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Published in:
Schizophrenia Research

DOI:
[10.1016/j.schres.2020.05.019](https://doi.org/10.1016/j.schres.2020.05.019)

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
2020

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Kuranova, A., Booij, S. H., de Jonge, P., Jeronimus, B., Lin, A., Wardenaar, K. J., Wichers, M., & Wigman, J. T. W. (2020). Don't worry, be happy: Protective factors to buffer against distress associated with psychotic experiences. *Schizophrenia Research*, 223, 79-86. <https://doi.org/10.1016/j.schres.2020.05.019>

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Don't worry, be happy: Protective factors to buffer against distress associated with psychotic experiences

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ARTICLE INFO

Article history:

Received 24 May 2019

Received in revised form 12 March 2020

Accepted 6 May 2020

Available online 27 May 2020

Keywords:

Psychotic experiences

Protective factors

Secondary distress

CAPE

HowNutsAreTheDutch

Psychosis

ABSTRACT

Background: Around 6–7% of the general population report psychotic experiences (PEs). Positive PEs (e.g. hearing voices) may increase the risk of development of psychotic disorder. An important predictor of the transition to a psychotic disorder is secondary distress associated with PEs. We examined the moderating effect of potential protective factors on this secondary distress.

Methods: Data come from 2870 individuals of the HowNutsAreTheDutch study. PEs were assessed with the Community Assessment of Psychic Experience (CAPE) questionnaire and were divided into three subdomains (“Bizarre experiences”, “Delusional ideations”, and “Perceptual anomalies”). Protective factors explored were having a partner, having a pet, benevolent types of humor, optimism and the high levels of personality traits emotional stability (reversed neuroticism), extraversion, openness to experience, conscientiousness, and agreeableness. We examined whether these protective factors moderated (lowered) the association between frequency of PEs and PE-associated distress.

Results: Due to low prevalence of perceptual anomalies in the sample, this domain was excluded from analysis. No moderating effects were observed of protective factors on the association between bizarre experiences and distress. Having a partner and high levels of optimism, self-enhancing humor, openness, extraversion and emotional stability moderated the association between delusional ideations and secondary distress, leading to lower levels of distress.

Conclusions: Several protective factors were found to moderate the association between frequency and secondary distress of delusional ideations, with high levels of the protective factors being associated with lower levels of distress. A focus on protective factors could be relevant for interventions and prevention strategies regarding psychotic phenomena.

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1. Introduction

Compared to psychotic disorders, mild, subclinical psychotic experiences (PE) are relatively common, with on average around 6–7% of the general population reporting any PE at least once in their life (McGrath et al., 2015; Van Os and Reininghaus, 2016), although large differences between cultures have been reported (McGrath et al., 2015; Sun et al., 2015, 2017). Most of these PEs are transient, with 80% of such

experiences estimated to occur only once in an individual's lifetime (Linscott and Van Os, 2013). Yet, PEs have been shown to increase the risk of developing clinical psychosis (Kline et al., 2012; Van Os and Reininghaus, 2016) and other mental illness in the future (Fisher et al., 2013; Kaymaz et al., 2012; Trotta et al., 2019; Werbeloff et al., 2012; Yoshizumi et al., 2004). For example, according to the meta-analysis by Linscott and van Os, 7.4% of people with baseline PE will develop a psychotic disorder later in life (Linscott and Van Os, 2013).

Therefore, factors that might affect the development of subclinical PEs into clinical psychotic phenomena have received extensive attention. Among the factors with the greatest influence on this development are the frequency and persistence of PEs and the level of associated or secondary distress (Connell et al., 2016; Garralda, 2015; Hanssen et al.,

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2005; Janssens et al., 2016; Linscott and Van Os, 2013; Murphy et al., 2017; Van Os and Reininghaus, 2016; Wusten et al., 2018). Associated distress may be the most important factor for future increase in the symptoms and need for care. Individuals who hallucinate and hear “voices” but appraise these experiences as positive tend to report fewer complaints and help-seeking behavior, even when the PEs are persistent and frequent (Baumeister et al., 2017; Powers et al., 2017). Additionally, individuals with a higher need for clinical care tend to appraise induced PEs as being more distressing than did individuals without need for care (Peters et al., 2017). Consequently, some people may experience some PEs as positive and without much distress (Brett et al., 2009; Mohr and Claridge, 2015; Moreira-Almeida and Cardeña, 2011; Powers et al., 2017) and individual differences in such appraisals can underlie variation in the level of secondary distress and clinical outcomes (Kline and Schiffman, 2014; O'Connor, 2009).

