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Original Research Reports

Physical Disease and Resilient Outcomes: A Systematic Review of Resilience Definitions and Study Methods

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Background: Findings from physical disease resilience research may be used to develop approaches to reduce the burden of disease. However, there is no consensus on the definition and measurement of resilience in the context of physical disease. **Objective:** The aim was to summarize the range of definitions of physical disease resilience and the approaches taken to study it in studies examining physical disease and its relationship to resilient outcomes.

Methods: Electronic databases were searched from inception to March 2013 for studies in which physical disease was assessed for its association with resilient outcomes. Article screening, data extraction, and quality assessment were carried out independently by 2 reviewers, with disagreements being resolved by a third reviewer. The results were combined using a narrative technique.

Results: Of 2280 articles, 12 met the inclusion criteria. Of

these studies, 1 was of high quality, 9 were of moderate quality, and 2 were low quality. The common findings were that resilience involves maintaining healthy levels of functioning following adversity and that it is a dynamic process not a personality trait. Studies either assessed resilience based on observed outcomes or via resilience measurement scales. They either considered physical disease as an adversity leading to resilience or as a variable modifying the relationship between adversity and resilience. **Conclusion:** This work begins building consensus as to the approach to take when defining and measuring physical disease resilience. Resilience should be considered as a dynamic process that varies across the life-course and across different domains, therefore the choice of a resilience measure should reflect this.

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INTRODUCTION

Globally, the prevalence of disease is expected to rise as populations live longer, bringing greater costs to individuals and to health services.^{1,2} Consequently, there is a need to develop interventions and activities to reduce this burden of disease. Promoting resilience to physical disease may be one such approach. Resilience was defined in a recent review by Windle:

...the process of effectively negotiating, adapting to, or managing significant sources of stress or trauma.

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Assets and resources within the individual, their life and environment facilitate this capacity for adaptation and “bouncing back” in the face of adversity. Across the life course, the experience of resilience will vary.³

However, despite Windle's and others attempts to produce an agreed definition, there is no universally accepted definition of resilience.^{3–5} The variability in the definition of resilience used by studies of physical disease resilience was highlighted in a recent systematic review by Stewart and Yuen.⁶ This examined the factors associated with predicting or promoting resilience in the physically ill and found that a range of variables including social support, psychologic factors, and coping strategies were associated with resilience.

Resilience research stems from the developmental psychology field and much of it focuses on children.³ Although early life experiences affect resilient outcomes in later life, it is also apparent that research specifically focusing on physical disease and resilience is a more recent development in the resilience field.^{7,8} The wide variations in the way resilience is defined and operationalized in the physical disease literature are a barrier for those wishing to study resilience and may explain the lack of robust evidence-based resilience interventions for health.⁹

Better consensus regarding the definition and operationalization of resilience in relation to physical disease is an important step toward the development of interventions aiming to reduce the burden of physical disease. The aim of this systematic review was to summarize the definitions of physical disease resilience and the approaches taken to study resilience in studies examining physical disease and resilient outcomes.

METHOD

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses 2009 checklist was used to guide the method development and reporting of findings.¹⁰ MEDLINE, EMBASE, PsycINFO, PubMed, and the Cochrane database of systematic reviews were searched from inception to March 17, 2013. The search strategy was comparable across all databases. The following search terms were employed in EMBASE and MEDLINE:

*Resilien** (**Title word or abstract**) AND ((*Neoplasms OR Diabetes Mellitus OR Hypertension OR Kidney disease OR Asthma OR Chronic obstructive lung disease OR Cerebrovascular accident OR Stroke OR Cardiovascular disease OR Neurologic disease OR Nervous System Diseases OR Epilepsy OR Arthritis OR Communicable Diseases OR Chronic Disease OR Disease OR Acute Disease OR Aging*) (**MeSH terms**) OR *multimorbid** (**title, abstract**)).

Studies in which physical disease was assessed for its association with resilient outcomes were included. Peer-reviewed quantitative studies with 100 or more participants were eligible. The sample size restriction was applied for pragmatic reasons, as our early work demonstrated that studies of physical disease and resilient outcomes often involved complex analyses with multiple variables and that analyses with smaller populations were often underpowered. Studies examining only psychiatric disorders and resilience at a family or community level were excluded, as were studies not in the English language. The authors were contacted for studies that were not accessible.

Titles, abstracts, and full texts were screened independently by 2 reviewers (M. C. J. and T. P.) and any disagreement was resolved by a third reviewer (C. B.). The references of included articles were screened for relevance.

