DOCUMENT RESUME

ED 368 128 EC 302 883

AUTHOR Guess, Doug; And Others

TITLE Replication and Extended Analysis of Behavior State, Environmental Events, and Related Variables in Profound Disabilities.

PUB DATE Nov 93

NOTE 53p.; Paper presented at the Annual Conference of the Association for Persons with Severe Handicaps (Chicago, IL, November 4-6, 1993).

PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC03 Plus Postage.

DESCRIPTORS *Arousal Patterns; *Behavior Patterns; Children; Developmental Disabilities; Elementary Secondary Education; *Environmental Influences; *Multiple Disabilities; Neurology; Preschool Education; *Severe Disabilities; Youth

IDENTIFIERS *Behavior States

ABSTRACT

This investigation analyzed information pertaining to behavior states and their relationship to numerous environmental, physiological, and demographic variables and events. The 66 participants ranged in age from 1 to 21 years and were classified as having profound and multiple disabilities, with developmental ages that ranged to 24 months. Behavior state and environmental codes were used to collect continuous data over an extended time period for subjects in 21 different educational settings. Participants were placed into eight groups by profiles that represented similar patterns of state conditions (inactive sleep, active sleep, drowse, daze, awake inactive-alert, awake active-alert, awake active-alert with stereotypy, and crying/agitation). The results were consistent with other investigations in the following areas: percentage of time students were observed in the eight states; relatively small time intervals between state shifts; similar probabilities that one particular state will follow another over time; a weak association between environmental events and state changes; a close similarity in the types of environmental variables and events present during observation sessions and settings; and a high correspondence in percentage occurrences for several demographic variables, levels of skill development, and extent of motor impairments and sensory losses. Results provided strong replication of previous findings and new information that further focused on the complex nature of state phenomena and associated variables. (Contains 30 references.) (JDD)

Replication and Extended Analysis of Behavior State, Environmental Events, and Related Variables in Profound Disabilities[1,2]

Doug Guess
and
Sally Roberts
University of Kansas

Ellin Siegel-Causey
University of Nebraska at Lincoln

Jane Rues
Rockhurst College

Abstract

Behavior state is increasingly recognized as a major variable that affects learning and development among persons with profound and multiple disabilities. This investigation extends the collection and analysis of information pertaining to state behavior and its relationship to numerous environmental, physiological, and demographic variables and events. Behavior state and environmental codes were used to collect continuous data over an extended time period for students with profound disabilities in 21 different educational settings. Results confirmed profile groupings derived from the quality of state behavior, and differences between profiles based on sequences of state changes, influences from environmental events, and a variety of demographic and characteristic data that included developmental levels, motor and sensory impairments, and medications. Results provided strong replication of findings from previous studies, and new information that further focused on the complex nature of state phenomena and associated variables.

Replication and Extended Analysis of Behavior State, Environmental Events, and Related Variables in Profound Disabilities

Educational and clinical observations indicate that children and youth with profound and multiple disabilities have difficulty in attending and responding to environmental stimuli (Ferguson, 1985; Thompson & Guess, 1989), suggesting a problem with the quality and consistency of their *behavior state* conditions (Campbell, 1989; Helm & Simeonsson, 1989; Landesman-Dwyer & Sackett,1978; Rainforth, 1982; Reid, Phillips, & Green, 1991; Sailor, Gee, Goetz, & Graham, 1988). Behavior state has been described by Wolff (1959) as levels of alertness and responsiveness reflecting behavioral and physiological conditions in typical infants; and, as "...expressions of the maturity, status, and organization of the central nervous system...which mediate the child's ability to respond to the environment and stimulation" (Helm & Simeonsson, 1989, p. 203). Most state studies have been conducted with normally developing infants, including the extensive analysis of sleep-wake patterns (Thoman & Whitney, 1990).

Our investigations over the past eight years (Guess, Roberts et al., 1993; Guess, Siegel-Causey et al., 1993; Guy, Guess, & Mulligan-Ault, 1993) indicate that state behavior has a significant influence on the alertness and responsiveness of children and youth with profound disabilities and, indirectly, on their learning, development, and overall "quality of life." Our initial studies were designed to measure the quality of state behavior in this population (Guess et al., 1988). Later research identified endogenous (organismic) and exogenous (environmental) variables associated with state conditions (Guess et al., 1990), and then explored, over time, the relationship between state behavior and ongoing environmental events (Guess, Roberts et al., 1993; Roberts, 1992). Based upon results from these studies, a model was formulated to help measure and analyze state variables and conditions (Guess, Siegel-Causey et al., 1993).

The model was derived partly from Als' synactive theory (1986, 1982) for assessing preterm infants and Wolf's (1987) longitudinal investigations on state behavior of normally developing infants. The model further agrees with Korner (1972) and Helm and Simeonsson (1989) that state can be viewed as: 1) an *obstacle* that compromises assessment; 2) a *variable* that reflects influences of endogenous and exogenous factors and conditions; and 3) a *mediator* that affects responsiveness to stimulation. Accordingly, it is assumed that state conditions and organization mediate attentiveness and responsiveness to environmental stimuli, and the outcomes of this mediation are influenced by dynamic interactions between endogenous and exogenous variables existing at the point of observation.

The present investigation had two major purposes. First, we wanted to replicate various important findings that were indicated in earlier studies. This included overall assessment of state quality among students with profound and multiple disabilities, and the presence of variables associated with state organization patterns; such as, predictable state sequences, and time durations between changes in state categories. Second, we wanted in this study to assess the extent to which environmental changes influenced state, and to evaluate more extensively the characteristic and demographic variables that earlier appeared associated with different state profiles.

Method

Participants

In selecting participants, teachers were first asked to identify their lowest functioning students with profound and multiple disabilities. Next, two members of the research staff needed to concur on each student met three or more of these criteria: a) severe motoric limitations; b) non responsiveness to environment; c) nonverbal; and d) interventions implemented at a basic, sensory input level. The 66 participants ranged in age from 1 year 11 months to 21 years 2 months, and included 41 males and 25 females. They were all classified as having profound and multiple disabilities with developmental ages that ranged to 24 months. Fifty one students received some type of medication, anticonvulsants, tranquilizers, antihistamines, and/or muscle relaxants. Table 1 summarizes other medical and developmental information.

(Insert Table 1 Here)

Settings

The population came from 21 preschool, elementary, and secondary programs for students with profound and multiple disabilities who resided in ten rural and urban communities. Ten students attended early intervention programs and 20 students were located in programs housed in public elementary school buildings. Seven students attended classrooms located in middle or high school settings. Ten students attended a separate special education facility, but lived in their natural homes, and 19 participants were in classrooms located on the grounds of a residential facility.

Equipment

Portable event recorders (S & K Computer Products, Ltd., Model #PC-8300) were used to collect continuous behavior state and environmental data. The recorders allowed data from each code to be entered throughout the session, and subsequently transferred to a personal computer for analysis.

Data Collection Codes

Behavior state. The state observation scale was originally adapted from the Neonatal Behavioral Assessment Scale (Brazelton, 1984) and has been used in our previous investigations (Guess et al., 1988, 1990, Guess, Roberts et al., 1993). The code, Table 2, included definitions for the eight categories of inactive sleep, active sleep, drowse, daze, awake inactive-alert, awake active-alert, awake active-alert with stereotypy, and crying/agitation, which also included self-injury.

(Insert Table 2 Here)

Environmental. Categories of the environmental code were identified from extensive staff experiences with persons having severe, profound, and multiple disabilities. Environmental events and conditions with potential interactive effects on state were further ascertained from observations of coders in earlier studies (Guess et al., 1988, 1991), and from numerous sources in the areas of behavior state, and applied and experimental psychology. The code described the following major conditions and events.

The occurrence or nonoccurrence of **direct social interaction** from an adult or a peer was recorded. This interaction involved touching, talking to, and/or looking at the subject. If an interactive activity was observed, it was further noted who was doing the interacting (i.e., adult or another student) and what **type of activity** was occurring. The type of activity included **self help** (e.g., toileting, feeding, dressing), **maintenance** (e.g., adjusting equipment or materials), or **play/ instructional/other** (e.g., nonstructured free time, instructional training, leisure activity). If **no interaction** was occurring, it was noted whether or not another individual was in **close proximity** to the student (within five feet). **Level of activity** within a ten foot radius of the student was rated as active, moderate, or inactive. The **presence or absence of material** was recorded, with "presence" requiring accessibility through the student's available sensory modalities. Finally, if no mobility was occurring, **body position** was recorded for the **sitting**, **standing**, **prone**, **supine**, or **sidelying** position. It was also recorded when mobility produced a change in **body position**, **location**, or **both**.

Student and Family Evaluation Form (SFEF)

The Student and Family Evaluation Form (SFEF) from previous studies (Guess et al., 1990, 1991) was used to collect demographic and characteristic information on participants. Information was taken from medical, hospital birth, and school health records, and educational and psychological files. Categories included: levels of mental retardation and adaptive behavior, AAMD medical diagnosis/etiology, early medical experiences (including APGAR scores), developmental levels, motor dysfunction and primitive reflexes, mobility, sensory impairments, medications, seizure activity, health care maintenance needs, and nutrition status. A physician reviewed and confirmed the etiology information for all participants.

Procedures

Training for coders. Graduate research assistants who collected data were first required to memorize state and environmental code definitions, and then score 100% on a written examination. This was followed by coding from video tapes of students where a minimum of 85% agreement with two research staff was required. Four practice coding sessions were next conducted in classroom settings where, again, a minimum interobserver agreement score of 85% was required. Finally, sessions were conducted in classrooms to practice the smooth exchange of coders and agreement observers.

Data collection. State and environmental code data were collected during a single, 5 hour period for most participants, beginning shortly after arrival in class. Because of half-day programs, ten preschoolers were observed only for two and one-half or three hour sessions. Coders were exchanged at 20 minute intervals.

Coders activated separate keys on the event recorders that corresponded to each state condition. When present, seizure activity was entered as a nonstate category. An elapsed time of 3 seconds was required before another key was pressed to signify a state change. This time lapse allowed for differences in reaction times between coders, and it ensured the participant was, in fact, changing states.

Separate keys also identified various environmental events. A change in conditions was recorded within three seconds of its occurrence. First, the interactor (adult or student) and type of activity were entered for the interaction category. When no interaction was observed, the presence or absence of an adult or child within five feet of the student was entered. Level of activity and availability of material were next recorded. Finally, body position (e.g., sitting, supine) was entered if the student was not moving, or in the process of being moved. When movement was occurring, a change in position or location was noted.

Measures of interobserver agreement. During sessions for measures of interobserver agreement, the primary coders (research assistants) followed the same data collection procedures described above. An observer (research staff) with a separate event recorder stood next to a primary coder. The recorders were cabled together allowing the machine used by the primary coder to transfer elapsed time to the machine of the observer. This permitted both machines to encode key presses within the same real time frame.

