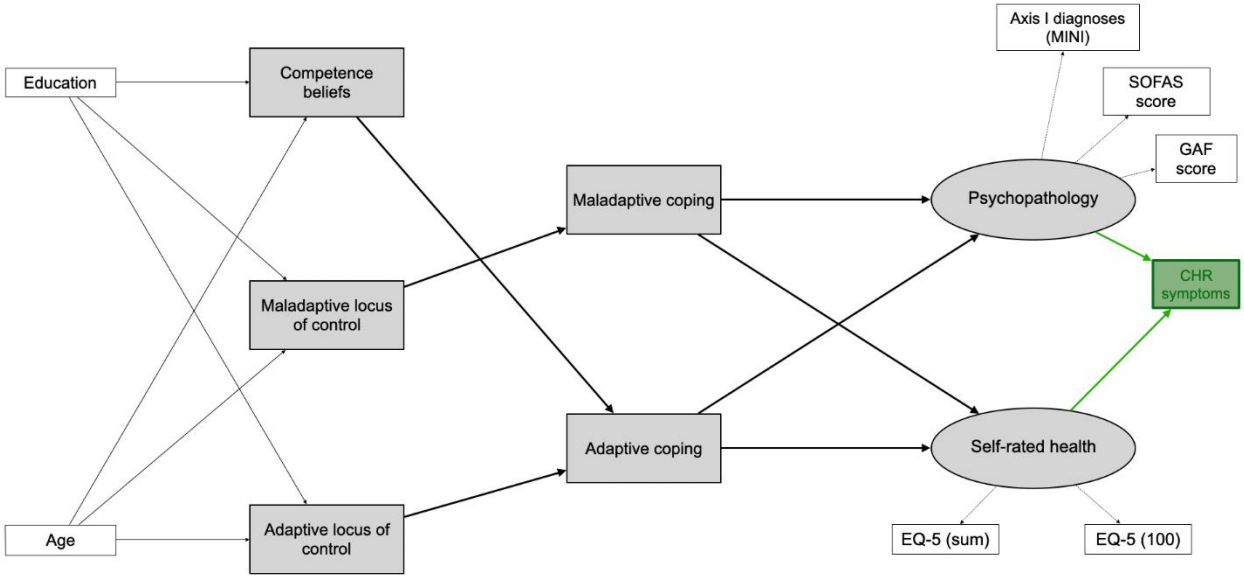
## eFigure 7 – Model 3.2.




*Note:* CHR symptoms: Clinical High-Risk symptoms; EQ-5 (100): score on the 0-100 analogue scale of the EuroQoL-5D, 3 level version (EQ-5D-3L) analogue scale; EQ-5 (sum): sum score on the EQ-5D-3L – see eText 5 for details; SOFAS score: Social and Occupational Functioning Scale score; GAF score: Global Assessment of Functioning score; MINI: Mini-International Neuropsychiatric Interview.



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**eTable 4: Fit indices of the six alternative SEM-models to the community sample**

| *Model* | CFI | TLI | RMSEA | 90%CIs | SRMR | AIC | BIC |
|---|---|---|---|---|---|---|---|
| ***1.1.*** | 0,926** | *0,871* | 0,078** | 0.067-0.089* | 0,052*** | 39735,789 | 39961,037 |
| ***1.2.*** | 0,923** | *0,863* | 0,086* | 0.075-0.098* | 0,055*** | **39484,669** | 39684,418 |
| ***2.1.*** | 0.926** | *0,865* | 0,080** | 0.069-0.091* | 0,051*** | 39739,031 | 39972,780 |
| ***2.2.*** | 0,922** | *0,859* | 0,088* | 0.076-0.100* | 0,055*** | 39486,477 | 39690,476 |
| ***3.1.*** | 0,923** | *0,875* | 0,077** | 0.067-0.088* | 0,055*** | 39739,283 | 39947,532 |
| ***3.2.*** | 0,921** | *0,867* | 0.085* | 0.074-0.097* | 0.057*** | 39485,825 | **39677,074** |

*Note:* * = acceptable fit; ** = good fit; *** = excellent fit. Values in cursive represent poor fit to the data. The best, i.e., lowest AIC and BIC values are in bold.
CFI (comparative fit index) is considered excellent if >0.95, good if >0.90, poor if <0.90;
TLI (Tucker-Lewis index) is considered excellent if >0.95, good if >0.90, poor if <0.90;
RMSEA (root-mean-square error of approximation) is considered excellent if <0.60, good if 0.06-0.08, acceptable if 0.08-0.10. poor if >0.10;
90%CI (confidence interval) is considered excellent if it does not include 0.08, good if relatively narrow (e.g. 0.70 to 0.80), acceptable if relatively wide (e.g. 0.60 to 0.93), poor if very wide (e.g.0.50 to 0.10);
SRMR (standardized root mean square residual) is considered excellent if <0.08, good if 0.08-0.10, poor if >0.10.



