KENNEDY AXIS V: RELIABILITY AND VALIDITY, INCLUDING COMPARISONS TO AXIS V (GAF), HoNOS, AND THE BPRS

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ABSTRACT

Objective: Evaluate the interrater reliability and validity of the Kennedy Axis V (K Axis) and, in the process, compare the K Axis to some of psychiatry's top assessment tools.
Methods: The validity was addressed by correlating the K Axis with three of the most commonly used assessment tools in psychiatry: 1) Global Assessment of Functioning (GAF), 2) Health of Nations Outcome Scale (HoNOS), and 3) Brief Psychiatric Rating Scale (BPRS). In the study these instruments were used to measure the functioning of adult patients with severe mental illness.
Results: Statistical analyses indicated that the K Axis correlations were high where expected between the other three instruments. Like the GAF, the K Axis can generate a specific global score. Like the HoNOS, the K Axis can provide an overview of the patient's clinical profile, as well as focus on specific clinical areas. Like the BPRS, the K Axis is a good measure of psychiatric symptoms. By design the K Axis can generate a GAF, this is not a feature of either the HoNOS or the BPRS. In addition, study of the K Axis' interrater reliability reveal it to be in the very good range.
Conclusions: The K Axis is a reliable instrument whose validity and flexibility are demonstrated when compared to some of the world's top psychiatric assessment tools.

INTRODUCTION

Describing and tracking a patient's symptoms is critical to good psychiatric practice; however, it often involves the use of a rather subjective methods of examination[1]. To address the subjectivity of the clinical examination, attention has increasingly been paid to the development of tools that can make a psychiatric assessment more systematic and transparent[2,3]. With the introduction of antipsychotics and antidepressants in the late 1950s and the subsequent development of treatment guidelines, the need for more objective evaluations of treatment effects became very apparent. This began to rapidly increase the development of standardized scales in psychiatry[4,5], including the widespread use of the Brief Psychiatric Rating Scale (BPRS)[6] to measure the effectiveness of antipsychotic medication and the Hamilton Depression and Anxiety Scales (HAM-D and HAM-A)[7,8] to assess the influence of antidepressants and anxiolytics. In addition to symptom severity scales, standardized diagnostic interviews such as the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID)[9] and the Schedule for Clinical Assessment in Neuropsychiatry (SCAN)[10] were designed as well.

The aim of these instruments is to help clinicians assess patients in a more reproducible manner, rather than on a subjective basis. In this systematic way of assessing a patient, the risk of missing or trivializing characteristics or symptoms is decreased[11]. Medical literature subscribes this positive effect by suggesting that data gathered in a structured way results in more reliable and more accurate final assessments.[2]

Also, recently it has been demonstrated that structured assessments compared to assessments "...based purely on clinical judgment" ...may be more effective with helping to "... reduce incidents of aggression and use of restraint and seclusion in psychiatric wards."[12]

On the other hand, a scale can never cover the complete spectrum of possible problems or symptoms, not even the most extensive diagnostic questionnaires.[13] Therefore, the value of

psychiatric assessment tools must be considered supportive and supplementary to the usual examination by a psychiatrist or other clinician, but never a replacement of it.[13,14]

"Despite these real challenges, the advantages of moving to measurement-based care in clinical settings outweigh the drawbacks."[5] This shift in psychiatric assessment/care is captured in "Implementing Standardized Assessments in Clinical Care: Now's the Time."[5] In fact, in many areas of mental health the use of psychiatric assessment tools has already found acceptance.[15]

At or near the top of these standardized assessment are instruments that address the measurement of global functioning. This was established by the introduction of Axis V (Global Assessment of Functioning or GAF) in the DSM-III and continues as Axis V in DSM IV-TR.[16] Axis V is often an integral part of psychiatric evaluations. This has been followed by other global assessments of functioning, including the HoNOS[17], and the K Axis.[18,19] The need for future research in this area is emphasized in "Global Assessment of Functioning (GAF): Properties and Frontier of Current Knowledge."[20]

METHODS

Sample and Sub-Sample
For this study 274 patients with SMI living in the greater Rotterdam area were recruited from four psychiatric hospitals and one department of psychiatry of a general university medical centre. Patients were only asked to participate after a request for court ordered admission, mostly for violence to others, not violence to self, had been done. Eventually 207 psychiatric patients (76%) signed the informed consent form and were included. During the study 7 of the total population of 207 patients were lost to the study. Of these 7 patients, one patient committed suicide, one emigrated, two refused further participation and three could not be traced. Table 1 provides demographic information about these 207 patients.