Primary data extraction was carried out by M. C. J. and T. P., with 3 others acting as independent second reviewers (C. D. B., A. E., and L. I.). The data extraction form was prepared by M. C. J. and finalized after discussion with the other reviewers. Data extraction included the study characteristics, the theoretical definition of resilience given by the authors, and the measures of resilience used. Any disagreement between the reviewers following this process was resolved by the third reviewer (C. B.). We used the Scottish Intercollegiate Guidelines Network critical appraisal checklists to assess the quality of included studies.¹¹ The quality of the study was not used as an exclusion criterion but as a guide to inform interpretation of the findings.

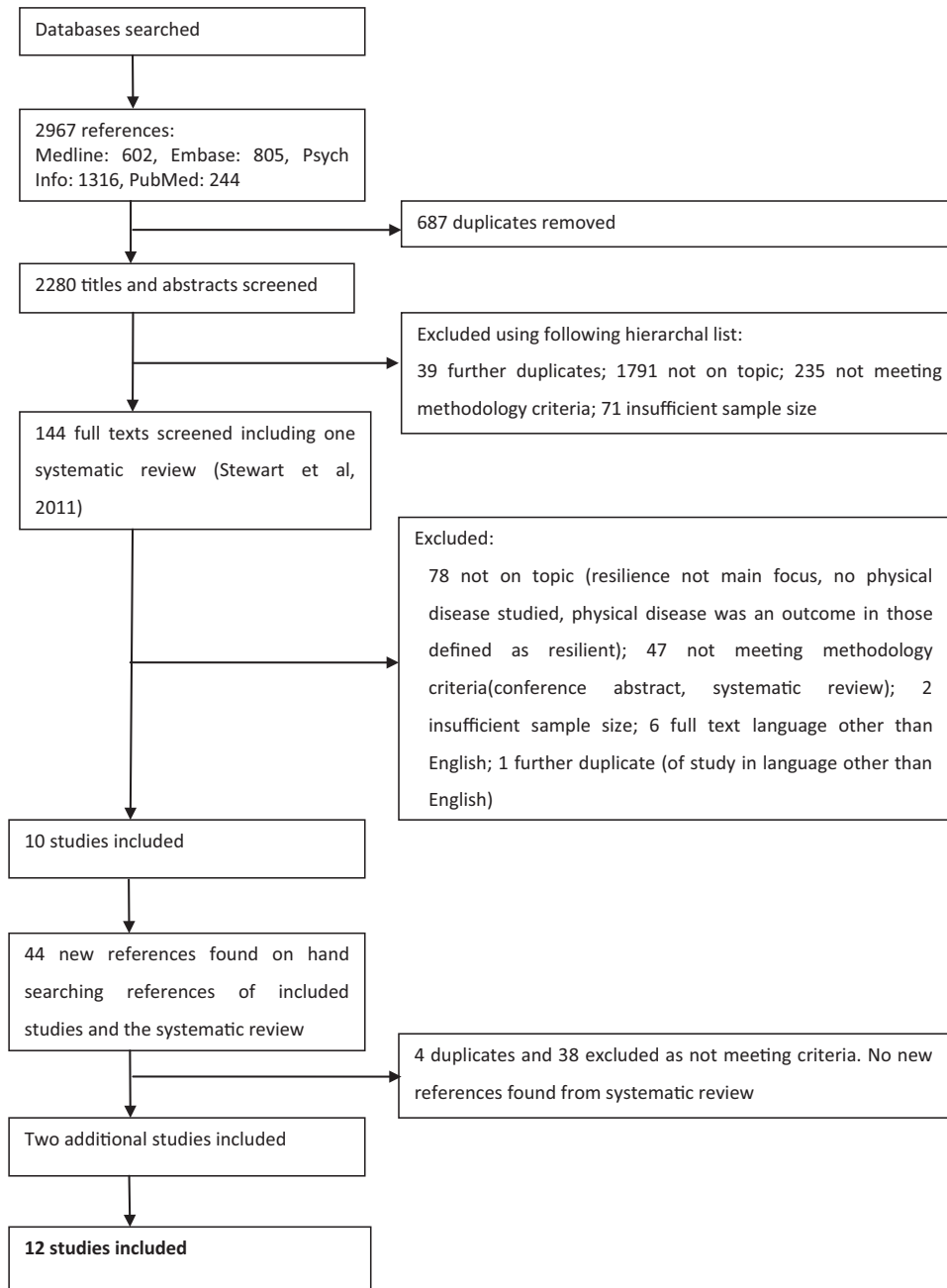
Owing to the heterogeneity of the studies and their findings, a meta-analysis was not carried out and the results were combined using a narrative technique.

