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# Psychological Distress Trajectories in Chronic Physical Health Conditions

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***Objective:*** The onset of a chronic health condition (CHC) can have a severe impact on an individual's life, affecting mental and physical health. This study's goal was to investigate psychological distress trajectories starting from 1 year before to 4 years after the onset of a physical CHC. The specific aims were to identify the number and shape of longitudinal psychological distress trajectories and to test health-related, psychological, social, and demographic factors predicting these trajectories. ***Method:*** Two samples were drawn from the Swiss Household Panel data set: a CHC sample ($n$ = 361) and a 1-to-1 matched comparison sample of healthy individuals. Latent growth mixture modeling was used to identify psychological distress trajectories over 6 years. Factors predicting trajectories were then tested using multinomial logistic regression. ***Results:*** Four psychological distress trajectories were identified in the CHC sample: resilience (53.9%), chronic (22.2%), delayed (15.0%), and recovery (8.9%). In the comparison sample, two trajectories were identified: low psychological distress (90%) and elevated psychological distress (10%). Protective factors associated with resilient trajectory membership in the CHC sample were higher emotional stability, higher relationship satisfaction, and male gender. ***Conclusion:*** Individuals living with a CHC had an increased risk of vulnerability compared with a sample of healthy individuals. This advocates awareness of mental health issues following the onset of a CHC. In this regard, biopsychosocial factors (gender, emotional stability, and relationship satisfaction) offer prevention and intervention opportunities for more vulnerable individuals.

*Keywords:* chronic disease, psychological adaptation, resilience, depression, latent growth mixture modeling

*Supplemental materials:* http://dx.doi.org/10.1037/hea0000820.supp



A chronic health condition (CHC) can significantly affect a person's plans, wishes, and physical and mental health (de Ridder, Geenen, Kuijer, & van Middendorp, 2008). CHCs are defined as long-standing health problems, such as heart disease, lung disease, cancer, and diabetes (World Health Organization, 2019). The disruption caused by a CHC implies an ongoing psychological adaptation to the demands of this new life situation. *Psychological adaptation* refers to the temporal process fostering mental and

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emotional balance in response to adversity, which can lead to more or less well-adapted outcomes. These outcomes are often operationalized with life satisfaction, mental health, or other indicators of well-being (Biesecker & Erby, 2008).

In recent decades, psychological adaptation trajectories following various adverse life events have been identified and interindividual differences have been observed. A literature review summarizing the findings of longitudinal studies reported that the majority of individuals belong in a resilient trajectory (65.7% on average) characterized by minimal impairment and a relatively quick return to a baseline state (Galatzer-Levy, Huang, & Bonanno, 2018). The second biggest subgroup of individuals display a recovery trend (20.8% on average) with an eventual return to the baseline state. The vulnerable trajectory (10.6% on average) is defined by a relatively high level of psychological impairment, which may persist for years. The smallest subgroup of individuals experiences a delayed reaction (8.9% on average), with low psychological impairment around the baseline, followed by a progressive increase in psychological impairment. However, Infurna and Luthar (2016, 2018) criticized the constraints previously used in other studies, which might have led to an overestimation of the prevalence of the resilient trajectory following an adverse event. More studies using a methodological approach that would prevent such an overestimation (i.e., freely estimated variances) are needed to validate the actual prevalence of psychological adaptation trajectories following adverse life events (Infurna & Luthar, 2016, 2018). Moreover, many of the past studies were limited by the absence of pre-event data (Bonanno & Diminich, 2013). Pre-event data are needed to disentangle general vulnerability from vulnerability in the face of an adverse event.

When it comes to the study of psychological adaptation following physical CHC, research has focused on single chronic diseases, such as cancer or heart disease, alone in a clinical context (Galatzer-Levy et al., 2018). However, it has been suggested that similar trajectories of mental health can be identified in different diagnostic groups (e.g., cancer, arthritis, or heart disease; van Leeuwen, Hoekstra, van Koppenhagen, de Groot, & Post, 2012). Although each CHC has distinct symptomology, they are all characterized by the persistence of health issues over a prolonged period of time (World Health Organization, 2019). Additionally, affected individuals are frequently faced with similar challenges, such as self-management, long-term engagement, work participation, or impacts on mental health (Brown, Daly, & Rickel, 2007; Scharn et al., 2019). Consequently, van Leeuwen et al. (2012) proposed that studying psychological adaptation in a sample with any type of physical CHC would enable drawing more general conclusions on the impact of CHCs on mental health.

The objective of the present study was thus to investigate psychological adaptation trajectories across different types of physical CHCs with the inclusion of pre-event data in a nonclinical population. The first aim of the study was to identify the number and shapes of psychological adaptation trajectories from 1 year before to 4 years after the onset of a physical noncongenital CHC, using psychological distress as psychological adaptation indicator. Consistent with past literature, we expected to identify three to five trajectories, including a resilience, recovery, and vulnerable trajectory (Bonanno & Diminich, 2013; Galatzer-Levy et al., 2018). Moreover, we analyzed a comparison sample of healthy individuals to check whether the identified trajectories of psychological distress are related to the onset of a CHC or, rather, represent general patterns of change over time unrelated to any life event.