For analyses of the validity of the K Axis, data from all 207 patients was used.

Table 1 Characteristics of total sample (n = 207)

Variables	(n (%))
Gender, male	138 (66.7)
Age, years (mean (s.d.); range)	35.3 (13.6);18.2 - 83.8
Age males, years (mean (s.d.))	32.7 (12.4)
Age females, years (mean (s.d.))	40.4 (14.4)
Marital status	
Married	23 (11.1)
single, divorced, widowed	184 (88.9)
Diagnosis	
schizophrenia	140 (67.6)
other psychotic disorders	23 (11.1)
bipolar I disorder	26 (12.6)
other mood disorders	13 (6.3)

other / no Axis I diagnosis	5 (2.4)
Duration illness, years (mean (s.d.))	10.8 (7.7)
GAF-score (mean; median)	42.2; 35

For the K Axis interrater reliability analysis a sub-sample of 45 pairs of patient measurements were used whereby two observers interviewed each patient and briefly discussed each case. In addition to interviewing the patients, the raters also interviewed each patient's mental health care worker and a family member or friend to get supplemental information. Once the interviews and discussions were completed, each rater independently rated the K Axis on each patient. On two occasions, a patient was selected for a second interrater reliability interview; therefore, the interrater reliability investigation captured 45 pairs of measurements on 43 patients. Table 2 shows the demographics of the subsample (n = 45; 43 patients).

Table 2 Characteristics of sub-sample (n = 45 measurements; 43 patients) (this sub-sample was used for the K Axis interrater reliability)

Variables	(*n* (%))
Gender, male	33 (73.3)
Age, years (mean (s.d.); range)	35.0 (14.0);18.8 - 81.7
Age males, years (mean (s.d.))	33.0 (12.8)
Age females, years (mean (s.d.))	40.7 (15.9)
Marital status	
Married	3 (6.7)
single, divorced, widowed	42 (93.3)
Diagnosis	
schizophrenia	27 (60.0)
other psychotic disorders	5 (11.1)
bipolar I disorder	10 (22.2)
other mood disorders	2 (4.4)
other / no Axis I diagnosis	1 (2.2)
Duration illness, years (mean (s.d.))	11.5 (9.4)
GAF-score (mean; median)	45.4; 45

Raters
The 21 raters who took part in the project were medical students, who were in at least the second year of their study, and psychology students, who were in at least their fourth year. Before they started doing the interviews, they had been trained extensively in using the K Axis, the HoNOS, the GAF and the BPRS. The raters were always under supervision by a clinician.

Instruments

Kennedy Axis V (K Axis)
The K Axis can be regarded as a summary measure of the level of functioning of a psychiatric patient. It was designed as a more complete version of the well-known Global Assessment of Functioning scale (GAF).[16] The K Axis was developed by James Kennedy, M.D. and consists of seven subscales/domains.[18] The Dutch translation of the K Axis was used in this study[21]. The seven subscales assess: (1) psychological impairment; (2) social skills; (3) violence; (4) activities of daily living (ADL)-occupational skills; (5) substance abuse; (6) medical impairment; and (7) ancillary impairment (mostly environmental stress). Each of these subscales can be rated with a score varying from 5 to 100, rounded off to the nearest multiple of 5. Each decile is accompanied by a matching description of the patient's condition. Like the GAF, a higher score indicates better functioning in the subscale.[18]

DSM-IV-TR's GAF score incorporates psychological, social and occupational functioning[13,16]. Many of the anchor points in the first four subscales of the K Axis were drawn directly from the GAF. Howard Goldman, MD, PhD indicated "The rules [for the GAF] direct the rater to assess the different manifestations of psychopathology and to make a rating based on the lowest level of functioning."[22] This allows the K Axis to generate a GAF (GAF K) score by simply selecting the lowest rating from the first four subscales or rating only the subscale from the first four that is obviously the most impaired. This should give a rating that is essentially identical to the GAF.

