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# CONSTRUCT VALIDITY OF NEGATIVE SYMPTOMS: AN EMPIRICAL AND CONCEPTUAL REVIEW

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**ABSTRACT.** *The construct validity of negative symptoms is reviewed, and findings on deficit negative symptoms are also incorporated. A valid negative symptom construct should: (a) have replicable relationships with observable phenomena and other constructs; (b) have good reliability, temporal stability, and homogeneity; and (c) predict prognosis and response to treatment, possess convergent and discriminant validity, and be useful to clinicians. Although a number of well-replicated findings provide support for the validity of the construct, modification is warranted. Specifically, the data suggest that there is a highly correlated set of negative symptoms, which includes flat affect, alogia, anhedonia, and avolition. Primary and enduring symptoms from this set have good predictive and discriminant validity and can be studied in the context of the deficit syndrome, as well as with current negative symptom rating scales. Future studies should examine whether deficit negative symptoms are better conceptualized as a dimension or a category, elucidate the relationship between deficit symptoms and additional clinical and behavioral variables (e.g., response to newer neuroleptic medications and diminished emotional responding), and explore differences between the pattern of correlates of deficit symptoms and those of the positive and thought disorder symptoms. © 1997 Elsevier Science Ltd*

Until recently, most schizophrenia research was focused on the more overtly psychotic or positive symptoms, such as delusions and hallucinations. In the past two decades, however, a substantial amount of research has focused on the negative symptoms. Although there is not complete consensus as to which symptoms comprise the negative "category," flat affect, poverty of speech (alogia), anhedonia, and avolition are commonly labeled as negative (e.g., Fenton & McGlashan, 1992; Silk & Tandon, 1991; Walker & Lewine, 1988).

The importance of negative symptoms is demonstrated by their relationships with other aspects of schizophrenia. For example, negative symptoms have been found to be related to structural brain abnormalities, cognitive impairment, poor response to

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antipsychotic medication, and poor prognosis (e.g., Bogerts, Falkai, Degreef, & Lieberman, 1991; Crow, 1985; Perlick, Mattis, Stastny, & Silverstein, 1992). Also, some researchers have hypothesized that negative symptoms might result from a pathophysiological process that differs from the processes producing other schizophrenia symptoms (e.g., Buchanan & Carpenter, 1994; Crow, 1985).

Recognizing that some negative symptoms often resemble features of medication side effects (e.g., akinesia), depression, anxiety, and paranoia, Carpenter and colleagues refined the construct of negative symptoms by distinguishing primary and secondary negative symptoms (e.g., Carpenter, 1991; Carpenter, Buchanan, & Kirkpatrick, 1991; Carpenter, Heinrichs, & Alphs, 1985; Carpenter, Heinrichs, & Wagman, 1988). The observable phenomena that constitute primary and secondary negative symptoms are the same (e.g., diminished facial expression, poverty of speech, etc.). However, secondary negative symptoms are related to medication side effects, depression, anxiety, or paranoia, whereas primary negative symptoms do not appear to be related to transient or episodic factors.

Distinguishing between primary and secondary negative symptoms is analogous to the standard clinical practice of distinguishing between delusions and hallucinations that are primary to schizophrenia versus those related to drug use, seizures, or another psychiatric disorder (Carpenter, Buchanan, Kirkpatrick, Thaker, & Tamminga, 1991; Carpenter, Buchanan, Kirkpatrick, Tamminga, & Wood, 1993). Surprisingly, the distinction between patients with primary and secondary negative symptoms is not routinely made in the clinical or research literature in schizophrenia. Nonetheless, the primary/secondary distinction is particularly crucial for studying negative symptoms because negative symptoms share many common features with akinesia, depression, paranoia, and anxiety, making differentation among these phenomena important. Also, most hypotheses about negative symptoms are undoubtedly referring to symptoms that are primary features of schizophrenia and not related to a secondary source (Carpenter, 1991).

Using the primary/secondary distinction as a guide, Carpenter et al. (1988) proposed the deficit syndrome concept. The deficit syndrome is comprised of primary negative symptoms that are also enduring over time. Based on Kraepelin's (1971) description of the avolitional process in schizophrenia, the symptoms that comprise the deficit syndrome include restricted affect, diminished emotional range, poverty of speech, curbing of interests, diminished sense of purpose, and diminished social drive (Carpenter et al., 1988).

At this point, it is important to clarify the similarities and differences among the terms negative symptoms, primary negative symptoms, secondary negative symptoms, deficit negative symptoms, and the deficit syndrome. Figure 1 illustrates how these different terms represent different levels of specificity, ranging from the more global (negative symptoms) to the more specific (deficit syndrome). In general, negative symptoms represent a reduction in a variety of different behaviors, including facial expression, speech, pleasurable activities, and goal-directed activity. The term *negative symptoms* does not imply anything about the presumed origin of the symptoms. At the next level, negative symptoms can be considered either primary or secondary. As noted above, secondary negative symptoms are believed to be secondary to other factors such as depression or medication side effects, whereas primary negative symptoms do not appear to be related to such factors. Further specificity is gained by making the distinction between primary — enduring (e.g., temporally stable for at least 1 year) and primary — nonenduring negative symptoms. Primary, enduring