To identify vulnerable individuals and avenues of intervention, past research has investigated factors predicting better psychological adaptation following a physical CHC. It has been shown that some health-related (e.g., better health; Burton, Galatzer-Levy, & Bonanno, 2015; Zhu, Galatzer-Levy, & Bonanno, 2014), psychological (e.g., emotional stability; Hampson & Friedman, 2008; Strickhouser, Zell, & Krizan, 2017), and social (e.g., more social support; Dunn et al., 2013; Harris et al., 2010) factors are associated with more resilience (i.e., better mental health). On the other hand, factors such as past adverse life events (Brewin, Andrews, & Valentine, 2000; Butler, Koopman, Classen, & Spiegel, 1999), sex (Ginzburg & Ein-Dor, 2011; Moergeli, Wittmann, & Schnyder, 2012; Zhu et al., 2014), age (Havik & Maeland, 1990; Moergeli et al., 2012), income (Lyons, Heywood, & Rozbroj, 2016), civil status (Havik & Maeland, 1990; Moergeli et al., 2012; Morris, Yelin, Panopalis, Julian, & Katz, 2011), or education (Morris et al., 2011; van Leeuwen et al., 2012) have been inconsistently associated with psychological adaptation following a CHC. Using a sample with different types of CHCs could lead to the identification of the most important factors that are related to psychological adaptation to a physical CHC overall.

The second aim of the study was thus to determine the health-related, psychological, social, and sociodemographic factors that predict membership in a resilient trajectory, that is, good mental health, following the onset of a physical CHC. Based on the reviewed literature, we hypothesized that more positive health-related factors (e.g., self-rated health, overall health status, subjective health; Burton et al., 2015; Zhu et al., 2014), higher emotional stability (Hampson & Friedman, 2008; Strickhouser et al., 2017), higher sense of spirituality (Smith, 2011), lower number of past negative life events (Brewin et al., 2000; Butler et al., 1999), more social support (Dunn et al., 2013; Harris et al., 2010), and less financial scarcity (Lyons et al., 2016) would increase the probability of belonging to a more resilient trajectory. We further hypothesized that trajectory membership is not predicted by age, sex, civil status, or education (Bonanno & Diminich, 2013; Ginzburg & Ein-Dor, 2011; Moergeli et al., 2012; Morris et al., 2011).

## Method

### Design and Data Set

The present longitudinal study examined the evolution of psychological distress across six measurement time points: from 1 year before to 4 years after the onset of a CHC. Data were drawn from the 2007 to 2015 waves of the Swiss Household Panel (SHP) data set. This nationally representative panel study includes Swiss private households and their inhabitants aged 14 years or older. The SHP was initiated in 1999 and data is collected annually from September through February via telephone interviews (see Graf, 2009, for further information).

### Samples and Participants

Two samples were selected from the SHP individual data set. First, individuals from the SHP 2013 wave who indicated the presence of a "chronic (long-standing) illness or condition (health

problem) with a physical cause" having started between 2009 and 2011 were included in a CHC sample ($n$ = 361; 204 women and 157 men). Individuals reporting a congenital CHC or a CHC resulting from psychological causes were excluded. Second, a comparison sample of healthy individuals was selected including 361 individuals from the SHP 2013 wave who never indicated a CHC, accident, or illness between 2007 and 2015. To ensure the similarity and, hence, comparability between the CHC and the comparison sample, one-to-one propensity scores matching (nearest neighbor) were implemented, accounting for sex, age, residence region, and interview language (German, French, and Italian—the three main languages in Switzerland).

## Measures

**Psychological adaptation indicator.** Psychological distress was assessed from 1 year before to 4 years after the CHC onset with the following single item of the World Health Organization Quality Life Survey (WHOQOL Group, 1998): "Do you often have negative feelings such as blue mood, despair, anxiety, depression?" (0 = *never*, 10 = *always*). This item has been shown to have good content validity (Yao, Wu, & Yang, 2008) as well as good responsiveness (Chiu et al., 2006). This psychological distress item is a good indication of mental health because it has been showed to correlate well with the number of admissions in Swiss psychiatric hospitals over the years (Spearman correlation $p$ = .75; Morselli, 2017).

**Health-related psychological, social, and sociodemographic factors.**

***Health-related factors.*** Four health-related variables were included as predicting factors of psychological adaptation: daily health impediment ("To what extent, generally, your health is an impediment in your everyday activities, in your housework, your work or leisure activities?"; 0 = *not at all*, 10 = *a great deal*), improvement in health ("Has your health improved or worsened during the last twelve months?"; 0 = *greatly worsened*, 10 = *greatly improved*), health status ("Talking about your health: How do you feel right now?"; 1 = *very well*, 5 = *not well at all*), and satisfaction with health status ("How satisfied are you with your state of health?"; 0 = *not at all satisfied*, 10 = *completely satisfied*).

***Psychological factors.*** Three psychological factors were included: personality, number of past negative life events, and spirituality. Personality was assessed with the 10-item Big Five Inventory (Rammstedt & John, 2007). This validated questionnaire assesses extraversion, emotional stability, conscientiousness, agreeableness, and openness with two items each. Participants indicated to what extent they see themselves as someone who, for instance, "is outgoing, sociable," "is reserved," "does a thorough job," or "has artistic interests" (0 = *completely disagree*, 10 = *completely agree*). The number of past negative life events was measured by summing the number of adverse life events reported between 2007 and 2015 for each individual. The list of adverse life events includes the following: "illness, accident of closely related person," "death of closely related person," "termination of close relationship," "dismissal, unemployment," "financial difficulties," "material damage," and "psychological trauma." For spirituality, participants indicated their praying habits (how frequently they pray apart from church, from 0 = *never* to 4 = *daily or almost daily*).

