Chapter 14
The Association Between Resilience and Survival Among Chinese Elderly*

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Introduction

Resilience, a psychological construct, has been defined differently in extant theoretical writings. Luthar et al. (2000) characterized resilience as a dynamic process encompassing positive adaptation within the context of significant adversity. Lamond et al. (2009) stated that resilience connoted the ability to adapt positively to adversity, or in other words, the ability to bounce back from negative events by using positive emotions to cope (Tugade et al. 2004). The former definition viewed resilience as a dynamic process, whereas the latter regarded it as a personality trait. In this paper, we adopt the second definition.

As researchers and clinicians have become more interested in resilience in recent decades, there is an increasing need for high quality measures of this construct. Wagnild and Young (1993) proposed the 25-item Resilience Scale (RS), representing two factors of resilience: personal competence and acceptance of self and life. More recently, Friborg et al. (2003) developed the 45-item Resilience Scale for Adults (RSA). It aimed to measure the presence of protective resources that promote adult resilience such as personal competence, social competence, family coherence, social support, and personal structure. Connor and Davidson (2003) have developed the 25-item Connor–Davidson Resilience Scale (CD-RISC). In contrast to the RSA, the CD-RISC focused on qualifying resilience itself, and covered five dimensions of resilience including personal competence, tolerance of negative affect and stress-related growth, acceptance of changes, personal control and spiritual orientation. Although particular measurement of resilience for the elderly has not received sufficient attention yet, the RS and the CD-RISC have both been verified to be appropriate for use among older people (Wagnild 2003; Lamond et al. 2009).

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A growing focus on healthy aging and the availability of validated resilience scale tools have prompted researchers to investigate the role of resilience in health and survival in a multidisciplinary framework. Resilience scores were demonstrated to be positively correlated with mental health and physical functioning of the elderly (Wagnild 2003; Hardy et al. 2002), as well as with self-rated successful aging (Lamond et al. 2009). Other studies explored how resilience ameliorated the negative effect of adverse events such as loss of a loved one on health and well-being. Windle et al. (2008) discovered that psychological resilience moderated the negative effect of chronic illness on subjective well-being among the elderly aged 60+. Reker (2008) tentatively applied the latent construct approach and structural equation modeling, and found that resilience, either partially or fully, mediated the impact of stress on subjective well-being and physical health of the elderly.

Furthermore, several researchers have been engaged in exploring the mechanism through which resilience exerted a positive impact on survival and health. One possible channel was that resilient elderly were more likely to experience positive emotions (Masten 2001; Ong et al. 2006), and positive emotions were found to promote health and longevity (Levy et al. 2002; Giltay et al. 2004).

However, several limitations confined the development of research on resilience in aging. Above all, most of the prior studies were based on small samples, with especially limited numbers of oldest-old subjects, which restricted the estimation efficiency. Wagnild (2003) evaluated the Resilience Scale in a sample of 43 older adults and Nygren et al. (2005) reexamined the same scale in a sample of 125 Swedish oldest-old aged 85 years and older. Reker's work (2008) was based on a sample of 146 older adults. Lamond et al. (2009) made use of a larger sample of 1,395 community-dwelling elderly aged between 60 and 91 years old; but, all of the subjects were women, which hindered the generalization of the results among the whole population. Windle et al. (2008) utilized a random sample of 1,847 people aged between 50 and 90 from rural and urban areas in England, Wales, and Scotland. In both these studies, the people older than 90 years were not included, even though the fast aging of the elderly population called for more attention to the oldest-old.

Second, many studies were cross-sectional (Hardy et al. 2002; Windle et al. 2008; Lamond et al. 2009), and the few longitudinal designs were conducted to test the psychometric properties of resilience scales such as test–retest correlations (Friborg et al. 2003). Thus, they can only justify the correlation between resilience and current physical/psychological health. Whether resilience is associated with long-term health benefits, especially mortality risk, is not yet explored. A notable exception is the study by Surtees et al. (2006). They applied partial correlation analysis to show that a slower capacity to adapt to the consequences of adverse experience was associated with increased mortality after adjustment for age and sex. However, the authors did not control for initial health status and socio-economic characteristics of the elderly, which may confound the impacts of resilience on survival.