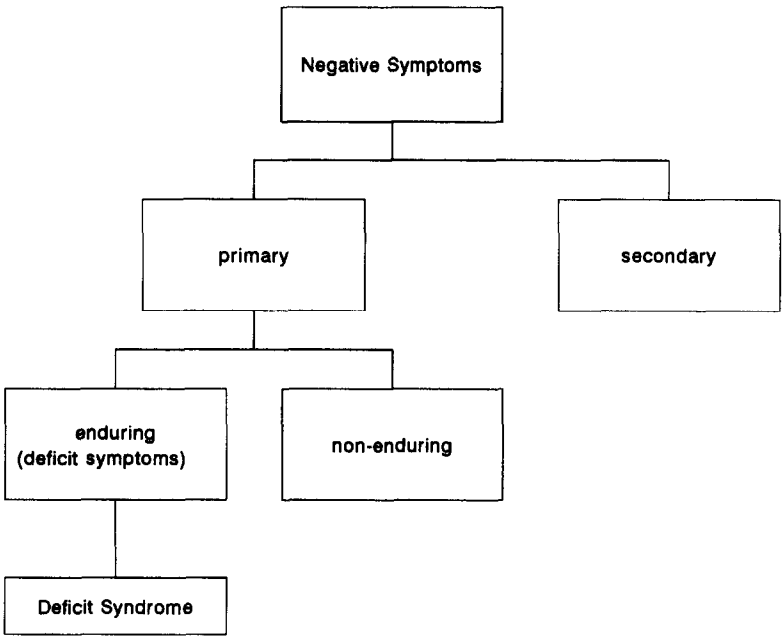


**FIGURE 1. A conceptual model of the levels of specificity for the negative symptom construct.**

negative symptoms are also called deficit symptoms. A further specification of deficit symptoms is the deficit syndrome. The deficit syndrome includes two or more of the six deficit symptoms that comprise the Schedule for the Deficit Syndrome (SDS; Kirkpatrick, Buchanan, McKinney, Alphs, & Carpenter, 1989). To illustrate the difference between deficit symptoms and the deficit syndrome, a schizophrenic patient who exhibited primary and enduring flat affect and diminished social drive (both of which are included in the SDS) would meet criteria for the deficit syndrome. However, a schizophrenic patient who exhibited primary and enduring symptoms of motor retardation and emotional withdrawal (neither of which is included in the SDS) would not meet criteria for the deficit syndrome, even though the symptoms would be considered deficit symptoms. Studies of the deficit syndrome typically compare patients who meet the SDS criteria for the deficit syndrome with those patients who do not. The patients who do not meet SDS criteria are broadly referred to as nondeficit patients. Specifically, a nondeficit group may include patients with no negative symptoms, patients with secondary negative symptoms, and patients with primary, nonenduring negative symptoms (Carpenter et al., 1988). To date, most research on negative symptoms has either been at the most global level of specificity (negative symptoms) or on the deficit syndrome.

Previous reviews of the validity of negative symptoms (e.g., Barnes & Liddle, 1990; Pogue-Geile & Zubin, 1988; Walker & Lewine, 1988) have not included studies that have distinguished primary/secondary or enduring/nonenduring negative symptoms. However, failure to make these distinctions may account for some of the inconsistencies in the literature. For example, there have been equivocal findings on negative symptoms' temporal stability and overlap with depression. As noted above, however, deficit negative symptoms are likely temporally stable and distinct from

depression, whereas nondeficit (i.e., secondary or nonenduring) negative symptoms are likely less stable over time and may overlap with depression. In addition, previous reviews of negative symptoms predated more recent studies addressing the neurobiological and neuropsychological correlates of negative symptoms. The goal of the present paper therefore is to review the validity of the global, negative symptom construct, while also incorporating more recent findings on the deficit syndrome and/or deficit symptoms. In addition, a number of more recent studies relevant to the validity of negative symptoms will be included.

The review will be guided by Skinner's (1981) framework for evaluating the construct validity of psychiatric classifications. Although negative symptoms are not a psychiatric classification per se, the Skinner framework provides a coherent organizational scheme to evaluate the construct validity of negative symptoms, which are often used as psychiatric classifications. In this scheme, construct validation is comprised of three stages: theory formulation, internal validation, and external validation. Applied to negative symptoms, a valid construct should: (a) have replicable relationships with observable phenomena and other constructs (theory formulation); (b) have good reliability and temporal stability (internal validity); and (c) predict prognosis and response to treatment, possess convergent and discriminant validity, and be useful to clinicians (external validity).

## THEORY FORMULATION

### *Definitional Issues*

The negative symptom construct is typically operationalized by the items on one of several different negative symptom rating scales (Abrams & Taylor, 1978; Andreasen, 1982; Iager, Kirch, & Wyatt, 1985; Kay, Fiszbein, & Opler, 1987; Krawiecka, Goldberg, & Vaughan, 1977; Overall & Gorham, 1962; Pogue-Geile & Harrow, 1984). As shown in Table 1, however, there is disagreement over which symptoms should be called negative (Fenton & McGlashan, 1992; Pogue-Geile & Zubin, 1988; Silk & Tandon, 1991; Walker & Lewine, 1988). Also, the rating scales differ on how individual negative symptoms are defined and on whether they use total, subscale, or individual negative symptom scores. The symptoms most commonly included in these rating scales include flat affect, alogia, anhedonia, and avolition.

Differences in the operational definitions of the negative symptom construct likely account for some of the inconsistencies in the empirical literature on negative symptoms (Fenton & McGlashan, 1992; Pogue-Geile & Zubin, 1988; Silk & Tandon, 1991; Sommers, 1985). That is, one operationalization of negative symptoms may be more strongly associated with a given variable than another operationalization of negative symptoms. Indeed, consistent operationalizations of negative symptoms would enable more straightforward interpretations of findings across studies. In addition, as we will argue below, consideration of the primary/secondary and enduring/nonenduring distinctions when operationalizing negative symptoms would also likely resolve some ambiguities in the literature.

The negative symptom construct is largely descriptive in that it is focused on observing and rating the severity of symptoms rather than the underlying etiology of these symptoms. While individual negative symptoms are typically rated along a dimension of severity, some negative symptom rating scales also provide guidelines for categorizing individuals into negative or positive subgroups (Andreasen, 1982; Kay, Opler, & Fiszbein, 1992; Pogue-Geile & Harrow, 1984). Empirical findings suggest,

**TABLE 1. Commonly Used Negative Symptom Rating Scales**

| | Scale | | | | |
|---|---|---|---|---|---|
| Symptom | SANS | BPRS | PANSS | KMS | SEB |
| Flat Affect | X | X | X | X | X |
| Alogia | X | | X | X | X |
| Emotional WD | X | X | X | | X |
| Avolition | X | | X | | X |
| Anhedonia | X | | X | | X |
| Asociality | X | | X | | X |
| Motor Ret. | X | X | | X | |
| Poor Rapport | X | | X | | X |
| Inapp. Affect | X | | | X | X |
| Poverty of Content | X | | | | |
| Attention Imp. | X | | | | |

*Note.* Emotional WD = Emotional withdrawal. Motor ret. = Motor retardation. Inapp. affect = Inappropriate affect. Poverty of content = Poverty of content of speech. Attention imp. = Attentional impairment. SANS = Scale for the Assessment of Negative Symptoms. BPRS = Brief Psychiatric Rating Scale. PANSS = Positive and Negative Syndrome Scale. KMS = Krawiecka-Manchester Scale. SEB = Scale for Emotional Blunting.

however, that the negative symptom construct is probably better conceptualized as a dimension rather than a discrete category (Pogue-Geile & Keshavan, 1991). By contrast, the deficit syndrome is considered to be a category, although it remains an empirical question as to whether deficit symptoms are better represented categorically or dimensionally.