RESULTS

Summary of Study Characteristics

Of 2280 articles, 12 met the study criteria (Figure).^{12–23} The study characteristics are reported in Table 1. Of

FIGURE. Flow Chart of Search Strategy.



these studies, 7 were cross-sectional and 5 were longitudinal; 6 were from North America, 4 were from Europe, and 2 were from Asia. The sample size at analysis ranged from 145–3347. The average age was 70 years or older for 5 of the studies.^{15–17,19,20} Of the 10 studies including both sexes, 8 had a greater proportion of women compared with men.^{12–14,16,17,19,20,23} Of the 7 studies reporting ethnicity, 5 had predominantly white

ethnicity.^{14–17,23} In addition, 1 study was of high quality,²² 9 were of moderate quality,^{12–18,20,21} and 2 were low quality.^{19,23}

There was complete agreement between the 2 reviewers for data regarding the theoretical definition of resilience and the resilience measurement. Arbitration by the third reviewer was required for the quality assessment in 5 studies. Hardy et al. (2004) analyzed a

TABLE 1. Baseline Characteristics of Included Studies

Study	Stated study aim	Study design	Study setting and location	Study population (follow-up if applicable)	Population characteristics: age, % F, ethnic group	Quality assessment
Bonanno et al. (2007) ¹²	The aim of the current study was to address this deficit [previous research too focussed on person-centred variables such as hardiness] by examining other factors that may inform resilience to PTEs, including demographics, social and material resources, and additional life stressors (Brewin, Andrews, & Valentine, 2000; Hobfoll, 1989, 2002) using the same large probability sample examined in the Bonanno et al. (2006) study.	Cross-sectional	Community; North America	2752	Age > 18 y; 54% F; mixed ethnicity	Moderate
Bonanno et al. (2008) ¹³	To examine trajectories of psychological functioning using latent class analysis on a sample of hospitalized survivors of the 2003 severe acute respiratory syndrome (SARS) epidemic in Hong Kong.	Longitudinal	Hospital; Hong Kong	Analysis on 890 with sufficient follow-up data	Mean age of 42 y; 61% F; ethnicity not reported	Moderate
Costanzo et al. ¹⁴	The primary objectives of the present study were to examine psychosocial impairment, resilience or thriving among cancer survivors in the general population by comparing them to individuals without a cancer history, with both evaluated longitudinally.	Longitudinal cohort nested in a larger follow-up survey	Community; North America	NR in detail, 1194 analyzed (0 lost to follow-up as retrospective design)	Mean age of 63 y; 63% F; predominantly white ethnicity	Moderate
Glymour et al. ¹⁵	Does not succinctly state aim. "We hypothesize that stroke survivors with more extensive social ties and greater emotional and instrumental social support immediately after stroke will experience greater improvements in cognitive function over 6 months of follow-up and achieve a higher level of cognitive functioning 6 months after stroke."	Longitudinal cohort based on unsuccessful randomised controlled trial	Hospital; North America	272 At baseline, 25 lost to follow-up	Mean age of 70 y; 49% F; predominantly white ethnicity	Moderate
Hardy et al. (2002) ¹⁶	The goals of the current study were to identify the life events that older persons experience as most stressful, to determine how often each type of event is identified as most stressful (particularly among those with a recent serious illness), to evaluate the perceived consequences of these events for the lives of older persons, and to evaluate the relationship between demographic factors and measures of health and functional status and these perceived consequences.	Cross-sectional	Community; North America	754	Median age of 78 y; 65% F; predominantly white	Moderate
Hardy et al. (2004) ¹⁷	To assess resilience of community-dwelling older persons using a new scale based on response to a stressful life event and to identify the demographic, clinical, functional, and psychosocial factors associated with high resilience.	Cross-sectional	Community North America	546 Analyzed of the 754 individuals available in the study (due to missing data)	All aged 70 y and more (38% older than 74 y); 64% F; predominantly white ethnicity	Moderate