Five separate schedules were used for collecting interobserver agreement data for each student during 25% of both the state and environmental observations (50% of the total session). These measures were spread over the session to control for observer drift. Primary coders were unaware of which condition (behavior state or environmental) was being observed. Percentages of agreement were automatically computed at the end of each session.

Collecting and recording SFEF data. Four steps were followed to train research assistants to use the form in gathering information from medical and educational records. The assistants were familiarized with each item, and the section in the records where the corresponding information was likely to be found. Each assistant then completed an SFEF for one student and highlighted the location of each item in the records. The research coordinator next took the same records and checked each item on the SFEF for accuracy and completeness. Finally, the assistant reviewed the same record again and independently updated the information. Training ended when the trial SFEF was accura.ely completed.

Release forms were sent to parents and guardians of students for obtaining medical, psychological, and educational information from appropriate health care agencies, hospitals, and private medical providers. A flow chart was used to monitor receipt of the requested materials, and to identify missing or incomplete records. Information on the SFEF was supplemented by written requests from parents, and interviews with them, teachers, and other direct service providers. Data from each SFEF were coded, and then entered into a personal microcomputer for analysis.

Two project researchers independently checked all items on the forms for accuracy and completeness. They compared agreement on 25 % of randomly selected items on each form. Although a formal analysis was not done, neither researcher found significant discrepancies between the records and information on the SFEF forms.

ANALYSIS 1: PERCENT TIME OBSERVED IN THE EIGHT STATE CONDITIONS

Results

The Mean interobserver agreement for the behavior state code was 92.51% (SD 6.72%) for 64 participants, with a range from 75.9% to 99.42 % for individual students. (Reliability data were lost in a transfer operation for two of the 66 participants.)

Percents were computed of the time each participant was observed in the eight state conditions. Percents were then averaged across students, with the following results: S^1, inactive sleep (7%); S^2, active sleep (1%); DR, drowse (5%); DA daze (3%); A^1, awake inactive-alert (46%); A^2, awake active-alert (18%); A^2/S, awake active-alert with stereotypy (17%) ; and C/A, crying/agitation (3%).

Profile groups

Based on earlier investigations (Guess et al., 1991; Guess, Siegel-Causey et al., 1993), participants were again grouped by profiles that represented similar state patterns. Table 3 shows percent occurrences observed in the eight state conditions for the total group and following profiles:

Profile Group 1. The eight participants in this group spent at least 75% of time in the educationally optimal awake inactive-alert and awake active-alert states. They averaged 38% observations in the awake inactive-alert state, and 48% in the awake active-alert state (Table 3).

Profile Group 2. This profile group of 21 participants was observed at least 75% of time in the awake inactive-alert and awake active-alert states, but less than 20% of that percentage was scored in the awake active-alert state, with at least 55% of the students entire set of state observations in the awake inactive-alert state. These students thus showed considerable alert behavior, but they infrequently interacted physically with their environment.

Profile Group 3. This group of 21 participants was observed less than 75% of time in the awake inactive-alert and awake active-alert states, with more of the remaining time recorded in the stereotypy and crying/agitation states than in the sleep, drowse, and daze states. Specifically, their combined awake active/stereotypy and crying/agitation states exceeded 25% of state observations, was at least 15% greater than the combined Sleep (S^1 and S^2) and drowse states, and at least 10% more than the daze state. This profile included students who displayed an average of 44% time engaged in stereotypy and 7% in the crying/agitation state, including observations of self-injury.

Profile Group 4. These participants spent less than 75% of time in the awake inactive-alert and awake active-alert states, with more of the remaining time observed in the sleep and drowse states than in the daze, stereotypy, and crying/agitation states. Specifically, their combined sleep and drowse states averaged 25% or more, was 15% or greater than the combined stereotypy and crying/agitation states, and more than 10% higher than the daze state. These students displayed considerable sleep and drowse behavior during daytime hours.

Profile Group 5. Three participants did not fit any of the above profiles and were observed to engage in a relatively large number of states without any particular focus. For purposes of analysis, they were observed less than 75% time in the awake inactive-alert and awake active-alert states. There was less than 5% difference between the combined sleep and drowse states when compared to the combined stereotypy and crying agitation states. Further, the combined sleep and drowse states and the combined stereotypy and crying/agitation states both exceeded percent time they were observed in daze.

Profile Group 6. This is a new state profile not reported in our previous investigations (Guess et al., 1990,1991). It depicts one participant who displayed an unusually high percent of time in daze. For computing this profile, the combined awake inactive-alert and awake active-alert states were less than 75%. Daze occurred for more 25% of the observations and, in each case, exceeded by 10% or more the combined stereotypy and crying agitation states, and the combined sleep and drowse states.

(Insert Table 3 Here)

Differences between profiles are illustrated in Figure 1 that shows, for each group, ratios for the various state conditions. These ratios represent mean percent states for each profile divided by the mean percents for all 66 participants. Ratio numbers over the value of 1 indicate percent occurrences in state conditions for a particular profile that exceed the total group means; ratio numbers less than the value of 1 depict state means for a profile that are less than the expected group means. A ratio of exactly 1 infers that the profile mean for a particular state does not differ significantly from its total group average. The ratios presented in Figure 1 support qualitative state differences between profiles.

(Insert Figure 1 Here)

Discussion

Measures of interobserver agreement show percent scores across participants that are consistent with our previous investigations (Guess et al. 1991; Guess, Roberts et al.,1993), and which support the existence of states as a phenomenon that can be reliably observed and quantified in the population under study.

A major finding is the nearly identical total percent occurrences in the eight state conditions between an earlier study (Guess et al.,1991) and the present investigation. The previous study included 50 students observed for 15 minute periods over 20 separate days using a10 second interval recording procedure; that is, the participant was observed for 10 seconds, followed by a 5 second interval to record the state that predominated during that interval. This procedure was continued over the 15 minute session and the state scores were averaged over 20 sessions for each participant. The total group percents reflected the average across the 50 participants. In the present research, behavior state averages where tabulated across 66 participants who were each observed for one, continuous session. The following results compare the eight states, with average percents from the earlier (Guess et al. 1991) study presented first: S^1 (7% vs. 8%); S^2 (1% vs 1%); DR (5% vs 4%); DA (3% vs. 11%); A^1 (46% vs, 41%); A^2 (18% vs. 17%); A^2/S (17% vs 15%); C/A (3% vs. 3%). Very similar state behavior was observed between the two separate populations, using quite different observation procedures and data collection methods.

Although total group comparisons of state between the two studies suggest a highly robust phenomenon in this population, there were differences in the percent of participants assigned to profile groups. The biggest difference was in Profile Group 2 where 12% of the participants were assigned in the Guess et al. (1991) study, compared to 32% in the present investigation. Further, 34% of participants were assigned to Profile Group 4 in the earlier investigation, compared to only 18% in this research. Percent participants assigned to the other profile groups were very close between the two investigations: Profile 1 (18%, Guess et al., 1991 vs. 12%, present study); Profile 3 (30%, Guess et al., 1991 vs. 32%, present study), and Profile 5 (6%, Guess et al., 1991 vs. 5%, present study).

Qualitative state differences demonstrated in the ratio graphs of Figure 1 give further credence to our subsequent analyses that compare profiles across variables important to understanding state phenomena among students with profound and multiple disabilities.

ANALYSIS 2: CHANGES IN STATE BEHAVIOR

Results

Participants showed widely varying occurrences of shifts between state conditions (i.e., movement into or out of a particular state). Table 4 shows the Mean shifts, by hour and minutes, for each state condition across the Total and Profile groups. An average 1.28 shifts per minute was recorded for the Total Group of 66 participants. Highest Mean shifts were recorded for Profiles 1 (2.06 per minute) and 3 (2.10 per minute). Group 2 showed the lowest average, with .78 shifts each minute.

(Insert Table 4 Here)

Figure 2 illustrates differences between groups from ratio scores th . represent mean state shifts for each profile divided by the mean shifts for the total group. Ratio numbers over the value of 1 indicate behavior state shifts for a particular profile that exceed total group means; ratio numbers less than 1 depict state shifts for a profile that are less than the expected total group means. A ratio of exactly 1 infers that the profile shift for a particular state does not differ significantly from the total group average.

(Insert Figure 2 Here)

Discussion

Data support previous findings (Guess, Roberts et al., 1993) that children and youth with profound and multiple disabilities show large amounts of movement into and out of state conditions across time. For the Total Group, average changes in state conditions occurred about 1.28 times each minute; or, approximately every 47 seconds (i.e., 60 sec/1.28). These frequent shifts between states likely impair learning opportunities that require, especially, extended durations of awake active-alert behavior.

Particularly rapid shifts were found for students in Profile Group 1 who displayed high occurrences of awake inactive-alert and awake active-alert behavior. This suggests that although these students spent considerable time in these two educationally optimal states, they did not sustain long durations of either awake inactive-alert or awake active-alert behavior. Similarly rapid state changes (2.1 per min.) were observed among students in Profile Group 3 who had excessive amounts of stereotypy and crying/agitation, including self-injury. Both of these high shift groups showed more motorically active behaviors (i.e., awake active-alert and stereotypy) than did the other profile groups.

Participants in Profile Group 2 showed the least shifts between states (.78 per minute). They also spent the greatest amount of time (80%) in the awake inactive-alert state, with minimal time observed in the awake active-alert, stereotypy (A^2/S), and crying/agitation states (cf. Table 5). Students in Profile Group 4 changed states on the average of 63.9 times per hour (1.06 shifts per minute). These students were observed for larger percents of time in the sleep and drowse states.

ANALYSIS 3: TRANSITIONAL PROBABILITIES FOR STATE CHANGE

Results

The purpose of this analysis was to identify short behavior state sequences for the total and profile groups. Transitional probabilities (Bakeman & Gottman, 1986) refer to the extent to which one event, or behavior, immediately follows another event. The term "lag" is used to indicate this displacement in time. Using lag sequential analysis, the probability that one state condition immediately followed another state condition in a sequence was calculated. The analyzed data were represented as the sequences of chains of the coded behavioral states, defined in a way that made them mutually exclusive and exhaustive. When sequences are analyzed, adjacent codes cannot be identical. This analysis does not take into account the relative amount of time consumed by the occurrence of any one event, but only that point in which one event is displaced in time by a different event (e.g., when one behavior state is displaced by a different state).

In using the *lag sequential method*, a "criterion" event (a particular behavior state) was identified. Next, other events (i.e., remaining state conditions) were selected as the "targets." Transitional probabilities were computed for two lags; that is, the target event (behavior state) immediately after the criterion (lag 1), and after one intervening event (lag 2). Each state was used as a criterion, with the remaining states as target behaviors.

A conservative approach was used to analyze data. The lag sequences were considered significant only if: 1) the number of occurrences of any state was at least 5% of the total number of events (states) for the profile or total groups; 2) the frequency of joint occurrence of a target and a given behavior in a transition was at least 10% of the total occurrences of the target behavior; and 3) the transitional probabilities for both Lag 1 and Lag 2 exceeded .20.

