Validation of the Aggressive Behavior Domains of a Screening Instrument for Challenging Behavior in a Health Organization for Mentally Retarded: AveleijnSDT's Risk Scan

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Abstract

Background: Aggression among mentally retarded who receive in- or outpatient care can have severe consequences for co-clients, staff, the care organization, society but also the aggressor themselves. To manage and prevent aggressive behavior among clients, knowledge is needed about types and characteristics of (historical) aggressive behavior. A new screening instrument, AveleijnSDT's Risk Scan (ARS), should enable rapid, systematic collection of data on displayed aggressive behavior.

Method: In a care institution, totaling 3232 mentally retarded clients, all present clients were screened on aggressive behavior using ARS during a four weeks period. The screening results were compared with past registrations made with the Staff Observation Aggression Scale-Revised. With this data sensitivity, specificity and predictive values for various threshold screening values were calculated. A ROC curve was drawn to calculate the Area Under the Curve (*AUC)*.

Results: A score of four more items yielded a sensitivity of 74% and a specificity of 80%. A positive predictive value of 0.32 and a negative predictive value of 0.96 was registered at this cutoff. The measured *AUC* was 0.86.

Conclusion: The aggressive behavior domains of ARS are a suitable instrument for the screening of aggressive behavior in a population of mentally retarded clients.

Introduction

Challenging behavior is a significant problem among people with mental retardation. According to an estimate of the The Netherlands Institute for Social Research (Sociaal Cultureel Planbureau) in 2001, approximately 112,000 citizens in the Netherlands were mentally retarded with an IQ below 80. This number will be stable for the coming ten years (Woittiez, I. & Crone F., 2005). Studies on the overall prevalence of challenging behavior among mentally retarded are scare. Emerson et al. (2001) found a prevalence rate of challenging behavior of 10-15% under mentally retarded who are in contact with educational, health or social care services in England.

Challenging behavior includes aggression, stereotypes and inappropriate social behaviors such as aberrant sexual behavior. There is no sufficient evidence for a direct relation between challenging behavior and mental retardation, but both do coexist (Allen & Davies, 2007). Among mentally retarded, challenging behavior has been correlated with substance abuse. Studies found that a significant number of mentally retarded suffer from alcohol or drugs abuse (Taggart et al., 2006; Diddena et al., 2009). Substance abuse is related to aggressive behavior, having higher levels of

risk-taking behavior including suicide attempts or being (sexually) exploited (Walters et al., 1995; Clarke & Wilson, 1999; Doody et al. 2000; McGillivray & Moore, 2001; Taggart et al., 2006).

Aggressive behavior represents a significant part of the overall challenging behavior under mentally retarded. The prevalence rate of aggressive behavior among mentally retarded ranged from 7% to 64% (Borthwick-Duffy, 1994; Bihm et al., 1998; Emerson et al., 2001; Tenneij & Koot, 2008; Crocker et al., 2007). Mentally retarded can develop serious aggressive behavior, whether or not in combination with substance abuse. This behavior could create risks for the client themselves, fellow patients, personnel at care organizations and society as a whole. Aggression among mentally retarded can have negative economic effects like damage of material goods or the need for medical attention. Other consequences include physical injury and death; isolation from family, peers and community; the development of related psychopathology and placement in restrictive environments (Bihm et al.,1998). People who work with aggressive mentally retarded can suffer from undermined morale, fear and the confrontation with ethical problems due to the required use of therapeutic procedures (Corrigan, Yudofsky & Silver, 1993).

Considering the possible severe consequences of aggressive behavior, the early identification of possible risk on aggressive behavior among mentally retarded clients is important. Further risk assessments can be done on the basis of an early collection of (historical) data on aggressive behavior at the intake of a client at a care institution. Periodical retests at the institution would quickly identify emerging trends in displayed aggression. After further risk assessments, interventions can be prepared in the environment of clients to eliminate incentives that feed aggression. This would ultimately have a preventive effect on aggressive behavior.