### *Relationships to Other Observable Phenomena*

***Premorbid functioning.*** Several studies have found that negative symptoms are associated with poor premorbid social, occupational, or sexual functioning (Addington & Addington, 1993; Breier, Schreiber, Dyer, & Pickar, 1992; deLeon, Peralta, & Cuesta, 1993; Fenton & McGlashan, 1991; Gupta, Rajaprabhakaran, Arndt, Flaum, & Andreasen, 1995; Levitt, Shenton, McCarley, Faux, & Ludwig, 1994; Peralta, Cuesta, & deLeon, 1995; Pogue-Geile & Harrow, 1985). Operationalizing premorbid functioning as educational level, some studies have found that more severe negative symptoms are associated with lower educational levels (deLeon et al., 1993; Johnstone, Owens, Gold, Crow, & Macmillan, 1981; Kay, Opler, & Fiszbein, 1986a; Peralta et al., 1995; Pogue-Geile & Harrow, 1984), whereas others have not (Green & Walker, 1985; Liddle, 1987a; Owens & Johnstone, 1980). Although different rating scales and patients of varying chronicity (i.e., duration of illness) were used in these studies, these factors alone cannot account for the inconsistent findings. That is, these factors did not systematically differ between studies that did and did not support the relationship between negative symptoms and educational level (Pogue-Geile & Zubin, 1988).

Although the deficit/nondeficit distinction was not made in any of the studies mentioned above, other studies have found that patients with the deficit syndrome have poorer premorbid social, sexual, and scholastic functioning than patients with

nondeficit symptoms (Buchanan, Kirkpatrick, Heinrichs, & Carpenter, 1990; Mayerhoff et al., 1994). Also, deficit patients have been found to exhibit more severe negative symptoms at first hospitalization than nondeficit patients (Fenton & McGlashan, 1994). These findings suggest that negative symptoms are present early in the illness for deficit patients and may be concurrent with poor functioning. In sum, the deficit syndrome may bear a particularly strong relation to poor premorbid functioning.

In addition to being related to total scores on negative symptom scales, poor premorbid functioning has also been linked to individual negative symptoms. For example, flat affect and poverty of speech have been found to be related to deterioration of social functioning in early adolescence, whereas attentional impairment and poverty of content of speech have been related to poor childhood school performance (Mukherjee, Reddy, & Schnur, 1991). In addition, flat affect and poverty of speech have been found to be more strongly related to poor premorbid functioning than other negative symptoms (deLeon et al., 1993).

***Neurotransmitters.*** Early theories differed in their views of the relationship between dopamine and negative symptoms. For example, Crow (1980, 1985) theorized that negative symptoms were the product of a structural brain abnormality and were not related to dopamine activity. By contrast, Mackay (1980) postulated that negative symptoms were the result of decreased dopaminergic activity.

Since the formulation of these early theories, several empirical studies have explored the relationship between negative symptoms and levels of the dopamine metabolite homovanillic acid (HVA). In some studies, low cerebrospinal (CSF) HVA levels have been associated with more severe negative symptoms (Lindstrom, 1985; Pickar et al., 1990; van Kammen, van Kammen, Mann, Seppala, & Linnoila, 1986). A significant source of this CSF HVA may be the frontal cortex (Berman & Weinberger, 1991; Pickar et al., 1990). Interestingly, Weinberger (1987) has proposed that decreased prefrontal dopamine activity may lead to negative symptoms, whereas increased subcortical dopamine activity may lead to positive symptoms. Indeed, positive symptoms have been associated with high plasma HVA levels, which may in part reflect subcortical dopamine activity (e.g., Davidson & Davis, 1988; Pickar et al., 1986, 1990).

Other neurotransmitters have also been implicated in the etiology of negative symptoms. For example, increased cholinergic activity may be associated with negative symptoms (Tandon & Greden, 1991a). Also, increased noradrenergic activity has been found to be associated with negative symptoms in relapsed patients, whereas decreased noradrenergic activity has been found to be linked to negative symptoms in clinically stable patients (van Kammen et al., 1991).

***Brain metabolism.*** A number of positron emission tomography (PET) studies examining brain metabolic rates have found decreased frontal lobe activity (hypofrontality) in schizophrenic patients (e.g., Andreasen et al., 1992; Buchsbaum, 1990). In addition, it has been noted that frontal lesions in animals produce social withdrawal and other emotional deficits, while similar lesions in humans can produce negative symptom type behaviors (Wolkin et al., 1992). Therefore, several studies have attempted to determine whether hypofrontality is related to negative symptoms.

A number of PET studies have found that negative symptoms are indeed associated with decreased frontal metabolism (Schroder, Buchsbaum, Siegel, Geider, & Niethammer, 1995; Siegel et al., 1993; Volkow et al., 1987; Wolkin et al., 1992). Also, studies

using single-photon emission computed tomography (SPECT) have found decreased frontal blood flow to be associated with negative symptoms (Andreasen et al., 1992; Lewis et al., 1992). However, negative symptoms have also been linked to decreased metabolism of other brain areas, such as parietal and temporal cortex and the thalamus (Siegel et al., 1993; Volkow et al., 1987). Similarly, patients with the deficit syndrome have been found to have lower metabolic rates in the frontal and parietal cortex and the thalamus compared to nondeficit patients (Tamminga et al., 1992). In sum, negative symptoms have been linked to decreased metabolism of a number of different brain regions, but the evidence appears to be most robust for frontal cortex. The frontal cortex seems to play a particularly important role in emotional and motivational processes that are disrupted in patients with negative symptoms.