TABLE 1. Continued

Study	Stated study aim	Study design	Study setting and location	Study population (follow-up if applicable)	Population characteristics: age, % F, ethnic group	Quality assessment
Lam et al. ¹⁸	Does not succinctly state aim. From background: "The distinct trajectories of psychological distress over the first year of the diagnosis with breast cancer and its determinants have not been explored."	Longitudinal	Hospital; China	405 Available at baseline and 285 without missing data over follow-up analyzed	Mean age of 51 y; 100% F; ethnicity not reported	Moderate
Lundman et al. ¹⁹	The aim of this study was to elucidate relationships among inner strength and objective physical status, diagnosed diseases, living arrangements, and self-reported social relationships in people aged 85 years and older.	Cross-sectional	Community; Europe	185	Age > 85 y; 64% F; ethnicity not reported	Low quality Resilience scale not validated, lack of information regarding sample selection, sample size small, and statistical analysis univariate
Perna et al. ²⁰	This study aims to investigate the association between resilience and health behaviours (such as physical activity and consumption of fruit and vegetables) in elderly individuals.	Cross-sectional	Community; Europe	3347	Median age of 72 y; 53% F; ethnicity not reported	Moderate
Scali et al. ²¹	This retrospective epidemiological study aims to evaluate resilience in a high-risk women sample... taking into account life-time history of trauma (distinguishing personal from non-personal events), socio-demographic characteristics and lifetime mental health.	Cross-sectional	Outpatients; Europe	238 Analyzed of 324 participating	Median age reported by resilience category: low (53), intermediate (54), and high (52); 100% F; ethnicity not reported	Moderate
Taylor et al. ²²	We explore the physical, psychological, and social factors associated with reporting a good QOL in the context of poor seizure control and socioeconomic disadvantage ("resilient" outcome) and the factors associated with reporting a poor QOL in the context of good seizure control and socioeconomic advantage ("vulnerable" outcome).	Longitudinal cohort based on RCT	Outpatients; UK	1611; analysis on 617 with sufficient follow-up data	Mean age of 38 y; 46% F; ethnicity not reported	High quality
Yi-Frazier et al. ²³	Whether coping may contribute to positive psychosocial resources such as resilience is unclear, although Rose et al. (2002) did find that those with higher self-efficacy and optimism showed more active coping behaviour. Our research aimed to expand on this finding by using a person-focused analysis to explore whether varying levels of resilience resources differentiated the coping profiles of patients with diabetes.	Cross-sectional	Community and hospital; North America	145	Median age of 49 y; 57% F, predominantly white	Low quality Lack of information regarding sample selection, use of a convenience sample introduces bias, and sample size is small

F = female; NR = not reported; PTE = potentially traumatic event; QOL = quality of life; RCT = randomized controlled trial.

subset of the population from a previous study¹⁶; however, both have been reported here as the study aims, exposures, and outcomes differed.¹⁷

Resilience Definitions

A theoretical definition of resilience was provided by 11 of 12 studies (Table 2).^{12–14,16–23} The following component parts of the definition were common to most studies:

- (1) An adversity must be experienced to demonstrate resilience (all studies).^{12–14,16–23}
- (2) Resilience is the ability to maintain healthy levels of function over time despite adversity or to return to normal function after adversity (8 of 11 studies).^{12–14,18–21,23}
- (3) Resilience is a dynamic concept as opposed to a fixed personality trait (10 of 11 studies).^{12–14,16–19,21–23}

All 11 studies described adversity in their theoretical definition. This is variously described as “adverse events” or “adversity,”^{14,16,17,19,22,23} “a potentially highly disruptive event,”^{12,13} “potential trauma,”¹⁸ “stressful situations,”²⁰ and “traumatic events.”²¹ Lundman *et al.* and Perna *et al.* did not identify an adversity in their study design, although they discussed it in their theoretical definitions of resilience.^{19,20}

Many studies referred to a previous work by Bonanno *et al.* and defined resilience as maintaining healthy levels of function over time despite adversity.^{12,13,18,21,23} Others similarly defined resilience as returning to normal function after adversity,¹⁴ retaining normal function,¹⁹ or adapting successfully to stressful situations.²⁰ In contrast to this, 2 studies included the concept of thriving under adversity,^{16,17} and the high-quality study by Taylor *et al.* defined resilience as unexpected positive outcomes in adverse conditions.²²

The study by Perna *et al.* was the only one that stated it was studying resilience as a protective personality factor. This was their justification for not including an adversity in their study design.²⁰ The remaining definitions treat resilience as a dynamic process, e.g., in 2 studies, Bonanno *et al.* described the ability to maintain stable functioning following adversity as evidencing resilience.^{12,13}

Resilience Measures

There were 2 approaches taken when measuring or identifying resilience in the included studies (Table 2):

- (1) Measuring it using a new or established “resilience scale.”^{16,17,19–21,23}
- (2) Identifying it based on outcomes observed in study participants.^{12–15,18,22}

Furthermore, 6 studies identified resilience using new^{17,19} or established resilience scales.^{16,20,21,23} In these studies, participants completed questionnaires from which scores indicating levels of resilience were derived. Most studies then defined categories of resilience on the basis of scores.^{17,20,21,23} For example, Scali *et al.* used an abridged form of the Connor-Davidson resilience scale, which was split into low, intermediate, and high resilience groups based on tertiles of scores.²¹

The remaining 6 studies identified resilience based on outcomes observed in study participants.^{12–15,18,22} For example, outcome categories for Bonanno *et al.* were based on the severity of the outcome, with the resilient group comprising those with the absence of or only one posttraumatic stress disorder symptom.¹² Costanzo *et al.* defined the resilient group as those in which there was no change in functioning before and after the adverse event.¹⁴ Furthermore, 2 studies examined how individuals responded psychologically to an adversity (severe acute respiratory syndrome¹⁰ and breast cancer¹⁵) and the way in which these responses changed over time. In these studies, the resilient group was defined as those who demonstrated high psychological functioning following the adversity that changed little over time.^{13,18}