Although the absence of distress and the positive appraisal of PEs have been associated with better outcomes (Baumeister et al., 2017; Brett et al., 2009; Moreira-Almeida and Cardeña, 2011; Osborne et al., 2017; Powers et al., 2017), little attention has been given to potential protective factors that may lower the secondary distress. Some studies showed that non-help-seeking individuals with PE reported lower levels of social and environmental adversity, normal cognitive functioning, high spirituality, and higher psychological and emotional well-being and social support compared to the individuals with PEs who experience need for help (Brett et al., 2014; Peters et al., 2016). This results are also in line with longitudinal studies on high-risk adolescents suggesting that high having a relatively high IQ, more positive atmosphere at home, and higher levels of social support reduced the prevalence of psychotic symptoms later in life (Crush et al., 2018a, 2019; Newbury et al., 2016; Riches et al., 2019). However, other protective factors may also buffer against common mental illness, but received little attention in the context of secondary distress by PEs. Such factors include having a partner (Lim et al., 2014), having a pet (McConnell et al., 2011; Shubert, 2012), benevolent types of humor (Fritz et al., 2017; Martin et al., 2003), optimism (Conversano et al., 2010; Dolphin et al., 2015), and certain levels of personality trait scores (high emotional stability, high extraversion, high openness to experience, high conscientiousness and high agreeableness) (Bos et al., 2016a; Boyette et al., 2014; Chowdhury et al., 2018; Hengartner et al., 2017; Levy et al., 2007; Zhan et al., 2018)

The aim of this study was to investigate whether the above-mentioned protective factors were associated with lower levels of PE-associated distress in adults from the general population. We hypothesize that protective factors will moderate the association between the frequency of PEs and PE-associated distress, so that higher levels of protective factors will be associated with a weaker associations between PE frequency and distress. Moreover, previous studies have shown that not all PEs are equally associated with distress (Capra et al., 2015; Peters et al., 2016; Unterrassner et al., 2017a; Wigman et al., 2011). Therefore, we examined our hypotheses separately for three domains of PEs (“Bizarre experiences”, “Delusional ideations”, and “Perceptual anomalies”), which were recently identified in a meta-analysis of the Community Assessment of Psychic Experience (CAPE) questionnaire (Konings et al., 2006; Mark and Touloupoulou, 2016).

2. Methods

2.1. Study design

2.1.1. Study sample

Data came from a large national crowdsourcing study in the Netherlands (www.HoeGekls.nl), which consists of an online platform for collecting self-reported data on mental health of the general population in the Netherlands. Participants were included after registration on the project website (launched December 19th 2013) and could take

part in both cross-sectional and longitudinal studies (Krieke et al., 2016). In these analyses, only data from the cross-sectional study were used. Measurements for the cross-sectional study were done in modules that consisted of one or more questionnaires on a specific domain (e.g., Mood, Well-being, Personality). Participants could choose the modules that they wanted to complete, but always had to start with a module assessing their socio-demographic profile. In this study, data on psychotic experiences from the Community Assessment of Psychic Experiences (CAPE) module and on protective factors from the ‘Start’, ‘Optimism’, ‘Humor’, and ‘Personality’ modules were used. The date of the data extraction for the current study was December 31, 2015. Participants who were 18 years or older and provided informed consent for the use of their data for research were included in the study. The study protocol was reviewed and exempted by the Medical Ethical Committee of the University Medical Center Groningen (registration number M13.147422 and M14.160855) (Krieke et al., 2016).

2.1.2. Instruments

2.1.2.1. Subclinical psychotic experiences. Lifetime subclinical psychotic experiences were assessed with the Community Assessment of Psychic Experiences (CAPE (Konings et al., 2006)). The CAPE is a 42-item questionnaire with three subscales: positive psychotic experiences (20 items), negative psychotic experiences (14 items) and depressive feelings (8 items; not assessed). For this work, only positive PEs were used, as studies suggest that positive experiences are specifically predictive for a development of clinical (psychotic) disorder and need for care (Chapman et al., 1994; Pedrero and Debbané, 2017; Wellham et al., 2009, 2010), whereas negative/cognitive symptoms seem to be more predictive of poorer psychosocial functioning (Kwapil et al., 2013; Wunderink, 2017). Each item assessed both symptom frequency (CAPE a) on 4-point scale, ranging from “never” to “nearly always”, and associated secondary distress (CAPE b) on a 4-point scale, ranging from “not distressed” to “very distressed”. Following a recent meta-analysis on the CAPE (Mark and Touloupoulou, 2016) the positive psychotic experiences were grouped into three domains: “Bizarre experiences” (7 items), “Delusional ideations” (9 items), and “Perceptual anomalies” (4 items). The domain affiliation of items is presented in Table 1. The frequency scores of all experiences were summed per domain (CAPE a) and the secondary distress scores were summed and dichotomized into no distress (0) and any distress (1) because of the highly skewed distribution. For the analyses, only those items that were endorsed were included, as items can only be experienced as distressing where they are present at all.

