TITLE PAGE

Title: Dimensions of insight in schizophrenia: exploratory factor analysis of items from multiple self- and interviewer-rated measures of insight

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ABSTRACT

Objective: Insight in schizophrenia is regarded as a multidimensional construct that comprises aspects such as awareness of the disorder and recognition of the need for treatment. The proposed number of underlying dimensions of insight is variable in the literature. In an effort to identify a range of existing dimensions of insight, we conducted a factor analysis on combined items from multiple measures of insight.

Method: We recruited 165 participants with enduring schizophrenia (treated for > 3 years). Exploratory factor analysis was conducted on itemized scores from two interviewer-rated measures of insight: the Schedule for the Assessment of Insight-Expanded and the abbreviated Scale to assess Unawareness of Mental Disorder; and two self-report measures: the Birchwood Insight Scale and the Beck Cognitive Insight Scale.

Results: A five-factor solution was selected as the best-fitting model, with the following dimensions of insight: 1) awareness of illness and the need for treatment; 2) awareness and attribution of symptoms and consequences; 3) self-certainty; 4) self-reflectiveness for objectivity and fallibility; and 5) self-reflectiveness for errors in reasoning and openness to feedback.

Conclusions: Insight in schizophrenia is a multidimensional construct comprised of distinct clinical and cognitive domains of awareness. Multiple measures of insight, both clinician- and self-rated, are needed to capture all of the existing dimensions of insight. Future exploration of associations between the various dimensions and their potential determinants will facilitate the development of clinically useful models of insight and effective interventions to improve outcome.

Keywords: schizophrenia; awareness of illness; clinical insight; cognitive insight; factor analysis; latent variable model

1. Introduction

In schizophrenia, insight is regarded as a multidimensional construct that comprises aspects such as awareness of the disorder and recognition of the need for treatment. Previous studies estimate that 50% to 80% of patients with schizophrenia are at least partially unaware of their illness (Amador and Gorman, 1998). Poor insight has significant prognostic and therapeutic consequences for outcome, including poor medication adherence (Lacro et al., 2002), greater frequency of hospitalizations and relapses (Drake et al., 2007), poor social and vocational functioning (Francis and Penn, 2001; Lysaker et al., 2002), and increased severity of symptoms (Mintz et al., 2003). The etiology of poor insight in schizophrenia remains unclear, which presents a major obstacle to the development of effective interventions (Amador and Kronengold, 2004; Markova and Berrios, 1995; Vohs et al., 2016).

In our view, one of the biggest barriers to understanding insight in schizophrenia is the variability in the number of proposed underlying dimensions. Studies have employed diverse measures that examine different dimensions of insight and may not overlap in content. A lack of proper training and establishment of interrater reliability also contribute to variability in insight assessment. Furthermore, some studies use clinician-rated scales while others use self-report measures, which makes comparisons difficult and does not capture both perspectives (Markova and Berrios, 1995). While the VAGUS insight into psychosis scale (Gerretsen et al., 2014) addresses the latter issue by including self-report and clinician-rated versions that assess multiple dimensions of clinical insight, it does not measure any aspects of cognitive insight, or the ability to properly evaluate and correct distorted beliefs and misinterpretations (Beck et al., 2004). Cognitive insight is increasingly seen as a malleable target for intervention (Riggs et al., 2012), which points to the importance of integrating this construct in a systematic exploration of clinical insight. To date, no study has evaluated the factor structure of the overarching construct of insight in schizophrenia using combined items from multiple measures of clinical and cognitive insight in a single, large cohort. A better understanding of the broad construct of insight and its underlying dimensions will allow us to examine various potential psychological and biological determinants.

The present study was conducted as part of a large cross-sectional research project aimed at investigating factors that may moderate various dimensions of insight in people with enduring schizophrenia. The initial phase of the project involved administering several self-report and clinician-rated measures of insight to a single cohort of participants. Latent variable modelling was applied to explore the number of dimensions that emerge and examine the pattern of variable loadings, with no a priori hypotheses as to the number of such dimensions.

2. Methods

2.1. Participants

Data were collected as part of a larger cross-sectional research project on insight in schizophrenia, for which a minimum sample size of 150 participants was estimated to be necessary to achieve sufficient power (80%) for a structural equation model with 30 parameters (5 participants per free parameter), following the recommendations of MacCallum and colleagues (1996). An additional 15 participants were added during the study to account for a higher non-completion rate than predicted. While there is no general agreement in the literature in the determination of sample size for factor analysis (Williams et al., 2010), a sample size of 150 participants and 29 items for the factor analysis would provide a sample to variable ratio of 5:1, with further inspection of the data for factorability once available.