The high-quality study by Taylor *et al.* identified resilience on the basis of better-than-expected outcomes following adversity rather than the maintenance of healthy levels of function over time. The study identified resilience in those who had experienced the adverse event (epilepsy) together with additional disadvantage (poor seizure control and socioeconomic disadvantage) while still maintaining a good outcome (good quality of life). The authors distinguished this from an “expected good” outcome (those who experienced epilepsy but no additional disadvantage and demonstrated good quality of life).²²

Summary of Study Approach

There were 2 general approaches taken in studying physical disease resilience when resilience was the

TABLE 2. Resilience Definitions and Resilience Measurement in all Included Studies

Study	Theoretical definition of resilience	Resilience measurement (resilience based on outcomes or measured using resilience scale/questionnaire)
Bonanno et al. (2007) ¹²	Bonanno (2004) defined adult resilience as “the ability of adults in otherwise normal circumstances who are exposed to an isolated and potentially highly disruptive event such as the death of a close relation or a violent or life-threatening situation to maintain relatively stable, healthy levels of psychological and physical functioning ... as well as the capacity for generative experiences and positive emotions. (pp. 20–21).”	Resilience based on outcomes. Outcome categories defined based on PTSD symptoms (assessed using the National Women's Study PTSD module) at 6 mo following September 11 terrorist attack. Three outcome categories: (1) <i>resilient</i> : 1 or 0 PTSD symptoms; (2) <i>mild-moderate trauma</i> : ≥ 2 PTSD symptoms; (3) <i>probable PTSD</i> : defined using standard Diagnostic and Statistical Manual of Mental Disorders criteria.
Bonanno et al. (2008) ¹³	Provided same definition as Bonanno, 2007 above.	Resilience based on outcomes. Psychologic functioning (MCS) was measured using the Short-Form 12 (SF-12). Authors defined their 4 trajectories of psychologic functioning identified by latent class growth curve analyses as: <ol style="list-style-type: none"> (1) <i>Resilient group</i>: high mean score for psychologic functioning on the SF-12 MCS that changed little over time (i.e., slope that was essentially zero). (2) <i>Chronic dysfunction group</i>: low mean SF-12 MCS score that changed little over time (i.e., slope that was essentially zero). (3) <i>Recovered group</i>: initial low mean SF-12 MCS score followed by steep positive increase/slope. (4) <i>Delayed dysfunction group</i>: initial high mean SF-12 MCS score followed by steep negative increase/slope. In defining these, they drew on previous work by Bonanno et al.
Costanzo et al. ¹⁴	O'Leary and Ickovics have proposed a model to describe three potential responses to adversity (O'Leary & Ickovics, 1995), which has been further elaborated by Carver (Carver, 1998). Following initial decline in functioning after adverse experience, Carver described survival with impairment as continuing compromised functioning, but he distinguished this pattern from resilience, defined as a return to normal or baseline functioning, which is then further distinguished from thriving, described as exceeding one's original level of functioning.	Resilience based on outcomes. Range of measures of “functioning” were compared before and after diagnosis: mental health, mood, psychologic well-being, social well-being, and spirituality/religiosity. Results were interpreted as follows: “Impairment indicates a decline, resilience indicates no change, and thriving indicates improvement in functioning from Wave 1 (prediagnosis) to Wave 2 (postdiagnosis).”
Glymour et al. ¹⁵	NR Implied definition of cognitive resilience is maintenance of cognitive function and absence of dementia.	Resilience based on outcomes. NR explicitly. Resilience appears to be based on improvement in cognitive function between day 17 (“baseline”) and 6 mo after stroke.
Hardy et al. (2002) ¹⁶	Resilience has been viewed as the process by which individuals survive or even thrive under adversity, incorporating both the internal traits, such as hardiness or high self-efficacy, and the external factors, such as social support, that promote coping.	Resilience measured using a resilience scale/questionnaire. Authors did not set out to measure resilience and instead interpret their findings using resilience theory in their discussion. Questions assessing the consequences of stressful life events were adapted from the Resilience Module of the Asset and Health Dynamics Among the Oldest Old study. Authors interpreted individuals who had positive responses to the negative event as responding “resiliently.”