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**eTable 5: Standardized regression coefficients (β), covariance coefficients (s) and p values in model 1.2.; community and clinical sample**

| Model 1.2., community sample (N=518) | | | Model 1.2., clinical sample (N=327) | |
|---|---|---|---|---|
| | **β** | **p** | **β** | **p** |
| **Psychopathology (PP)** | | | | |
| Maladaptive coping | 0.236 | <0.001** | *-0.053* | *0.401* |
| Adaptive coping | -0.108 | 0.009* | *-0.080* | *0.212* |
| CHR symptoms | 0.358 | <0.001** | 0.313 | <0.001** |
| Competence beliefs | *-0.033* | *0.518* | *-0.122* | *0.083* |
| Maladaptive LOC | *0.081* | *0.111* | *0.041* | *0.548* |
| Adaptive LOC | *-0.042* | *0.361* | *0.039* | *0.538* |
| **Maladaptive coping** | | | | |
| Maladaptive LOC | 0.525 | <0.001** | 0.433 | <0.001** |
| **Adaptive coping** | | | | |
| Competence beliefs | 0.188 | <0.001** | 0.275 | <0.001** |
| Adaptive LOC | 0.171 | <0.001** | 0.266 | <0.001** |
| **Self-rated health (SRH)** | | | | |
| Maladaptive coping | -0.201 | 0.001** | *-0.007* | *0.927* |
| CHR symptoms | -0.185 | <0.001** | -0.434 | <0.001** |
| Competence beliefs | *-0.030* | *0.636* | 0.230 | 0.004* |
| Adaptive coping | *0.060* | *0.239* | *0.003* | *0.971* |
| Maladaptive LOC | *-0.076* | *0.235* | *0.066* | *0.395* |
| Adaptive LOC | *0.088* | *0.126* | *-0.030* | *0.673* |
| **CHR symptoms** | | | | |
| Adaptive coping | *-0.003* | *0.947* | -0.153 | 0.005* |
| Maladaptive coping | 0.223 | <0.001** | 0.204 | <0.001** |
| **Competence beliefs** | | | | |
| ISCED level | 0.188 | <0.001** | *0.101* | *0.113* |
| age | *0.082* | *0.060* | *-0.123* | *0.054* |
| **Adaptive LOC** | | | | |
| ISCED level | 0.135 | 0.002* | *-0.020* | *0.756* |
| age | *-0.043* | *0.333* | *-0.004* | *0.948* |
| **Maladaptive LOC** | | | | |
| ISCED level | -0.128 | 0.004* | *-0.092* | *0.150* |
| age | -0.133 | 0.010* | *0.063* | *0.323* |
| | **s** | **P** | **s** | **P** |
| PP - SRH | -0.474 | <0.001** | -0.378 | <0.001** |
| Adaptive coping – maladaptive coping | *0.011* | *0.811* | *-0.066* | *0.237* |
| Competence beliefs – adaptive LOC | 0.502 | <0.001** | 0.364 | <0.001** |
| Competence beliefs – maladaptive LOC | -0.483 | <0.001** | -0.446 | <0.001** |
| Adaptive LOC – maladaptive LOC | -0.233 | <0.001** | -0.130 | 0.021* |
| Age – ISCED level | 0.166 | <0.001** | 0.495 | <0.001** |