A Dutch care institution for mentally retarded created AveleijnSDT's Risk Scan (ARS). This scan should enable rapid, systematic collection of (historical) data on challenging behavior. The ARS is administrated at the intake of a new client. A periodical rescan will monitor changes in behavior. The target population of this screening instrument are mentally retarded clients of all ages and all

levels of mental retardation. The goal of this scan is to identify possible risk groups for challenging behavior. Future measures to prevent challenging behavior under mentally retarded clients will be based on the collected data by ARS. The ARS contains 65 items spread over five behavior domains on challenging behavior, namely 'Aggression and Other Impulses Aimed at Others', 'Aggression and Impulses Aimed at Objects', 'Auto-aggression', 'Addictive Behavior' and 'Aberrant Sexual Behavior'. ARS is comparable to existing instruments that measure observer-rated challenging behavior like the Abberant Behavior Checklist (Aman & Sing, 1985) and the Behavior Problem Inventory (Rojahn et al., 2001). These instruments contain comparable items on challenging behavior. However, ARS measures a broader spectrum of challenging behavior, including addictive behavior and aberrant sexual behavior. Also the inclusion of registered frequencies in specific time frames for various items is a distinctive factor of ARS.

Since ARS is a new instrument, the validity of this instrument had not yet been established. An important question is to what extend this new instrument is able to distinguish mentally retarded clients that might display challenging behavior and thus need further examination and adjustments in environment or supervision, from clients that are not likely to display challenging behavior.

In this study the validity of ARS with respect to the measurement of aggression, as part of the challenging behavior spectrum, will be examined. This study will concern the domains of ARS related to aggression namely, 'Aggression and other Impulses Aimed at Others', 'Aggression and Impulses Aimed at Objects' and 'Auto-aggression'.

Methods

Sample

All 3232 clients registered at a Dutch institution for mentally retarded people in the east of the Netherlands in June 2009 were included in this study. The selected clients received supervised

living care, outpatient care and/or support in daytime activities. All 69 care clusters of the institution, which are spread over the region, were involved in this study. The care clusters differ in size, client group and in the types of care that are provided. All 460 personal supervisors employed at the care clusters during this study were asked to participate. Personal tutors supervise multiple clients in their daily activities. Each client has one main personal tutor. A total of 115 clients who came into care after 01-01-2009 at the institution were excluded from this study. Personal tutors are considered not to have a complete view on the behavior of these clients and will be unable to rate the displayed behavior.

Data collection

The validity of the new instrument to classify clients on aggression namely ARS, is examined in this study. Historical data on aggression, which are used to rate the validity of ARS, are derived by means of Staff Observation Aggression Scale-Revised (SOAS-R).

ARS

ARS is developed by listing challenging behavior that was considered worth registering on management level of the institution that created the scan. Current policies on reporting behavior at the organization, legislation on criminal activities like abuse and Dutch norms for the harmonization of quality review of health care and welfare (HKZ norms) were used as sources. A panel of personal tutors and behavioral scientists at the institution adapted the list of challenging behavior, using their expertise and practical experience. Their input, as a result of several pilot studies in which ARS was administered by personal tutors and behavioral scientist, resulted in the current ARS.

ARS starts with the inventory of general characteristics of the client and administrator namely the client number, date of birth and sex of client. The name of the administrator of the test, the

registration number of the location at which the test is administrated and the date of administration are also registered. Subsequently, the clients are screened on five domains of challenging behavior. The domain that concerns ‘Aggression and Impulses Aimed at Others’, screens the degree of aggressive behavior from the client, specific to other people or animals.

Aggressive behavior that is specific aimed at objects in the client’s environment is screened in the domain ‘Aggression and Impulses Aimed at Objects’. Under the domain ‘Auto-aggression’ items are placed which screen to what extent a client shows challenging behavior involving self-harm. The domain ‘Addictive Behavior’ screens for the abuse of psychoactive substances such as alcohol and drugs and impulse control problems such as (pathological) gambling. The last domain ‘Aberrant sexual behavior’ is mainly based on input from expert employees and on legislation. This category includes behavior that can be labeled as paraphilia or other sexual behavior that could lead to a risk for mentally retarded clients themselves or others.