This chapter made use of the 2002–2005 Chinese Longitudinal Healthy Longevity Survey (CLHLS) dataset, covering 16,064 Chinese elderly aged 65 and older. The CLHLS was initiated to meet the needs of scientific research on the oldest-old (older than 80 years) in the 1998 baseline survey, and further expanded to also cover the young-old aged 65–79 years in the 2002 and 2005 survey.

The purpose of our study is to explore the impact of total resilience scores as well as each resilience indicator on the mortality risks of Chinese elderly.

Our research is unique in two aspects. First, the longitudinal survey has investigated the elderly with a sufficiently large proportion of oldest-old individuals, and also collected more information on demographic and socio-economic characteristics and health status of this population. This provided us with a good opportunity to separate the effect of resilience on survival from other confounding effects, and to produce more efficient estimates. Second, we addressed resilience and survival in a developing country, China, whereas almost all previous studies on this topic dealt with developed countries. It was realized that resilience factors vary among different developmental and environmental contexts (Fraser et al. 2004), and it is worth examining the resilience scale and its impact on longevity in China.

Data

The data used in this paper were from the Chinese Longitudinal Healthy Longevity Survey (CLHLS). This survey was carried out in 1998, 2000, 2002, 2005, and 2008–2009 in randomly selected half of the countries/cities in 22 Chinese provinces, covering 85% of the total population in China (Zeng et al. 2008). The 1998 baseline and the 2000 follow-up wave interviewed the oldest-old aged 80 and older only; since the 2002 wave, younger elderly aged 65–79 were also included in the sample. Gu and Zeng (2004) have conducted a careful evaluation (such as reliability coefficients and factor analysis) and shown that the data quality of this survey was reasonably good.

This study was based on the 2002–2005 longitudinal sample to explore the impact of resilience on survival among the elderly aged 65+ over a 3-year interval. Those who survived to be interviewed in the 2005 survey were considered as censored. We excluded elderly individuals who were lost to follow-up in the 2005 survey and individuals who had missing information on the year of death or the month of death. We further dropped the cases that had incomplete information on ethnicity, marital status, education, and activities of daily living (ADL). The final sample size of the valid cases used in this study was 13,800 elderly, consisting of 5,686 men (41.20%) and 8,114 women (58.80%).

Measurements

Resilience

Indicators of resilience in this paper were derived based on the framework of the Connor–Davidson Resilience Scale (CD-RISC, Connor and Davidson 2003). CD-RISC was a 25-item scale involving personal competence, tolerance of negative affect and stress-related growth, acceptance of changes, personal control and spiritual

orientation. Of the total 25 items, we used 7 available items to measure resilience (Table 14.1). There are three reasons why we only have 7 items. First reason was cultural relevance, namely, only a few Chinese elderly are Christians, thus items such as "sometime fate or God can help" in CD-RISC were not suitable. Second, our research objects were people aged above 65, so items like "you work to attain your goals" and "prefer to take the lead in problem solving" were not suitable. Third, the CLHLS is study focusing on various factors which may affect healthy longevity rather than a special study focusing on psychology, and thus we cannot include too many items in the questionnaire. We asked respondents whether the statements fit with them (denoted as 1) or not (denoted as 0). Thus, total resilience scores ranged from 0 to 7, with higher scores reflecting greater resilience.

The rate of missing values on item 1, item 2, item 3, item 4, and item 7 was 10.84, 10.17, 10.21, 10.31, and 10.91%, respectively. Items 5 and 6 had complete information. We found that those interviewees with a missing value for the variables mostly had poor mental health and physical capacity. Thus, we did not conduct imputation for each of these variables, and instead treated the group with a missing value as a separate category of "missing" (Zeng et al. 2007).

Socio-Demographic Variables

As shown in Table 14.2, age, race (Han or minority), current residence (urban or rural), primary occupation before age 60 (non-manual job or manual job), education (literate or illiterate), and marital status (currently married or not) were included as socio-demographic controls.

Health Status

As the follow-up mortality risk was highly correlated with the initial health status, we controlled for two dimensions of health status in 2002: physical capacity and mental well-being. Physical capacity was measured by ADL, consisting of six items such as eating, dressing, indoor transferring, using toilet, bathing, and continence. Following the studies by Guralnik et al. (1994) and Zeng et al. (2007), if the elderly can complete all six activities without others' assistance, he/she was classified as "ADL independent"; if the elderly needed help in at least one activity, he/she was classified as "ADL dependent."