Hardy et al. (2004) ¹⁷	Same text as Hardy 2002.	Resilience measured using a resilience scale/questionnaire. A new resilience scale was developed (authors do not specify if they developed this scale). This 6-item scale measured response to a stressful event. Three groups examined: low-, intermediate-, and high-level resilience groups based on tertiles of scores on resilience scale.
Lam et al. ¹⁸	“Resilience is considered to be the most common outcome following exposure to potential trauma. Bonanno (2005) proposed four distinct patterns of adjustment in response to potential trauma: (1) chronic disruption of normal functioning, (2) recovery with a relatively mild and short-lived disruption of functioning, (3) delayed disruption of functioning, and (4) resilience with little or no disruption of functioning.” References the same work as Bonanno, 2008 and therefore has a similar operationalized definition and the same resilience groups.	<ul style="list-style-type: none"> • Resilience based on outcomes. • Psychologic distress measured using Chinese Health Questionnaire (CHQ-12) at 4 time points (5 d, 1 mo, 4 mo, and 8 mo) after surgery for breast cancer. • Authors defined their 4 trajectories of psychologic distress identified by latent class growth curve analyses as: <ol style="list-style-type: none"> (1) <i>Resilient</i>: relatively stable levels of low distress across assessment points. (2) <i>Chronic distress</i>: stable high levels of distress at each measurement. (3) <i>Recovered</i>: initial elevated distress that gradually declined. (4) <i>Delayed recovery</i>: initially relatively low distress that elevated before reducing again.
Lundman et al. ¹⁹	Resilience has been referred to as a kind of plasticity that influences the ability to recover and achieve psychosocial balance after adverse experiences and as the ability to bounce back in the face of adversity. Resilience in older people has been described as the ability to achieve, retain, or regain physical or emotional health after illnesses or losses.	Resilience measured using a resilience scale/questionnaire. This study treated resilience as a component part of “inner strength.” Inner strength was a sum score created from factor analysis of 4 assessment scales—the Resilience Scale (Wagnild and Young), the Sense of Coherence Scale, Purpose in Life Scale, and the Self-Transcendence Scale.
Perna et al. ²⁰	Resilience is generally understood as the ability to adapt successfully to stressful situations (Luthar et al., 2000; Schumacher et al., 2004). In our study, resilience is conceptualized as protective personality factor, referring to the ability to adapt successfully to stressful experiences.	Resilience measured using a resilience scale/questionnaire. Used a short version of the resilience scale developed by Wagnild and Young. Groups defined based on the resilience score: resilient/high resilience = scores in upper third of scores; nonresilient/low resilience scores = scores in middle or lower third of scores.
Scali et al. ²¹	Resilience has been defined as the capacity of individuals to cope with traumatic events, namely the capacity to “maintain relatively stable, healthy levels of psychological and physical functioning as well as the capacity for generative experiences and positive emotions” (Bonanno, 2004).	Resilience measured using a resilience scale/questionnaire. Used the Connor-Davidson resilience scale CD-RISC 10, an abridgment of CD-RISC (a 25-item scale).
Taylor et al. ²²	Resilience can be conceptualized as the process of achieving unexpected positive outcomes in adverse conditions, as opposed to an individual trait.	Three groups examined: low-, intermediate-, and high-level resilience groups based on tertiles of scores. <ul style="list-style-type: none"> • Resilience based on outcomes. • Four groups identified based on seizure control and socioeconomic status: <ol style="list-style-type: none"> (1) Resilient = good QOL despite poor seizure control and socioeconomic disadvantage. (2) Vulnerable = poor QOL despite good seizure control and socioeconomic advantage. (3) Expected good = good QOL with good seizure control and socioeconomic advantage. (4) Expected poor = poor QOL with poor seizure control and socioeconomic disadvantage.

TABLE 2. Continued

Study	Theoretical definition of resilience	Resilience measurement (resilience based on outcomes or measured using resilience scale/questionnaire)
Yi-Frazier et al. ²³	<p>...resilience, defined as an individual's capacity to maintain psychological and physical well-being in the face of adversity, has flourished across many disciplines of psychology and health because of the rising popularity of positive psychology in these areas. Although sparsely studied in the diabetes population, in other areas of chronic illness and stress such as HIV+ men, survivors of violent trauma or battered women in shelters, resilience has been found to be associated with better emotional and physical health.</p>	<p>Resilience measured using a resilience scale/questionnaire. A resilience factor score was derived using 4 scales, used to measure: optimism, self-esteem, self-efficacy, and self-mastery. Three groups identified: low, moderate, and high resilience based on the lower, middle, and upper tertiles of the resilience factor score.</p>

NR = not reported; PTSD = posttraumatic stress disorder; QOL = quality of life.

outcome: physical disease may influence resilience either by being an adversity leading to resilience or a variable modifying the relationship between adversity and resilience (Table 3).