Table 5 presents transitional probabilities over .20 for the Total Group, and Profile Groups 1, 2, 3, 4, and 5. Results are not presented for the one student in Profile Group 6. Findings are further illustrated in Figure 3 that graphically shows Lag 1 configurations for the groups. Direction of arrows in the figure corresponds to significant probabilities from Table 4.

(Insert Table 5 Here)

Sequential Analysis of State Conditions for the Total Group

For the Total Group there was a strong likelihood that students would move to the awake inactive-alert (A^1) state from awake active-alert (A^2), awake active-alert with stereotypy

(A^2/S) and daze (DA). Lower, but significant, probabilities (Table 5) also showed that the awake active-alert state often followed the awake inactive-alert and stereotypy states; and stereotypy frequently came after awake inactive-alert and awake active-alert. The reciprocal sequence of state movement between the A^1, A^2, and A^2/S states is illustrated in Figure 3.

Results in Table 5 further show that for the Total Group (and also the Profile Groups) states have a strong probability of returning to themselves at Lag 2. For example, at Lag 1 awake inactive-alert has a .387 probability of moving to the awake active-alert state. Following this, however, there is a .740 probability (Lag 2) that the student will return to the awake inactive-alert state, as shown in the bottom section of the table.

(Insert Figure 3 Here)

Sequential Analysis of State Conditions for the Profile Groups

Profile Group 1 (High occurrences of A^1 and A^2 states). Expectedly strong Lag 1 reciprocal probabilities are found between the awake inactive-alert and awake active-alert states. Stereotypy often followed the awake active-alert state and it frequently preceded both awake active-alert and awake inactive-alert.

Profile Group 2 (High occurrences of the A^1 state). For this profile group, the awake inactive-alert state had a high probability of following both the awake active-alert, daze, and drowse states. To a lesser extent, the awake active-alert and daze states followed awake inactive-alert behavior.

Profile Group 3 (Relatively high occurrences of A^2/S and C/A states). The major finding for this group is that awake inactive-alert, awake active-alert, and awake active-alert/stereotypy all have significant probabilities of both preceding and following one another. Additionally, crying/agitation (C/A) often precedes stereotypy (A^2/S).

Profile Group 4 (Relatively high occurrences of S^1, S^2, and DR states). This profile group has the largest number (10) of significant Lag 1 probabilities. Inactive sleep (S^1) has significant reciprocal sequence probabilities with active sleep (S^2) and drowse (DR); and the awake inactive-alert state has significant reciprocal interactions with both awake active-alert and drowse. Further, both awake inactive-alert and drowse often follow daze (DA).

Profile Group 5 (Balanced). For the small number of participants in this group, the awake inactive-alert state interacts reciprocally with the awake active-alert and stereotypy states. Additionally, stereotypy has a significant probability of following awake active-alert; and awake inactive-alert behavior often came after daze. This is also the only profile group where a significant Lag 2 occurred, other than when a state returned to itself. In this case, stereotypy had a likelihood of following awake active-alert after an intervening state occurred (i.e., awake active-alert, followed by another state, followed by stereotypy).

Discussion

For the Total Group, a sequence of reciprocal interactions occurred at Lag 1 for the awake inactive-alert, awake active-alert, and awake active-alert/stereotypy states. This finding takes into account that some participants did not engage in stereotypy, while others did so at a low rate. The relationship between these three states is likely due, in part, to their high percent occurrences among participants (A^1, 46%; A^2, 18%; and A^2/S, 17%).

The significant reciprocal Lag 1 sequence for the awake inactive-alert and awake active-alert states was also found for all profile groups, although at widely varying percent levels. This is an expected finding because attending (A^1) and responding (A^2) are co-dependent behaviors that dominate interactions with the environment. Of practical importance is the finding that the awake inactive-alert (A^1) state is significantly followed by daze for Profile 2 , stereotypy for Profiles 3 and 5, and drowse for Profile 4 . All of these lags represented movement from awake inactive-alert to states that were less educationally optimal.

At Lag 1, stereotypy often came after the awake active-alert state for the Total and Profile Groups 1, 3, and 5. The reciprocal relationship between the A^2 and A^2/S states was especially strong for Profile 3. Further, for this group, stereotypy often followed the crying/agitation state which, for some participants, was manifested by self-injury. This is an important finding that needs to be pursued in subsequent state investigations where stereotypy and self-injury are examined in relation to each other, and the remaining state conditions.

Although its overall percent occurrence was low, the daze condition often preceded the awake inactive-alert state for the Total Group, and Profiles 2 , 4 , and 5. Further, Drowse often preceded the awake inactive-alert state for Profiles 2 and 4. Drowse often followed daze for Profile Group 4. Consistent with previous findings (Guess, Roberts et al., 1993), we did not find evidence that daze served as an intermediate state between drowse and awake inactive-alert, as suggested in the typically developing infant literature (Thoman, 1985). For the 12 participants in Profile Group 4, however, drowse appeared to serve as a pivotal state between the awake inactive-alert and inactive asleep conditions; a finding consistent with an earlier observation by Thelen (1990) that drowse constitutes a weak attractor state that is easily perturbed into the stronger attractor states of awake active-alert or inactive asleep (cf. also, Guess & Sailor, 1993).

The tendency of states to return to themselves (Lag 2) after movement to another (intermediate) state is consistent with previous results (Guess, Roberts et al., 1993), and supports the durability of state organization patterns (Guess, Siegel-Causey et al., 1993) among children and youth with profound and multiple disabilities.

ANALYSIS 4: ENVIRONMENTAL CONDITIONS AND EVENTS

Results

For 64 subjects, the interobserver agreement means and ranges for the four environmental events used in the analysis were as follows: *Interaction* Mean 91.73% (SD 4.31%), Range 72.70%-99.10%; *Material* Mean 97.48% (SD 2.44%), Range 89.10%-99.92%; *Position* Mean 97.69% (SD 3.08%), Range 84.32%-100%; and *Location* Mean 96.93% (SD 4.48%), Range 70.97%-100%).

Results of the lag sequential method were presented in Table 5 and Figure 3 to show transitional probabilities over .20 for the Total Group and Profiles 1 through 5. These same significant Lag 1 sequences were used here to analyze possible relationships between behavior state changes and the environmental variables of Interactions, Materials, (body) Position, and Location change. These variables were identified in a previous investigation (Guess, Roberts et al., 1993) to have some influence on state. Descriptive environmental data are presented in Table 6 for Profiles 1 through 5, and the Total Group.

All data presented in Table 6 are group averages. Mean Total State Shifts shows the average number of specific behavior state shifts that *followed* a change in one of the four environmental conditions (Interaction, Material, Position, or Location). For example, in Profile Group 1 there was a total of 26, A^1 to A^2 state shifts that came after one of the environmental changes. The next four sections of the table show shift data (numbers and percents) for the separate environmental conditions. Of the 26 Mean Total State Shifts that followed changes in environmental conditions, there were 17 (65%) for Interactions, 4 (15%) for Materials, 2 (8%) for Position, and 3 (12%) for changes in Location. The table presents also average time durations in seconds that elapsed before the environmental condition preceded a state shift. Following an Interaction, for example, the participants averaged 20 seconds in the A^1 (awake inactive-alert) state before making a shift to A^2 (awake active-alert).

(Insert Table 6 Here)

Environmental Conditions Preceding State Changes for the Total Group

There was an average of 357 total shifts from one state to another for the 66 participants. This number represented all state shifts, including those not found to have the significant Lag 1 probabilities that were identified in Table 5 and Figure 3. Of the 357 shifts, an average of 126 shifts followed a change in one of the four environmental conditions. This computes to 35% occurrences in which a change in an environmental event (primarily Interactions, Materials, Position, and Location) was followed by a shift from one state to another.

Table 6 shows that Interactions was the primary environmental event that preceded state shifts, when they did occur. There were few differences between Materials, Position, and

Location as events that preceded the shifts. Further, there was relative consistency across all categories in average duration of seconds (range 9"-23") that elapsed between the occurrence of an environmental event and a subsequent state shift.

Environmental Conditions Preceding State Changes for the Profile Groups

Profile Group 1 (High occurrences of A^1 and A^2 states). This profile group averaged 310 state shifts during a session, of which 109 (35%) were preceded by one of the environmental categories. State shifts were more likely to follow Interactions, with few differences in percent shifts resulting from occurrences of the remaining environmental conditions. These findings appear independent of state categories.

Profile Group 2 (High occurrences of the A^1 state). The 21 participants in this group had an average of 192 shifts per session, of which 64 (33%) were preceded by a change in the environment. . The majority of shifts were preceded by an Interaction, especially shifts from awake inactive alert (A^1) to daze, and vise versa.

Profile Group 3 (Relatively high occurrences of A^2/S and C/A states). Participants in this group averaged 577 state shifts, of which 209 (36%) followed an environmental change. Interactions preceded various shift sequences for slightly more than 50% of these occurrences. The remaining percents were somewhat evenly divided between Materials, Position, and Location.

Profile Group 4 (Relatively high occurrences of S^1, S^2, and DR states). The 12 participants in this profile averaged 275 shifts, of which 94 (34%) followed a change in one of the environmental categories. Interactions was the primary event preceding state shifts, although shifts from A^1 to A^2 and A^2 to A^1 frequently followed changes in the other environmental categories.

Profile Group 5 (Balanced). The three participants in this group averaged 447 shifts. Of this number, 161 (36%) followed a change in one of the environmental categories. Changes in Interactions occurred often (mostly above 80%) prior to the various shift changes. Changes in Position and Location were infrequently followed by state shifts for this group.

Percent Occurrences for the Environmental Events

There were low percent occurrences in the temporal relationship between environmental events and state shifts. Supplementary data in Table 7 for the Total and Profile Groups show the average percent time in which the four environmental categories were actually present in the educational settings. For the Total group, interactions with adults averaged 42% of the time and peers 2% of the observations. Percent interactions were highest in Profile Group 1 (51% for adults; no peer interactions) and lowest in Profile Groups 4 (37% adults; 1% peers) and 5 (36% adults; 2% peers). Interactions included the subcategories of Self-help, Maintenance and Play/Instructional/Other activities. Other results showed that materials were present during 60% of the observations, the students were usually in the sitting position (67%), and they spent 75% time in their primary classroom locations. Overall, there were no major differences between profile groups in the percent occurrences for the four environmental categories (Interactions, Materials, Position, Location).

(Insert Table 7 Here)

Discussion

Findings indicated generally low percentages in which state shifts followed an Interaction, Material, Position, or Location event. When they occurred, most state shifts were preceded by an Interaction, primarily with adults. Rather large time durations, usually 10 to 20 second averages (Table 6), occurred between onset of the environmental event and a state shift. These durations are compared to our results showing the average state shift interval for participants was 47 seconds. Accordingly, students demonstrated rapid overall state shifts, while they also showed rather slow changes in state behavior (when the shifts did occur) following environmental events. These findings suggest that environmental events used in the analysis were not strongly associated with changes in state. This speculation is supported by Guess, Roberts et al. (1993) where a correspondence analysis procedure showed relatively few *associations* between state conditions and identified environmental events; and, most associations that did occur were likely related to either feeding activities or sleep.