***Structural brain abnormalities.*** Negative symptoms have been linked to structural abnormalities in a number of brain regions, including, for example, the amygdala and the frontal lobe (e.g., Bogerts et al., 1991; Levin, 1984). Also, some studies have found that schizophrenic patients with more severe negative symptoms have enlarged lateral or third ventricles (e.g., Andreasen et al., 1990; Andreasen & Olsen, 1982; Kemali et al., 1987; Klausner, Sweeney, Deck, Haas, & Kelly, 1992; Williams, Reveley, Kolakowska, Ardern, & Mandelbrote, 1985), whereas others have not (e.g., Besson, Corrigan, Cherryman, & Smith, 1987; Kelip et al., 1988; Losonczy et al., 1986; Pearlson et al., 1989; Pfefferbaum et al., 1988).

These inconsistent findings might be explained in a number of ways. First, ventricular enlargement may actually covary more strongly with other third variable phenomena (e.g., impairment on various cognitive tests) that often coexist with negative symptoms (Andreasen, 1989; Andreasen, Olsen, Dennert, & Smith, 1982; Kelip et al., 1988; Kemali et al., 1987). Second, Losonczy et al. (1986) noted that the studies finding a relationship between negative symptoms and enlarged ventricles have generally used medicated patients. They suggested that the apparent negative symptoms in some medicated patients may have been medication side effects that resembled negative symptoms (e.g., akinesia). Thus, the observed relationship might be one between, for example, akinesia and enlarged ventricles. However, Nibuya et al. (1995) found that patients with the deficit syndrome, whose negative symptoms do not appear to be secondary to medication side effects, had larger lateral and third ventricles than nondeficit patients. These studies highlight the importance of distinguishing primary from secondary negative symptoms.

***Neuropsychological performance.*** Consistent with the findings on brain metabolism and structural abnormalities, negative symptoms have been found to be associated with poor performance on neuropsychological tests designed to assess frontal lobe function (Bilder & Goldberg, 1987; Breier, Schreiber, Dyer, & Pickar, 1991; Brown & White, 1991; Perlick et al., 1992), as well as on general cognitive tests, such as attention, memory, and nonverbal recognition tasks (Mayer, Alpert, Stastny, Perlick, & Empfield, 1985; Morrison-Stewart et al., 1992; Perlick et al., 1992; Wolkin et al., 1992). Similarly, compared to nondeficit patients, patients with the deficit syndrome have been found to perform more poorly on a variety of neuropsychological tests, including tests designed to assess frontal and parietal lobe functioning (Buchanan et al., 1990, 1994; Wagman, Heinrichs, & Carpenter, 1987). However, other phenomena that may cooccur with negative symptoms, such as movement disorder or thought disorder, are also associated with cognitive impairment and thus may account for some of the

observed relationships between negative symptoms and neuropsychological test performance (Bilder, Mukherjee, Rieder, & Pandurangi, 1985; Brown & White, 1991). Indeed, both positive and thought disorder symptoms have been linked to poor performance on a wide variety of neuropsychological tests (Bilder & Goldberg, 1987; Bilder et al., 1985; Liddle, 1987a; Morrison-Stewart et al., 1992).

***Summary.*** Several general conclusions can be drawn about the theory formulation of the negative symptom construct. First, operationalizations of the negative symptom construct are quite variable and can make comparisons across studies difficult. Second, negative symptoms are probably best conceptualized as a descriptive, dimensional construct. Third, negative symptoms have been linked to a number of other phenomena, such as poor premorbid functioning, dysfunction of neurotransmitter systems, decreased metabolism and blood flow in a number of different brain regions, enlarged ventricles, and poor performance on neuropsychological tests. However, some of these phenomena, such as dysfunction of neurotransmitter systems and poor performance on neuropsychological tests, are also related to the positive and thought disorder symptoms of schizophrenia. Interestingly, the deficit syndrome may have a particularly strong relationship to premorbid social, sexual, and occupational functioning and certain structural brain abnormalities.

## INTERNAL VALIDATION

### *Factor Analyses*

To support the internal validity of negative symptoms, factor analysis of symptom ratings is often conducted. Factor analysis also helps to refine the operational definition of the construct and helps to determine whether negative symptoms represent a distinct factor of schizophrenia symptomatology. Several exploratory factor analysis (EFA) studies have found that three orthogonal factors best describe the data, commonly labeled negative, positive, and thought disorder/disorganization (e.g., Andreasen, Arndt, Alliger, Miller, & Flaum, 1995; Andreasen, Arndt, Miller, Flaum, & Nopoulos, 1995; Arndt, Alliger, & Andreasen, 1991; Arndt, Andreasen, Flaum, Miller, & Nopoulos, 1995; Bilder et al., 1985; Liddle, 1987b; Liddle & Barnes, 1990; Malla, Norman, Williamson, Cortese, & Diaz, 1993a; Thompson & Meltzer, 1993). Also, many of these same studies have found that two symptoms often considered negative, inappropriate affect and poverty of content of speech, seem to be more related to the disorganization factor than to the negative factor (Andreasen, Arndt, Alliger et al., 1995; Andreasen, Arndt, Miller et al., 1995; Liddle, 1987b; Liddle & Barnes, 1990; Malla et al., 1993a; Thompson & Meltzer, 1993). In addition, attentional impairment has strong loadings on both negative and disorganization factors (Andreasen, Arndt, Alliger, et al., 1995; Andreasen, Arndt, Miller, et al. 1995; Arndt et al., 1991; Bilder et al., 1985; Malla et al., 1993a; Peralta, deLeon, & Cuesta, 1992), thus it is unclear whether this symptom fits better within the negative or disorganization factor.

Confirmatory factor analysis (CFA) studies have found that although a two-dimensional model (Crow, 1980: negative and positive symptoms are uncorrelated) fits the data better than either a bipolar model (Andreasen & Olsen, 1982: negative and positive symptoms are negatively correlated) or a severity/liability model (Gottesman, McGuffin, & Farmer, 1987: negative and positive symptoms are positively correlated), models with more than two factors fit the data even better (Brekke, DeBonis, & Graham, 1994; Cuesta & Peralta, 1995; Lenzenweger, Dworkin, & Weth-

ington, 1989; Smith, Mar, & Turoff, 1994). In sum, both EFA and CFA studies have found that: (a) three distinct factors (negative, positive, and disorganization) most likely underlie the structure of schizophrenia symptomatology; (b) two-dimensional models (positive and negative) of schizophrenia symptomatology may be an oversimplification; and (c) positive, negative, and thought disorder symptoms are independent phenomena.