***Social factors.*** Relationship satisfaction and social contacts were included as social factors. Relationship satisfaction was measured with the single item, "How satisfied are you with your personal, social, and family relationships?" (0 = *not at all*, 10 = *completely*). Social contacts were measured as an aggregation of the number ("With how many . . . are you on good terms and enjoy a close relationship?") and frequency ("How frequently do you see them?") of contacts with close friends, relatives, and neighbors.

***Sociodemographic factors.*** The following sociodemographic characteristics were included: years of education, partnership status (having a partner or not), occupation (paid work or not), and financial scarcity ("If you consider the total of your household's income and expenses, would you say that currently your household: 1 = can save money or spends what it earns; 2 = eats into its assets and savings or gets into debts?").

**Control variables.** Sex and standardized age were used as control variables in all regression models.

As the factors tested are considered predictors of the trajectory membership, and in order to avoid an influence of the CHC on the measures, all psychological, social, and sociodemographic factors were measured 1 year before onset, except for personality (measured at the onset year) and spirituality (measured 2 years before the onset), because of data collection inconsistency in the SHP. Moreover, health-related factors were measured 1 year after the onset in order to capture the influence of the CHC.

## Data Analyses

Latent growth mixture modeling (LGMM) was used to identify the number and shapes of psychological distress trajectories. LGMM is a person-centered approach that identifies unobserved subgroups sharing similar trajectories. It simultaneously models growth parameters (slope indicating the rate of change and intercept representing the baseline status) and classifies individuals in different trajectories according to these parameters (Wickrama, Lee, O'Neal, & Lorenz, 2016). Following standard LGMM procedure, an iterative process was applied to test increasing numbers of subgroup trajectories until the best-fitting model was acquired and the corresponding number of trajectories identified. The best-fitting model was defined according to multiple fit statistics: the Bayesian information criterion (BIC), the Akaike information criterion (AIC), the Lo-Mendell-Rubin adjusted likelihood ratio test (LRT), the bootstrap likelihood ratio test (BLRT), entropy values, and sample size per trajectory, as well as interpretability of the trajectory parameters based on theoretical meaningfulness and past literature.

Five types of longitudinal models were estimated with decreasing constraints applied to the model parameters (Infurna & Luthar, 2018). First, simple growth models were applied to determine the shape and growth parameters of the overall sample trajectory. Second, a latent class growth analysis (LCGA) was performed to determine subgroup trajectories while constraining within- and between-class variance. Third, LGMMs with released within-class variance were modeled. Fourth, models with freely estimated within- and between-class variances (LGMMvar) were computed. Fifth, variances and covariances were freely estimated (LGMM varcov). In the LCGA, LGMM, LGMMvar, and LGMMvarcov

two- to six-trajectory solutions were tested, but the six-trajectory solutions never converged despite extensive increasing of random starts. The decision to test a range of two to six trajectories is based on Ram and Grimm's (2009) suggestion to test at least one additional trajectory than the expected number of trajectories. Every model has been rerun with at least twice the random starts to confirm that the best log-likelihood is replicated. The number of individuals with missing values varied between 4.99% and 23.55% among the different time points (see Table 1). Incomplete data were handled using full information maximum likelihood.

To identify how health-related, psychological, social, and sociodemographic factors predicted trajectory membership, Vermunt's (2010) three-step approach was used. This approach (a) estimates the LGMM model, (b) computes the misclassification errors rate (trajectory membership uncertainty rate), and (c) tests predicting factors with multinomial logistic regression directly in the LGMM model while adjusting for misclassification errors (Wickrama, Mancini, Kwag, & Kwon, 2013). The predictors were tested in two steps because a multinomial logistic regression with 20 predictors lacked statistical power. First, four separated multinomial logistic regressions were run: one with the five health-related factors, one with the seven psychological factors, one with the two social factors, and one with the three demographic factors. Then, in a final multinomial regression model, the predictors that were significant ($<.05$) or marginally significant ($<.10$) in the first regressions were included in the final model. Only this final model is presented in the Results section, but the results of the other models are available in the online supplemental materials. Note that sex and age were controlled for in every regression model in order to identify the factors related to trajectory membership over and above the influence of sex and age. The models were also run with standardized age squared to control for the potential curvi-