2.1.2.2. Protective factors. Available demographic factors included having a partner (yes/no) and/or a pet (yes/no). Optimism was assessed with The Life Orientation Test – Revised (LOT-R) (Scheier et al., 1994) using 10 items scored on a 5-point Likert scale. The ‘optimism’ sum score was calculated using optimism-related items and reversed pessimism related items, and higher scores represent higher optimism levels. Humor styles were assessed with Humor Style Questionnaire (HSQ) (Martin et al., 2003) using 32 items scored on a 7-point Likert scale. Separate sum scores for benign styles of humor (‘self-enhancing humor’ and ‘affiliative humor’) were calculated, with higher scores indicating higher levels of this type of humor.

Personality traits were assessed with the 60-item NEO Five Factor Inventory (NEO-FFI-3) (Costa and McCrae, 1992) or 12 items per domain scored on 5-point Likert scales. Domain scores for the traits ‘extraversion’, ‘openness to experience’, ‘agreeableness’, ‘conscientiousness’ and ‘emotional stability’ (the inverse of neuroticism thus low neuroticism) were studied as protective factors, with higher scores representing higher trait levels.

Table 1
CAPE Subdomains of positive PEs, from Mark and Toulopoulou, 2016

Bizarre experiences	
CAPE 5	Do you ever feel as if things in magazines or on TV were written especially for you?
CAPE 17	Do you ever feel as if electrical devices such as computers can influence the way you think?
CAPE 24	Do you ever feel as if the thoughts in your head are being taken away from you?
CAPE 26	Do you ever feel as if the thoughts in your head are not your own?
CAPE 28	Have your thoughts ever been so vivid that you were worried other people would hear them?
CAPE 30	Do you ever hear your own thoughts being echoed back to you?
CAPE 31	Do you ever feel as if you are under the control of some force or power other than yourself?
Delusional ideations	
CAPE 2	Do you ever feel as if people seem to drop hints about you or say things with a double meaning?
CAPE 6	Do you ever feel as if some people are not what they seem to be?
CAPE 7	Do you ever feel as if you are being persecuted in some way?
CAPE 10	Do you ever feel as if there is a conspiracy against you?
CAPE 11	Do you ever feel as if you are destined to be someone very important?
CAPE 13	Do you ever feel that you are a very special or unusual person?
CAPE 15	Do you ever think that people can communicate telepathically?
CAPE 20	Do you believe in the power of witchcraft, voodoo or the occult?
CAPE 22	Do you ever feel that people look at you oddly because of your appearance?
Perceptual anomalies	
CAPE 33	Do you ever hear voices when you are alone?
CAPE 34	Do you ever hear voices talking to each other when you are alone?
CAPE 41	Do you ever feel as if a double has taken the place of a family member, friend or acquaintance?
CAPE 42	Do you ever see objects, people or animals that other people cannot see?

2.2. Analyses

For each of the three studied PE domains, we first tested the main effect of the frequency of PEs on the secondary distress of these PEs with binominal logistic regression. Effects are expressed in Odds Ratio (OR).

After that, the correlations between PE frequency scores and levels of protective factors were examined, to check the presence of an association between these variables for the main analysis. For that, Spearman's rank correlation coefficient was used due to a skewed distribution of the frequency items and potential non-linear association between variables.

Next, potential moderation effects of the protective factors on the association between frequency of PEs and distress caused by these experiences were investigated by entering the interaction between the protective factors and PE frequency scores into the model and testing if this interaction was significant. Multiplicative interactions were tested, as we assumed relationship between the frequency of a PE and associated distress to differ conditionally on the presence and level of protective factors, and this effect to be multiplicative (different OR's depending on the presence and level of protective factors). The models were constructed for each subdomain of psychotic experiences and for each protective factor separately. All tests were corrected for age and gender (Brañas et al., 2017; Kelleher et al., 2012). To correct for multiple testing, the False discovery rate (FDR) correction was applied following the Benjamini–Hochberg procedure (Benjamini and Hochberg, 1995) with an alpha level set at 0.05, thus allowing for 5% of obtained significant results to be false positive.