Interaction was the environmental event that most often preceded a state shift. This finding transversed profiles, even though Profile 3 (relatively high occurrences of stereotypy and crying/agitation) showed the least influence of interactions on state shifts; an expected finding when considering the behavioral and developmental characteristics associated with high rates of stereotypy (Guess & Carr, 1991). Although there were differences in the types of state shift between profiles, there were no appreciable variations in the percentages of environmental category events that preceded these shifts; that is, the Interaction category was most likely to be followed by state shifts, with the remaining categories (Material, Position, and Location) somewhat evenly distributed.

The overall average percentage of interactions between students and an adult or peer (44%) compares with 42% found in a previous study where the environmental code was used with 25 students (Guess, Roberts et al., 1993; Roberts, 1992). Percentages of available materials were almost identical between the present study (60%) and the previous investigation (62%). The times students were observed in the five body positions were also nearly the same between this investigation and the prior study: sitting, 67% Vs 65%; supine, 14% Vs 17%; standing, 9% Vs 4%; sidelying, 7% Vs 9%; and prone, 3% Vs 5%. These results represent a strong replication when considering the two studies differed in subject populations, classrooms, observers, and data collection procedures.

ANALYSIS 5: RELATIONSHIPS BETWEEN STATE PROFILES, DEMOGRAPHIC, AND CHARACTERISTIC VARIABLES AND EVENTS

Results and Discussions

Descriptive data from the Student and Family Evaluation Form (SFEF) were analyzed for the total and six profile groups. Results and Discussions are combined for each sub-area of the SFEF.

Comparison of Demographic Information Between Profile Groups

Demographic information in Table 8 shows an overall higher number of males in the investigation, and especially so for Profile Group 4 (Relatively high occurrences of S^1, S^2, and DR states). Ages ranged from 2-21 years, with a mean of 10.6. The eight students in Profile Group 1 (High occurrences of A^1 and A^2 states) had a mean age (4.6 years) that was substantially lower than the other groups.

Most participants were identified as profound mental retardation, although two of six students in Group 1 were assessed at the severe level of mental retardation and adaptive behavior. Almost half of the participants (47%) were located in educational settings that provided access to nondisabled students, with an equal distribution between students located in self-contained schools in the community (26%) or residential centers (27%). Profile Group 1 (High occurrences of A^1 and A^2 states) included the smallest percent of students in "integrated" settings, while Profile Group 4 (Relatively high occurrences of S^1, S^2, and DR states) had the largest percent in these settings. A higher percent (63%) of students in preschools were found in Group 1. The other groups had similar grade placement levels.

Age ranges and means for the four major profile groups (i.e., profiles with eight or more students) are consistent with earlier findings (Guess et al., 1990), although participants in the present investigation were slightly older than the previous population; 10.6 vs. 8.9 years. As before, Profile Group 1 had the youngest students.

(Insert Table 8 here)

Comparison of Etiologies Between Profile Groups

Etiologies presented in Table 9 were derived from the 1983 AAMD classification system (Grossman, 1983). Unknown Prenatal Influence was the largest category (36.3%) for all subjects. Notable differences between groups included the relatively large percent (37.5%) of students in Profile 1 with Chromosomal Anomalies, and the comparatively small percent (4.7%) of students in Group 3 (Relatively high occurrences of stereotypy and crying/agitation) in the Infections and Intoxications category.

(Insert Table 9 here)

Comparison of Developmental Levels Between Profile Groups

Table 10 displays development at six month intervals for six areas across groups. More advanced gross and fine motor development was found for Profiles 1 (High occurrences of A^1 and A^2 states) and 3 (Relatively high occurrences of A^2/S and C/A states). These two profiles also showed higher developmental gains in communication, cognitive, social, and self-help skills. Four students (50%) in Profile 1 (High occurrences of A^1 and A^2 states) were assessed to have cognitive skills between 12 and 18 month.

Similar to earlier findings (Guess et al., 1990), students in Profile Groups 1 and 3 had comparatively more advanced fine and gross motor skills. Further, in this study, there were even greater differences between Groups 1 and 3 versus 2 and 4 in measures of cognitive, communication, and social skill development. These differences (cf. Table 3) are likely related to larger percents of awake active-alert (A^2) behavior associated with Profile Group 1 (48%), especially, and Group 3 (24%). Guess et al. (1993) discussed implications of A^2 behavior for learning and development, and its low occurrence among persons with profound and multiple disabilities.

(Insert Table 10 here)

Comparison of Motor Impairments Between Profile Groups

The large percent of students with significant delays in motor skills indicated the need to further compare profiles for the type and extent of impairments in this area. This information, Table 11, showed that motor impairments (including cerebral palsy) were uniformly high across groups. Students in Profiles 2 (High occurrences of the A^1 state) and 4 (Relatively high occurrences of S^1, S^2, and DR states) were more likely to have spastic muscle tone. Group 3 (Relatively high occurrences of A^2/S and C/A states) had a lower percent of students with severe degrees of motor impairment and quadriplegia. This group also had a higher percent of students who walked with aid or independently.

Percentages of muscle tone type and degree of involvement for profile groups were very similar to our earlier study (Guess et al., 1990). The major difference is that Profile 2 had a larger percent of students with spastic muscle tone in the current study. The extent and severity of motor impairments in Profile Groups 2 and 4 are consistent with extensive delays in their fine and gross motor development and, likely, the overall severity of their delayed skill development. Profile Group 1 also had a high percent of students with severe muscle involvement, although their gross and fine skills were not as delayed as Profiles 2 and 4. The younger ages of students in Profile Group 1 and the lower percent of them with motor impairments might account for this discrepancy.

(Insert Table 11 here)

Comparison of Visual and Hearing Impairments Between Profile Groups

Percentages of students who presented with vision and hearing impairments are shown in Table 12. Sixty nine percent of participants were diagnosed as having a visual loss, and 27.7% evidenced a hearing impairment. There were no significant differences in percent hearing losses in the four major profile groups, although a comparatively large percentage of students (58.3%) in Profile Group 4 (Relatively high occurrences of S^1, S^2, and DR states) were diagnosed to have a hearing loss, primarily sensorineural in origin.

Previous research (Guess et al., 1990) indicated 68.1% of students with vision losses and 25.5% with hearing losses. These total percents are virtually identical to those found in the present investigation. Additionally, the percentages of vision and hearing losses for profile groups are comparable between the studies. It is interesting that in neither investigation did the small number of students in Profile Group 5 (Balanced) have vision or hearing losses.

(Insert Table 12 here)

Comparison of Medications and Seizure Activity Between Profile Groups

Table 13 identifies total number and percentage of medications received by students in each profile group. Overall, 15 (23%) students were not on medications. The remaining 51 (77%) participants received from 1 to 8 prescribed medications. The fewest medications were recorded in Profile 3 (Relatively high occurrences of A^2/S and C/A states) where 11 (52%) of the 21 students received no (0) medications, 5 (24%) were given one medication, and the remaining 5 students (24%) took two or more. In contrast, all 12 (100%) students in Profile 4 (Relatively high occurrences of S^1, S^2, and DR states) were given medications, and 11 of them (92%) received two or more. The number of medications received by students in Profiles 1 (High occurrences of A^1 and A^2 states) and 2 (High occurrences of the A^1 state)) fell between these extremes, although one third of the students in the latter profile received 3 or more medications.

(Insert Table 13 here)

Table 14 lists medications that can produce drowsiness, and the number of students that received them. The totals for "Other" medications administered on a regular basis are also provided. Results showed no major differences between profile groups in medications that potentially produce drowsiness, including anticonvulsants. Among the major groups, total number of separate medications (12) was lowest in Profile 1 (High occurrences of A^1 and A^2 states) and highest (43) in Profile 2 (High occurrences of the A^1 state).

(Insert Table 14 here)

Seventy two percent of total participants had a diagnosed seizure disorder, and they were observed among 15.3% of the students during data collection sessions. All participants in Profiles 4 (Relatively high occurrences of S^1, S^2, and DR states), 5 (Balanced) and 6 (High occurrence of daze) had a diagnosed disorder. Eighty five percent of students in Group 2 (High occurrences of the A^1 state) had diagnosed seizures, followed by 62.5 % in Group 1 (High occurrences of A^1 and A^2 states) and a low of 42.9% in Group 3 (Relatively high occurrences of A^2/S and C/A states).

Findings (Table 13) indicated that a larger percentage of students in Profile Group 4 were receiving multiple medications. Further analysis, however, showed no differences between this group and the other profiles in the percentage of students on anticonvulsant and other medications with potential side-effects of drowsiness. These findings suggest that, if medications are implicated as a cause for excessive sleep and drowsiness in Profile Group 4, the effects might result from interactions between multiple drug combinations; or, interactions between other variables (e.g., nutrition) and medications. State data indicated that seizure activity observed during sessions for some students was not strongly associated with sleep and drowsiness.

SUMMARY AND CONCLUSIONS

A major contribution of the present study was the extent to which results replicated those from previous investigations including especially, Guess et al. (1990) and Guess, Roberts et al., (1993) that used different subjects, observers, coding procedures, and session lengths and numbers. The following major results were consistent across these investigations: a) percentage time students were observed in the eight states; b) relatively small time intervals between state shifts; c) similar probabilities (lag analysis) that one particular state will follow another over time; d) a weak association between environmental events and state changes; e) a close similarity in the type of environmental variables and events present during observation sessions and settings; and f) a high correspondence in percentage occurrences for several demographic variables, levels of skill development, and extent of motor impairments and sensory losses. Additionally, the relationship between these variables and state profile groups remained consistent across studies. The present research with a larger student population differentiated even more clearly behaviors and characteristics associated with the major profile groups. Further, one participant had a high level of daze behavior that required the addition of a new state profile.

The consistency of findings across our studies underscores the robustness of the phenomena and, accordingly, theoretical and practical implications for students with profound and multiple disabilities. We identified numerous variables associated with behavior state and related environmental and physiological conditions. Nevertheless, it is essential to emphasize that state interacts dynamically with these variables. Recently, for example, Guess and Siegel-

Causey (1993) showed that a third of participants in the present investigation demonstrated complex nonlinear state trajectories that meet criteria for strange attractors in chaos theory literature (cf. Guess & Sailor, 1993). The remaining participants did not show evidences of linearity, suggesting considerable randomness in their movements between the eight states. Identifying parameters that more reliably predict state organization will likely require longitudinal investigations that measure state change processes in relation to other interacting endogenous and exogenous variables. The logic of General System Theory (cf. Bertalanffy, 1968) is suited to this type of complex analysis.