Table 1
*Descriptive Statistics*

| Factors | CHC sample | | | | Comparison sample | | t-test |
|---|---|---|---|---|---|---|---|
| | Time points | *n* missing | *M* | *SD* | *M* | *SD* | *t* |
| Psychological distress | | | | | | | |
| At 1 year before onset | −1 year | 85 | 2.03 | 1.90 | 1.56 | 1.68 | 3.35*** |
| At onset year | Onset year | 56 | 2.19 | 2.09 | 1.52 | 1.73 | 4.49*** |
| At 1 year after onset | +1 year | 36 | 2.34 | 2.01 | 1.56 | 1.60 | 5.64*** |
| At 2 years after onset | +2 years | 18 | 2.27 | 2.10 | 1.52 | 1.61 | 5.30*** |
| At 3 years after onset | +3 years | 18 | 2.38 | 2.04 | 1.60 | 1.70 | 5.55*** |
| At 4 years after onset | +4 years | 27 | 2.37 | 1.94 | 1.50 | 1.71 | 6.32*** |
| Health-related factors | | | | | | | |
| Daily health impediment | +1 year | 37 | 2.90 | 2.61 | .75 | 1.47 | 13.55*** |
| Improvement in health | +1 year | 36 | 5.00 | 1.56 | 5.19 | .89 | −1.09 |
| Health status | +1 year | 36 | 2.23 | .66 | 1.74 | .50 | 10.94*** |
| Satisfaction with health status | +1 year | 37 | 6.92 | 1.84 | 8.69 | 1.11 | −15.41 |
| Psychological factors | | | | | | | |
| Personality: Extraversion | Onset year | 65 | 6.80 | 1.71 | 6.65 | 1.75 | 1.14 |
| Personality: Emotional stability | Onset year | 66 | 6.42 | 1.69 | 6.78 | 1.60 | −2.80 |
| Personality: Conscientiousness | Onset year | 65 | 7.41 | 1.45 | 7.47 | 1.47 | −.41 |
| Personality: Agreeableness | Onset year | 66 | 6.88 | 1.29 | 6.98 | 1.33 | −.96 |
| Personality: Openness | Onset year | 65 | 6.23 | 1.81 | 6.30 | 1.65 | −.36 |
| No. of past negative life events | Until +4 years | 0 | 3.49 | 3.25 | 3.40 | 2.78 | 9.44*** |
| Praying | −2 years | 106 | 3.09 | 1.58 | 2.86 | 1.68 | 1.75* |
| Social factors | | | | | | | |
| Relationship satisfaction | −1 year | 85 | 8.05 | 1.27 | 8.27 | 1.35 | −2.05 |
| Social contact | −1 year | 93 | 5.52 | 5.94 | 5.50 | 2.99 | 1.12 |
| Sociodemographic factors | | | | | | | |
| Years of education | −1 year | 50 | 13.24 | 3.32 | 13.88 | 3.09 | −2.55 |
| Having a partner [*n* (%)] | −1 year | 85 | 224 | 81.16 | 295 | 81.94 | .25 |
| Occupation: Paid work [*n* (%)] | −1 year | 50 | 185 | 59.49 | 260 | 72.02 | −3.45 |
| Financial scarcity: Yes [*n* (%)] | −1 year | 56 | 24 | 7.87 | 21 | 5.82 | .46 |
| Control variables | | | | | | | |
| Female gender [*n* (%)] | Onset year | 0 | 204 | 64.56 | 203 | 56.23 | 1.18* |
| Age | Onset year | 0 | 51.18 | 18.01 | 51.97 | 14.46 | .07 |
| CHC typology [*n* (%)] | | | | | | | |
| Accident moderate functioning | +1 year | 23 | 19 | 5.62 | — | — | — |
| Illness low functioning | +1 year | 23 | 32 | 9.47 | — | — | — |
| Illness moderate functioning | +1 year | 23 | 54 | 15.98 | — | — | — |
| Illness good functioning | +1 year | 23 | 24 | 7.10 | — | — | — |
| Low functioning not worsening | +1 year | 23 | 61 | 18.05 | — | — | — |
| Good functioning with pain | +1 year | 23 | 32 | 9.47 | — | — | — |
| Good functioning | +1 year | 23 | 116 | 34.32 | — | — | — |

*Note*. CHC typology's *n*s and percentages are based on the most likely membership. CHC = chronic health condition.
* $p < .05$. *** $p < .001$.

linear impact of age, but this control variable was not included in the final analysis because it was never significantly related to the outcomes. The number of missing values varied between 9.97% and 39.36% among the different predicting factors (see Table 1). Missing values were imputed at the mean level using multiple imputations (20 imputed data sets), taking into account the item-level variables. All analysis were run using Mplus Version 8 (Muthén & Muthén, 2010). The Mplus syntax is available in the online supplemental materials. The present article followed the Guidelines for Reporting on Latent Trajectory Studies (van de Schoot, Sijbrandij, Winter, Depaoli, & Vermunt, 2017).

## Results

### Descriptive

Demographic characteristics and descriptive statistics are provided in Table 1. Skewness and kurtosis coefficients indicated that the psychological distress items were non-normally distributed (range = 0.86–1.15 and 3.13–4.21 for skewness and kurtosis, respectively). Robust maximum likelihood estimation was thus used in order to withstand the non-normal distribution of the data (Muthén & Muthén, 2010). Intercorrelations between the variables of interest are available in the online supplemental materials.

The SHP questionnaire does not contain information on specific CHC diagnoses. Hence, to better describe our CHC sample, a CHC typology was computed using latent class analysis (LCA). LCA is a person-centered approach that classifies individuals based on the similarity of their scores on several variables (Magidson & Vermunt, 2002). Fifteen variables measured 1 year after CHC onset were used to conduct the LCA (e.g., self-reported health status, everyday impediment, medication needed, worsening in health, back problems, frequency of doctor consultations; see the online supplemental materials for the full list). Seven types of CHCs with different functioning issues and varying levels of severity were identified as best representing our data (see the online supplemental materials for the fit indices and estimated probabilities of the best-fitting typology). This implies that our sample represents a large variety of CHCs, such as accident with moderate functioning, illness with three different degrees of functioning (low, moderate, and high), and good functioning with pain symptoms. The seven CHC types identified and their prevalence are displayed in Table 1.