ARS distinguishes two item categories that are displayed light and dark. These two categories reflect the severity of the behavior. The light category includes behavior or impulses, which are expected to be adjusted by the personal supervisor and/or the client itself over time. The second, dark category represents behavior or impulses that need urgent attention and interventions involving higher manager and expert opinions. Each client is screened over all 65 items spread over the five domains. Each item is represented by a box that contains a description of a specific type of behavior. Various items are restricted with a time frame and a minimum displayed frequencies to distinguish state from trait behavior characteristics. If the type of (historical) behavior is applicable to the client, the box is ticked. If the type of (historical) behavior is or has not been displayed by the client, the box remains empty. Administrators of ARS are allowed to use various data sources like, personal observations, behavior report systems and other test results.

SOAS-R

The SOAS-R reporting system is an instrument based on observer-rated aggression by staff (Nijman et al., 1999). This instrument is an improved version of the Staff Observation Aggression Scale (Palmstierna & Wistedt, 1987). The SOAS-R is used for research on the prevalence, severity and determinants of inpatient aggression (Nijman et al., 2002). In this system, employees register aggression incidents immediate after occurrence. The provocation, means used by patient, target, consequences and measures taken to stop the aggressive behavior are registered by boxes that have to be ticked. (Nijman et al., 2002). Lastly, there is an option present for extra comments to provide additional information that could not be registered by tick boxes. Tennij et al. (2009) states that the SOAS-R is a good instrument to classify clients as aggressive or nonaggressive. In this study, in over a month, about 81% of the clients were correctly classified. The kappa value of 0.62 indicated good agreement between raters, although there was noted that the observations could have taken place at different moments in time. The number of clients classified incorrectly as nonaggressive was further reduced when using a longer period of SOAS-R data to categorize clients.

Since 2006, a digital version of SOAS-R is operational at the institution. In 2008 about 1500 incidents concerning aggressive behavior among clients were registered. After analysis of the SOAS-R registrations of the first quarter of 2009, 487 incidents were reported caused by 205 different clients. At the institution, all personal tutors are familiar with the use of the reporting system. The reporting system is accessible on every location through the intranet of the institution. The use of SOAS-R is formalized in organizational policy. During frequent meetings on all organizational levels, the use of the report system is encouraged.

Procedure

In the first week of July 2009, a packet was sent to all clusters by mail. This packet included a personal letter with instructions to the personal tutors and cluster managers, a manual for every personal tutor at the cluster location and an ARS form to be administered to every client at the cluster. The cluster manager was asked to instruct the tutors and spread the manuals with the ARS forms over the clusters.

In the letter accompanying the scans, personal tutors were asked to first read the manual before administering ARS to the clients they tutor. In the manual the purpose and the procedure to administer ARS was explained. Lastly, the manual included an extended explanation of every item of the scan. After reading the manual, personal tutors were allowed to administer the scans to their clients. The personal tutors were given four weeks, from 06-07-2009 until 03-08-2009, to administer the scans to the clients. It was allowed to administer one scan per client. Every client was scanned one single time. Various information sources were allowed in order to fill out the scan. They could fill out the quick scan solely on their personal experience with the client, but they were also able to use any historical files from different report systems or tests on behavior to complete the scan. Once the scans were filled out, the scan was send back to the administrative headquarters of the institution. After the ARS results were collected and registered at the administrative headquarters, for every screened client was registered if they had or had not a

SOAS-R registration. This information was extracted from a SOAS-R analysis report on client level retrieved from the SOAS-R database at the institution for the period of 01-01-2006 until 01-07-2009.

Statistical analysis

After collection, the results of the scans were entered in SPSS 16.0. The validity of ARS with respect to the measurement of aggressive behavior was assessed with SOAS-R registrations as

criterion measure. Sensitivity and specificity for registered ARS scores were calculated. Cutoff scores for ARS were calculated for various item thresholds in order to determine the optimal screening threshold. Predictive values were calculated for the various thresholds. A ROC curve was plotted to calculate the area under the curve (*AUC*). This measurement is used as a summary measure of the overall discriminative ability of the scan.

Results

In four weeks time, 1505 ARS screening results of clients were registered. This resulted in a response-rate of 47%. Of the screened clients 43% were female, 55% were male and from 2% the sex is unknown. The mean age was 37 (*SD*=17; Range = 3-87). A total of 59 care clusters participated in this study and 278 different personal tutors filled out the scans.