Mental well-being was measured by the Mini-Mental State Examination (MMSE) questionnaire, which was adapted to Chinese cultural context. The questionnaire included 24 items regarding orientation, registration, attention, calculation, recall, and language, with a total score ranging from 0 to 30. The same cutoffs as the MMSE international standard were used to define a total score of 24 and above as "normal mental health" and a score below 24 as "impaired mental health."

Table 14.1 Measures of resilience: statements concerning self-reported resilience

Item	Relevant part of the CLHLS questionnaire		Summarized and dichotomized item statements			
	Questions asked	Codes	Item statements	Yes	No	Missing
1	Do you feel the older you get, the more useless you are?	0.always; 1.often; 2.sometimes; 3.seldom; 4. never	I don't feel the older you get, the more useless I am.	4,542 (32.91)	7,761 (56.24)	1,497 (10.85)
2	Do you always look on the bright side of things?	4.always; 3.often; 2.sometimes; 1.seldom; 0. never	I always look on the bright side of things.	11,785 (85.40)	611 (4.43)	1,404 (10.17)
3	Do you often feel fearful or anxious?	0.always; 1.often; 2.sometimes; 3.seldom; 4. never	I don't often feel fearful or anxious.	9,015 (65.33)	3,375 (24.46)	1,410 (10.22)
4	Do you often feel lonely and isolated?	0.always; 1.often; 2.sometimes; 3.seldom; 4. never	I don't often feel lonely or isolated	8,310 (60.22)	4,067 (29.47)	1,423 (10.31)
5	To whom do you usually talk most frequently in daily life?	1. Family members/friends/ neighbors/ social workers/ caregivers; 0. Nobody.	I talk frequently to family members or friends in daily life	12,463 (90.31)	1,337 (9.69)	0
6	Who do you ask first for help when you have problems/difficulties?	1. Family members/friends/ neighbors/ social workers/ caregivers; 0. Nobody.	when I have problems, I can turn to my family or friends for help	12,873 (93.28)	927 (6.72)	0
7	Can you make your own decisions concerning your personal affairs?	4.always; 3.often; 2.sometimes; 1.seldom; 0. never	I can make my own decisions concerning my personal affairs	10,287 (74.54)	2,006 (14.54)	1,507 (10.92)

Notes: (1) We dichotomized the answers of each of the seven questions in two categories "Yes" and "No" of the item statements. For Items 1, 3, and 4, the scores 0,1, and 2 are grouped as "No", and the scores 3 and 4 are grouped as "Yes". For Items 2 and 7, the scores 0 and 1 are grouped as "No", and the scores 2, 3, and 4 are grouped as "Yes". For Items 5 and 6, the code 0 is "No" and the codes 1 is "Yes".
(2) In the columns of "Yes" and "No", the numbers which are not within the parentheses are the number of respondents, and their percentages are presented in parentheses.
(3) Missing cases include those who are unable to answer.

Table 14.2 Descriptive statistics of the potentially confounding variables

Confounding variables	Number	Percent
Socio-demographic characteristics		
Mean age	86.40	–
Gender		
Male	5,896	42.72
Female	7,904	57.28
Race		
Han	12,956	93.88
Minority	844	6.12
Current residence		
Urban	5,941	43.05
Rural	7,859	56.95
Education		
Literate	8,637	62.59
Illiterate	5,163	37.41
Primary occupation before age 60		
Non-manual job	1,110	8.04
Manual job	12,690	91.96
Marital status		
Currently married	4,081	29.57
Divorced, widowed, never married	9,719	70.43
Initial health status		
Activities of daily living		
Independent	9,697	70.27
Dependent	4,103	29.73
MMSE		
Good	8,160	59.13
Impaired	5,640	40.87

Note: Variables are measured at the 2002 interview

Methods

We calculated the Pearson correlation coefficients between individual items and the total score of the resilience scale, and evaluated the internal consistency of the resilience scale using Cronbach's alpha statistic. Principal component analysis (PCA) with varimax rotation was conducted to assess the factor composition of the resilience scale among Chinese elderly. Principle component analysis, a common form of factor analysis, aimed to transform these seven possibly correlated items into a smaller number of uncorrelated factors. Varimax rotation was to make the PCA results as easy as possible to identify each item with a single factor and thus to facilitate the interpretation of factors.