### Psychological Distress Trajectories

An LGMM was performed to identify the best-fitting trajectories of psychological distress covering a period of six time points. A quadratic model with freely estimated variances across trajectories (LGGMvar) best fitted the data (see Table 2). The BIC and AIC (lower numbers indicate better fit) indicated that a three-trajectory solution should be preferred. The LRT (one less trajectory should be preferred if non-significant) pointed to a three- or a four-trajectory solution. However, the three-trajectory solution's

Table 2
*Fit Indices of Latent Growth Mixture Models (n = 361)*

| Trajectories | BIC | AIC | LRT (*p*) | BLRT (*p*) | Entropy | Trajectory counts[a] |
|---|---|---|---|---|---|---|
| GM | | | | | | |
| 1lin | 7,404.04 | 7,361.26 | — | — | — | 361 |
| 1quad | 7,419.46 | 7,361.12 | — | — | — | 361 |
| LCGA | | | | | | |
| 2 | 7,570.25 | 7,519.70 | .00 | .00 | .86 | 237/124 |
| 3 | 7,458.63 | 7,392.52 | .07 | .00 | .83 | 199/123/39 |
| 4 | 7,431.40 | 7,349.73 | .21 | .00 | .84 | 199/113/39/10 |
| 5 | 7,398.85 | 7,301.63 | .18 | .00 | .78 | 141/99/77/24/20 |
| LGMM | | | | | | |
| 2[b] | 7,379.55 | 7,317.33 | .10 | .00 | .84 | 329/32 |
| 3[b] | 7,357.21 | 7,279.43 | .11 | .00 | .83 | 288/47/26 |
| 4[b] | 7,351.09 | 7,257.75 | .38 | .00 | .78 | 239/70/27/25 |
| 5[b,c] | 7,346.90 | 7,245.79 | .39 | .00 | .80 | 255/36/33/20/17 |
| LGMMvar | | | | | | |
| 2[b] | 7,375.63 | 7,305.63 | .25 | .00 | .51 | 229/132 |
| 3[b,c] | 7,313.58 | 7,224.13 | .00 | .00 | .67 | 135/136/30 |
| 4[b] | 7,341.85 | 7,225.18 | .04 | .20 | .71 | 211/74/49/27 |
| 5[b,d] | 7,377.18 | 7,237.18 | .50 | 1.00 | .75 | 211/74/49/27/0 |
| LGMMvarcov | | | | | | |
| 2[b,c] | 7,332.80 | 7,266.69 | .00 | .00 | .61 | 226/135 |
| 3[b] | 7,326.00 | 7,224.89 | .03 | .00 | .69 | 199/131/31 |
| 4[b,c] | 7,334.65 | 7,214.10 | .06 | .20 | .70 | 186/126/31/18 |
| 5[b] | 7,373.53 | 7,217.97 | .54 | .30 | .73 | 170/131/34/20/6 |

*Note.* BIC = Bayesian information criterion; AIC = Akaike information criterion; LRT = Lo-Mendell-Rubin adjusted likelihood ratio test; BLRT = bootstrapped likelihood ratio test; LCGA = latent class growth analysis; LGMM = latent growth mixture modeling.
[a] Trajectory counts = final class counts and proportions for the latent classes based on their most likely latent class membership. [b] Variance of the quadratic term fixed to zero in all trajectories in order to avoid negative variance. [c] The variance of the linear term fixed to zero in one of the trajectories in order to avoid negative variance. [d] One or more parameters were fixed to avoid singularity of the information matrix.

entropy was less optimal (recommended value >.70), and more constraints had to be applied to the three-trajectory model in order to avoid a nonpositive definite matrix. Consistent with recommendations for mixture model testing (Muthén, 2004), the less constrained four-trajectory solution was chosen for parsimony and theoretical interpretability reasons. Indeed, the four-trajectory solution (see Figure 1B for the estimated mean trajectories and the online supplemental materials for individual trajectories) identified an additional unique trajectory that was potentially clinically relevant, characterized by very high psychological distress, which would have been unobserved in the three-trajectory solution (see Figure 1A).

The most common subgroup of the final four-trajectory solution was characterized by a resilient trajectory (53.9% of the sample), with stable low psychological distress from 1 year to before 4 years post-CHC onset. The second subgroup described a chronic