Over the 1505 scans that were included in this study, 934 scans contained one or more positive items in one or more aggression categories of ARS. This indicates that 934 (62%) of the registered clients have a history of aggression. A number of 571 scans (38%) were returned negative, which means no aggression was displayed by these clients. A total of 3612 positive items (*SD*= 3.1; Range 0-17) were ticked in the three aggression categories together of ARS. This results in a mean of 2.4 positive items per administered scan. Among the 1505 registered clients, 171 clients (11%) had a registration of displayed aggression in the SOAS-R reporting system over the period 01-01-2006 to 01-01-2009.

Table 1 shows the number of clients scanned positive for aggression with ARS, the number of positive scanned clients with ARS that also had a SOAS-R registration, sensitivity, specificity and predictive values for various cutoff values for ARS. A cutoff value represents a threshold. This threshold determines the number of positive items on ARS from which a client is classified aggressive or not. A client who scores equal to the selected cutoff value or higher is classified as

aggressive. Clients who score below the selected cutoff value are classified nonaggressive. By setting cutoff values for ARS, the user can influence the performance of the test.

Table 1: Validity of AveleijnSDT's Risk Scan (N= 1505)[a]

Number of positive items on ARS	Clients *(N)*	SOAS-R *(N)*	Sensitivity *(%)*	Specificity *(%)*	PPV *(%)*	NPV *(%)*
1	934	168	98	43	18	99
2	686	162	95	61	24	99
3	516	140	82	72	27	97
4	395	127	74	80	32	96
5	290	112	66	88	39	95
6	219	94	55	91	43	94
7	160	70	41	92	44	92
8	127	54	32	95	43	91
9	94	40	23	96	43	91
10	69	28	17	97	41	90
11	46	20	12	98	44	88
12	30	12	7	99	40	89
13	24	10	6	99	41	89
14	11	3	2	99	27	89
15	8	1	1	99	13	89
16	5	1	1	99	20	89
17	1	0	0	99	0	89

a. A score of 4 or more (shaded) was chosen as optimal cutoff.

Sensitivity and specificity

The sensitivity and the specificity for various cutoffs values of ARS scores are displayed in Table 1. A screening score of four or more can be chosen as the optimal cutoff, as it provided a sensitivity of 74% (95% confidence interval (*CI*)=0.71–0.77) and a specificity of 80% (95% *CI*=0.77–0.83). A higher threshold cutoff results in a loss of sensitivity without a considerable increase in specificity. The selection of lower threshold cutoffs will result in a considerable loss of specificity. By selecting four or more positive items as threshold, the level of sensitivity leads that seven out of ten people showing aggression will correctly be identified as aggressive by ARS. This level of specificity leads that eight out of ten people who are nonaggressive would be successfully screened out.