Recruitment was conducted at the Douglas Mental Health University Institute and affiliated external resources. A sample of 165 people (113 men, 52 women) aged 18-50 years from the local catchment area who were diagnosed with a non-affective psychotic disorder as confirmed by the Structured Clinical Interview for DSM-IV were recruited. All participants were in an enduring phase of illness, defined by a minimum of three years of pharmacological treatment for psychosis. A semi-structured interview was conducted to determine the age of illness onset and duration of illness. Clinical data were confirmed by medical chart review. Participants were English or French-speaking, and were otherwise physically healthy. Data were collected from November, 2011 to June, 2015.

Exclusion criteria included low IQ score (>2 standard deviations below group mean) as estimated by the 4-test version of the Wechsler Abbreviated Scale of Intelligence (WASI), history of medical or neurological condition that can affect cognition, family history of hereditary neurological disorders, or current substance dependence. Written informed consent was obtained from all participants or from a legally-appointed decision maker. Research protocols were approved by the Douglas Institute's Research Ethics Committee.

2.2. Evaluations

Participants were evaluated during three sessions over 2-3 weeks. Socioeconomic status (SES) was rated using the Hollingshead two-factor index of social position (Miller, 1991). The education scale was modified accordingly for Quebec. Assessments were completed in English or French. IQ was estimated using the 4-test version of the Wechsler Abbreviated Scale of Intelligence (WASI).

The Scale for the Assessment of Positive Symptoms (SAPS) (Andreasen, 1984b) and the Scale for the Assessment of Negative Symptoms (SANS) (Andreasen, 1984a) were used to measure the severity of positive and negative symptoms. Inter-rater reliability on the SAPS and SANS items was assessed using two-way mixed, consistency, average measures ICCs, with scores in the excellent range (ICC = .90) and the good range (ICC = .64) for the SAPS and SANS composite total scores, respectively (Cicchetti, 1994). The Calgary Depression Scale (CDS)

(Addington et al., 1990) and the Hamilton Anxiety Scale (HAS) (Riskind et al., 1987) were used to quantify symptoms of depression and anxiety.

2.3. Measures

Interviewer rated measures: The abbreviated Scale for the Assessment of Unawareness of Mental Disorder (SUMD) (Amador et al., 1994; Michel et al., 2013), is a clinician-rated tool that examines patients' current and retrospective awareness for general aspects of the disorder as well as awareness and attribution of specific symptoms. This study included scores for current awareness only. The Schedule for the Assessment of Insight – Expanded (SAI-E) (Kemp and David, 1997) is a clinician-rated measure that evaluates three dimensions of insight: recognition that one is suffering from a mental illness; compliance with treatment; and ability to relabel unusual mental events as pathological.

Self-report measures: The Birchwood Insight Scale (BIS) (Birchwood et al., 1994) is an 8-item self-report scale that measures similar insight dimensions as the SAI-E. The Beck Cognitive Insight Scale (BCIS) (Beck et al., 2004) is a 15-item self-report scale that evaluates two key metacognitive processes of cognitive insight: Self-Reflectiveness (SR), or a willingness to acknowledge fallibility and recognition of dysfunctional reasoning; and Self-Certainty (SC), or a tendency to be overconfident. A composite index score is calculated by subtracting SC from SR.

After administration, we removed duplicated and highly correlated items from our dataset, as well as items with very low correlations with other variables in the model (see Supplementary Material). Many participants in our sample had missing data on the SUMD items pertaining to awareness and attribution of symptoms, because specific symptoms are not rated if they are not observed or reported by the participant during the symptom evaluation. For this reason, our analysis included only the symptom awareness and attribution items from the SAI-E, which evaluate the four most prominent symptoms observed or reported.

The items that were included in the analysis were as follows: SUMD #1-2b; SAI-E #1, 4, 5, 7,8; BCIS #2-11,13-14; and BIS #1, 2, 4, 6-8, for a total of 26 items. Where an item score was missing in error, the mean score of all participants on that item was imputed (9 cases). Items from the SUMD and the BCIS self-certainty subscale were reverse-scored so that higher scores reflected better insight for all items included in the analysis.