At the practical level, it is important to recognize that state organization does affect quality of life among persons with profound and multiple disabilities, and it interacts in fundamental ways with environmental and physiological conditions to influence success of intervention programs. Further, our studies have shown repeatedly that predominant state patterns observed in this population are neither conducive to learning nor the development of adaptive behavior; especially for students frequently observed in states other than awake inactive-alert and awake active-alert. We also know, however, that state organization can be changed and improved. In a recent intervention we found positive improvements in state quality for some students with excessive sleep and drowsiness following changes in their environments, nutrition, and medications (Ault et al., 1993). Optimism from these results is tempered only by the realization that: a) more potent intervention strategies and approaches must be developed for significantly improving the educational impact on these students (Guess, Siegel-Causey et al., 1993); and, b) major successes will come only when we better understand and address the complex environmental and organismic interactions that influence state organization. Results from the current research provided information for addressing both of these challenges.

References

Als, H. (1986). A synactive model of neonatal behavioral state organization: Framework for the assessment of neurobehavioral development in the premature infant and for support of infants and parents in the neonatal intensive care environment. *Physical and Occupational Therapy in Pediatrics, 6*(3/4), 3-55.

Als, H. (1982). Towards a synactive theory of development: Promise for the assessment of infant individuality. *Infant Mental Health Journal , 3,* 229-243.

Ault, M. M., Guy, B., Bashinski, S., Roberts, S., Niew, W., & Guess, D. (1993). Analyzing Behavior State and Learning Environments: Application in Instructional Settings. Unpublished manuscript, The University of Kansas, Lawrence.

Bakeman, R., & Gottman, J. M. (1986). *Observing interaction: An introduction to sequential analysis.* Cambridge, NY: Cambridge University Press.

Bertalanffy, L. von (1968). *General system theory: Foundations, development, application* (rev. ed.). New York: Cambridge University Press.

Brazelton, T.B. (1984). *Neonatal behavioral assessment scale* (2nd ed.). Spastics International Medical Publications. Philadelphia: J.B. Lippincott Co.

Campbell, P.H. (1989). Dysfunction in posture and movement in individuals with profound disabilities: Issues and practices. In F. Brown & D. H. Lehr (Eds.), *Persons with profound disabilities: Issues and practices* (pp. 163-189). Baltimore: Paul H. Brookes, Publishing Co.

Ferguson, D. (1985). The ideal and the real: The working out of public policy in curricula for severely handicapped students. *Remedial and Special Education*, 6, 52-60.

Grossman, H. J. (Ed.) (1983). *Classification in mental retardation.* Washington DC: American Association on Mental Deficiency.

Guess, D., & Carr, E. (1991). Emergence and maintenance of stereotypy and self-injury. *American Journal on Mental Retardation, 96*(3), 299-319.

Guess, D., Mulligan Ault, M., Roberts, S., Struth, J., Siegel-Causey, E., Thompson, B., & Bronicki, G. J. (1988). Implications of biobehavioral states for the education and treatment of students with the most profoundly handicapping conditions. *The Journal of the Association for Persons with Severe Handicaps, 13*(3), 163-174.

Guess, D., Roberts, S., Siegel-Causey, D., Mulligan Ault, M., Guy, B., Thompson, B., & Rues, J. (1991). Investigations into the state behaviors of students with severe and profound handicapping conditions. *Monograph of the Department of Special Education, University of Kansas.* No. 1.

Guess, D., Roberts, S., Siegel-Causey, E., Ault, M., Guy, B., Thompson, B., & Rues, J. (1993). An analysis of behavior state conditions and associated environmental variables among students with profound handicaps. *American Journal on Mental Retardation, 97,* 634-653.

Guess, D. & Sailor, W. (1993). Chaos theory and the study of human behavior: Implications for special education and developmental disabilities. *The Journal of Special Education, 27*(1), 16-34.

Guess, D., Siegel-Causey, E., Roberts, S., Guy, B., Mulligan Ault, M., & Rues, J. (1993). Analysis of state organizational patterns among students with profound disabilities. *The Journal of Association for Persons with Severe Handicaps,*

Guess, D., Siegel-Causey, E., Roberts, S., Rues, J., Thompson, B., & Siegel-Causey, D. (1990). Assessment and analysis of behavior state and related variables among students with profoundly handicapping conditions. *The Journal of the Association for Persons with Severe Handicaps, 15*(4), 211-230.

Guy, B., Guess, D., & Ault, M. (1993). Classroom procedures for the measurement of behavior state among students with profound disabilities. *The Journal of the Association for Persons with Severe Handicaps, 18*(1), 53-60.

Helm, J. M., & Simeonsson, R. J. (1989). Assessment of behavioral state organization. In D. B. Bailey & M. Woolery (Eds.), *Assessing infants and preschoolers with handicaps* (pp. 202-224). Columbus, OH: Merrill Publishing Co.

Korner, A. F. (1972). State as variable, as obstacle, and as mediator of stimulation in infant research. *Merrill-Palmer Quarterly, 18*, 77-95.

Landesman-Dwyer, S., & Sackett, G. P. (1978). Behavioral changes in nonambulatory, mentally retarded individuals. In C. E. Meyers (Ed.), *Quality of life in severely and profoundly mentally retarded people: Research foundations for improvement* (Monograph No. 3) (pp. 55-144). Washington, DC: American Association on Mental Deficiency.

Rainforth, B. (1982). Biobehavioral state and orienting: Implications for educating profoundly retarded students. *Journal of the Association for the Severely Handicapped, 6*(4), 33-37.

Reid, D. H., Phillips, J., & Green, C. (1991). Teaching persons with profound multiple handicaps: A review of the effects of behavioral research. *Journal of Applied Behavior Analysis, 24,* 319-336.

Roberts, S. (1992). *An investigation and analysis of behavior state conditions and related environmental events among children and youth with multiple severe and profound disabilities.* Unpublished doctoral dissertation, University of Kansas, Lawrence.

Sailor, W., Gee, K., Goetz, L., & Graham, N. (1988). Progress in educating students with the most severe disabilities: Is there any? *Journal of the Association for Persons with Severe Handicaps, 13*(2), 87-99.

Thelen, E. (1990). Dynamical systems and the generation of individual differences. In J. Colombo & J. W. Fagan (Eds.), *Individual differences in infancy* (pp. 19-43). Hillsdale, NJ: Lawrence Erlbaum Associates. Inc.

Thoman, E. B. (1985). *States of sleep and wakefulness in infants. Ecological Observations.* Unpublished manuscript, University of Connecticut, Department of Biobehavioral Sciences, Storrs.

Thoman, E. B., & Whitney, M. P. (1990). Behavioral states in infants: Individual differences and individual analyses. In J. Colombo & J.W. Fagan (Eds.), *Individual differences in infancy* (pp. 113-135). Hillsdale, N.J.: Lawrence Erlbaum.

Thompson, B., & Guess, D. (1989). Students who experience the most profound disabilities. In F. Brown & D. Lehr (Eds.), *Persons with profound disabilities: Issues and practices* (pp. 3-41). Baltimore: Paul H. Brookes, Publishing Co.

Wolff, P. H. (1959). Observations on newborn infants. In L. J. Stone, H. T. Smith, & L. B. Murphy (Eds.), *The competent infant* (pp. 257-272). New York: Basic Books.

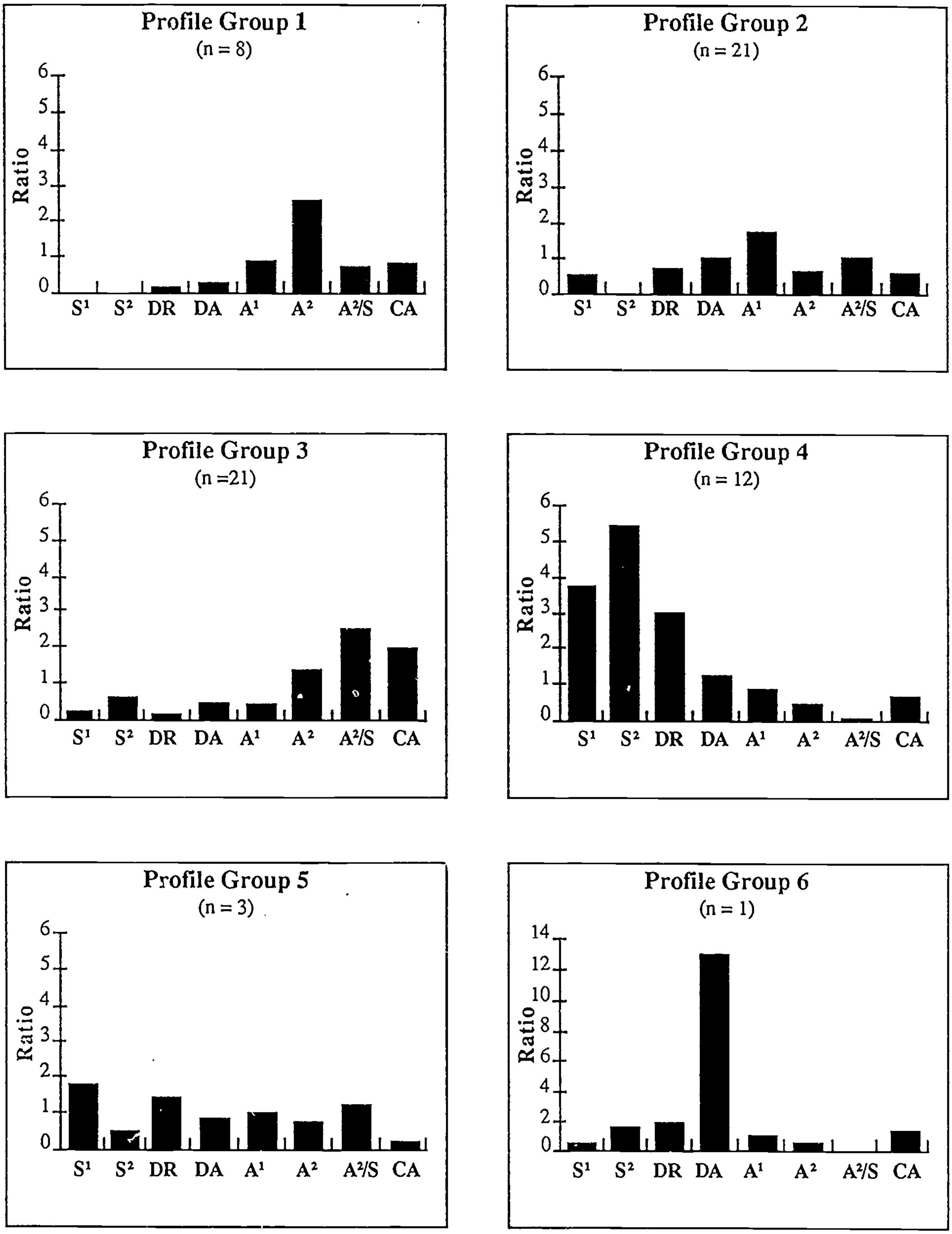
Wolff, P. H. (1987). *The development of behavioral states and the expression of emotions in early infancy: New proposals for investigation.* Chicago: The University of Chicago Press.