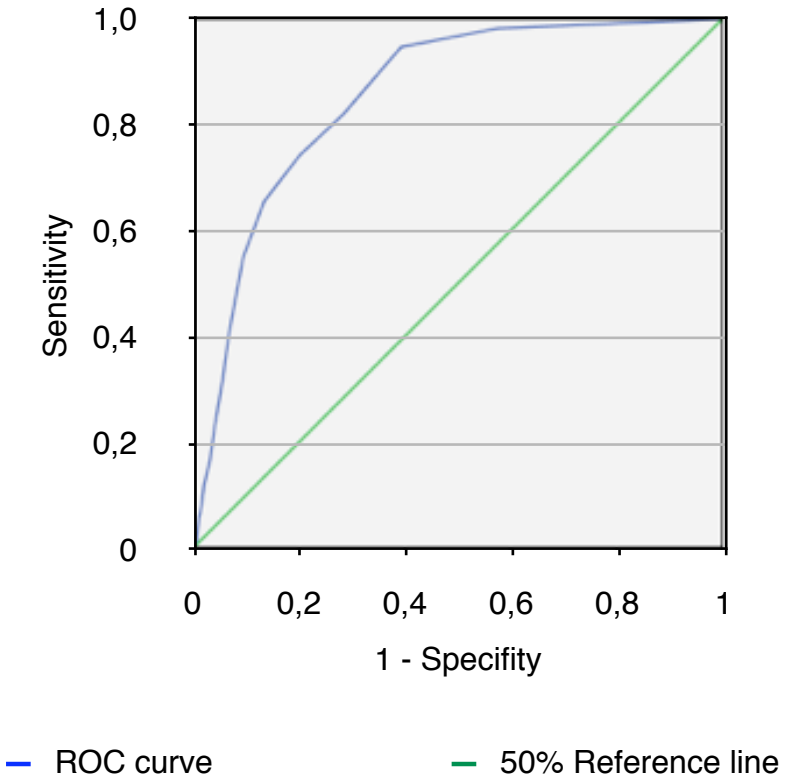
Predictive values

The predictive values of various cutoff points are displayed in Table 1. The positive predictive value in the selected cutoff point is 32% (95% *CI*=0.29-0.35). This indicates 32% of mentally retarded clients at the institution with positive test results on ARS also had a SOAS-R registration. A negative predictive value of 96% (95% *CI*=0.93-0.99) was calculated. This indicates that 96% of the clients at the institution with negative test results on ARS did also have no SOAS-R registration.

ROC curve

A graphical representation of the trade off between the sensitivity and specificity for every possible, registered cutoff was made with a ROC curve as specified in Table 1. The ROC curve of the Aggressive Behavior Domains of ARS with SOAS-R as criterion measure is displayed below in Figure 1. The measured *AUC* is 0.86 (95% *CI*=0.83-0.89). An *AUC* of 0.86 means that a randomly selected client considered as aggressive has a test value larger than that for a randomly chosen individual that is considered to be nonaggressive at 86% of the time.

Figure 1: Curve of the Receiver Operating Characteristics at Different Cutoff Points of the Aggressive Behavior Domains of AveleijnSDT's Risk Scan Item Scores. (*N*= 1505)



Discussion

The results of this study indicate that the aggressive behavior domains of ARS enable the classification of mentally retarded clients as either aggressive or nonaggressive. The sensitivity of 74% and specificity of 80% of the aggressive behavior domains of ARS can be labeled as good. By selecting four or more positive items as threshold optimum, 74% of the clients displaying aggression will correctly be identified as aggressive. Among the clients who are not considered to display aggression, 80% would be successfully screened out. The positive predictive value of the aggressive behavior domains of ARS is low. About 32% of the mentally retarded clients in this study with positive test results on ARS also had a SOAS-R registration. The negative predictive value could be labeled as high. About 96% of the clients in this study with negative test results on ARS did also have no SOAS-R registration. The *AUC* shows that 86% of the time, randomly

selected clients considered as aggressive will have a test value larger than that for a randomly chosen client that is considered to be nonaggressive. The discriminative value of the aggressive behavior domains of ARS can be rated as high. Summarized, the validity of the aggressive behavior domains of ARS, using SOAS-R as a criterion measure, can be considered good.

Despite the chosen threshold of four ore more gives optimal values for sensitivity and specificity, the selection of the optimal cutoff is subjected to the preferences of the user of the instrument. In case of clients that show aggression, a significant amount of false negatives can have severe consequences for the institution. A lower cutoff point will increase sensitivity and will screen out a larger part of the aggressive clients, but will also results in a loss of specificity. A loss of specificity can result in unnecessary follow-ups or interventions. These tradeoffs should be considered by the user.

A significant low predictive value of the aggressive behavior domains of ARS is found. The low predictive value of ARS could be explained by the relatively low prevalence of 171 (11%) of registered aggression by SOAS-R under the screened clients. This negatively influences the fraction of true positives and false positives and will positively influence the fraction of false negatives and true negatives. In populations with higher prevalence rates of aggression, the predictive values will improve. Low predictive values and higher proportions of false positives are a known issue in other studies of low prevalence populations, for example in sexually transmitted disease screening evaluations (Zenilman et al. 2003). Lower positive predictive values obtained when screening low prevalence populations have to be taken into account during the use of these instruments. Repeated testing, preferably with a different assay, and disclosure of the undeniable potential for false positive test results is preferable in screenings in low prevalence populations (Zenilman et al. 2003; McNally, 2008).

A relatively large amount of clients were labeled as aggressive, while they did not had a SOAS-R registration in the past. Besides the influence of low prevalence of aggression, the amount of false

positives can be caused by random measurement faults. Incidentally misinterpretation of items by the rater can be a cause. Also a fundamental difference between the aggressive behavior domains of ARS and SOAS-R is possible. This causes nonaggressive clients as rated by SOAS-R to be labeled as aggressive by ARS. A structural misinterpretation of items on the scan, can be the result of wrongly operationalized constructs and/or difficult to interpret items by the rater. Related to the measured construct, ARS can measure different aspects of the aggressive behavior spectrum, which are not included in SOAS-R. If ARS entails a larger part of the spectrum of aggressive behavior, it is likely it will scan more clients as positive than SOAS-R. Only future validation with different rating instruments for aggressive behavior as criterion measure can rule this out.