The GAF Equivalent (GAF-Eq) captures both low and high functioning areas, i.e. problems and strengths. It is derived from the K Axis by adding up the first four subscales and dividing this total by four. This leads to a more global, i.e. average rating of functioning. Using the GAF or GAF K, a very high functioning patient may get a very low rating due to a particularly severe symptom, e.g. serious suicidal impulses. By averaging, the GAF-Eq captures the higher areas of functioning, along with the most impaired areas; therefore, the GAF Eq is felt to be a better measure of a patient's overall functioning because the GAF and GAF K capture only the area that is most impaired. The simultaneous use of the GAF or GAF K and the GAF-Eq helps one to measure the severity of the target symptoms, as well as prevent the severity of target symptoms from covering up areas of strength.

Global Assessment of Function (GAF or Axis V)
Like the K Axis and the HoNOS, the GAF is regarded as a global measure of the level of functioning of a psychiatric patient. As mentioned above, DSM-IV-TR's GAF score incorporates psychological, social and occupational functioning.[13,16] Because of its incorporation into DSM-IV-TR's diagnostic system, it is likely the most widely used measure in psychiatry.

Health of Nations Outcome Scale (HoNOS)
Like the K Axis, the Health of Nations Observation Scale (HoNOS)[17,23,24] can be regarded as a global measure of the level of functioning of a psychiatric patient. Following the United Kingdom's Health of the Nation Strategy of 1992, the HoNOS was developed by the Royal College of Psychiatrists. Unlike the K Axis and GAF, even though the HoNOS acts as a global assessment of functioning, it doesn't generate a single number that reflects that global measurement. Unlike the K Axis which has 7 items and the GAF which has only 1 item, the HoNOS has 12 items, including separating the psychiatric symptomatology into different items.

Brief Psychiatric Rating Scale (BPRS)
The BPRS is a rating scale for measuring psychopathology[6]. It is widely used in psychiatry, especially as an outcome measure of response to psychotropic medication. Unlike the K Axis, the HoNOS, and the GAF, the BPRS is not regarded as a global measure of functioning of a psychiatric patient. Rather, its focus is on psychiatric symptoms of psychosis, depression, anxiety, and violence to self and others.

RESULTS

Analysis
This study analyzes construct validity and interrater reliability of the K Axis. Construct validity of the Kennedy Axis V will be addressed first.

Construct Validity of the Kennedy Axis V
Two forms of construct validity exist: convergent and divergent validity. The first one measures the extent to which two scales that intend to be measuring the same concept correlate. Divergent or discriminant validity works just the opposite. It is based on the fact that there will not be a correlation between one scale measuring a concept and another scale measuring unrelated items.[25] To assess convergent and divergent validity, as mentioned, three scales (HoNOS, GAF, and BPRS) were selected. It was postulated that these scales and/or elements of these scales would correlate where expected with the K Axis and/or not correlate where no correlation was expected.

Convergent and divergent validity was assessed by calculating the non-parametric correlation coefficient Spearman's rho. Correlation coefficients between (-)0.10 and (-)0.29 indicate correlations of small strength, between (-)0.30 and (-)0.49 of medium strength and above 0.50 or below -0.50 the strength is considered large.[26]

Table 3 Part A presents the correlation coefficients of the K Axis Subscales 1-4 and Part B presents the correlations coefficients of the K Axis Subscales 5-7. All correlations were significant at the 0.01 level, except for one: the correlation between K Axis 6 (Medical Impairment) and GAF was only significant at the 0.05 level.