2.4. Statistical Analysis

An exploratory factor analysis (EFA) using principal components extraction was performed on itemized responses from the four measures of insight. Models with varying numbers of components were compared for fit and factor loadings were rotated to facilitate interpretation. A parallel analysis using Watkins' Monte Carlo PCA program (2008) was conducted in order to compare eigenvalues obtained in our data set with those generated from random data and

determine the number of components to retain. Measures of reliability and summary scores for each component were calculated, and correlations between the identified dimensions of insight were examined. A sensitivity analysis was conducted using polychoric correlations (see Supplementary Material). All statistical analyses were performed using SPSS Statistics version 22.

3. Results

3.1. Demographics

Of the 165 individuals recruited to the study, 24 met exclusion criteria (see Supplementary Material). The final sample included 141 participants. Sociodemographic and clinical characteristics of the sample are shown in Table 1. Scores on the four measures of insight are presented in Table 2.

Table 1. Sociodemographic and clinical characteristics of the sample (N=141)

	Mean	SD	Range	Median	n	%
Gender M					103	73
F					38	27
Age (years)	35.7	7.9	21-50	35		
Education (years)	11.3	2.5	4-22	11		
IQ[a]	94.7	14.1	66-134	94		
Socioeconomic status						
Lower to Lower Middle					47	33.3
Middle					47	33.3
Upper Middle to Upper					22	15.6
Unknown					25	17.7
Diagnosis						
Schizophrenia					100	70.9
Schizoaffective disorder					30	21.3
Unconfirmed psychotic disorder					11	7.8
Current hospitalization status						
Outpatient					127	90.1
Inpatient					14	9.9
Age of onset (years) (n=139)	22.3	6.6	8-44	21		
Duration of illness (years) (n=139)	13.3	7.7	3-37	12		
# of hospitalizations (n = 132)	4.9	4.1	0-22	4		
Duration of hospitalization (days)[b] (n = 115)	82	127	1-1271	51		
Chlorpromazine equivalent[c] (n = 134)	790	843	11-4835	551		
SAPS total	18.7	16.9	0-85	14		
SANS total	25.5	10.7	0-55	25		
SANS total without attention	23.0	10.1	0-51	22		
CDS	2.9	2.9	0-15	2		
HAS	7.0	5.1	0-22	7		

[a] IQ score estimated as per Wechsler Abbreviated Scale of Intelligence (WASI)
[b] Value refers to grand mean of each participant's mean length of stay
[c] Antipsychotic chlorpromazine-equivalent dose was calculated according to Leucht et al. (2014)
SAPS, Scale for the Assessment of Positive Symptoms; SANS, Scale for the Assessment of Negative Symptoms; CDS, Calgary Depression Scale; HAS, Hamilton Anxiety Scale

Table 2. Means, standard deviations, and range of scores on measures of insight (N = 141)

Measure of insight	Mean	SD	Range
SUMD[a]			
(1) Awareness of mental disorder	1.62	1.26	1 – 5
(2) Awareness of response to medication	1.56	1.14	1 – 5
(2b) Awareness of need for medication	1.62	1.29	1 – 5
SAI-E[b] (total items 1-8)	13.87	4.38	1.33 – 20
BIS[b] (total)	8.35	2.42	0 – 12
BCIS			
Self-reflectiveness[b] (SR)	13.40	4.20	3 – 26
Self-Certainty[a] (SC)	8.09	3.54	0 – 16
Composite Index[b] (SR-SC)	5.31	5.62	-10 – 22

[a]Higher scores indicate poorer insight
[b]Higher scores indicate better insight
SD, standard deviation; SUMD, Scale for the assessment of Unawareness of Mental Disorder; SAI-E, Schedule for the Assessment of Insight – Expanded; BIS, Birchwood Insight Scale; BCIS, Beck Cognitive Insight Scale

3.2. Factor analysis

After the initial extraction, the first eight components had eigenvalues > 1 (Table 3). A scree plot suggested retaining five factors (Figure 1). The parallel analysis (Watkins, 2008) also suggested retaining five factors, as the eigenvalues for the first five components exceeded the corresponding eigenvalues generated by random data (Table 3). The five-factor solution cumulatively explained 47.6 % of the variance in the data. The factor loading of item 2 from the BIS, which rates agreement with the statement “I am mentally well”, was difficult to interpret and this item was removed from the analysis (see Supplementary Material). After varimax rotation, the five-factor model explained 48.3% of the variance in the data. Each item had a primary factor loading of .4 or greater (Table 4).