We estimated a Cox proportional hazards regression model controlling for the potential confounding factors to explore the association between resilience and survival of the elderly. Survival time from the 2002 survey to the time of death (for

those who died) or to the 2005 survey (for those censored) was measured in years (with decimal points).[1] In the survival analyses, we included seven resilience indicators and the total score of resilience separately, to examine the impact of each individual item as well as the overall impact of resilience. To better understand how the impact of resilience on mortality is moderated by other confounding variables, we adopted a stepwise method. Model 1 only included seven resilience indicators or the total resilience score; Model 2 controlled for socio-demographic variables. Model 3 further adjusted for initial physical and mental health.

Results

Sample Characteristics

As shown in Table 14.1, of the 13,800 elderly individuals who had complete information on key variables, 33% did not consider that the older they get, the more useless they are, and 85% always tended to look on the bright side of things. About two thirds did not often feel fearful, anxious, lonely, or isolated. More than 90% talked frequently to their family and friends, or turned to them for help when needed. 75% of the elderly were in control of their personal affairs.

Table 14.2 presented that the mean age of the participants was 86.4 years (sd = 11.69). Most of the elderly were Han (93.9%). 43% resided in urban areas. 37.4% had at least 1 year of schooling. Only 8% held a non-manual job before age 60. Nearly 30% were currently married, and the remaining elderly were widowed. 70.3% were ADL independent, and about half of the elderly had good mental health.

Properties of the Resilience Scale

The mean total score of seven resilience indicators in our sample was 5.43 (sd = 1.28).[2] Item-total correlations (correlations between individual item scores and total scores) ranged from $r = 0.29$ ("when I have problems, I can turn to my family or friends for help") to $r = 0.69$ ("I do not often feel lonely or isolated"), which was considered appropriate (Munro 2005). Because of the small number of items, the Chronbach's α for the scale was 0.478, indicating moderate and acceptable internal consistency.

[1]For those died: survival time = (year of death-2002) + (month of death − month of the 2002 survey)/12; For those censored: survival time = (2005–2002) + (month of the 2005 survey − month of the 2002 survey).

[2]We only considered 11,938 cases with complete information on seven resilience indicators to examine the psychometric properties.

Table 14.3 Factors and factor loading of the seven-item resilience scale

Item	Factors and item statements	Eigenvalue	Variance explained (%)	Factor loading
Factor 1: self-approval, calmness, and sociability		1.78	24.7%	
1	I don't feel the older I get, the more useless I am	–	–	0.65
3	I don't often feel fearful or anxious	–	–	0.78
4	I don't often feel lonely or isolated	–	–	0.79
Factor 2: close relationship with family and friends		1.30	18.9%	
5	I talk frequently to family members or friends in daily life	–	–	0.78
6	when I have problems, I can turn to my family or friends for help	–	–	0.81
Factor 3: optimism and control of own life.		1.01	14.8%	
2	I always look on the bright side of things	–	–	0.38
7	I can make my own decisions concerning my personal affairs	–	–	0.93

A principal component analysis with varimax rotation was conducted to transform the seven resilience measures into a smaller number of uncorrelated factors. This procedure generated three uncorrelated factors with eigenvalues ≥1, explaining 58.4% of the total variance. The factor loadings (the correlation coefficients between the items and factors) ranged from 0.38 to 0.93. These factors could be interpreted as follows: Factor 1 containing three items reflecting self-approval, calmness, and sociability; Factor 2 containing three items corresponding to close relationship with family and friends; and Factor 3 including two items related to optimism and control of own life (Table 14.3).

Results of Survival Analyses

Impact of Seven Resilience Indicators on Mortality Risk of the Elderly

Tables 14.4 and 14.5 contained hazard ratios of the effects of seven resilience indicators and total resilience scores on mortality at old ages, which were the focus of this chapter. Without controlling for any confounding factors, those who didn't feel the older they got, the more useless they became had 22.4% lower mortality risk at old ages (Model 1). The effect of this resilience indicator was ameliorated after adjusting for socio-demographic characteristics and initial health status (Models 2 and 3), but remained significant at the $p < 0.01$ level. Those who had missing values on this indicator were faced with significantly higher mortality risks in Model 1. However, after controlling for other covariates, there was no significant difference in mortality between those with and without missing values.