Footnotes

[1] Support for the research reported here comes from *An investigation of interactions between behavioral state conditions and environmental events among children and youth with profound and multiple handicaps* (Contract No. HI33G00078), Washington, DC: National Institute of Disability Rehabilitation and Research.

[2] The authors express sincere appreciation to Marilyn Ault, Barbara Guy, and Susan Bashinski who provided support to the implementation and interpretation of results in the research reported in this article.

List of Figures


Profile Group 1
(n = 8)
Profile Group 2
(n = 21)
Profile Group 3
(n =21)
Profile Group 4
(n = 12)
Profile Group 5
(n = 3)
Profile Group 6
(n = 1)
Ratio
0
1
2
3
4
5
6
8
10
12
14
S¹ S² DR DA A¹ A² A²/S CA

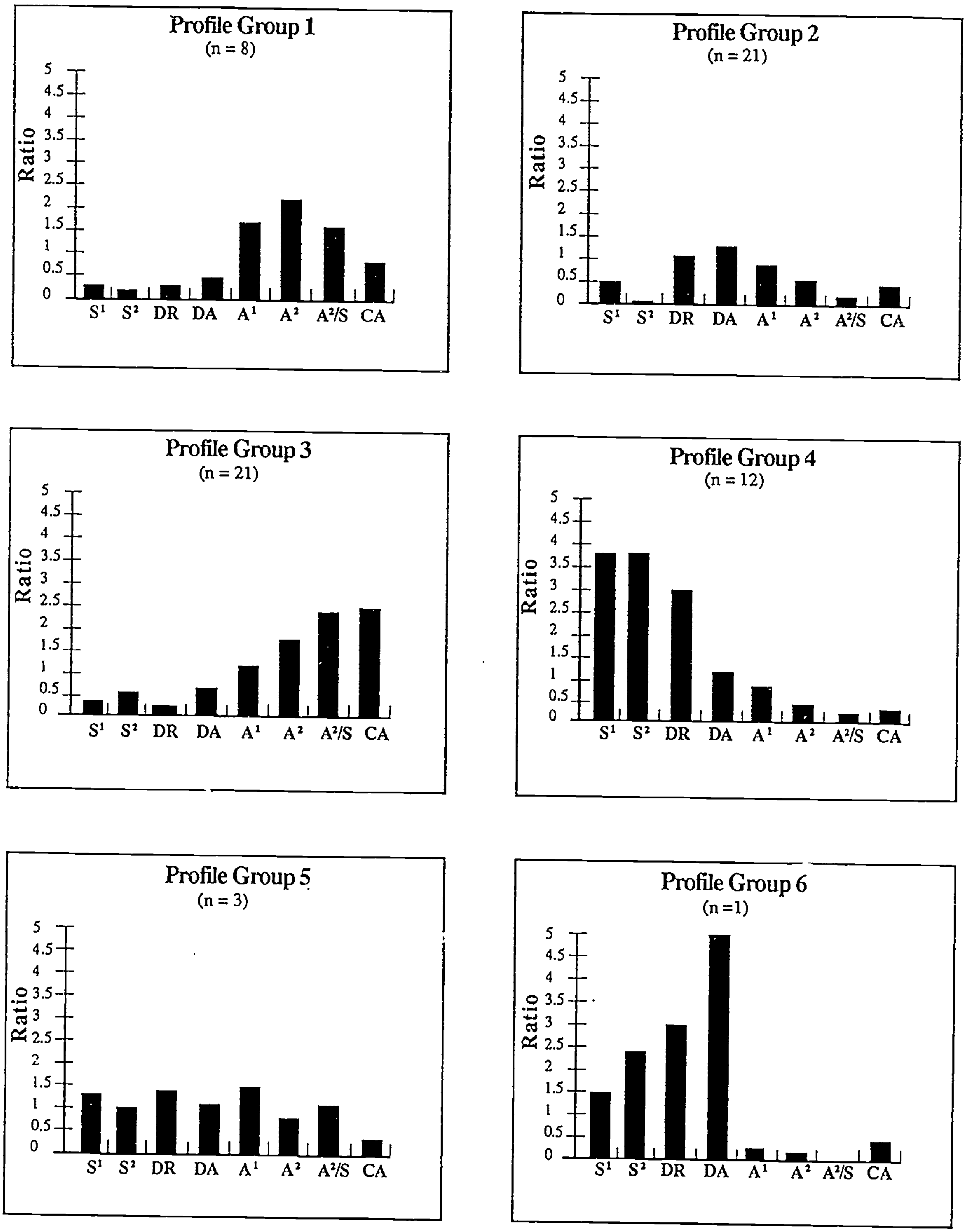
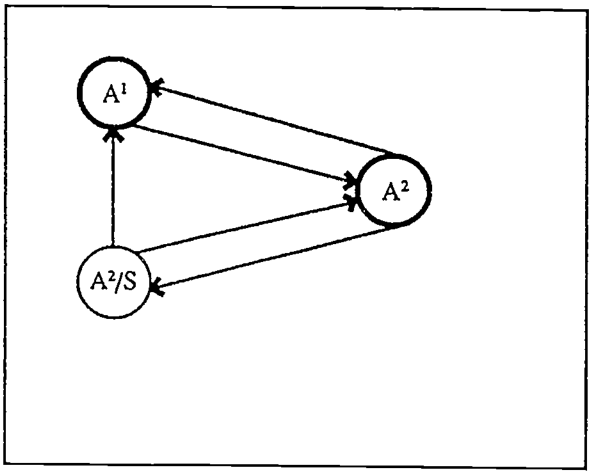
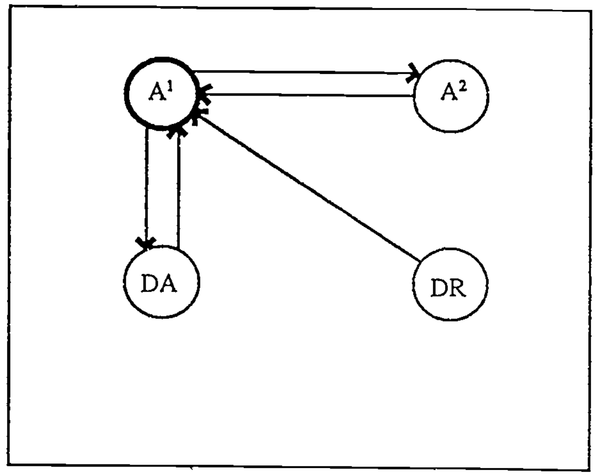

Profile Group 1
(n = 8)
Profile Group 2
(n = 21)
Profile Group 3
(n = 21)
Profile Group 4
(n = 12)
Profile Group 5
(n = 3)
Profile Group 6
(n =1)
Ratio
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
S¹ S² DR DA A¹ A² A²/S CA

Fig 2

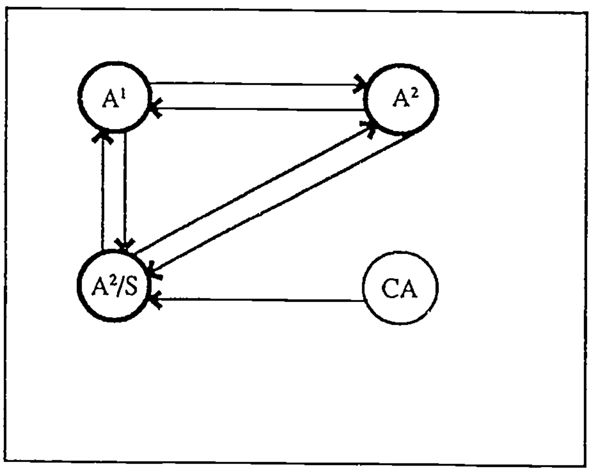
Group 1 (n = 8)



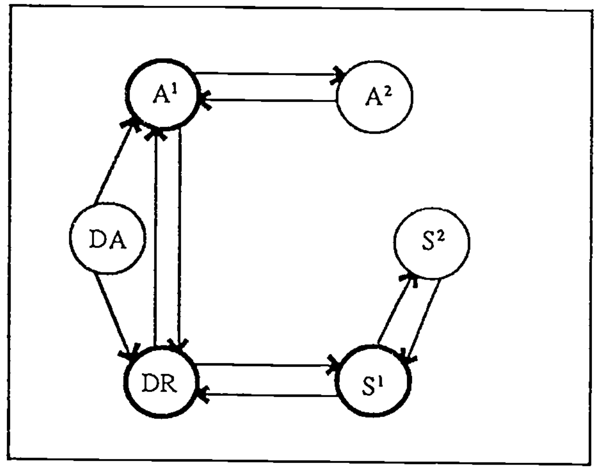
Group 2 (n = 21)



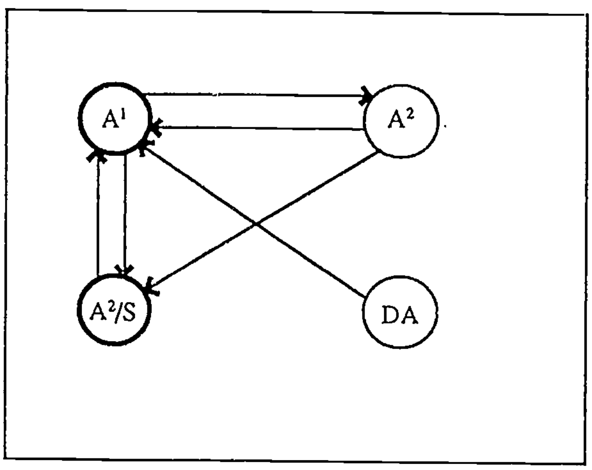
Group 3 (n = 21)



Group 4 (n = 12)



Group 5 (n = 3)



Total Group (n = 66)

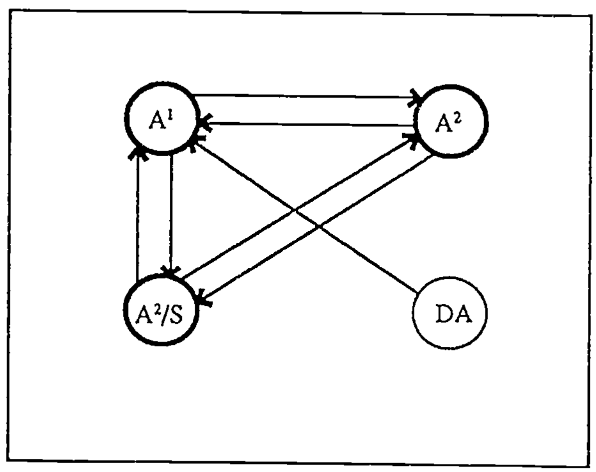


Table 1
Medical and Developmental Characteristics of the Total Group

Etiology (AAMD Classifications)	%	(n)
Infections and Intoxications	18	(12)
Trauma or Physical Agent	18	(12)
Metabolism or Nutrition	2	(1)
Gross Brain Disease (Postnatal)	2	(1)
Unknown Prenatal Influence	36	(24)
Chromosomal Anomalies	9	(6)
Other Conditions Originating in the Perinatal Period	12	(8)
Other Conditions	3	(2)