In 6 studies, the disease of interest was considered to be the “adverse event.”^{13-15,18,22,23} In 5 of these, all study participants were selected on the basis of having the physical disease being studied, and so these studies did not examine whether physical disease led to *increased* or *decreased* resilience.^{13,15,18,22,23} In the remaining study, Costanzo et al. compared cancer survivors with those without a cancer history.¹⁴ The study found cancer survivors had impairment relative to the comparison group in mental health, mood, and some aspects of psychologic well-being, but they showed resilient social well-being, spirituality, and personal growth.¹⁴

In the remaining 6 studies, physical disease was studied for its association with resilient outcomes in populations exposed to adverse events such as bereavement or illness. The nature of the physical diseases that was considered varied. More than 1 physical disease was included in 5 studies.^{12,16,17,19,20} Hardy et al. found no association between physical disease and resilience.^{16,17} The remaining 4 studies did find a statistically significant association, although the direction of this association varied.^{12,19-21} For example, Scali et al. found women scoring at an intermediary level of resilience were significantly more likely than those with low resilience to have been exposed to a recent breast cancer,²¹ whereas Perna et al. found a greater prevalence of “high resilience” in those *without* disease when compared to those with disease.²⁰

DISCUSSION

We systematically reviewed studies examining physical disease and its relationship to resilient outcomes to summarize the range of definitions of physical disease resilience and the approaches taken to study it.

Interpretation of Results

The component parts of the resilience definition shared by most studies were as follows: an adversity must be experienced to demonstrate resilience, resilience is the ability to maintain healthy levels of function over time despite adversity or to return to normal function after adversity, and resilience is a dynamic concept as opposed to a fixed personality trait. This is in agreement with

Windle's definition and also with others including those in the developmental, the psychobiology, and the neurobiology literature.^{3,8,24,25} This provides support for the fact that the definition of resilience in the context of physical disease is no different from when it is used in other contexts.

It is noteworthy that many studies of physical disease refer to resilience in terms of returning to or maintaining normal function.^{14,18,19,23} This implies a

resilient outcome need not necessarily be an exceptional outcome, particularly if function before the adverse event was not at a high level. Indeed, for those whose baseline functioning was low before the adverse event, the measurement of good function after the event may be evidence for thriving not resilience. Thriving is commonly defined as not solely returning to a normal level of function (as for resilience) but achieving a higher level of functioning.^{5,26} Therefore, the concept of

TABLE 3. Summary of Study Approach

Study	Physical disease adverse event	Effect of physical disease on resilience	
<i>Studies in which resilience is assessed in those exposed to a physical disease adversity</i>			
Bonanno et al. (2008) ¹³	SARS	All participants had disease.*	
Costanzo et al. ¹⁴	Any cancer except skin	Exposed group (cancer survivors) and nonexposed group. <ul style="list-style-type: none"> • Cancer survivors demonstrated impairment relative to the comparison group in mental health, mood, and some aspects of psychologic well-being. • Survivors exhibited resilient social well-being, spirituality, and personal growth. 	
Glymour et al. ¹⁵	Stroke	All participants had disease.*	
Lam et al. ¹⁸	Surgery for breast cancer	All participants had disease.*	
Taylor et al. ²²	Epilepsy	All participants had disease.*	
Yi-Frazier et al. ²³	Diabetes	All participants had disease.*	
Study	Adverse event population exposed to (if described)	Physical disease	Effect of physical disease on resilience
<i>Studies in which the physical disease and other variables are assessed for their association with resilience</i>			
Bonanno et al. (2007) ¹²	World Trade Centre September 11 terrorist attacks.	Physician-diagnosed chronic disease (exact nature not described)	Statistically significant association of lower resilience with increasing number chronic diseases.
Hardy et al. (2002) ¹⁶	Personal illness or injury, death of a family member or friend, illness or injury of a family member or friend, and nonmedical events.	13 Self-reported physician-diagnosed chronic conditions, dichotomised into ≥ 2 or < 2 .	Not associated with resilience.
Hardy et al. (2004) ¹⁷	As for Hardy, 2002.	As for Hardy, 2002.	Not associated with resilience.
Lundman et al. ¹⁹	Did not include.	Range of diseases considered.	Resilience included in inner strength score. Conditions significantly associated with inner strength: COPD, heart failure, and osteoporosis. Conditions not significantly associated: cerebrovascular disease and cataract.
Perna et al. ²⁰	None.	Disease (present/absent): diabetes mellitus, myocardial infarction, and stroke.	Higher prevalence of high resilience in those without disease compared with those with disease.
Scali et al. ²¹	Recent breast cancer, lifetime psychiatric diagnoses or lifetime traumatic event (included cancer disease, death of close relative and other life-threatening illness).	Breast cancer	Women scoring at an intermediary level of resilience were significantly more likely than those with low resilience to have been exposed to a recent breast cancer.

COPD = chronic obstructive pulmonary disease; SARS = severe acute respiratory syndrome.