Additional support for the independence of negative, positive, and thought disorder/disorganization symptoms comes from studies that have examined zero-order correlations between the symptoms. Although a few studies have found that positive and negative symptoms are negatively correlated (Andreasen & Olsen, 1982) or positively correlated (Kay et al., 1987), the majority of studies have found that positive and negative symptoms are uncorrelated (e.g., Johnstone et al., 1981; Kelip et al., 1988; Lewine, Fogg, & Meltzer, 1983; Lindenmayer, Kay, & Friedman, 1986; Losonczy et al., 1986; McKenna, Lund, & Mortimer, 1989; Pogue-Geile & Harrow, 1984). Similarly, negative symptoms have been found to be uncorrelated with thought disorder symptoms (e.g., Andreasen, Arndt, Alliger, et al., 1995; Bilder et al., 1985; Gur et al., 1991). While Bilder et al. (1985) found thought disorder to be positively correlated with alogia and attentional impairment, as noted above attentional impairment does not clearly fit into the negative symptom factor. Additionally, one of the components of the alogia scale used by Bilder et al., poverty of content of speech, fits better with the disorganization factor and may explain the positive relationship between alogia and thought disorder. Similarly, studies on the deficit syndrome have found that patients with the deficit syndrome and nondeficit patients do not differ in severity of positive and thought disorder symptoms, suggesting that the deficit/nondeficit distinction is uncorrelated with positive and thought disorder symptoms (Carpenter et al., 1988; Gur et al., 1991; Ribeyre et al., 1994; Tamminga et al., 1992; Wagman et al., 1987).

***Reliability*** Negative symptom rating scales, as well as their individual symptom subscales, have been found to have moderate to good internal consistency (e.g., Andreasen & Olsen, 1982; Brown & White, 1991; Goldman, Tandon, Liberzon, Goodson, & Greden, 1991; Gur et al., 1991; Kay, Fiszbein, Lindenmayer, & Opler, 1986b; Mueser, Sayers, Schooler, Mance, & Haas, 1994; Peralta et al., 1995; Pogue-Geile & Harrow, 1984, 1985; Stolar, Berenbaum, Banich, & Barch, 1994). In addition, negative symptom scales and their subscales have been found to have moderate to high levels of interrater reliability (e.g., Blanchard, Kring, & Neale, 1994; deLeon et al., 1993; Iager et al., 1985; Kay, Opler, & Lindenmayer, 1989; Kirkpatrick et al., 1989; Kring, Alpert, Neale, & Harvey, 1994; Lewine, 1990; Lewine et al., 1983; Mueser et al., 1994; Pearlson et al., 1989; Peralta et al., 1995; Ragin, Pogue-Geile, & Oltmanns, 1989). Similarly, the Schedule for the Deficit Syndrome has been found to have good internal consistency and interrater reliability (e.g., Fenton & McGlashan, 1994; Kirkpatrick et al., 1989).

### *Temporal stability*

A number of studies have found that negative symptoms are chronic features of schizophrenia (e.g., Fenton & McGlashan, 1991; Knight, Roff, Barnett, & Moss, 1979; Marneros, Rohde, & Diester, 1995; Pfohl & Winokur, 1982), which suggests that they should be stable over time. Temporal stability is typically examined by correlating negative symptoms assessed at two different time periods. Conclusions about stability

generally seem to be dependent upon whether the patients are assessed during a continuous inpatient or outpatient period or across an inpatient/post-hospitalization period. That is, negative symptoms seem to be stable across a post-hospitalization period (Biehl, Maurer, Schubert, Krumm, & Jung, 1986; Malla, Norman, & Williamson, 1993b; Pogue-Geile, 1989; Pogue-Geile & Harrow, 1985), as well as across a period of continuous hospitalization (Goldman et al., 1991; Johnstone, Owens, Frith, & Crow, 1986; Kay et al., 1989; Kay & Singh, 1989). In contrast, most studies have found negative symptoms to be unstable across an inpatient/post-hospitalization period (Lindenmayer et al., 1986; Pogue-Geile, 1989; Ragin et al., 1989, but see Arndt et al., 1995).

These inconsistent findings highlight the importance of distinguishing deficit from nondeficit negative symptoms. In some cases, the symptoms manifested across an inpatient/post-hospitalization period might be secondary negative symptoms, perhaps attributable to severe positive symptoms. In this scenario, improvement in positive symptoms would lead to a simultaneous improvement in the secondary symptoms and to hospital discharge. By contrast, the negative symptoms that persist across an extended and continuous inpatient or outpatient period are perhaps more likely to be deficit symptoms, but careful assessment of secondary sources of negative symptoms is necessary before this conclusion can be reached (Lieberman, 1995). Consistent with this notion, studies that have made the deficit/nondeficit distinction have found the symptoms comprising the deficit syndrome to be stable over time (Carpenter et al., 1988; Fenton & McGlashan, 1992; Kirkpatrick, Buchanan, Breier, & Carpenter, 1993; Wagman et al., 1987).

### *Summary*

Negative symptoms represent a distinct and independent factor underlying the structure of schizophrenia symptomatology (the other two likely being positive and disorganization symptoms). In addition, the negative symptom construct has good reliability (i.e., internal consistency and interrater reliability). Much of the research examining the temporal stability of negative symptoms suggests that they are not invariant, but are dependent upon the individual's inpatient/outpatient status. However, these discrepancies may result from the failure to distinguish deficit and nondeficit negative symptoms.

## EXTERNAL VALIDATION

### *Predictive validity*

Many studies have found that the severity and/or stability of negative symptoms is predictive of later poor social, work, or global functioning (e.g., Biehl et al., 1986; Breier et al., 1991; Fenton & McGlashan, 1991; Husted, Beiser, & Iacono, 1992; Pogue-Geile & Harrow, 1985). However, other studies have found that initial high severity of negative symptoms is associated with later good functioning (Lindenmayer et al., 1986; Prudo & Blum, 1987).