Significant interactions were visualized, thus PE frequency*distress was stratified for low and high values of the protective factors to further investigate the size and shape of the moderating effect. For continuous protective factors, the frequency–distress associations were plotted for groups with mean ± 1 standard deviation (Aiken and West, 1991) and for dichotomous variables, we plotted the associations for the two categories.

All analyses were conducted in R, version 3.6.0.

3. Results

3.1. Sample and PEs

From the 12,503 participants who completed one instrument ($M_{\text{age}} = 45.0$ ($SD = 15.0$), 65.2% female) we selected the subsample

of 2870 participants who completed the CAPE ($M_{\text{age}} = 48.73$ ($SD = 13.88$), 66.72% female). CAPE-completers were slightly more often female (67% versus 65%, $p < 0.05$) and older (mean = 48.7 years [$SD = 13.9$] vs. 44.2 years [$SD = 14.7$]; $p < 0.001$) than non-completers. More details can be found in the previous publication on the HowNutsAreTheDutch sample (Wigman et al., 2017). Bizarre experiences were reported by 1127 participants (39.27% of total sample; PE mean = 1.79, $SD = 1.4$) of whom 40% reported secondary distress ($n = 449$). Delusional ideations were reported by 2735 participants (95.30% of total sample; mean = 4.22, $SD = 2.61$) of whom 71% reported secondary distress ($n = 1932$). Perception Anomalies were reported by 353 participants (12.30% of total sample; mean = 1.43, $SD = 0.89$) of whom 28% reported secondary distress ($n = 99$). These three domains showed substantial overlap (Spearman correlations; 'Bizarre experiences'–'Delusional ideations': $\rho = 0.45$, $p < 0.001$; 'Bizarre experiences' – 'Perception anomalies': $\rho = 0.27$, $p < 0.001$; 'Delusional ideations'–'Perceptual Anomalies': $\rho = 0.31$, $p < 0.001$).

3.2. Protective factors

The distributions of the protective factors are presented in Table 2 for the total sample and per PE domain. Because not all participants completed all modules, each model was based on different numbers of people (see Table s1). There were no differences in the distribution of non-responders across these subsamples (see Table s1).

3.3. Associations between protective factors and frequency of PEs

The associations between protective factors and frequency of PEs are presented in table s2. Most of the protective factors were significantly associated with the frequency of PEs, however the effect sizes of these associations were very low ($\rho = -0.07$ on average), with the exception of factors openness ($\rho = 0.23$ with the frequency of Delusional Ideations) and emotional stability ($\rho = -0.23$ with the frequency of Bizarre Experiences and $\rho = -0.25$ with the frequency of Delusional ideations).

3.4. Associations between frequency of PEs and associated secondary distress

PE frequency score was positively associated with distress for each domain (Bizarre Experiences: $OR = 2.62$, $p < 0.001$; Delusional Ideations:

Table 2
Distribution of the protective factors (% , n, mean and SD) in total sample and per subsamples of PEs.

Protective factors	Total sample (n = 2870)		Bizarre experiences subsample (n = 1127)		Delusional ideations subsample (n = 2735)		Perceptual anomalies subsample (n = 353)	
	% yes	n yes	% yes	n yes	% yes	n yes	% yes	n yes
Having a partner	74.11%	2127	72.40%	816	74.22%	2030	70.54%	249
Having a pet	44.29%	1271	44.63%	503	44.46%	1216	49.29%	177
	M	SD	M	SD	M	SD	M	SD
Optimism	13.73	2.58	13.78	2.60	13.73	2.60	13.70	2.64
Affiliative humor style	39.32	9.26	38.72	9.26	39.29	9.06	38.60	8.78
Self-enhancing humor style	36.64	8.65	36.62	8.87	36.62	8.70	37.30	8.66
Extraversion	27.24	7.10	26.69	7.30	27.21	7.12	26.27	7.28
Agreeableness	25.15	5.38	24.65	5.59	25.05	5.39	25.41	5.64
Conscientiousness	26.76	6.20	25.94	6.40	26.71	6.22	25.50	6.98
Openness	23.36	6.32	23.89	6.22	23.45	6.30	26.20	6.12
Emotional stability	28.68	9.32	26.18	9.25	28.45	9.31	26.55	9.83

OR = 1.47, $p < 0.001$; Perceptual Anomalies: OR = 1.74, $p = 0.001$). Because of the low frequency of Perceptual anomalies, subsequent analyses were only performed for of the Bizarre experiences and Delusional ideations domains.