Table 3 Part A Kennedy Axis V (Subscales 1-4) Correlation Coefficients

K Axis (Subscale)	Variable	Spearman's Rho
K Axis 1 (PSY)	GAF	0.688*
	BPRS	-0.815*
	HoNOS 1-4, 6-8	-0.739*
	1) Overactive, aggressive, disruptive behavior	
	2) Non-accidental self-injury	
	3) Problem drinking or drug taking	
	4) Cognitive problems	
	6) Problems with hallucinations and delusions	
	7) Problems with depressed mood	
	8) Other mental & behavioural problems	
K Axis 2 (SOC)	GAF	0.608*

	HoNOS 9 (Problems with Relationships)	-0.749*
K Axis 3 (VIO)	GAF	0.427*
	HoNOS 1 (Overactive, aggressive, disruptive behavior)	-0.670*
	HoNOS 2 (Non-accidental self-injury)	-0.198*
	HoNOS 1 (Overactive, aggressive, disruptive behavior) + HoNOS 2 (Non-accidental self-injury)	-0.693*
	BPRS 5 (Hostility) + 17 (Uncooperativeness) + 19 (Suicidality)	-0.545*
K Axis 4 (ADL)	GAF	0.611*
	HoNOS 10 (Problems with activities of daily living)	-0.733*
	BPRS 20 (Self-neglect)	-0.557*
K AXIS 1-4 (GAF-Eq)	GAF	0.721*
K AXIS 1,2,4	GAF	0.734*

* Correlation is significant at the 0.01 level (2-tailed).

The HoNOS correlated very well with the K Axis. This is true for the correlation between the composite scores of both scales as well as for the correlations between the different HoNOS items and K Axis Subscales. Only K Axis 1 (Psychological Impairment) correlated better with the BPRS total score (ρ = -0.817). The Spearman's correlation coefficients of these higher correlations ranged from ρ = -0.566 for K Axis 7 (Ancillary Impairment [Environmental Stress]) / HoNOS 11 (Problems with [Access to Reasonable] Living Conditions) + 12 (Problems with [Access to Reasonable] Occupation and Activities) to ρ = -0.842 for K Axis 5 (Substance Abuse) / HoNOS 3 (Problem Drinking or Drug Taking). The strength of these higher correlations is considered large.[26] The GAF also correlated well (large) with the K Axis where expected; however, where correlation was expected to be low (Substance Abuse, Medical Impairment, and Ancillary Impairment), the correlation was, as expected, small. The correlation was small between the K Axis Violence Subscale and the HoNOS Item 2 (Non-accidental self-injury), because the sample used in this study was selected based on mostly violence to others, not violence to self.

From these results the conclusion can be drawn that the K Axis is a valid instrument as evidenced by having both convergent and divergent validity.

Interrater Reliability of the Kennedy Axis V
The results of the interrater reliability analyses of the K Axis using the quadratic weighted kappa values are shown in Table 4. All quadratic weighted kappas were statistically significant (p < 0.001). Five of seven quadratic weighted kappa results were "almost perfect" and the other axes (K Axis Subscale 2 - Social Skills and K Axis Subscale 4 - ADL-Occupational Skills) yielded "substantial" scores varying from κ = 0.666 for K Axis Subscale 4 (ADL-Occupational Skills) to κ = 0.767 for K Axis Subscale 2 (Social Skills). The observers agreed the most on K Axis Subscale 5 (Substance Abuse) and the least on K Axis Subscale 4 (ADL-Occupational Skills).