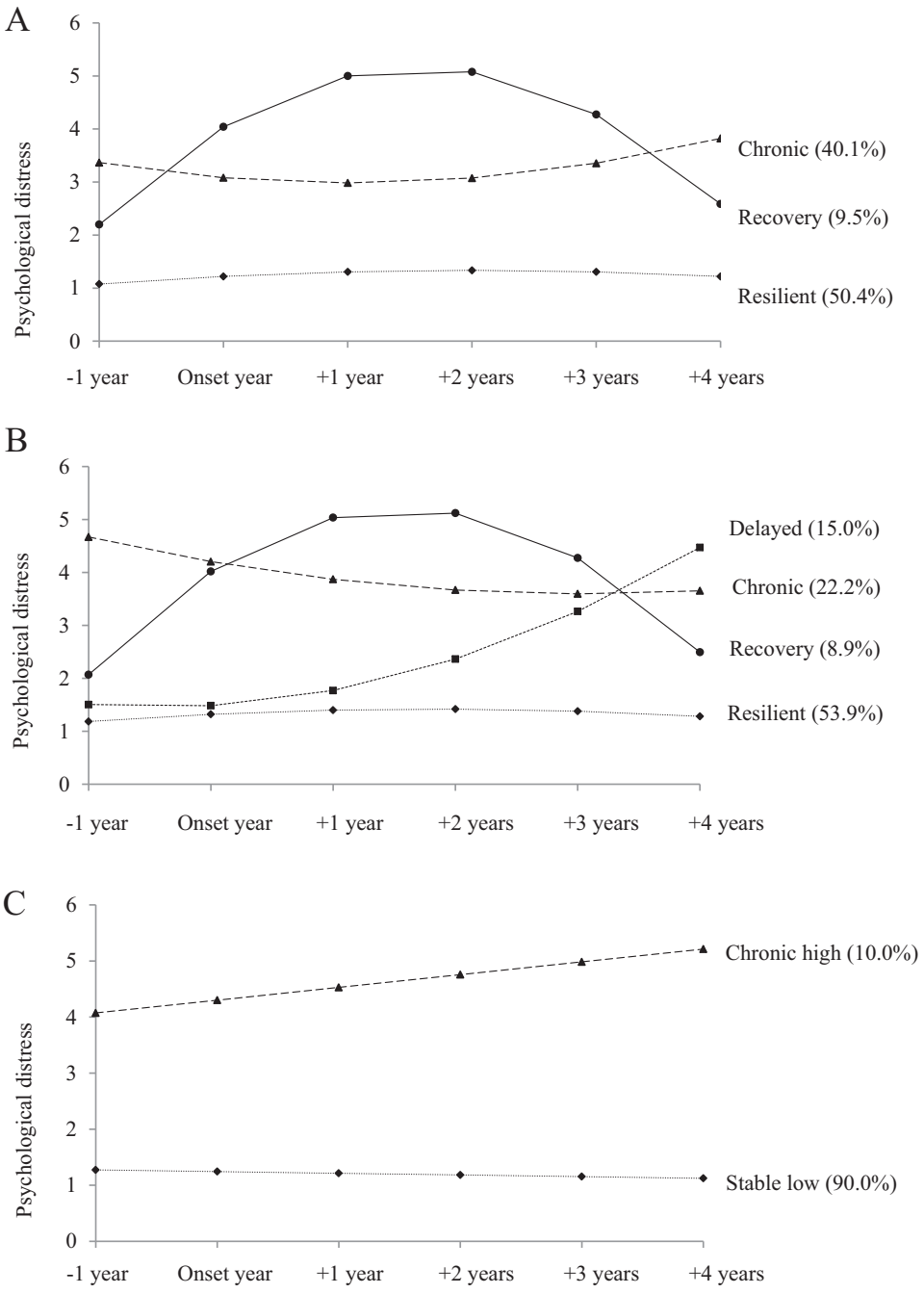


*Figure 1.* (A) Estimated means of the three-trajectory solution in the chronic health condition sample. (B) Estimated means of the final four-trajectory solution in the chronic health condition sample. (C) Estimated means of the two-trajectory solution in the comparison sample.

psychological distress trajectory (22.2%), with elevated levels of psychological distress already before the onset year and across all time points. The third subgroup described a delayed trajectory (15.0%), with stable low psychological distress until 1 year after onset followed by a progressive rise in psychological distress starting at 2 years after onset of the CHC, and the highest level of psychological distress 4 years after onset. The fourth subgroup described a recovery trajectory (8.9%), with an increase in psychological distress from 1 year before to 1 year after the CHC onset followed by a gradual decline 3 and 4 years after the onset of the CHC. Parameter estimates of the four identified trajectories are available in the online supplemental materials.

Results of the comparison sample trajectory analysis identified a two-trajectory linear model with freely estimated variances across trajectories as best fitting the healthy individual's data (fit indices for the comparison sample are available in the online supplemental materials). The great majority of the comparison sample belonged to a *stable low* psychological distress trajectory (90%), and a minority displayed a *chronic high* psychological distress trajectory (10%), with consistently elevated levels of psychological distress across all time points (see Figure 1C).

## Predicting Factors

Multinomial logistic regressions (see Table 3) identified sex, relationship satisfaction, and emotional stability as significant predictors of more resilient response to the onset of a CHC. Hence, males and individuals with higher relationship satisfaction had an increased probability of showing a resilient trajectory compared with a delayed trajectory. Also, higher emotional stability increased the probability of showing a resilient trajectory compared with a chronic trajectory. Additionally, some marginally significant results were observed, with higher daily health impediment, higher satisfaction with health, higher extraversion, less praying, and less past negative life events increasing the probability of being in the resilient trajectory compared with one of the other trajectories. Note that the CHC typology identified by the LCA was also tested as a predictor of the psychological distress trajectories. Results showed that none of the CHC types were related to trajectory membership.

# Discussion

The present study identified heterogeneous psychological distress trajectories from 1 year before to 4 years following the onset of a physical CHC. In the CHC sample, *resilience* (53.9%), *chronic* (22.2%), *delayed* (15.0%), and *recovery* (8.9%) trajectories were identified. In the comparison sample with no CHCs, accident, or illness during the observed time period, *low psychological distress* (90%) and *elevated psychological distress* (10%) trajectories were identified. Concerning protective factors associated with resilient trajectory, membership in the CHC sample are characterized by higher emotional stability, higher relationship satisfaction, and male gender.

## Psychological Adaptation Trajectories

The comparison of the two samples validates the claim that the elevated levels of psychological distress are the consequence of the physical CHCs rather representing general patterns of change over time. Results indicated that only 10% of the healthy individuals (comparison group) showed a chronic high psychological distress trajectory, whereas 46.1% of the CHC individuals showed elevated levels of psychological distress at least over 2 years following a CHC.