The protective factors showed no significant interaction effects with PE frequency in predicting distress for Bizarre experiences. For Delusional ideations, the protective factors having a partner, optimism, self-enhancing humor, extraversion, openness, and emotional stability

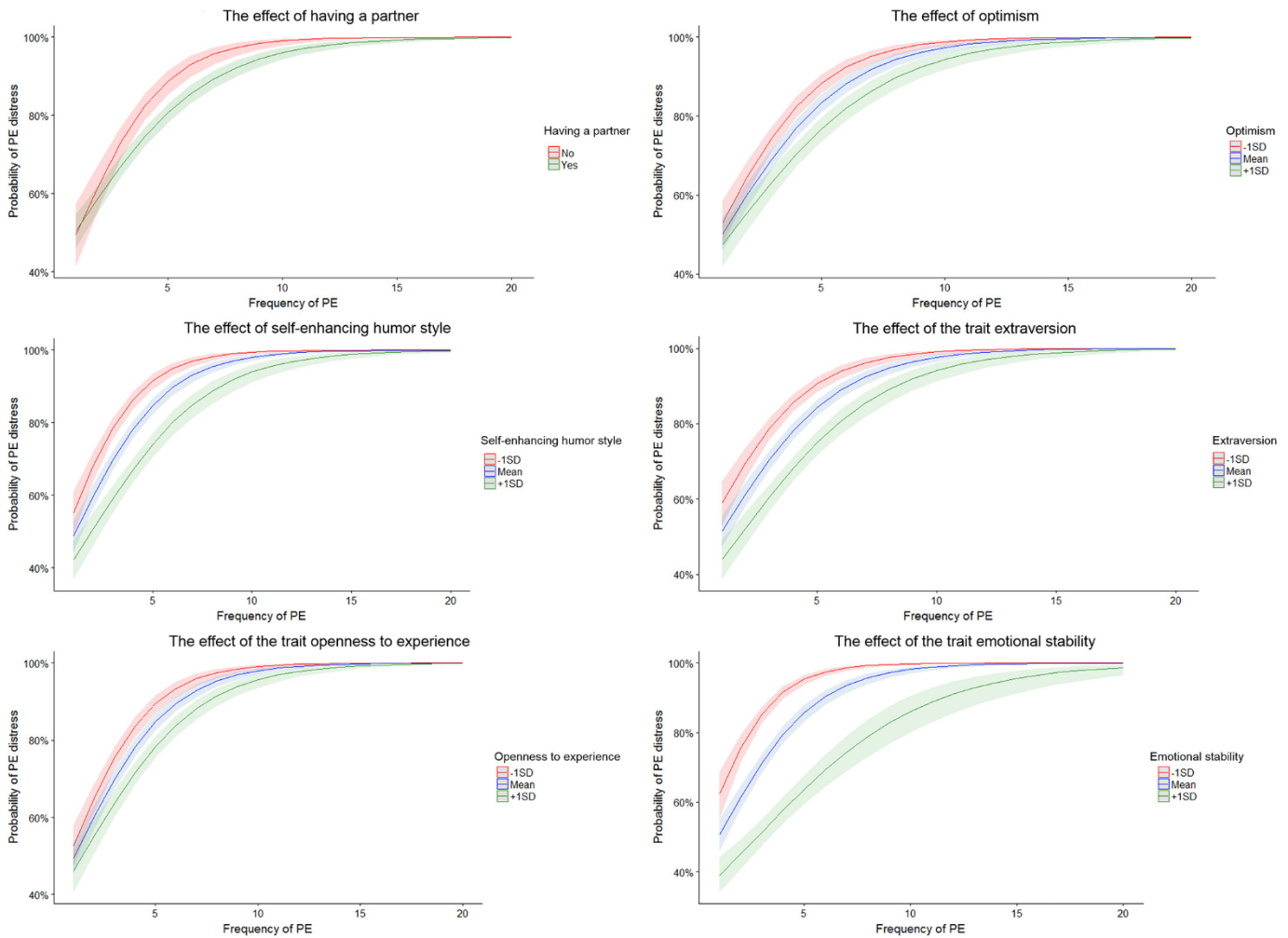


Fig. 1. Visualization of the effect sizes: plots of association between frequency of PEs (x-axis) and probability of associated distress (y-axis) per ± 1 SD and mean values of protective factors (yes/no for 'having a partner'). *Footnote:* In these graphs, X-axes correspond to the frequency of PEs (CAPE a sumscores), and y-axes – to the probability of the distress associated with PEs. For the first graph, 'the effect of having a partner', red upper line corresponds to the absence of partner, and green lower line – to the presence of partner. For other graphs, the upper red line corresponds to the low level of protective factor (-1 SD), middle blue line – to the mean level of protective factor, and lower green line – to the high level of protective factor ($+1$ SD). The interpretation of the effects is as follows: for example, for emotional stability, a person with low emotional stability (-1 SD) and 5 frequency of Delusional ideations will have ~95% chance to experience distress, and a person with high emotional stability ($+1$ SD) and also 5 frequency score will have ~60% change of experiencing distress.