One of the limitations of this study is the selection of SOAS-R as *golden standard* for the classification of aggressive behavior. Despite this instrument is not impeccable, SOAS-R is tested for a sensitivity of more than 81% and good inter-rater agreement (Tennij et al., 2009). Due to the good psychometric value of SOAS-R, it is unlikely the results are spurious. However, the use of historical data, like SOAS-R data, for future preventive measures is debatable. Historical behavior of mentally retarded does not have to correlate with current or future behavior. Aggressive behavior can be considered as a reoccurring trait or a single, temporary state of a client (Suris et al. 2004). Given the categorizations in time frames and registered frequencies within these timeframes, the aggressive behavior domains of ARS tends to collect data on both. The restrictions in time frames and registered frequencies within time frames vary per item. Caution on interpreting the results in practice is advised, since trends in aggression can shift depending on their state or trait nature.

The discriminative value of the aggression domains of ARS is rated good in this study. However, the registered ROC characteristics are influenced by inter-rater variation. Due to personal characteristics of the rater, different raters may rate one and the same client differently. These different raters may rate on different ROC curves. Ratings of different raters can also move along the same ROC curve. No distinction between results of different raters is made in this study. The

ROC curve in this study displays the combined results of the personal tutors present at the institution, representing the situation when ARS is used in future practice.

Lastly, under-report of incidents in SOAS-R could explain a number of the false positives. The occurrence of under-report of aggression by staff is found in other studies (Crilly et al., 2004; MacPhersson, 1994; Tenneij et al., 2009). ARS screens a wide spectrum of mild to severe aggressive behavior. It is possible that only moderate to severe cases are reported, due to staff that is accustomed to behavior. ARS may be useless in milder cases, because raters fail to report mild behavior. A good example is verbal aggressive behavior. Verbal aggressive behavior in combination with anger outburst will be easily picked up. Mild verbal aggressive behavior, like name calling or cursing, may not be reported al all. Raters are accustomed to milder behavior or do not take it as serious enough to be reported. Next to staff that is accustomed to behavior, also peer pressure not to report, fear of blame or excessive administrative work can be reasons for under-report of milder but also severe aggression (Crilly et al., 2004 Lanza, 1992; Lyneham, 2000; Forrester, 2002). Since the report system was operational for more than two years, staff was familiar with the instrument during the study. Several measures are taken by the institution in the past to reduce under-report in SOAS-R. Firstly, the use of SOAS-R is formalized in institutional policy. Besides this, reporting of incidents in SOAS-R is constantly encouraged in staff meetings on all levels of the institution.

Final Conclusion

It can be concluded that the aggressive behavior domains of ARS are suitable to distinguish aggressive mentally retarded clients from nonaggressive mentally retarded clients. ARS is an efficient instrument for the analysis of data on client aggression either as state and trait in contrast to SOAS-R. SOAS-R data needs further analysis to extract the same summarized information on state and trait aggression characteristics.

Test results of the aggressive behavior domains of ARS should be evaluated with care in the field. The relatively low prevalence of aggression in population influences the predictive values of the instrument. One should be aware of the occurrence of false positive and false negatives while using ARS. Besides this, ARS registers aggression either as state or trait of a client. Each of these two behavioral states should be considered carefully on basis of registered frequencies in specific time frames, before making follow-up decisions.

Several ideas for future research come forth from this study. A review of the knowledge domain 'aggression', either as state and trait, is needed to determine if all relevant behavior is correctly and completely operationalized in ARS. To confirm the correctness of operationalizations, future validation with different rating instruments for aggressive behavior as criterion measure is recommended. Lastly, the sample was limited to employees and clients from one institution. These clients varied in the extend of mental retardation, type of care and care environment and prevalence of behavior. Besides this, raters might have been influenced by the culture, routines and expertise present in the organization. The validity of ARS in different care settings and for different client groups has to be examined.

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