*Note:* ** = p < .001; * = p < .05; *italics*: not significant



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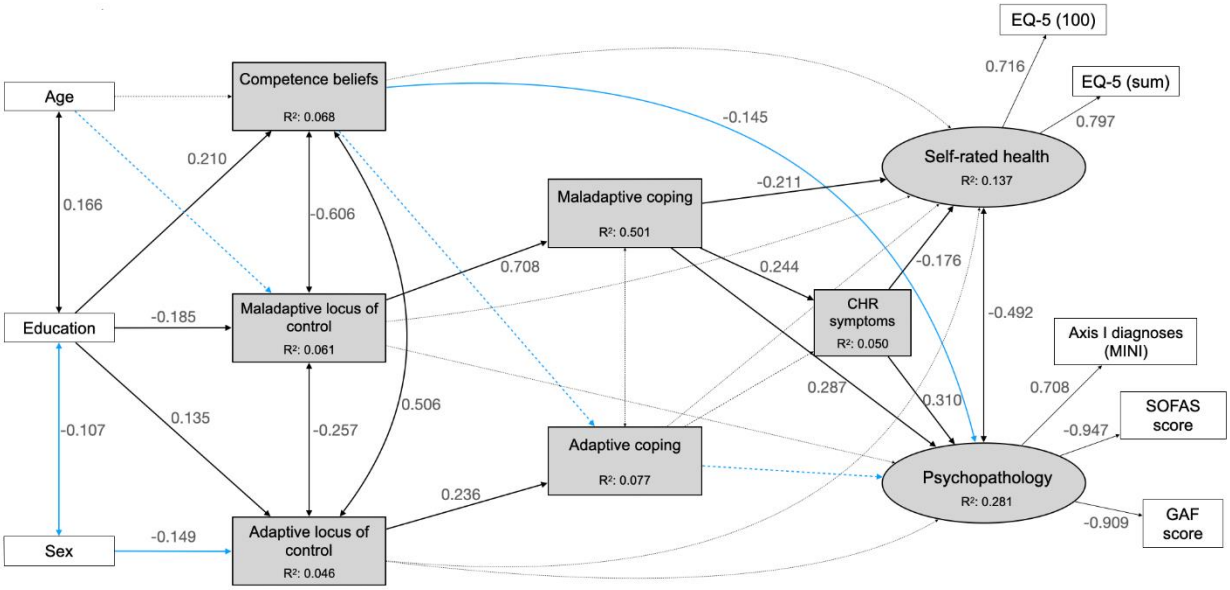
## eFigure 8: Community sample, sensitivity analysis




*Note:* rectangles represent observed variables, ovals represent unobserved latent variables; black lines with double-ended arrows represent covariances; black lines with single-ended arrows represent significant paths; dashed grey lines with double- or single-ended arrows represent non-significant covariances or regression paths, respectively; numbers next to the lines indicate coefficients of significant standardized regressions and covariances, or factor loadings; the coefficients of non-significant covariances and regressions are not reported here to facilitate the figure's interpretation; blue arrows represent differences from the original analyses in the community sample. CHR symptoms: Clinical High-Risk symptoms; EQ-5 (100): score on the 0-100 analogue scale of the EuroQoL-5D, 3 level version (EQ-5D-3L) analogue scale; EQ-5 (sum): sum score on the EQ-5D-3L – see eText 5 for details; SOFAS score: Social and Occupational Functioning Scale score; GAF score: Global Assessment of Functioning score; MINI: Mini-International Neuropsychiatric Interview.
Model fit indices: CFI = 0.989, TLI = 0.982, RMSEA = 0.04, SRMR = 0.045



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## eTable 6: Community sample - Standardized regression coefficients (β) and p values for paths in model 1.2., sensitivity analysis

| Model 1.2., community sample, sensitivity analysis (N=518) | | |
|---|---|---|
| | **β** | **p** |
| **Psychopathology (PP)** | | |
| Maladaptive coping | 0.287 | <0.001** |
| *Adaptive coping* | *-0.085* | *0.053* |
| CHR symptoms | 0.310 | <0.001** |
| Competence beliefs | - 0.145 | 0.033* |
| **Maladaptive coping** | | |
| Maladaptive LOC | 0.708 | <0.001** |
| **Adaptive coping** | | |
| *Competence beliefs* | *0.069* | *0.169* |
| Adaptive LOC | 0.236 | <0.001** |
| **Self-rated health (SRH)** | | |
| Maladaptive coping | -0.211 | 0.012* |
| CHR symptoms | -0.176 | <0.001** |
| **Competence beliefs** | | |
| ISCED level | 0.210 | <0.001** |
| **Adaptive LOC** | | |
| ISCED level | 0.135 | 0.003* |
| Sex | -0.149 | 0.005* |
| **Maladaptive LOC** | | |
| ISCED level | -0.185 | <0.001** |
| *age* | *-0.085* | *0.090* |
| | **s** | **P** |
| PP - SRH | -0.492 | <0.001** |
| Competence beliefs – adaptive LOC | 0.506 | <0.001** |
| Competence beliefs – maladaptive LOC | -0.606 | <0.001** |
| Adaptive LOC – maladaptive LOC | -0.257 | <0.001** |
| Age – ISCED level | 0.166 | <0.001** |
| ISCED level - sex | -0.107 | 0.049* |

*Note:* ** = p < .001; * = p < .05; *italics*: not significant in the sensitivity analysis