Table 3
ORs for the protective factor * frequency of PEs (CAPE A) interactions, per domains of PEs.

Protective factors	Bizarre experiences					Delusional ideations				
	OR	95% CI		p	Adj.p	OR	95% CI		p	Adj.p
Having a partner	1.04	0.74	1.44	0.80	0.84	0.84 ^a	0.74	0.96	0.01	0.04
Having a pet	0.85	0.62	1.16	0.30	0.4	0.99	0.9	1.1	0.9	0.9
Optimism	0.96	0.91	1.03	0.28	0.4	0.97a	0.95	0.99	0.001	0.01
Affiliative humor style	0.99	0.97	1.01	0.18	0.3	1.00	0.99	1.00	0.17	0.3
Self-enhancing humor style	1.00	0.98	1.01	0.63	0.79	0.99 ^a	0.98	0.99	<0.001	<0.001
Extraversion	0.99	0.96	1.01	0.22	0.34	0.99 ^a	0.98	1.00	0.01	0.03
Agreeableness	0.99	0.97	1.02	0.68	0.8	1.01	1.00	1.02	0.03	0.07
Conscientiousness	0.98	0.96	1.01	0.12	0.24	0.99	0.98	1.00	0.03	0.07
Openness	1.00	0.97	1.02	0.77	0.84	0.99 ^a	0.98	1.00	0.003	0.01
Emotional stability	0.99	0.97	1.00	0.12	0.24	0.98 ^a	0.97	0.99	<0.001	<0.001

^a Corresponds to the significant interaction effects after the FDR correction. Note that the 95% confidence intervals were not corrected for multiple testing.

showed significant interaction effects on the association between frequency of PEs and PEs distress. More specifically, having a partner, optimism, self-enhancing humor, extraversion, openness, and emotional stability reduced the association between frequency of PEs and the level of secondary PE distress (Fig. 1). The odds ratios (ORs) for the interaction terms of the logistic regression analyses are presented in Table 3, however it must be noted that these ORs cannot be directly interpreted as effect sizes. The interpretation of effect sizes presented in Figure as follows: for example, for the trait emotional stability, a person with low emotional stability (-1 SD) and 5 frequency of Delusional ideations will have ~95% chance to experience distress, and a person with high emotional stability ($+1$ SD) and also 5 frequency score will have ~60% change of experiencing distress.

4. Discussion

The aim of this study was to investigate whether several protective factors reduced the level of distress associated with different types of subclinical psychotic experiences (PEs) in adults from the general population. First, in all three PE domains higher PE frequency was associated with higher probability of distress. This effect was most pronounced for Bizarre Experiences. Second, the protective factors showed different moderating effects on Bizarre Experiences than on Delusional Ideations. For Bizarre Experiences, there were no significant interactions between studied protective factors and PE associated distress. For Delusional Ideations, the following factors significantly moderated the association between the frequency of PEs and the distress associated with them: having a partner, higher levels of optimism, higher levels of a self-enhancing humor style, higher extraversion, higher openness, and higher emotional stability.

It is difficult to explain why these protective factors only appeared in the context of Delusional Ideation and not for Bizarre Experiences. One possible explanation of the absence of significant results for the domain 'Bizarre experiences' may lie in the smaller sub-sample size, as 'Delusional ideations' were reported almost twice as often than 'Bizarre experiences'. Moreover, in our sample, Bizarre experiences were associated with higher level of distress than Delusional ideations. Therefore, it could be speculated that the buffering effect of protective factors is less strong in case of more intensely distressing experiences. In our sample 71% reported having any distress by Delusional ideations, whereas for Bizarre experiences any distress reported only 40% of participants. These results may be explained by the intra-item distribution of frequency and distress: in particular, in Bizarre experiences, more frequent items were also highly distressing, whereas in Delusion ideations more frequent items were generally less distressing. Our observation that Bizarre experiences are more distressing than Delusional ideations is not consistent with previous findings (Capra et al., 2015). This inconsistency may be explained by the discrepancies in PE classification: because we followed the model of Mark and Touloupoulou (Mark and Touloupoulou, 2016), we included grandiose and persecutory items in the delusional

ideations. However, grandiose items are known to be less distressing (Ronald et al., 2014; Wigman et al., 2011) or even beneficial for mental health (Unterrassner et al., 2017b). Additionally, some delusional items were very frequently endorsed (e.g. "Do you ever feel as if some people are not what they seem to be?"), potentially tapping into more normal experiences and thus being less distressing.