One reason for the inconsistencies may be that these studies used a variety of different negative symptom rating scales. Also, most of these studies did not differentiate between deficit and nondeficit symptoms. As the studies that found an association between negative symptoms and later poor functioning also found that the negative symptoms were temporally stable across the assessment period (Biehl et al.,

1986; Breier et al., 1991; Fenton & McGlashan, 1991; Husted et al., 1992; Pogue-Geile & Harrow, 1985), these studies may have been looking at deficit symptoms. However, in the studies that did not find an association between negative symptoms and poor functioning, the negative symptoms were temporally unstable (Lindenmayer et al., 1986; Prudo & Blum, 1987), suggesting that they may have been nondeficit symptoms. Consistent with this notion, in studies that have made the deficit/nondeficit distinction, patients with the deficit syndrome have been found to have a poorer prognosis than patients with nondeficit symptoms (Carpenter et al., 1988; Fenton & McGlashan, 1992, 1994; Mayerhoff et al., 1994). In sum, deficit negative symptoms may be a particularly good predictor of later poor functioning.

It is important to note at this point that the ability of negative symptoms to predict prognosis has been questioned on theoretical grounds. Specifically, some of the same elements are components of both symptom and outcome measures (e.g., social functioning), and thus it is not altogether surprising that scores on negative symptom scales would be correlated with prognosis (Mayerhoff et al., 1994). However, there are reasons to believe that at least some negative symptoms still bear a unique relationship to poor prognosis. For example, definitions of flat affect do not contain a social functioning component, and flat affect has been found to have a particularly strong relationship with poor prognosis (Carpenter, Bartko, Strauss, & Hawk, 1979; Endicott, Nee, Cohen, Fleiss, & Simon, 1986; Knight et al., 1979). Also, social functioning is not a component of the deficit syndrome, and patients who meet these criteria seem to have a poorer prognosis.

Another component of predictive validity is the usefulness of negative symptoms in predicting response to antipsychotic medication. Some studies have found that negative symptoms are responsive to medication (e.g., Breier et al., 1987; Kane, Honigfeld, Singer, & Meltzer, 1988; Meltzer, 1991; National Institute of Mental Health, 1964), whereas others have not (e.g., Angrist, Rotrosen, & Gershon, 1980; Earnst et al., 1996; Johnstone, Frith, Crow, Carney, & Price, 1978).

A few factors may account for the inconsistencies. First, these studies often examined different negative symptoms, and some negative symptoms may be more treatment resistant than others. Indeed, flat affect seems to be particularly unresponsive to treatment (e.g., Angrist et al., 1980; Earnst et al., 1996; Johnstone et al., 1978; Meltzer, 1991). Second, these studies did not differentiate between deficit and nondeficit negative symptoms. The response of deficit symptoms or the deficit syndrome to medication has not yet been sufficiently tested, but it seems that the deficit syndrome may be particularly unresponsive to medication (Breier et al., 1994; Conley, Gounaris, & Tamminga, 1994). By contrast, negative symptoms resulting from sources secondary to schizophrenia are often quite responsive to treatment (Carpenter et al., 1985).

### *Convergent and Discriminant validity*

To demonstrate convergent validity, correlations among negative symptom rating scales should be high. Indeed, several studies have found that negative symptom scales are significantly correlated with one another, even though they often contain different items (Breier et al., 1987; deLeon et al., 1993; Fenton & McGlashan, 1992; Gur et al., 1991; Iager et al., 1985; Kay et al., 1989; Kring et al., 1994; Kuck, Zisook, Moranville, Heaton, & Braff, 1992; Peralta et al., 1995). Also, the concordance between the deficit syndrome and categorical definitions of negative symptoms subgroups has been found to be fairly high (Fenton & McGlashan, 1992). These high correlations between

different rating scales may be a result of high correlations among the various negative symptoms (Fenton & McGlashan, 1991, 1992). That is, patients with one negative symptom are likely to have several other negative symptoms, and thus would tend to have similar scores on scales covering differing numbers of negative symptoms.

Many studies also support the discriminant validity of negative symptoms by finding nonsignificant correlations between negative symptom and depression scales (Addington, Addington, Maticka-Tyndale, 1993; Brekke et al., 1994; Craig, Richardson, Pass, & Bregman, 1985; House, Bostock, & Cooper, 1987; Iager et al., 1985; Kuck et al., 1992; Kulhara et al., 1989; Lewine et al., 1983; McKenna et al., 1989; Prosser et al., 1987). However, other studies have found significant correlations between negative symptom and depression scales (Craig et al., 1985; Lindenmayer & Kay, 1989; McKenna et al., 1989; Prosser et al., 1987). In most instances, the significant correlations were found between negative symptoms and vegetative symptoms of depression, such as motor retardation (Craig et al., 1985; Kulhara et al., 1989; Prosser et al., 1987). In contrast, cognitive features of depression, such as depressed mood, suicidal ideation, and guilt, do not appear to be correlated with negative symptoms (Prosser et al., 1987). One of the presumed sources of secondary negative symptoms is depression, which may also account for some of the overlap between depression and negative symptoms. Indeed, nondeficit patients have been found to have more severe self-reported and observer-rated depression than patients with the deficit syndrome, and this difference between deficit and nondeficit patients also remains stable over time (Kirkpatrick, Buchanan, Breier, & Carpenter, 1994).

The discriminant validity of negative symptoms can also be examined by comparing the severity of negative and depressive symptoms in schizophrenic and depressed patients. These discriminant validity studies have generally found that schizophrenic patients show more severe negative symptoms than depressed patients and that depressed patients show more severe depression than schizophrenic patients (Lewine, 1990; Pogue-Geile & Harrow, 1984).