* All selected on basis of having the disease, so no assessment of whether having it led to increased resilience.

thriving is different and its place in the resilience spectrum should be considered further and clarified.

There were 2 approaches to measuring or identifying resilience in the included studies: measuring it using a new or established “resilience scale” or identifying it based on outcomes observed in study participants. In all but 2 studies, resilience was measured at a single time point following the adversity.^{13,18} Given the consensus that resilience is a dynamic concept that varies across the life-course, it may be more appropriate to measure resilience at greater than one time point.^{3–5,8,12–14,16–19,21–23}

It would also seem reasonable that measured outcomes either encompass more than one life-course domain or that authors are clear that by measuring resilience using a single outcome only one domain of resilience is therefore being assessed. Of the studies examining outcomes, 3 used composite health indicators such as the short-form 12 questionnaire^{13,14,18} and 3 did not.^{12,15,22} Composite outcome measures may capture a wider spectrum of the resilient outcome, as may self-rated health measures, which are viewed as being reliable and valid measures of individual and population level health and have been found to be powerful predictors of future morbidity and mortality.^{27,28}

The characteristics of the resilience measurement scales were not well described by studies but all included a range of psychometric properties. A recent methodologic review of resilience measurement scales concluded that many were lacking conceptual adequacy by focusing on psychometric properties and failing to examine resilience across multiple levels.²⁹ This involved scales used by studies in this review, including the Wagnild and Young Resilience Scale^{19,20} and the Connor-Davidson resilience scale.^{12,15,18,21}

We found that physical disease may be considered as an adversity after which an individual may or may not demonstrate a resilient outcome. Our work also found that physical disease may act as a variable that promotes or reduces resilience following an adverse event. The promotion of resilience may be an example of a “steeling effect,” whereby a negative experience strengthens resilience to another stress.⁸ In addition to this, there was a large degree of variability between studies. The nature of the adversity experienced, the characteristics of the disease, the timing and the nature of the measurement of resilience, and the individual's sociocontextual and personality risk and protective factors are all likely to affect the resilient outcome.^{6–8}

Strengths and Limitations

There are few systematic reviews in the resilience literature and no previous reviews have summarized the literature surrounding the definition and measurement of resilience in studies of physical disease and resilient outcomes. Therefore, our review addresses an important research gap regarding how resilience is defined and measured in physical disease.

In the literature, the term “resilience” has been used interchangeably with psychological terms such as hardiness, mastery, and thriving.^{3,5,6} However, there is debate as to whether these terms represent component parts of resilience rather than being synonymous with resilience.³ Therefore, we did not include these concepts as search terms. However, we acknowledge that as many in the literature treat these terms as synonymous with resilience, we may have missed some potentially informative studies regarding the relationship between physical disease and resilience. We also only concentrated on those studies in which resilience was an outcome in those with physical disease and have not included studies in which physical disease is an outcome in those assessed to be resilient.

We applied fairly strict exclusion criteria to ensure that our results could be reported in an informative and useful manner. Despite our restrictions, there were still large differences across studies in study design and quality. As a result, the reviewers encountered challenges in reaching agreement in these areas. Of particular note, the inclusion of the study by Glymour et al. was subject to some debate owing to its focus on “cognitive resilience,” which is generally treated as a component part of cognitive reserve and thus could be seen as a more specialized form of resilience than our review in relation to physical disease aimed to cover.¹⁵

The sample size restriction was applied for pragmatic reasons as our early work demonstrated that studies of physical disease and resilient outcomes often involved complex analyses with multiple variables. Therefore, analyses of populations with fewer than 100 participants were often underpowered. This was further validated by the classification of the 2 studies with the smallest sample sizes in this review as being “low quality.” The limitation to adults only is reasonable, given that the burden of physical disease is known to increase with age.²

Owing to the differences across included studies, we were unable to carry out a meta-analysis; however, we have presented our results in a structured manner to assist interpretation.

Implications and Conclusion

The definitions of resilience used in these studies of physical disease and resilience broadly reflect the definition proposed by Windle, which supports its use by future researchers of physical disease resilience. Our results strongly suggest that resilience is a dynamic process rather than a personality trait, and therefore, it may be more appropriate to measure resilience longitudinally and using more than one outcome measure. It is unlikely to be feasible for researchers to examine the entire range of potential resilience outcomes across an individual's life-course in a single study. But there is at the very least, a need to be transparent about the form of resilience being measured in a particular study and a need to acknowledge the limitations of only measuring resilience at a single time point.

Disease prevalence is rising as our population ages and findings from physical disease resilience research

may be used to develop evidence-based approaches to promote resilience to reduce the burden of disease. Therefore, improving consensus regarding the definition and measurement of physical disease resilience is important, and this work begins to build this consensus by summarizing approaches taken by current researchers in the field.

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