Regarding the CHC sample, as hypothesized, four distinct psychological distress trajectories were identified. This supports the assumption of a common experience in terms of psychological distress regardless of the CHC type (van Leeuwen et al., 2012). If the psychological adaptation response was very different for every physical CHC, then a higher number of trajectories would have been observed. Moreover, the identified trajectories correspond to the four most consistently found in past research examining isolated CHCs or other negative life events (Bonanno & Diminich, 2013; Galatzer-Levy et al., 2018). However, the resilient trajectory identified in this study

Table 3
*Multinomial Logistic Regression Estimates for Predictors of Trajectory Membership*

| | Resilient vs. | | | | | | Recovery vs. | | | | Delayed vs. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Recovery | | Delayed | | Chronic | | Delayed | | Chronic | | Chronic | |
| Factors | Estimate | *SE* | Estimate | *SE* | Estimate | *SE* | Estimate | *SE* | Estimate | *SE* | Estimate | *SE* |
| Sex | .84 | 1.03 | 1.17* | .57 | .24 | .58 | .33 | 1.07 | −.61 | 1.14 | −.93 | .67 |
| Standardized age | −.06 | .60 | −.09 | .32 | −.10 | .32 | −.03 | .63 | −.04 | .72 | −.01 | .39 |
| Health status | 2.05 | 1.42 | .35 | .60 | .94 | .81 | −1.70 | 1.35 | −1.11 | 1.45 | .59 | .69 |
| Daily health impediment | .16 | .26 | −.24[a] | .15 | .08 | .14 | −.40 | .29 | −.08 | .30 | .32* | .14 |
| Satisfaction with health status | .09 | .35 | −.33[a] | .18 | −.21 | .22 | −.42 | .34 | −.30 | .31 | .13 | .21 |
| Praying | .36 | .33 | .09 | .19 | .35[a] | .18 | −.27 | .35 | −.02 | .33 | .26 | .23 |
| Number of life events | −.09 | .15 | −.01 | .07 | .11[a] | .06 | .07 | .16 | .19 | .17 | .12 | .09 |
| Extraversion | −.38[a] | .23 | −.25 | .16 | −.18 | .16 | .13 | .25 | .20 | .26 | .07 | .19 |
| Emotional stability | −.12 | .28 | −.12 | .17 | −.44* | .22 | .00 | .30 | −.32 | .34 | −.32 | .24 |
| Relationship satisfaction | .07 | .36 | −.49** | .20 | −.43[a] | .25 | −.57 | .36 | −.51 | .37 | .06 | .25 |

*Note.* *SE* = standard error.
[a] $p < .10$.
* $p < .05$. ** $p < .01$.

showed a slightly different shape compared with the one described in previous research (Bonanno, Westphal, & Mancini, 2011), as increased levels of psychological distress were not observed at any time point. This difference probably results from the yearly measurement time points that preclude identification of an early change in psychological distress during the first months. Past studies using narrow measurement time points (e.g., monthly measurement) indeed reported a transient minimal impairment in the resilient trajectory (Chilcot et al., 2013; Nash et al., 2015; Zhu et al., 2014), whereas studies with wider measurement time points (yearly measurement) have not observed such minimal impairment (Bonanno, Kennedy, Galatzer-Levy, Lude, & Elfström, 2012; Burton et al., 2015; Galatzer-Levy & Bonanno, 2014) and identified—similar to the present study—a stable low impairment resilient trajectory.

The majority of our sample belongs to the resilient trajectory (53.9%), with stable low psychological distress. Nonetheless, the percentage of individuals belonging to the resilient trajectory is lower than the percentage reported by several past reviews (65.7%, on average; Bonanno & Diminich, 2013; Bonanno et al., 2011; Galatzer-Levy et al., 2018). Specific studies of adaptation following physical CHCs also found higher proportions of resilient trajectory compared with the present study: 74% after cancer diagnosis (Burton et al., 2015), 72% after the onset of chronic pain (Zhu et al., 2014), 68% after heart attack (Galatzer-Levy & Bonanno, 2014), and 66.1% after onset of a spinal cord injury (Bonanno et al., 2012). The lower rates of resilient individuals in the present study might be a result of the statistical method used to identify the trajectories. Indeed, in most of the past psychological adaptation studies the variance around the mean was constrained to be equal across trajectories. It implies that the model tested will constrain the individuals in a resilient trajectory to have a similar variance as the chronic or the recovery trajectory. As noted by Infurna and Luthar (2016), such a constraint does not make theoretical sense, because individuals are expected to vary less in the shape of their resilience but vary highly in the case of more vulnerable trajectories (e.g., individuals in a more vulnerable trajectory would show more ups and downs around their respective trajectory means). Research has showed that constraining the variances across trajectories leads to a model with higher percentages in the resilient trajectory compared with the same model with freely estimated variance (Infurna & Luthar, 2016). The present study followed this line of reasoning and suggests that the proportion of individuals struggling with psychological distress following the onset of a physical CHC might be higher than past studies have suggested.

Another methodological particularity of the present study is the inclusion of pre-event data. This enabled the observation that the elevated psychological distress of the chronic trajectory does not start with CHC onset but preexisted it in a higher percentage (22.2%) compared with the healthy individuals in the comparison group (10%). Some of the individuals in the chronic trajectory might thus have suffered from early lower mental health because of the presence of health symptoms years before the actual diagnosis of the CHC (Costanzo, Ryff, & Singer, 2009; Verbrugge & Jette, 1994).