Table 4 Quadratic weighted kappa values of the Kennedy Axis V

	Quadratic Weighted Kappa			
K AXIS	**Kappa**	**s.e.**	**p**	**% agreement**
1 (PSY)	0.901	0.148	0.000	98.8
2 (SOC)	0.767	0.149	0.000	97.0
3 (VIO)	0.903	0.148	0.000	98.8
4 (ADL)	0.666	0.148	0.000	96.9
5 (SAB)	0.918	0.148	0.000	99.0
6 (MED)	0.842	0.149	0.000	98.2
7 (ANC)	0.804	0.147	0.000	98.2

When comparing the quadratic kappa values of the K Axis with the interrater reliability indices of the HoNOS[27], the results of the K Axis turn out to be somewhat better. The outcomes of the HoNOS studies are 'fair' ($\kappa = 0.21 - 0.40$) to "moderate" ($\kappa = 0.41 - 0.60$) or "moderate" to "substantial" ($\kappa = 0.61 - 0.80$), while five of seven quadratic kappa values of the K Axis in this study exceed the kappa value of $\kappa = 0.80$. The lowest quadratic kappa value in this study was $\kappa = 0.666$, which is still classified as "substantial."

Overall, the interrater reliability of the K Axis turns out to be classified as very good.

DISCUSSION

The focus of this study is to test the interrater reliability and validity of the Kennedy Axis V (K Axis)[18,19]. The validity of the K Axis was tested by demonstrating the correlation between the K Axis and three of the most commonly used psychiatric assessment tools. As indicated earlier, the three tools chosen were the Global Assessment of Functioning (GAF)[16], the Health of Nations Outcome Scale (HoNOS)[17,22], and the Brief Psychiatric Rating Scale (BPRS)[6]. Interrater reliability was analyzed based on 45 pairs of ratings.

As indicated in the results, this study continues to support the finding that the K Axis is a valid and reliable instrument.[18,19,28] This raises the question "When should the K Axis be used instead of other widely used instruments, such as the GAF, HoNOS, or even the BPRS? The following comparisons offer some answers:

Use of the Kennedy Axis V Verses the Global Assessment of Functioning (GAF)
The K Axis and the GAF are valid and reliable instruments for global assessments of mentally ill patients. A major advantage of the K Axis over the GAF is its ability to provide a multidimensional measure of a patient's functioning.[17,18,30] In addition to being able to focus on areas of strengths, as well as weaknesses, its multidimensional measures allow the K Axis to profile patients and agencies. This has been shown in a study whereby the K Axis separated different diagnostic groups based on their K Axis profiles.[28,29]

Once you know the patient, both the GAF and the K Axis can be quickly rated. If you only need the GAF rating, the K Axis has the flexibility of quickly generating a GAF, i.e. once you have identified the most impaired of the first four K Axis subscales, then the rating from that subscale (GAF K) should be equal to the GAF rating.[22] The K Axis can also be used to

generate a GAF Equivalent which represents an overall average functioning of a patient, rather than like the GAF, focusing in on only the most impaired domain.

Use of the Kennedy Axis V Verses the Health of Nations Outcome Scale (HoNOS)
When considering the descriptions of both scales and the context in which they were developed, obvious similarities can be found.[18,31] They both measure a wide range of behaviors, impairments, symptoms, social functioning and environmental factors. Like the K Axis, the HoNOS was primarily developed as an instrument for a global assessment of functioning and in that it succeeds, according to the correlation results with the HoNOS and GAF in Table 3 Part A and in Table 3 Part B.

Table 3 Part B Kennedy Axis K (Subscales 5-7) Correlation Coefficients

K Axis (Subscale)	Variable	Spearman's Rho
K Axis 5 (SAB)	GAF	0.191*
	HoNOS 3 (Problem drinking or drug taking)	-0.842*
K Axis 6 (MED)	GAF	0.169**
	HoNOS 5 (Physical illness or disability problems)	-0.806*
K AXIS 7 (ANC)	GAF	0.250*
	HoNOS 11 (Problems with [access to reasonable] living conditions)	-0.545*
	HoNOS 11 + HoNOS 12) Problems with [access to reasonable] living conditions + problems with [access to reasonable] occupation and activities	-0.566*

* Correlation is significant at the 0.01 level (2-tailed).
** Correlation is significant at the 0.05 level (2-tailed).

On the other hand, when comparing the K Axis to the HoNOS, there are number of significant differences. To start, the HoNOS has 12 items, whereas the K Axis has only 7. Therefore, the K Axis is easier to score and it covers all of the major psychiatric functional areas. Also, unlike the K Axis, the HoNOS does not have the ability to generate a GAF or to generate an overall average functional score (GAF Equivalent).