Having an eye on the bright side of things raised the mortality risk by 14% in Model 1 but was only marginally significant at the 0.1 level. When the other potentially

Table 14.4 Hazard ratios of the effects of seven resilience indicators on mortality risk

	Model 1	Model 2	Model 3
Resilience measurements			
I don't feel the older I get, the more useless I am (no)	0.776***	0.849***	0.894***
Missing (no)	1.280***	1.029	0.982
I always look on the bright side of things (no)	1.140*	1.021	1.049
Missing (no)	1.411***	1.177	1.145
I do not often feel fearful or anxious (no)	0.920**	0.887***	0.931**
Missing (no)	0.970	0.911	0.937
I do not often feel lonely or isolated (no)	0.807***	0.910***	0.932**
Missing (no)	1.195	1.105	1.039
I talk frequently to family members or friends in daily life (no)	0.722***	0.880***	0.939
When I have problems, I can turn to my family or friends for help (no)	0.947	0.914*	0.919
I can make my own decisions concerning my personal affairs (no)	0.723***	0.881***	0.920**
Missing (no)	1.519***	1.185*	1.126
Socio-demographic characteristics			
Age	–	1.067***	1.054***
Male (female)	–	1.298***	1.378***
Han (minority)	–	1.200***	1.076
Urban (rural)	–	1.004	0.984
Literate (illiterate)	–	1.026	1.0517
Non-manual job (manual job)	–	0.894*	0.908
Currently married (divorced, widowed, never married)	–	0.759***	0.759***
Initial health status			
Independent ADL (dependent)	–	–	0.619***
Good MMSE (impaired)	–	–	0.705***
Observation	13,800		

Note: *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

confounding factors were added to the model (Models 2 and 3), the coefficient lost its marginal significance. The significant difference in mortality between those with and without missing values on this indicator diminished after we controlled for other covariates.

Not feeling fearful or anxious significantly reduced the mortality risk by 6.9–11.3%. Those elderly who did not feel lonely or isolated were also faced with 6.8–19.3% lower mortality risk. The mortality risks of the elderly with missing information on these two indicators were not significantly different from the elderly with complete information.

Talking frequently to family members or friends in daily life reduced the 3-year mortality risk by 27.8%. When socio-demographic characteristics were added in Model 2, the effect shrank to 12% lower mortality risk. After further controlling for initial physical and psychological health in Model 3, the effect was no longer

Table 14.5 Hazard ratios of the effects of total resilience scores on mortality risk

	Model 1 (all elders)	Model 2 (all elders)	Model 3 (all elders)	Model 4 (young-old)	Model 5 (oldest-old)
Total resilience score					
≥6 (<6)	0.647***	0.772***	0.845***	0.800***	0.870***
Missing (<6)	2.082***	1.278***	1.085**	1.353**	1.107***
Socio-demographic characteristics					
Age	–	1.068***	1.054***	1.077***	1.039***
Male (female)	–	1.288***	1.376***	1.303***	1.327***
Han (minority)	–	1.196***	1.073	0.898	1.117
Urban (rural)	–	0.998	0.980	0.897	0.986
Literate (illiterate)	–	1.024	1.051	1.125	1.032
Non-manual job (manual job)	–	0.889*	0.906	0.921	0.908
Currently married (divorced, widowed, or never married)	–	0.757***	0.757***	0.823***	0.803***
Initial health status					
Independent ADL (dependent)	–	–	0.614***	0.473***	0.637***
Good MMSE (impaired)	–	–	0.694***	0.582***	0.736***
Observations	13,800	13,800	13,800	5,990	7,810

Note: *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

significant. Turning to family members or friends for help had insignificant effect on mortality in Models 1 and 3. Self decision-making reduced the mortality risk by 27.7%. When controlling for socio-demographic characteristics and health status, those in control of personal affairs were faced with 9.1% lower mortality risk.