Another speculative explanation for the differential effects of Delusional ideations and Bizarre experiences may lie in the different nature of these domains. Bizarre experiences may be felt as more real and external (i.e. coming from outside) and be perceived as less controllable and less verifiable than Delusional ideations. For example, in our sample the most distressing item from the domain of Delusional ideations was "feeling as being persecuted in some way". This feeling may be to a certain extend verified, whereas for the most distressing Bizarre experiences item, "feeling as if the thoughts in your head are being taken away from you", verification is more difficult. Such reasoning is in the line with recent cognitive model of psychosis which highlights the importance of the externalizing appraisal of psychotic experiences (Garety et al., 2001). Therefore, there may be more options for cognitive and emotional reappraisals for Delusional ideations than for Bizarre Experiences. Following this argument, it can be imagined that, after a discussion with a partner, the level of distress from "feeling being persecuted in some way" may decrease because a partner can provide some contradictory evidence (or potentially help in case of persecution, and awareness of this can reduce distress). In the case of "feeling as if the thoughts in your head are being taken away from you", such 'reality testing' or expected help is more difficult.

Within the domain of Delusional ideations, several factors were found to moderate (i.e. lower) the effect of PE frequency on lower secondary distress. Three personality traits had significant effects (high extraversion, high openness and high emotional stability), consistent with the literature and our expectations. Higher levels of openness and extraversion and emotional stability were associated with more adaptive emotional regulation and beneficial coping strategies (Connor-Smith and Flachsbar, 2007; Purnamaningsih, 2017), which may in turn lead to more positive reappraisal of psychotic experiences. Similar reasoning may be applicable to the effects of optimism and self-enhancing humor (Jenaabadi et al., 2015; Perchtold et al., 2019). A possible reason for the absence of an effect for affiliative humor may be that this humor style is more connected with relationships with others (Martin et al., 2003), and therefore may be less relevant for the positive appraisal of subjective PEs.

For socio-demographic protective factors, having a partner was associated with lower distress for Delusional ideations, which is consistent with findings of a general protective effect of social support (Beetz et al., 2012; Brett et al., 2014; Lim et al., 2014; Ogechi et al., 2016). Although having a pet has been shown to have some psychological and physical benefits (McConnell et al., 2011), the evidence is somewhat contradictory (Mueller et al., 2018). In addition, the type of pet, which we did not assess, seems important (Westgarth et al., 2010). Furthermore, although pets could also be seen as (proxies of) social support

(Bos et al., 2016a), as it was discussed earlier, part of the beneficial effect of social support may occur due to the opportunity for reality testing, which is less the case through interactions with animals.

It is also necessary to note that these results possibly may be explained by a mediating rather than a moderating effect of the protective factors. In this case, the association of higher level of protective factors with lower probability of distress may be explained by the fact the protective factors are associated also with the lower frequency of PEs, and because of that, also with lower probability of distress. However, based on the low correlations between frequency and protective factors, this explanation seems unlikely. Among protective factors with significant interaction effects, only openness and emotional stability were relatively highly associated with PE frequency. Moreover, for openness this association is positive, meaning that higher levels of openness are associated with higher frequency of PEs, and so for this factor the moderation may exist despite this association. Therefore, the only one factor for which it is not possible to state the absence of mediation is emotional stability.