Akinesia also shares common features with negative symptoms. Many of the same items, such as diminished facial expression, expressive gestures, and spontaneous speech and difficulty initiating behaviors, are used to assess both negative symptoms (particularly flat affect) and akinesia, and thus finding positive correlations between ratings of negative symptoms and akinesia is not uncommon (Prosser et al., 1987). Despite similarities in the items used to assess negative symptoms and akinesia, there are reasons to believe that negative symptoms can exist independently of any medication side effects. First, flat affect, one negative symptom that particularly resembles akinesia, has been observed in schizophrenic patients who were medication free at the time of testing (Kring, Kerr, Smith, & Neale, 1993; Kring & Neale, 1996). Second, negative symptoms were observed in schizophrenic patients prior to the use of neuroleptics (Bleuler, 1950; Pfohl & Winokur, 1982; Rogers, 1985), suggesting that they can be independent of any medication effects. Third, in a study that made the deficit/nondeficit distinction, deficit syndrome patients had more severe negative symptoms than nondeficit patients, but the two groups did not differ on severity of medication side effects (Bustillo, Kirkpatrick, & Buchanan, 1995). Thus, increasing severity of negative symptoms is not necessarily accompanied by increasing severity of medication side effects. In sum, various methods of examining the discriminant validity of negative symptoms suggest that negative symptoms overlap to some degree with both depression and akinesia. Perhaps not surprisingly, the deficit syndrome appears to overlap less with these factors.

### *Clinical Validity*

Despite the emphasis placed on negative symptoms in early descriptions of schizophrenia (e.g., Bleuler, 1950), they have not been stressed in the different versions of the *DSM* and have never been necessary for a diagnosis of schizophrenia. However, literature reviews preceding the introduction of *DSM-IV* (American Psychiatric Association, 1994) suggested that negative symptoms demonstrated acceptable reliability and validity and deserved greater emphasis in the diagnostic system (Andreasen & Carpenter, 1993; Andreasen & Flaum, 1991; Flaum & Andreasen, 1991). As a result, in *DSM-IV*, negative symptoms are one of five major defining symptom criteria. The negative symptoms mentioned are flat affect, alogia, and avolition, whereas only flat affect and inappropriate affect were mentioned in *DSM-III-R*.

### *Summary*

Correlations among various negative symptom rating scales are high, suggesting good convergent validity. Also, increased emphasis on negative symptoms in *DSM-IV* suggests some clinical validity. However, findings concerning the relationship between negative symptoms and variables such as poor prognosis and medication response are inconsistent, and ratings of depression and medication side effects are sometimes correlated with ratings of negative symptoms. These findings might be partially explained by a lack of differentiation between primary/secondary or enduring/nonenduring negative symptoms and by different operationalizations of negative symptoms across studies.

## CONCLUSIONS AND FUTURE DIRECTIONS

A number of studies support the validity of the negative symptom construct. Among the well-replicated findings, negative symptoms are related to poor premorbid functioning, they represent one of three factors underlying the structure of schizophrenia symptomatology, and their reliability is quite good. In addition, various negative symptom rating scales are highly intercorrelated, suggesting good convergent validity. That these findings have been well-replicated despite inconsistent operationalizations of the construct supports the usefulness of the negative symptom concept.

However, this literature is not without inconsistencies, which suggests that modifications to the negative symptom construct are needed. Certainly an important modification would be the development of a consistent operational definition of negative symptoms. The empirical data reviewed above suggests that there is a commonly observed constellation of negative symptoms, which includes flat affect, alogia, anhedonia, and avolition. Indeed, these four symptoms consistently have strong loadings on the negative factor in factor analytic studies and are also included on many of the negative symptom rating scales (see Table 1). Other symptoms that are included in some rating scales, such as inappropriate affect, poverty of content of speech, and attentional impairment, do not seem to fit well within the negative symptom construct. Also, motor retardation is not specific to schizophrenia (Carpenter, Buchanan & Kirkpatrick, 1991), thus making it difficult to determine whether the symptom is related to schizophrenia, depression, akinesia, or some combination of these factors. Finally, asociality, poor rapport, and emotional withdrawal seem to fit into the category of social/interpersonal impairment (Silk & Tandon, 1991), or "disorders of

relating" that has been conceptualized as one of the major components of schizophrenia symptomatology (Strauss, Carpenter, & Bartko, 1974).

In addition to studying this constellation of negative symptoms, examining each of these symptoms individually can also be quite useful for a number of reasons (Persons, 1986). Using an individual symptom approach, the specific behaviors that comprise the symptom can be elucidated, leading to increased understanding and ultimately more accurate assessment of the symptom. For example, recent studies of one component of flat affect, diminished facial expression, have found that while schizophrenic patients often exhibit diminished observable facial expression in response to emotional stimuli they report experiencing as much emotion in response to these stimuli as their nonpatient counterparts (Berenbaum & Oltmanns, 1992; Dworkin, Clark, Amador, & Gorman, 1996; Kring et al., 1993; Kring & Neale, 1996). Thus, patients' outward expressivity does not always reflect their underlying emotional experience. Further, studies of anhedonia in nonpatients have shown that although anhedonic participants report experiencing less positive emotion in response to positive emotional stimuli than nonanhedonic participants, anhedonic participants exhibited similar or greater facial expressivity (electromyographic activity) in response to these stimuli than nonanhedonic participants (Fiorito & Simons, 1994; Fitzgibbons & Simons, 1992). Future research on anhedonia should examine whether this same pattern of emotional responding is found among anhedonic schizophrenic patients.

Another source of inconsistencies in the negative symptom literature appears to be related to the failure to examine deficit negative symptoms. Specifically, while there are somewhat inconsistent findings on the temporal stability, prognostic utility, and discriminant validity of the global negative symptom construct, deficit symptoms (as defined in the deficit syndrome) seem to be stable over time, predictive of poor prognosis and poor medication response, and distinct from depression and akinesia. It should be noted that examining either primary negative symptoms or enduring negative symptoms in isolation can be problematic. For example, primary negative symptoms may also be nonenduring, and nonenduring negative symptoms have been found to have less predictive utility than enduring symptoms (Mueser, Douglas, Bellack, & Morrison, 1991). Similarly, enduring negative symptoms could potentially be secondary to chronic, medication side effects or severe, unremitting paranoia. Consequently, it is important to examine negative symptoms that are both primary and enduring.