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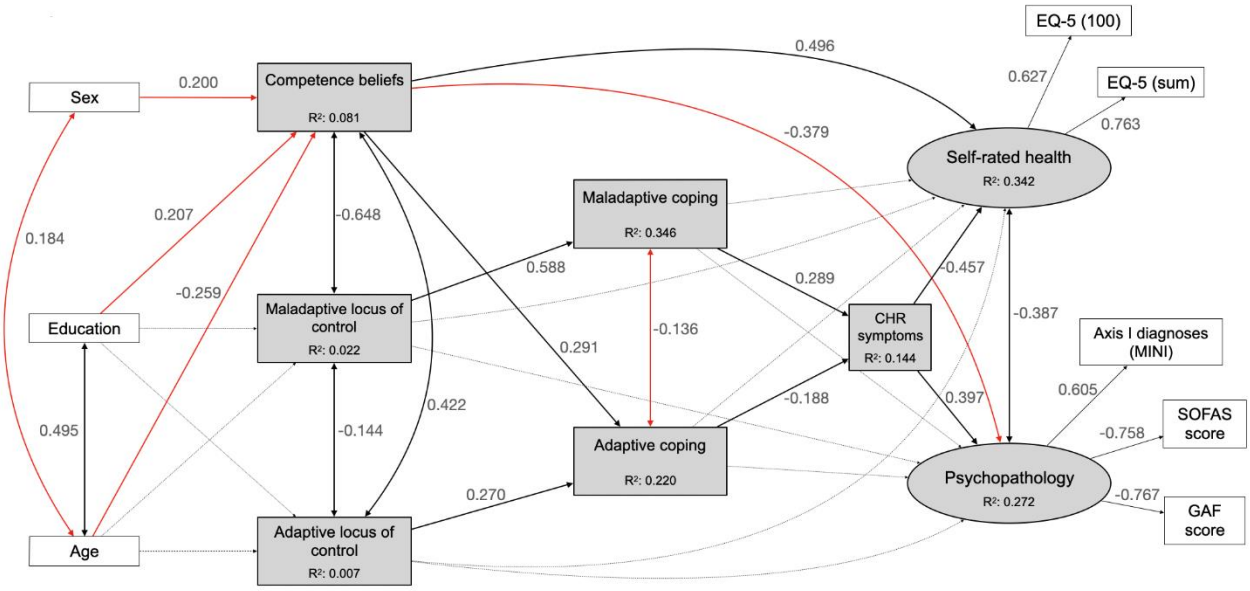
## eFigure 9: Model 1.2., clinical sample, sensitivity analysis




*Note*: rectangles represent observed variables, ovals represent unobserved latent variables; black lines with double-ended arrows represent covariances; black lines with single-ended arrows represent significant paths; dashed grey lines with double- or single-ended arrows represent non-significant covariances or regression paths, respectively; numbers next to the lines indicate coefficients of significant standardized regressions and covariances, or factor loadings; the coefficients of non-significant covariances and regressions are not reported here to facilitate the figure's interpretation; red arrows represent differences from the original analyses in the clinical sample. CHR symptoms: Clinical High-Risk symptoms; EQ-5 (100): score on the 0-100 analogue scale of the EuroQoL-5D, 3 level version (EQ-5D-3L) analogue scale; EQ-5 (sum): sum score on the EQ-5D-3L – see eText 5 for details; SOFAS score: Social and Occupational Functioning Scale score; GAF score: Global Assessment of Functioning score; MINI: Mini-International Neuropsychiatric Interview.
Model fit indices: CFI = 0.942, TLI = 0.898, RMSEA= 0.068, SRMR = 0.068



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## eTable 7: Clinical sample - Standardized regression coefficients (β) and p values for paths in model 1.2., sensitivity analysis