Motor Involvement	%	(n)
Students with Motor Involvement including Cerebral Palsy	88	(58)

Tone	%	(n)
spastic	58	(38)
hypotonic	18	(12)
ataxic	2	(1)
mixed	11	(7)

Classification[a]	%	(n)
diplegia	7	(4)
quadriplegia	87	(48)
hemiplegia	6	(3)

Degree of Involvement	%	(n)
severe	62	(41)
moderate	11	(7)
mild	15	(10)

Seizures	%	(n)
Students with diagnosed disorder	72	(47)
Students with seizures during observations	15	(10)

Medications	%	(n)
None	15	(23)
One or more medications	51	(77)

Mobility Status	%	(n)
Limited	70	(46)
Walks with Aid	6	(4)
Walks	24	(16)

Developmental Levels[b]

	Developmental Ages by Months					
Area	0-3 % (n)	3-6 % (n)	6-9 % (n)	9-12 % (n)	12-18 % (n)	18-24 % (n)
gross motor	36 (24)	23 (15)	8 (12)	8 (12)	7 (11)	6 (4)
fine motor	36 (24)	24 (16)	15 (10)	12 (8)	8 (5)	5 (3)
communication	20 (13)	35 (23)	24 (16)	14 (9)	7 (4)	2 (1)
cognition	30 (20)	30 (20)	20 (13)	12 (8)	5 (3)	3 (2)
social	18 (12)	30 (20)	23 (15)	17 (11)	9 (6)	3 (2)
self help	26 (17)	24 (16)	21 (14)	18 (12)	6 (4)	5 (3)

Note. [a]Anatomical classification was not determined for three individuals with motor impairments.
[b]These data were based on a variety of assessments including: Callier Azusa, Vineland, and Learning Accomplishments Profile.

Table 2
Definitions of Behavior State

Sleep States	**S^1 Asleep-Inactive** Person's eyes are closed. Respiration is relatively slow and regular. Exhibits little or no motor activity (startle, mouthing, brief limb/body movements).	**S^2 Asleep-Active** Person's eyes are closed. Respiration is generally uneven. Sporadic movements (tossing and turning, head and limb twitching), may occur but muscle tone generally low between movements. Person may exhibit rapid eye movements (REM). Other behavior may include facial expressions (smile, grimaces, frowns) and/or vocalizations (sighs, grunting, gurgling).
Indeterminate States	**DR Drowsy** Person's eyes are either open and eyelids appear "heavy" or eyes are opening/closing repeatedly. Vocalizations may occur.	**DA Daze** Non orientation to visual, auditory, or tactile stimuli predominates. If person's vision is intact eyes are open and appear glassy, dull, and immobile. Motor movements (that are not orienting) may occur such as brief limb/body movements, startles). Respiration is regular.
Preferred Awake States	**A^1 Awake Inactive-Alert** Person's eyes are open and some active visual or auditory orientation, focusing, or tracking is displayed (oriented/focused on stimuli, turning head, eyes towards stimuli, or following stimuli). Motor movements (that are not orienting) may occur such as brief limb/body movements, startles). Demonstrates regular respiration. Vocalizations may occur.	**A^2 Awake Active-Alert** Person attempts to engage/interact using visual, auditory, or tactile modes. If person's vision is intact eyes are open, bright, and shiny. Visual, auditory, or tactile interaction patterns are exhibited with distinct fine and gross motor movements (reaching, leaning towards/away, moving towards/away, eating, touching etc.). Vocalizations may occur.
Other Awake States	**A^2/S Awake-Active/Stereotypy** Person exhibits behaviors of A^2 with movements that are self stimulatory or stereotypical (idiosyncratic, repetitive rhythmic movements of body or body parts). Movements may include headweaving, rocking, mouthing hand or objects, arm and finger flapping.	**C/A Crying/Agitated** Person may exhibit intense vocalizing, crying, or screaming. Self injurious behavior possible. Respiration may be irregular and eyes may be open or closed. Intense motor activity possible.

Table 3
Mean Percents and Ranges of the Eight State Conditions for the Total and Profile Groups

Profile Group		State Categories							
		S^1	S^2	DR	DA	A^1	A^2	A^2/S	CA
1 (n=8)	Mean %	0	0	1	1	38	48	11	3
	Range	(0-2)	(0-0)	(0-3)	(0-2)	(7-78)	(23-90)	(0-20)	(0-9)
2 (n=21)	Mean %	3	0	3	3	80	8	2	1
	Range	(0-20)	(0-0)	(0-12)	(0-13)	(60-93)	(0-17)	(0-12)	(0-7)
3 (n=21)	Mean %	2	0	0	1	20	24	44	7
	Range	(0-20)	(0-2)	(0-3)	(0-9)	(1-56)	(3-44)	(0-85)	(0-26)
4 (n=12)	Mean %	27	3	16	3	39	8	1	2
	Range	(5-71)	(0-9)	(4-36)	(0-14)	(2-64)	(0-32)	(0-11)	(0-7)
5 (n=3)	Mean %	12	0	7	2	46	12	20	1
	Range	(2-20)	(0-1)	(4-13)	(1-3)	(31-59)	(7-15)	(15-27)	(0-1)
6 (n=1)	Mean %	3	1	11	33	36	9	0	5
	Range	(3-3)	(1-1)	(11-11)	(33-33)	(36-36)	(9-9)	(0-0)	(5-5)
Total (n=66)	Mean %	7	1	5	3	46	18	17	3
	Range	(0-71)	(0-9)	(0-36)	(0-33)	(1-93)	(0-90)	(0-85)	(0-26)

Table 4
Mean Number of State Shifts for the Eight State Conditions and the Total Mean Number of Shifts by Hour and Minutes for the Profile Groups

Profile Group	State								Total # of Shifts	
	S^1	S^2	DR	DA	A^1	A^2	A^2/S	CA	Hour	Minute
1	0.5	0.0	1.1	1.6	43.8	46.3	26.9	3.6	123.8	2.06
2	1.0	0.1	4.6	5.6	21.5	9.2	2.6	2.3	46.9	.78
3	0.7	0.5	1.0	2.7	30.0	36.2	41.3	13.4	125.8	2.10
4	7.1	3.4	13.0	5.7	21.5	8.9	2.8	1.5	63.9	1.06
5	2.1	0.9	6.5	5.2	37.8	14.6	20.8	1.5	89.4	1.49
6	2.4	2.0	11.0	20.7	13.0	3.2	0.0	5.8	58.1	.97
Total	1.8	0.8	4.3	4.3	24.2	19.2	16.9	5.2	76.7	1.28

Table 5
Percent Probabilities for Behavior State Lags 1 and 2 Across the Total and Five Profile Groups

Lag 1 Probabilities

Profile Group	$A^1 \rightarrow A^2$	$A^2 \rightarrow A^1$	$A^2/S \rightarrow A^1$	$A^2/S \rightarrow A^2$	$A^2 \rightarrow A^2/S$	$A^1 \rightarrow A^2/S$	$CA \rightarrow A^2/S$	$DA \rightarrow A^1$
1	.73	.69	.42	.55	.28	-	-	-
2	.38	.87	-	-	-	-	-	.73
3	.39	.35	.42	.44	.56	.47	.35	-
4	.23	.61	-	-	-	-	-	.50
5	.31	.78	.83	-	.20	.44	-	.83
Total	.39	.62	.43	.26	.23	.24	-	.50

Lag 1 Probabilities

Profile Group	$DR \rightarrow A^1$	$A^1 \rightarrow DA$	$A^1 \rightarrow DR$	$S^1 \rightarrow S^2$	$S^1 \rightarrow DR$	$S^2 \rightarrow S^1$	$DA \rightarrow DR$	$DR \rightarrow S^1$
1	-	-	-	-	-	-	-	-
2	.51	.22	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-
4	.43	-	.38	.28	.50	.44	.40	.32
5	-	-	-	-	-	-	-	-
Total	-	-	-	-	-	-	-	-

Lag 2 Probabilities

Profile Group	$A^1 \rightarrow A^1$	$A^2 \rightarrow A^2$	$A^2/S \rightarrow A^2/S$	$DA \rightarrow DA$	$DR \rightarrow DR$	$CA \rightarrow CA$	$S^2 \rightarrow S^2$	$S^1 \rightarrow S^1$
1	.77	.78	.47	-	-	-	-	-
2	.92	.70	.24	.35	.38	.22	-	-
3	.55	.64	.68	-	-	.27	-	-
4	.72	.51	-	.30	.62	-	.36	.49
5	.85	.58	.61	.28	.57	-	-	-
Total	.74	.65	.43	.26	.36	.24	-	-

Table 6
Number and Percent of Behavior State Shifts Following Environmental Changes of Interactions, Materials, Positions, and Locations for the Total and Five Profile Groups

	State Shifts	Mean Total State Shifts After Environmental Change	Interactions: Mean Percentage of State Shifts[a] % (n)	Interactions: Mean Duration in Seconds	Materials: Mean Percentage of State Shifts % (n)	Materials: Mean Duration in Seconds	Positions: Mean Percentage of State Shifts % (n)	Positions: Mean Duration in Seconds	Locations: Mean Percentage of State Shifts % (n)	Locations: Mean Duration in Seconds
Profile Group 1: (n=8)	A^1-A^2	26	65 (17)	20	15 (4)	18	08 (2)	21	12 (3)	12
	A^2-A^1	26	69 (18)	20	12 (3)	18	15 (4)	8	08 (2)	13
	A^2-A^2/S	11	73 (8)	24	00 (<1)	38	08 (1)	13	18 (2)	22
	A^2/S-A^2	6	50 (3)	9	17 (1)	10	17 (1)	21	07 (1)	11
	A^2/S-A^1	11	73 (8)	14	09 (1)	17	00 (<1)	21	18 (2)	10
Profile Group 2: (n=21)	A^1-A^2	14	73 (10)	27	16 (2)	27	07 (1)	28	03 (<1)	19
	A^2-A^1	10	70 (7)	20	10 (1)	24	10 (1)	28	10 (1)	15
	A^1-DA	11	82 (9)	54	09 (1)	38	00 (<1)	92	09 (1)	29
	DA-A^1	3	100 (3)	10	00 (<1)	12	00 (0)	0	00 (<1)	25
	DR-A^1	3	100 (2)	9	00 (<1)	19	00 (0)	0	00 (<1)	12
Profile Group 3: (n=21)	A^1-A^2	20	55 (11)	15	15 (3)	14	10 (2)	9	20 (4)	8
	A^2-A^1	21	52 (11)	17	12 (3)	13	18 (4)	10	19 (4)	11
	A^1-A^2/S	23	52 (12)	16	22 (5)	14	09 (2)	13	17 (4)	11
	A^2/S-A^1	28	61 (17)	20	18 (5)	18	07 (2)	11	14 (4)	10
	A^2-A^2/S	34	50 (17)	14	12 (4)	11	21 (7)	9	18 (6)	8
	A^2/S-A^2	39	51 (20)	20	15 (6)	15	15 (6)	9	18 (7)	10
	CA-A^2/S	8	63 (5)	9	13 (1)	9	11 (<1)	11	13 (1)	9

Table 6, cont.