The majority of negative symptom research has been done with rating scales that do not make the primary/secondary and enduring/nonenduring distinctions. Nonetheless, there appears to be considerable overlap between negative symptom rating scales and the SDS, which was specifically designed to assess the deficit syndrome. First, the SDS items of restricted affect, poverty of speech, curbing of interests, and diminished sense of purpose are defined similarly to the set of negative symptoms noted above — flat affect, alogia, anhedonia, and avolition (Fenton & McGlashan, 1992). Second, patients with the deficit syndrome have been found to score higher on all of the negative symptom subscales of the SANS compared to patients without these symptoms (Gur et al., 1991). Third, concordance between the deficit syndrome category and categorical definitions of negative symptom subgroups is fairly high (Fenton & McGlashan, 1992). Fourth, negative symptom rating scales have been used to assess both deficit symptoms and the deficit syndrome and have yielded results similar to studies using the SDS (e.g., Gerbaldo et al., 1995; Gerbaldo & Philipp, 1995; Mayerhoff et al., 1994). All of these findings suggest that both the SDS and negative

symptom rating scales can be used to assess deficit symptoms. Although other negative symptom rating scales do not contain explicit instructions for examining the stability of symptoms or for ruling out possible secondary sources of symptoms, the useful guidelines provided by the SDS could be incorporated into assessments with these other scales.

Two other SDS symptoms, diminished emotional range and diminished social drive, are not included among the negative symptoms supported by factor analytic and reliability studies. Diminished emotional range is characterized by diminished experience of both positive and negative emotion. Diminished social drive is defined by a lack of desire to affiliate with other people and is conceptually distinct from asociality or social withdrawal (Carpenter et al., 1988). While these two symptoms are highly correlated with the other SDS symptoms, they have not yet been included in factor analyses of negative symptoms. Future factor analyses of schizophrenia symptomatology should include these two symptoms to determine whether they also have high loadings on the negative symptom factor.

Shifting the focus of negative symptom research from a more global to specific level will likely improve the validity and usefulness of the construct, and a number of specific hypotheses about deficit symptoms can be empirically tested. For example, it remains unclear whether deficit symptoms are better conceptualized as a dimension or category. Using the SDS, the deficit/nondeficit distinction is categorical, which is in contrast to data suggesting that negative symptoms are best conceptualized as a dimension. The theory underlying the deficit syndrome provides the rationale for making such a categorical distinction. Specifically, according to deficit syndrome theory, the presence of the deficit syndrome may be indicative of a pathophysiological process not found in patients without the deficit syndrome (Carpenter et al., 1985, 1988, 1993). Because neurological patients with lesions in the frontal cortex and the limbic system exhibit temporally stable features that resemble features of the deficit syndrome, dysfunction of these brain areas is hypothesized to underlie the deficit syndrome. If patients with the deficit syndrome are found to have a different underlying pathology from patients without the deficit syndrome, deficit and nondeficit patient groups might represent different etiologic subtypes (categories) of schizophrenia (Carpenter et al., 1985, 1988, 1993).

Although deficit syndrome theory supports a categorical conceptualization of deficit symptoms, some of the existing data on the deficit syndrome support a dimensional model. For example, recent evidence suggests that the deficit syndrome is associated with a dysfunction of the dorsolateral prefrontal circuit, which involves connections among the frontal and parietal cortex, the striatum, and the thalamus (Buchanan et al., 1990, 1994; Ross et al., 1996; Tamminga et al., 1992; Thaker et al., 1989). Although some of these studies did not compare the deficit and nondeficit patient groups to nonpatient controls, Buchanan et al. (1994) and Ross et al. (1996) found that while nondeficit patients were more impaired than controls, patients with the deficit syndrome were more impaired than both nondeficit patients and controls. These findings suggest that dysfunction of the dorsolateral prefrontal circuit may be more severe for deficit patients, which is consistent with a dimensional or severity continuum of deficit symptoms. Future studies should examine whether the severity of deficit symptomatology is correlated with, for example, the severity of neurobiological and neuropsychological dysfunction and poor prognosis.

The linkages between deficit negative symptoms and other clinical and behavioral variables are not yet well understood. For example, findings suggesting that the deficit

syndrome is treatment resistant need to be replicated with larger samples (Carpenter, Conley, Buchanan, Breier, & Tamminga, 1995), and the effects of newer neuroleptic medications (e.g., risperidone) on deficit negative symptoms have not yet been examined (Umbricht & Kane, 1995). In addition, a number of features of the deficit syndrome (e.g., restricted affect, diminished emotional range, curbing of interests) suggest diminished emotional responding among deficit patients. Indeed, the essence of the deficit syndrome is thought to be the Kraepelinian (1971) avolitional process that produces "emotional dullness, failure of mental activities, loss of mastery over volition, of endeavor, and of ability for independent action" (p. 74). However, emotional responding in deficit patients has not yet been systematically examined.

Limitations of the deficit symptom concept must also be acknowledged. Admittedly, studying deficit symptoms represents a conservative approach to studying negative symptoms. Specifically, the co-occurrence of negative symptoms and depression, akinesia, anxiety, or paranoia does not necessarily indicate that the negative symptoms are secondary to these factors (Tandon & Greden, 1991b). That is, there are reasons to believe that negative symptoms are distinct from these other factors despite their overlapping features. Yet, in the absence of definitive methods to differentiate among these phenomena, it seems reasonable to consider negative symptoms that co-occur with these other factors as secondary — the approach taken when using the SDS guidelines, for example. The elucidation of methods whereby negative symptoms can be reliably distinguished from these co-occurring phenomena will be tremendously valuable. As a first step, examining how negative symptoms and these other factors relate differently to variables such as temporal stability, medication response, and neurobiological correlates might be a useful for strategy for differentiating among these phenomena.

In sum, although there are a number of well-replicated findings in the negative symptom literature, modification to the construct is warranted. Specifically, empirical findings suggest that the set of negative symptoms should include flat affect, alogia, anhedonia, and avolition. Also, negative symptoms that are both primary and enduring seem to have particularly good predictive and discriminant validity, suggesting that they are a useful direction for future research on negative symptoms. Deficit negative symptoms can be studied with the SDS as well as with commonly used negative symptom rating scales. Future research that focuses on further refining the definition of deficit negative symptoms and elucidating their relationships to additional clinical and behavioral variables will contribute to our understanding of negative symptoms and will also make the search for underlying etiology more straightforward.

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