Table 3. Comparison of extracted eigenvalues to randomly generated eigenvalues for parallel analysis

Eigenvalue #	Extracted eigenvalue	% of variance	Cumulative %	Random eigenvalue[a]	SD
1	5.16	19.83	19.83	1.90	.082
2	2.22	8.56	28.38	1.75	.060
3	1.82	6.99	35.37	1.63	.052
4	1.65	6.33	41.71	1.54	.046
5	1.53	5.88	47.59	1.47	.040
6	1.21	4.64	52.22	1.38	.038
7	1.08	4.17	56.39	1.32	.032
8	1.05	4.05	60.49	1.25	.034
9	0.93	3.59	64.02	1.19	.034
10	0.92	3.57	67.59	1.13	.030
…	…	…	…	…	…
26	0.19	0.72	100	0.37	.031

[a]Obtained from Monte Carlo PCA for parallel analysis (Watkins, 2008)
SD, standard deviation for randomly generated eigenvalues

Table 4. Summary of the five-factor solution after varimax rotation (N = 141)

		Illness & treatment	Symptoms & consequences	Self-certainty	Objectivity & fallibility	Reasoning & feedback
		1	**2**	**3**	**4**	**5**
Eigenvalues[a]		3.81	1.99	2.36	2.05	1.85
% of variance[a]		15.2	8.0	9.5	8.2	7.4
Coefficient α[b]		.81	.57	.64	.47	.44
Item #	**Description**	**Rotated component loadings[c]**				
SUMD 2	Awareness of response to medication	**.79**				
SUMD 2b	Awareness of need for medication and perceived benefit	**.74**				
SUMD 1	Awareness of mental disorder	**.72**				
BIS 6	"I do not need a doctor or psychiatrist"	**.64**		.33		
SAI-E 1	Awareness of psychological difficulties	**.62**				
BIS 7	"If someone said I had a mental illness they would be right"	**.51**				.37
BIS 8	"Unusual experiences are not due to an illness"	**.47**				
BIS 4	"My stay in hospital was necessary"	**.40**			.38	
SAI-E 7	Rate awareness of the 4 most prominent symptoms		**.70**			
SAI-E 8	Rate attribution of the 4 most prominent symptoms	.34	**.58**			
SAI-E 4	Explanation of disorder or illness		**.52**			
SAI-E 5	Awareness of adverse consequences of the illness	.37	**.48**			-.37
BCIS 9	"I know better than anyone else what my problems are"			**.72**		
BCIS 7	"If something feels right, it means that it is right"			**.62**		
BCIS 11	"I cannot trust other people's opinion about my experiences"			**.62**		
BCIS 2	"My interpretations of my experiences are definitely right"			**.59**		
BCIS 13	"I can trust my own judgment at all times"		.33	**.41**		.30
BCIS 10	"When people disagree with me, they are generally wrong"			**.38**	.46	
BIS 1	"Some symptoms were made by my mind"				**.65**	
BCIS 8	"Even though I feel strongly that I am right, I could be wrong"				**.61**	
BCIS 6	"Some ideas turned out to be false"				**.55**	.39
BCIS 14	"There is more than one possible explanation"				**.40**	-.38
BCIS 4	"I jump to conclusions"					**.65**
BCIS 3	"Others understand the cause of my unusual experiences"					**.65**
BCIS 5	"Some experiences have been due to my imagination"		.30		.34	**.43**

[a] Values refer to sums of squared loadings after rotation; note that components are not presented in order of eigenvalue
[b] Calculation based on the items that were retained on each component
[c] Factor loadings in bold indicate items that were retained on the respective component; loadings < |.3| are not presented to facilitate review
SUMD, Scale for the Assessment of Unawareness of Mental Disorder; BIS, Birchwood Insight Scale; SAI-E, Schedule for the Assessment of Insight – Expanded; BCIS, Beck Cognitive Insight Scale

3.3. Interpretation of components

The extracted components clearly distinguished between clinical and cognitive insight and were re-numbered based on whether items loading on the components pertained to clinical insight (components 1 and 2) or cognitive insight (components 3-5), rather than by order of decreasing eigenvalue.