Further, the HoNOS separates the psychiatric symptomatology into more specific items. The benefit of this is that the seriousness of each symptom/item can be considered separately; however, rating each individual symptom separately means that the item list becomes longer and the bigger picture is less clear. With the K Axis, psychiatrists and other mental health workers can focus in on the most serious problem area and to what extend that area leads to functional impairment. This ability to quickly focus in on the most impaired area, while at the same time being able to see the bigger picture is a powerful feature of the K Axis' global scores and its subscales.

This is further enhanced by the wide scoring range of the K Axis. With a range from 5 to 100 (at 5 point intervals) the severity can be indicated more precisely than with a range from 0 to 4, as with the HoNOS. This sensitivity also helps the K Axis to more effectively capture relatively small changes during the course of treatment.

Use of the Kennedy Axis V Verses the Brief Psychiatric Rating Scale (BPRS)

The BPRS is focused in on psychiatric symptoms and tracking response to medication changes. The fact that all psychiatric symptoms are assessed collectively on K Axis Subscale 1 (Psychological Impairment) and K Axis Subscale 3 (Violence) allows the K Axis, like the BPRS, to effectively convey the severity of the patient's psychiatric symptoms and track their response to treatment. On the other hand, major clinical areas addressed by the K Axis are missing from the BPRS, including measuring skills, substance abuse, medical impairment, and stress. These limitations also contribute to the BPRS' inability to make global assessments of functioning.

Of note, the K Axis and the BPRS were used together in a recent study in which they might have helped "...reduce incidents of aggression and use of restraint and seclusion in psychiatric wards."[12]

Standardization

When used properly, measurement instruments indirectly have a good calibrating effect on the user. This is done by compelling a clinician to compare his/her expertise to that of others and sometimes even reconsider his/her ideas on certain topics in daily practice.[14] This standardization should carry across agencies, as well as across disciplines. This calibrating function of scales also helps improve the clarity of communication between care providers about a patient's condition as they use the same standard "language."[2] For example, knowing that a K Axis or GAF score of 30 reflects severe impairment for a patient, helps one to quickly communicate to other clinicians that the patient has some very serious impairment in his/her functioning.

Further advancing standardization of the K Axis ratings is the accompanying book, *Mastering the Kennedy Axis V,* from American Psychiatric Publishing.[18] This helps to assure similar K Axis rating across clinical situations. This was demonstrated in a recent study in which the K Axis was shown to maintain consistency in ratings across agencies, as well as across disciplines, e.g. nurses, teachers, psychologists, and psychiatrists.[28]

Treatment Planning

The K Axis is organized in such a way that it can be used to develop comprehensive problem lists for psychiatric treatment planning, as well as for tracking treatment outcome. This is a feature unique to the K Axis and is documented in an associated book, *Fundamentals of Psychiatric Treatment Planning, Second Edition*.[32,33]

SUMMARY

Increasingly the field of psychiatry is realizing the critical need for the use of standardized instruments to assist with describing and tracking a patient's symptoms as a part of good clinical practice. The K Axis is a valid and reliable instrument that captures much of the functionality of three of the most widely used instruments within the field of psychiatry. Wider use of the K Axis in the United States is suggested to take advantage of the multidimensional power of the K Axis over the unidimensional GAF(Axis V) and the BPRS' focus only on psychiatric symptoms. As indicated, the K Axis overlaps substantially with the HoNOS on several relevant aspects and on some significant aspects it yields better results. The HoNOS is used routinely in the United Kingdom and Australia for global assessments of

psychiatric patients, but because of its strengths and flexibility, the K Axis should be considered as a substitute for the HoNOS in many situations.

In addition to the above, the K Axis is also able to maintain consistency in ratings across agencies and disciplines, as well as generate profiles which correlate with different diagnostic groups. The K Axis can be used to organize comprehensive psychiatric treatment plans. Finally, the K Axis might be helpful with reducing time in restraint and seclusion.

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