## Predictor of Psychological Distress Trajectories

The results of this study showed that the factors that increase the probability of exhibiting a resilient trajectory are male gender, having higher emotional stability, and indicating a higher relationship satisfaction. All other hypothesized factors did not have an effect on trajectory membership. In the CHC literature, personality traits such as emotional stability have been consistently shown to influence psychological adaptation (Strickhouser et al., 2017). As hypothesized, the present results further confirm that higher emotional stability is associated with resilience. Concerning social factors, the results of the present study were also in line with the hypothesis and the past literature. Several studies have indeed shown that higher social support is related to more positive outcomes following the onset of a CHC (Dunn et al., 2013; Harris et al., 2010). A review by Hogan, Linden, and Najarian (2002) highlighted the average effectiveness of social support interventions across different areas of application (including CHCs). For instance, psychological education for friends as well as relatives of elderly patients with lung disease have been shown to effectively increase the patients' social network size, emotional and practical support received, as well as support-seeking behaviors (Li et al., 2018). Such education could be implemented by local policies and should be recommended by general practitioners treating CHC patients with the intent to increase social support. As shown in the present study, this could, in turn, improve psychological adaptation and lower the risk of vulnerability following the onset of a CHC.

Sociodemographic factors such as years of education, partnership status, occupation, and age did not predict trajectory membership, except for sex. This sex effect was not hypothesized, because past studies showed inconsistent findings, with some reporting that females have a higher risk of experiencing depressive symptoms following a major health issue (Zhu et al., 2014), and others showing that sex is not associated with trajectory membership following traumatic injury or heart disease (Ginzburg & Ein-Dor, 2011; Moergeli et al., 2012). Further studies and meta-analysis are needed to clarify the role of sex in psychological adaptation following a CHC.

Surprisingly, health-related factors are not significantly related to resilient trajectory membership. This could result from the fact that our CHC sample had, on average, a rather good state of health, with few daily health impediments, high satisfaction with health, high health status, and more health improvement than worsening. Individuals with high self-reported physical impairment because of a CHC might be living in institutions and are thus not part of the household panel.

Results showed that the type of CHC presented by the participants is not related to trajectory membership. This finding is in line with a study about multiple health events that showed that type of health event (i.e., cancer, heart disease, lung disease, and stroke) is not related to trajectory membership (Morin, Galatzer-Levy, Maccallum, & Bonanno, 2017). Hence, these findings strengthen the assumption of a common experience of psychological adaptation across different CHCs, but replication studies are needed to confirm it.

## Strengths and Limitations

The main strength of the present project lies in its prospective study design, the use of state-of-the-art statistical techniques, and the inclusion of a matched comparison sample. Indeed, this project is one of the exceedingly rare studies investigating psychological adaptation with pre-event data. Moreover, going one step further than the constrained variance approach, applied by default in past studies, the present project followed current methodological guidelines for LGMM (Infurna & Luthar, 2016, 2018). Finally, the inclusion of a comparison sample enabled examining whether psychological distress trajectory characteristics are specific to the onset of a CHC.

Nevertheless, several limitations of the present project need to be acknowledged. First, researchers using the SHP should be aware that such general population data sets underestimate the degree of vulnerability in the general population, because individuals living in institutions are excluded from the survey (Voorpostel et al., 2018) and more physically impaired individuals generally participate less in cohort studies (Rothenbühler & Voorpostel, 2016). Thus, the prevalence of vulnerable trajectories in the present study might have been underestimated, and generalizing to more physically impaired individuals should be done with caution.

Second, the longitudinal data used provides only yearly measurements. Thus, psychological adaption changes in the early phase after CHC onset (months following onset) could not be observed. As already mentioned, this implies that the minimal short-term impairment expected for the resilient individuals (Bonanno & Diminich, 2013) could not be observed in the present study, because it commonly occurs in the first months following the onset of an adverse life event. Moreover, the measurement approach captures the yearly general recurrence (how often) of psychological distress. Thus, brief distress episodes might not be well assessed in this study. Future longitudinal studies would benefit from incorporating more frequent assessment intervals to detect acute fluctuations in psychological distress, especially in the early phase after the onset.

A third methodological limitation is the use of a single psychological adaptation indicator (psychological distress). The present study cannot account for outcomes of positively oriented indicators of psychological adaptation such as life satisfaction or positive emotions. Future investigation of multiple psychological adaptation indicators (i.e., life satisfaction, negative and positive affect) would lead to a more multifaceted investigation of psychological adaptation following the onset of a CHC (Infurna & Luthar, 2018).

## Conclusion

Individuals living with a CHC have a higher risk of vulnerability compared with the general population. The study results demonstrate that nearly half of the individuals with a CHC showed elevated levels of psychological distress at least over 2 years. By contrast, only one tenth of the comparison sample present elevated levels of psychological distress. Health professionals caring for individuals with a CHC might want to be attentive to potential comorbid depressive symptoms (Maurer et al., 2008). The present project identified higher emotional stability, male gender, and higher relationship satisfaction as protective factors related to lower psychological distress. Among these protective factors, relationship satisfaction is the one that is modifiable and is therefore a potential target of intervention for the improvement of mental health following the onset of a CHC.

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