Component 1 had eight salient loadings (≥ .4) for items relating to awareness of the mental disorder and beliefs regarding the need for medication, the need for a doctor or psychiatrist, and the need for hospitalization. This component was interpreted to reflect awareness of the illness and the need for treatment, and was labelled ‘Illness & treatment’. The four items loading saliently on component 2 pertained to awareness and attribution of symptoms and consequences of the disorder, as well as attribution or explanation of the illness itself. This component was labelled ‘Symptoms & consequences’.

Component 3 was analogous to the self-certainty subscale of the BCIS (Beck et al., 2004) and was also labelled ‘Self-certainty’. Component 4 had four salient loadings for items that relate to a willingness to be objective about one’s judgments and a willingness to acknowledge one’s fallibility or likelihood of making errors in judgment. These capacities require self-reflection (Beck et al., 2004), and this component was labelled ‘Objectivity & fallibility’. The three items loading saliently on component 5 also involve self-reflection, but relate more to recognizing errors in reasoning and demonstrating an openness to feedback from others. This component was labelled ‘Reasoning error & feedback’.

Item #10 from the BCIS, “When people disagree with me, they are generally wrong”, loaded most strongly on component 4 ‘Objectivity & fallibility’ (.46), but also loaded strongly on component 3 ‘Self-certainty’ (.38). Since this item is part of the original BCIS SC subscale, and its loading on the SR dimension was not easily interpretable, this item was retained on component 3. A sensitivity analysis using polychoric correlations produced similar results to the traditional factor analysis, with the exception that item SAI-E 5, “awareness of adverse consequences of the illness”, cross-loaded at ≥ .4 on component 1 ‘Illness & treatment’ and component 2 ‘Symptoms & consequences’. The original solution was retained.

3.4. Component reliability

The internal consistency reliability of each subscale derived from the factor analysis was determined using Cronbach's alpha (Table 4). Removal of any items from these subscales did not produce substantial increases in reliability. The 'Illness & treatment' and 'Self-certainty' components demonstrated good internal consistency reliability ($\alpha = .81$ and $\alpha = .64$, respectively), and several items loaded >.4 on each component, suggesting that summary scores derived from items loading on these components can reliably be used to quantify these dimensions of insight. In contrast, the minimal item loadings and low reliabilities of the 'Symptoms & consequences' ($\alpha = .57$), 'Objectivity & fallibility' ($\alpha = .47$), and 'Reasoning error & feedback' ($\alpha = .44$) components suggest that summary scores derived from these components do not currently provide reliable measures of the respective dimensions. Factor scores (Table 5) were calculated by summing the raw scores for individual items loading on each component (DiStefano et al., 2009). Higher scores indicate better insight for all subscales. Correlations between subscales can be found in Supplementary Material (Table S1).

Table 5. Descriptive statistics for summary scores derived from the five components of insight

Component	No. of items	Mean	SD	Min	Max	Skewness	Kurtosis
Illness & treatment	8	20.8	4.9	3	25	-1.72	2.67
Symptoms & consequences	4	7.4	2.9	0	12	-.42	-.66
Self-certainty	6	9.9	3.5	0	18	-.30	-.40
Objectivity & fallibility	4	6.9	2.3	0	11	-.09	-.51
Reasoning error & feedback	3	3.3	2.0	0	9	.59	.06

SD, standard deviation; Min, minimum possible score; Max, maximum possible score

4. Discussion

4.1. Dimensions of insight

This study sought to identify dimensions of insight derived from multiple established measures of clinical and cognitive insight in a large cohort of people with schizophrenia. A factor analysis identified five empirically-derived, independent dimensions of insight that account for 48% of the variance in the data.

Although insight is considered a multidimensional construct, factor analyses of measures designed to evaluate certain proposed dimensions of insight have often produced single factor solutions (Lincoln et al., 2007). The five-factor solution identified in this study confirms the multidimensional nature of the construct of insight in people with schizophrenia. The results also provide empirical evidence for the distinction of clinical and cognitive aspects of insight, as

items relating to clinical insight loaded onto separate components from items relating to cognitive insight. Thus, this study confirms that clinical and cognitive insight are independent but related phenomena within the overarching construct of insight in schizophrenia.