Regarding socio-demographic controls, female elderly had significantly lower mortality risks, consistent with many prior studies. Race, current residence, and education had no significant impact on mortality when the socio-demographic characteristics and initial health statuses were controlled for. Marriage was an important indicator for longevity. Those who were currently married were faced with 24.1% lower mortality risk than those who were divorced, widowed, or never married. Good health status, both physical and mental, significantly reduced mortality risk at old ages.

Impact of Total Resilience Scores on Mortality Risk of the Elderly

For those with complete information on seven resilience indicators, we computed their total resilience scores. Scores higher or equal to 6 were denoted as 1, reflecting higher resilience; scores lower than 6 were denoted as 0, reflecting lower resilience. For those respondents who had missing values on at least one resilience indicator, we treated them as a separate category of "missing" and did not do any imputation.

In the Cox proportional hazard model without controlling for any covariates, the elderly with higher resilience were faced with 35.3% lower mortality risk. Models 2 and 3 show that part of the effect of resilience was moderated by socio-demographic characteristics and initial health status. After adjusting for various covariates including the initial health, higher resilience reduced mortality risk at old ages by 15.5% (Model 3). In Model 1, the respondents with missing values on total resilience scores had about twice higher mortality risks than those with low resilience scores. After controlling for other confounding factors, the effect shrank to 8.5–27.8%.

In order to explore the relationship between resilience and survival among the oldest-old which was seldom examined in previous research, we further conducted survival analyses among the young-old (aged between 65 and 84) and oldest-old (aged 85 and older) separately (Models 4 and 5). The effect of high resilience on mortality was a bit smaller for the oldest-old, but remained significant at the 0.01 level.

The effects of socio-demographic characteristics and initial health status were similar to the estimates presented in Table 14.4.

Discussion and Conclusions

The present study was unique as it explored the association between resilience and longevity at old ages based on a large panel data with a sufficiently large subsample of the oldest-old in China, a developing country. Exploratory principal components analysis indicated that the resilience scale applied to Chinese elderly contained three dimensions: self-approval, calmness, and sociability; close relationship with family and friends; and optimism and control of own life. Survival analyses showed that most of the resilience indicators had significantly positive impacts on longevity of the elderly. Furthermore, we summed these seven resilience indicators to construct a total resilience measure. It was demonstrated that after controlling for socio-demographic characteristics and initial health status, higher resilience significantly reduced the risk of mortality, and the effect of total resilience among the young-old was a bit larger than the effect among the oldest-old.

Why was resilience positively associated with survival at old ages in China? One possible explanation was that resilience was positively correlated with better physical and psychological health, and better health status lowered the mortality risk. As shown in our survival analyses, the effect of each resilience indicator as well as the effect of total resilience score on the mortality risk substantially shrank after variables of initial health status were included in the model. Prior investigations also lent support to this explanation; for instance, Wagnild (2003) and Lamond et al. (2009) indicated that resilience had a positive association with physical and cognitive function. Ong et al. (2006) have demonstrated that resilient individuals were more likely to hold positive emotions, which promoted both resistance to and recovery from stress, and thus probably contributed to better health and longevity. However, due to data limitation, we were unable to explore the detailed mechanisms on how resilience worked.

The findings presented in this paper should be interpreted with caution given the limitations of our study. First, as the CLHLS was a demographic survey focusing on determinants of healthy longevity such as demographic characteristics, socio-economic status, life style and health status of the elderly, we did not have as many resilience indicators as other psychological surveys. Although the original Connor–Davidson resilience scale had 25 items, we only analyzed 7 of the items because of data limitations. Future research that collects the whole C-D resilience scale could improve our understanding of the association between resilience and mortality. Second, we only have examined the association between resilience and mortality, rather than the causal relationship between them. More detailed data and advanced methods such as instrumental analysis are called for to explore the causal relationship.

In conclusion, the present study provided evidence to support the conclusion that better resilience tended to reduce mortality risk among the young-old and oldest-old in a developing country. Thus, policy makers may need to take measures to promote resilience. The developed countries have formulated some resilience training programs, including organizing group activities, encouraging individual expressions and so on (Waite and Richardson 2004). The governments and societies in developing countries including China could learn from these matured training programs and adapt them to their own social and cultural contexts. These efforts would have long-term effects on the well-being and longevity of the elderly.

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