Our study has several other limitations. First, the PEs of different domains were unequally distributed in our sample. In particular, Perceptual Anomalies were not often reported in this general population sample, and their secondary distress was reported even less often, leading us to exclude this domain from interaction analyses. Therefore, the results of our study are not generalizable to populations experiencing Perceptual Anomalies and are not fully comparable to the studies using the full CAPE. Moreover, most of the people who reported Bizarre experiences also reported Delusional Ideations, and therefore they cannot be treated as belonging to separate individual samples. Therefore, no definite statements can be made about moderation effects on Bizarre experiences, as mostly all of these individuals also reported delusional ideations. Second, the distribution of distress was highly skewed. As other data transformations and use of ordinal regression models was not possible due to violation of proportional odds assumption, we decided to dichotomize the distress variables, which led to considerable loss of data and potential omission of important information. Third, the exact time between and order of assessments varied largely between participants and therefore the time between assessment of PEs and of protective factors was often different. However, all measures were assessed within the timespan of one year. Nevertheless, these differences may potentially lead to discrepant results (e.g. the status of relationships with a partner has changed between the moment of filling in the first module and the CAPE). In line with this, the CAPE asks for lifetime experiences and the actual PE may have taken place at a different time than the assessed risk factor is assessed, which might have added noise to the analysis. Fourth, due to the way the PEs were assessed, frequency scores represent a combination of the presence of PEs and their frequency, some people with the same scores might have had a very different combinations of PEs: e.g. frequency score of three might have meant both three different items which are experienced “sometimes”, or one which is experienced “nearly always”. This discrepancy might have added more noise to the analysis as well. Fifth, the used sample is not representative of the general population, because of its crowdsourced nature (Krieke et al., 2016) with people with high education and females being overrepresented. Therefore, generalizing our findings to the general population is not possible. Sixth, as our study is cross-sectional, we cannot establish the direction of the underlying processes; for example, it may still be that PEs actually influence personality rather than vice versa. This consideration complicated the interpretation of results, which must be considered preliminary until replicated on longitudinal cohort. Finally, other potential protective factors may explain the low level of distress despite high frequent PEs. Among these factors may be sleep quality (Andorko et al., 2017), empathy (Bonfils et al., 2017), physical activity (Crush et al., 2018b), green space (Bos et al., 2016b), as well as other, higher-level factors (i.e. family and community dynamics) (Coughlan et al., 2019; Crush et al., 2018b; Riches et al., 2019). Moreover, it is likely that these protective factors are correlated with each other. There may exist meaningful clusters of

protective factors, which may differ in regard of their buffering effect. Therefore, the next step is to establish such protective processes longitudinally and at the individual level (Fisher et al., 2018); future studies will benefit from including both clinical and non-clinical cohorts and data-driving clustering of the protective factors.

It must be noted that our study is closely connected to the concept of resilience. Psychological resilience is defined in different ways, and often is understood as an outcome of a dynamic process of successful adaptation to adversity, i.e. good (or stable) mental health despite stressful events and risk factors (Kalisch et al., 2017). In this framework of resilience, the protective factors studied in this paper can be seen as resilience-increasing factors that facilitate the process of adaptation in terms of a favorable outcome despite adversity. Future resilience studies could investigate the process of response responding to psychotic experiences in more detail in people with different levels of these protective factors.

In conclusion, our results indicate that several protective factors may influence the probability of PEs to be distressing and that this protective effect may differ between subdomains of PEs. However, due to the cross-sectional nature of the study, no conclusions on causality can be drawn. In the future, if replicated in longitudinal studies with more generalizable samples and including a wider selection of protective factors, these findings could be used to help identify individuals at higher risk of poorer outcome, and potentially to create tailored intervention and prevention approaches, focusing on enhancing individuals' protective factors (Falkenberg et al., 2011; Hudson and Chris Fraley, 2015; Karnieli-Miller et al., 2017; Malouff and Schutte, 2017; Roberts et al., 2017), such as school-based mental health trainings. Focusing on distress associated with PEs and on protective factors may enrich our understanding of the nature of PEs, and explain why despite having frequent PEs, some people are more resilient to psychopathology (Brett et al., 2009; Mohr and Claridge, 2015; Moreira-Almeida and Cardeña, 2011; Powers et al., 2017).

Authors' contributions

AK, JW, SB and MW were involved in the formulation of the research hypothesis and questions. PJ, BJ, KW, and JW participated in data collection and study design. PJ and BJ contributed to data management. JW and AK managed literature searches and statistical analyses and wrote the first version of the manuscript. SB and MW participated in editing and finalizing the manuscript. All authors have contributed to and have approved the final manuscript.

Role of the funding source

MW was supported by funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovative programme (ERC-CoG-2015; No 681466); The Netherlands Organization for Scientific Research (NWO) supported JW (Veni grant no. 016.156.019) and BJ (Veni 016.195.405). AL is supported by an National Health and Medical Research Council (NHMRC) Career Development Fellowship (#1148793). The funding agencies have played no role in the design or execution of this study.

Declaration of competing interest

All authors declare no conflict of interest.

Acknowledgments

We thank drs. Hans Burgerhof, who kindly gave advice on some aspects of statistical analysis.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.schres.2020.05.019>.

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