Component 1 'Illness & treatment' merges items that pertain to awareness of illness and awareness of the need for treatment onto a single dimension of insight. This finding is contrary to the commonly accepted notion that awareness of illness and of the need for treatment are distinct dimensions of insight in schizophrenia. Since the first multidimensional definition of insight was proposed by David (1990), the dimensions of awareness of the presence of a mental disorder and awareness of the need for treatment, among others, have been considered well-accepted, distinct dimensions of insight in schizophrenia (Lincoln et al., 2007; Mintz et al., 2003; Osatuke et al., 2008). Interestingly, some empirical findings do not support this theoretical model. As pointed out by Lincoln and colleagues (2007), factor analyses of the Insight and Treatment Attitudes Questionnaire (McEvoy et al., 1989), the Birchwood Insight Scale (Birchwood et al., 1994), the Schedule for the Assessment of Insight (David et al., 1992), and the Awareness of Illness Interview (Cuffel et al., 1996), did not produce unique factors for awareness of illness and need for treatment.

More recently, factor analyses of the abbreviated SUMD (Michel et al., 2013) and VAGUS self-report scale (Gerretsen et al., 2014) also demonstrated that awareness of illness and treatment-related items loaded onto a single factor, which supports our finding. Perhaps in schizophrenia, where diagnosis is typically followed by treatment, insight into the mental disorder may entail insight into the need for treatment, or vice versa. Awareness of illness and the need for treatment may refer to a single concept that is separate from the notion of medication adherence. Use of the label 'need for care/services' rather than 'need for treatment' may help to clarify this distinction. While studies in schizophrenia often use the score on a single test item (ex. SUMD item 1 "Awareness of mental disorder") to quantify the dimension of insight into illness, the sum score for component 1 'Illness & treatment' provides a more comprehensive assessment, and it is highly correlated with SUMD item 1 ($r = .74$, $p < .001$, two-tailed).

Component 2 'Symptoms & consequences' also merges several recognized dimensions of insight. Lincoln and colleagues (2007) suggest that awareness of symptoms and attribution of symptoms to mental illness should be considered separate dimensions of insight with potentially different etiology, namely neuropsychological deficits and reasoning biases, respectively. An earlier study showed that the BCIS total and SR subscale, but not SC, were significantly correlated with the relabeling subscale on the Birchwood Insight Scale (Pedrelli et al., 2004). Although our results do not support the independence of these dimensions, we hypothesize that items pertaining to these dimensions may have loaded onto a single factor based on a higher-order level of insight. Presumably, one must first be aware of an illness in order to explain its origins, attribute symptoms to the illness, and be aware of its consequences. Indeed, individuals

in our sample tended to demonstrate better insight into 'Illness & treatment' as compared with the 'Symptoms & consequences' dimension.

The fact that items pertaining to awareness and attribution of symptoms loaded onto a single factor may have diminished insight scores related to awareness of symptoms, because attribution of symptoms typically scores lower than awareness (Pousa et al., 2017). This may partly explain why the distribution of scores was slightly skewed towards higher scores on the 'Illness & treatment' dimension. Contrarily, having attribution items load onto the same factor as the typically higher-scoring awareness items may have attenuated the overall extent of insight deficits in this population. Nevertheless, the 'Symptoms & consequences' subscale contained only 4 items and demonstrated low reliability ($\alpha = .57$), thus few conclusions can be drawn presently.

Component 3 'Self-certainty' is identical to the BCIS self-certainty subscale, and the internal consistency of the subscale ($\alpha = .64$) is similar to that ($\alpha = .61$) reported by Beck et al. (2004). Contrarily, our results suggest splitting Beck's self-reflectiveness dimension into two unique components, 'Objectivity & fallibility' (component 4) and 'Reasoning error & feedback' (component 5), although the difference between them is subtle. Forcing the model to extract only four components did not load these items onto a single component. These components contain few items and have low reliabilities; thus, they may need to be re-examined as independent dimensions of insight as per our findings.

4.2. Assessment of insight

Our results indicate that summary scores derived from the "Illness & treatment' and 'Self-certainty' components can reliably be used to assess the respective dimensions of insight. Although our data met several requirements for factorability and the analysis produced five independent and interpretable dimensions of insight, three components in the model had few item loadings and poor internal consistency reliability. Similarly, Gerretsen and colleagues (2014) identified a multidimensional factor structure in the self-report version of the VAGUS scale, but reported that one factor (consisting of items pertaining to awareness of negative consequences, awareness of need for treatment, and symptom attribution) was difficult to interpret due to low primary item loadings and significant cross-loadings on another factor. Further studies using additional items and larger sample sizes are needed to confirm the structure of these components and determine the adequacy of the respective summary scores as measures of the underlying dimensions of insight.