| **Model 1.2., clinical sample, sensitivity analysis (N=327)** | | |
|---|---|---|
| | **β** | **p** |
| **Psychopathology (PP)** | | |
| *Maladaptive coping* | *-0.069* | *0.416* |
| *Adaptive coping* | *-0.037* | *0.601* |
| CHR symptoms | 0.397 | <0.001** |
| Competence beliefs | -0.379 | 0.002* |
| **Self-rated health (SRH)** | | |
| *Maladaptive coping* | *-0.042* | *0.698* |
| CHR symptoms | -0.457 | <0.001** |
| Competence beliefs | 0.496 | <0.001** |
| **CHR symptoms** | | |
| Adaptive coping | -0.188 | 0.003* |
| Maladaptive coping | 0.289 | <0.001** |
| **Maladaptive coping** | | |
| Maladaptive LOC | 0.588 | <0.001** |
| **Adaptive coping** | | |
| Competence beliefs | 0.291 | <0.001** |
| Adaptive LOC | 0.270 | <0.001** |
| **Competence beliefs** | | |
| ISCED level | 0.207 | 0.012* |
| Age | -0.259 | 0.001* |
| Sex | -0.200 | 0.019* |
| **Adaptive LOC** | | |
| *ISCED level* | *-0.066* | *0.315* |
| **Maladaptive LOC** | | |
| *ISCED level* | *-0.118* | *0.098* |
| *age* | *0.067* | *0.280* |
| | **s** | **P** |
| PP - SRH | -0.387 | 0.001** |
| Adaptive coping – maladaptive coping | -0.136 | <0.001** |
| Competence beliefs – adaptive LOC | 0.422 | <0.001** |
| Competence beliefs – maladaptive LOC | -0.648 | <0.001** |
| Adaptive LOC – maladaptive LOC | -0.144 | 0.002* |
| Age – ISCED level | 0.495 | <0.001** |
| Age - sex | -0.184 | 0.009* |
| ISCED level - sex | *-0.037* | *0.602* |

*Note:* ** = p < .001; * = p < .05; *italics:* not significant in the sensitivity analysis



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**eTable 8: Mediation effect analyses and 95% bias-corrected bootstrap CI, sensitivity analysis in the community and the clinical sample**

| | **Model 1.2., community sample** (N=518) | | | **Model 1.2., clinical sample** (N=327) | | |
|---|---|---|---|---|---|---|
| | **Standardized coefficient** | **p** | **95%CI** | **Standardized coefficient** | **p** | **95%CI** |
| **Mediation pathway** | | | | | | |
| ***Competence beliefs – adaptive coping – CHR symptoms*** | | | | | | |
| Indirect effect | | | | *-0.028* | *0.112* | *-13.008, 0.830* |
| Total effect | | | | -0.224 | 0.002* | 1.495, 72.304 |
| ***Adaptive LOC – adaptive coping – CHR symptoms*** | | | | | | |
| Indirect effect | | | | *-0.027* | *0.104* | *-0.054, 2.560* |
| Total effect | | | | *0.015* | *0.800* | *-12.467, 0.020* |
| ***Maladaptive LOC – maladaptive coping – PP*** | | | | | | |
| *Indirect effect* | *0.208* | *0.080* | *0.004, 0.038* | | | |
| *Total effect* | *0.169* | *0.573* | *-0.009, 0.032* | | | |
| ***Maladaptive LOC – maladaptive coping - SRH*** | | | | | | |
| *Indirect effect* | *-0.213* | *0.080* | *-0.715, -0.084* | | | |
| *Total effect* | *-0.102* | *0.723* | *-0.338, 0.492* | | | |
| ***Maladaptive LOC – maladaptive coping – CHR symptoms*** | | | | | | |
| *Indirect effect* | *0.076* | *0.516* | *-0.003, 0.022* | *0.027* | *0.304* | *-0.007, 0.041* |
| *Total effect* | *0.087* | *0.422* | *-0.011, 0.024* | 0.155 | 0.008* | -2.246, 0.156 |
| ***Maladaptive coping – CHR symptoms – SRH*** | | | | | | |
| *Indirect effect* | *-0.031* | *0.333* | *-0.168, 0.011* | *-0.026* | *0.329* | *-6.838, 0.035* |
| Total effect | -0.432 | 0.016* | -1.472, -0.256 | *-0.033* | *0.699* | *-0.774, 0.071* |
| ***Maladaptive coping – CHR symptoms – PP*** | | | | | | |
| *Indirect effect* | *0.030* | *0.308* | *-0.001, 0.007* | *0.019* | *0.326* | *-0.002, 0.369* |
| Total effect | 0.422 | 0.007* | 0.011, 0.052 | *-0.034* | *0.616* | -0.027, 0.004 |
| ***Adaptive coping – CHR symptoms – SRH*** | | | | | | |
| Indirect effect | | | | *0.043* | *0.097* | *-19.236, 0.179* |
| Total effect | | | | *0.046* | *0.564* | *-0.075, 5.894* |
| ***Adaptive coping – CHR symptoms – PP*** | | | | | | |
| Indirect effect | | | | *-0.031* | *0.101* | *-0.012, 1.010* |
| Total effect | | | | *-0.110* | *0.090* | *-1.536, -0.003* |

*Note:* ** = p < .001; * = p < .05; *italics:* not significant; value missing: indirect effect was not analyzed in the corresponding sample.



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