This study highlights the fact that no single measure currently captures all of the existing insight dimensions in people with schizophrenia. To assess the five dimensions identified in this study, a minimum of two measures must be administered. For example, either the SUM-D or the SAI-E

can be administered to capture the 'Illness & treatment' and 'Symptoms & consequences' dimensions, in combination with the BCIS which covers the self-certainty and self-reflectiveness dimensions.

The results also emphasize the importance of incorporating self- and clinician-rated measures in assessing insight, particularly the 'Illness & treatment' dimension. A study comparing self-report and clinician-rated insight scales in individuals with first-episode psychosis showed low correlations between the measures, likely attributable to differences in perspectives between the raters due to neurocognitive deficits, personal experience, stigma, or other variables (Tranulis, 2008). Furthermore, a study of depression severity found that self-report and clinician ratings of severity provide unique, non-redundant clinical information that is relevant for prognosis (Uher et al., 2012). Discrepancy scores between subjective and objective assessments of insight may provide an additional method for quantifying awareness, as is often used in assessing insight in dementia (Marková, 2005). Overall, this work has the potential to inform the development of novel measures of insight that capture both perspectives. One potential avenue of interest could be to address the lack of a clinician-rated measure of cognitive insight.

4.3. Limitations

One limitation of this study is the use of ordinal data in a parametric analysis. However, a sensitivity analysis using polychoric correlations that account for both continuous and ordinal data produced a nearly identical factor solution. Secondly, while our sample size may be considered small for factor analysis, our data met the requirements for several indicators of adequacy and factorability (Costello and Osborne, 2005). Nevertheless, the summary scores produced by only two of the identified components were deemed to be reliable for quantifying the underlying respective dimensions of insight. Future analyses using larger samples and additional items may further clarify the number and composition of existing dimensions of insight in schizophrenia. Finally, individuals in our sample tended to demonstrate good insight, especially on the 'Illness & treatment' dimension, which suggests that we may not have captured the full range of insight levels. Individuals in an enduring phase of illness can develop 'pseudo-insight' by acquiring a medical vocabulary that can influence the way they respond to questions about their mental illness (Thompson et al., 2001). The choice of items may have also biased the scores towards higher insight. We included SAI-E items that assess for awareness and attribution of the four most prominent symptoms, and excluded SUMD items that assesses awareness of symptoms such as anhedonia and asociality which may be less apparent to the individual and could produce lower insight scores. Including items from a larger selection of measures and assessing participants with a broader range of insight levels could reduce this potential bias.

4.4. Future directions

Systematic examination of the associations between the different dimensions of insight and various potential determinants can facilitate the development of clinically useful models of

insight. Gilleen and colleagues (2010) demonstrated that awareness across various dimensions of insight is largely independent and may be predicted by distinct factors, suggesting a need for specific therapeutic targets. Indeed, there is some evidence that factors such as cognition and mood influence various dimensions of insight differently (Nair et al., 2014; Palmer et al., 2015). Furthermore, neuroimaging studies and studies on cellular abnormalities have identified specific neural correlates for different dimensions of clinical and cognitive insight (for review see Xavier et al., 2016). By applying the interventionist model of causality (Kendler and Campbell, 2009), a single potential causal factor in the model can be targeted, and the effect on insight can be examined. This can guide the design and implementation of interventions to improve specific dimensions of insight. For example, if poor theory of mind is found to be associated with low insight on the 'Illness & treatment' dimension, then an intervention designed to help people improve their ability to attribute mental states to themselves and others may be effective in improving awareness of illness and the need for treatment. Such an approach has previously been used to develop a targeted intervention for worry to reduce persecutory delusions in people with psychosis (Freeman et al., 2015).

4.5. Conclusions

The present study identified a five-factor model of insight in people with enduring schizophrenia and confirmed the independence of clinical and cognitive aspects of the construct of insight. Awareness of illness and the need for treatment appears to be a single, robust dimension of insight, and a sum score of the items loading on this component provides a comprehensive and reliable measure of this dimension. Multiple measures are needed to capture all of the existing dimensions of insight in schizophrenia, and both clinician- and self-rated measures should be incorporated into comprehensive assessments. Future work that explores the various dimensions of insight and their potential determinants will facilitate the development of clinically useful models of insight and effective interventions to improve outcome.

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Figure 1. Scree plot of the 26 eigenvalues after initial extraction. A point of inflection of the curve can be seen at 5 components.