Profile Group 4: (n=12)	A^1-A^2	11	54 (6)	22	18 (2)	17	09 (1)	25	18 (2)	14
	A^2-A^1	12	50 (6)	15	08 (1)	13	17 (2)	9	25 (3)	14
	A^1-DR	10	80 (8)	39	16 (2)	19	00 (<1)	81	03 (<1)	21
	DR-A^1	8	75 (6)	23	13 (1)	25	00 (<1)	11	12 (1)	10
	DA-A^1	3	67 (2)	14	16 (<1)	12	00 (<1)	9	16 (<1)	18
	DA-DR	2	100 (2)	23	00 (<1)	40	00 (<1)	3	00 (<1)	40
	S^1-DR	4	75 (3)	21	25 (1)	85	00 (<1)	5	00 (<1)	45
	DR-S^1	4	75 (3)	35	25 (1)	11	00 (0)	0	00 (<1)	7
	S^1-S^2	5	80 (4)	27	20 (1)	30	00 (<1)	6	00 (<1)	45
	S^2-S^1	2	100 (2)	14	00 (<1)	33	00 (<1)	64	00 (<1)	5
Profile Group 5: (n=3)	A^1-A^2	21	81 (17)	12	19 (4)	26	00 (<1)	37	00 (<1)	20
	A^2-A^1	16	88 (14)	23	13 (2)	14	00 (<1)	0	00 (<1)	1
	A^1-A^2/S	32	78 (25)	22	16 (5)	17	00 (<1)	21	06 (2)	9
	A^2/S-A^1	29	87 (25)	15	08 (2)	30	01 (<1)	6	05 (1)	9
	DA-A^1	7	100 (7)	6	00 (0)	0	00 (<1)	0	00 (<1)	1
	A^2-A^2/S	3	78 (2)	11	22 (1)	2	00 (<1)	0	00 (<1)	0
Total Group: (n=66)	A^1-A^2	17	65 (11)	21	18 (3)	19	06 (1)	17	12 (2)	11
	A^2-A^1	16	60 (10)	19	12 (2)	17	13 (2)	11	15 (2)	12
	A^1-A^2/S	12	61 (7)	20	19 (2)	14	07 (1)	23	14 (2)	14
	A^2/S-A^1	13	62 (8)	18	15 (2)	19	08 (1)	12	15 (2)	10
	A^2-A^2/S	13	54 (7)	15	15 (2)	13	15 (2)	9	15 (2)	9
	A^2/S-A^2	13	54 (7)	18	15 (2)	15	15 (2)	9	15 (2)	10
	DA-A^1	3	100 (3)	10	00 (<1)	10	00 (<1)	10	00 (<1)	18

[a]Note. All average percents are rounded to the nearest whole number

Table 7
Mean Percent Occurrences of the Evironmental Variable Categories and Subcategories Across the Total and Five Profile Groups

	Profile Groups					
	1	2	3	4	5	Total
Interactions (Total %)	51	44	46	38	38	44
Adult Self Help	14	12	11	9	15	11
Adult Maintenance	4	5	3	4	4	4
Adult Play/Instruction/Other	33	25	30	24	17	27
Student Self Help	0	0	0	0	0	0
Student Maintenance	0	0	0	0	0	0
Student Play/Instruction/Other	0	2	2	1	2	2
No Interactions (Total %)	49	57	54	61	62	56
Adult Near	29	22	27	21	19	24
Adult Away	10	19	14	19	13	16
Student Near	10	16	13	21	30	16
Student Away	0	0	0	0	0	0
Materials						
Present	63	57	65	58	58	60
Absent	37	43	35	42	42	40
Positions						
Sit	71	61	73	61	79	67
Stand	11	3	17	6	3	9
Prone	9	3	2	2	3	3
Supine	6	21	5	23	2	14
Sidelying	3	12	2	8	13	7
Locations						
Primary	69	82	67	76	86	75
Secondary	7	10	14	12	8	11
Community	2	0	7	2	3	3
Outside	14	5	1	3	0	4
Movement	8	3	12	6	3	7

Table 8
Demographic Information for Profile and Total Groups

	Profile Groups						
	Group 1 %(n=8)	Group 2 %(n=21)	Group 3 %(n=21)	Group 4 %(n=12)	Group 5 %(n=3)	Group 6 %(n=1)	All Groups %(n=66)
Gender							
Male	50.0 (4)	66.7 (14)	52.4 (11)	75.0 (9)	66.7 (2)	100.0 (1)	62.1 (41)
Female	50.0 (4)	33.3 (7)	47.6 (10)	25.0 (3)	33.3 (1)	--	37.9 (25)
Age (years)							
Mean	4.6	11.57	11.76	11.25	10.67	7.0	10.62
Range	2 - 8	3 - 20	3 - 21	4 - 21	6 - 14	NA	2 - 21
Level of Mental Retardation							
Profound	75.0 (6)	95.2 (20)	90.5 (19)	100.0 (12)	66.7 (2)	100.0 (1)	90.9 (60)
Severe	25.0 (2)	4.8 (1)	9.5 (2)	--	33.3 (1)	--	9.1 (6)
Adaptive Behavior Level							
Profound	75.0 (6)	100.0 (21)	95.2 (20)	100.0 (12)	67.0 (2)	100.0 (1)	93.9 (62)
Severe	25.0 (2)	--	4.8 (1)	--	33.0 (1)	--	6.1 (4)
Educational Placement							
Integrated	25.0 (2)	38.1. (8)	52.4 (11)	75.0 (9)	33.3 (1)	--	47.0 (31)
Self-Contained	75.0 (6)	28.6 (6)	19.0 (4)	--	33.3 (1)	--	25.8 (17)
Residential	--	33.3 (7)	28.6 (6)	25.0 (3)	33.3 (1)	100.0 (1)	27.3 (18)
Grade Level							
Preschool	62.5 (5)	19.0 (4)	9.5 (2)	25.0 (3)	--	--	22.7 (15)
Elementary	37.5 (3)	38.1 (8)	52.4 (11)	50.0 (6)	66.7 (2)	100.0 (1)	47.0 (31)
Secondary	--	42.9 (9)	38.1 (8)	25.0 (3)	33.3 (1)	--	30.3 (20)

Table 9
Etiology Classifications for Total and Profile Groups

Etiology	Group 1 (n=8)		Group 2 (n=21)		Group 3 (n=21)		Group 4 (n=12)		Group 5 (n=3)		Group 6 (n=1)		Total Group (n=66)	
	%	n	%	n	%	n	%	n	%	n	%	n	%	n
Chromosomal Anomalies	37.5	(3)	–		14.2	(3)	–		–		–		9.0	(6)
Unknown Prenatal Influence	25.0	(2)	28.5	(6)	47.6	(10)	41.7	(5)	33.3	(1)	–		36.3	(24)
Infections and Intoxications	25.0	(2)	28.5	(6)	4.7	(1)	16.7	(2)	–		100.0	(1)	18.0	(12)
Trauma or Physical Agent	12.5	(1)	19.0	(4)	19.0	(4)	25.0	(3)	–		–		18.0	(12)
Other Conditions Originating in the Perinatal Period	–		23.8	(5)	9.5	(2)	5.0	(1)	66.7	(2)	–		15.0	(10)
Gross Brain Disease	–		–		4.7	(1)	–		–		–		1.5	(1)
Metabolism or Nutrition	–		–		–		5.0	(1)	–		–		1.5	(1)

Table 10
Percent Levels of Development at Six Month Intervals for Profile and Total Groups

	Group 1 (n=8) % n	Group 2 (n=21) % n	Group 3 (n=21) % n	Group 4 (n=12) % n	Group 5 (n=3) % n	Group 6 (n=1) % n	All Groups (n=66) % n
Gross Motor							
0-6 mo.	50.0 (4)	100.0 (21)	4.8 (1)	83.3 (10)	66.7 (2)	100.0 (1)	59.1 (39)
6-12 mo.	50.0 (4)	--	47.6 (10)	8.3 (1)	33.3 (1)	--	24.2 (16)
12-18 mo.	--	--	28.6 (6)	8.3 (1)	--	--	10.6 (7)
18-24 mo.	--	--	19.0 (4)	--	--	--	6.1 (4)
Fine Motor							
0-6 mo.	50.0 (4)	100.0 (21)	9.6 (2)	91.6 (11)	33.3 (1)	100.0 (1)	60.6 (40)
6-12 mo.	50.0 (4)	--	57.2 (12)	--	66.7 (2)	--	27.3 (18)
12-18 mo.	--	--	19.0 (4)	8.0 (1)	--	--	7.6 (5)
18-24 mo.	--	--	14.3 (3)	--	--	--	4.5 (3)
Communi-cation							
0-6 mo.	25.0 (2)	76.2 (16)	23.8 (5)	83.4 (10)	66.7 (2)	100.0 (1)	54.5 (36)
6-12 mo.	75.0 (6)	23.8 (5)	57.1 (12)	8.3 (1)	33.3 (1)	--	37.8 (25)
12-18 mo.	--	--	14.3 (3)	8.3 (1)	--	--	6.1 (4)
18-24 mo.	--	--	4.8 (1)	--	--	--	1.5 (1)
Cognitive							
0-6 mo.	37.5 (3)	81.0 (17)	33.4 (7)	83.4 (10)	66.7 (2)	100.0 (1)	60.6 (40)
6-12 mo.	12.5 (1)	19.1 (4)	52.0 (11)	8.3 (1)	33.3 (1)	--	31.8 (21)
12-18 mo.	50.0 (4)	--	9.5 (2)	8.3 (1)	--	--	4.5 (3)
18-24 mo.	--	--	4.8 (1)	--	--	--	3.0 (2)
Social							
0-6 mo.	12.5 (1)	61.9 (13)	19.1 (4)	91.7 (11)	100.0 (3)	100.0 (1)	48.5 (32)
6-12 mo.	62.5 (5)	33.3 (7)	61.9 (13)	8.3 (1)	--	--	39.4 (26)
12-18 mo.	25.0 (2)	4.8 (1)	14.3 (3)	--	--	--	9.1 (6)
18-24 mo.	--	--	4.8 (1)	--	--	--	3.0 (2)
Self Help							
0-6 mo.	12.5 (1)	66.7 (14)	28.6 (6)	83.4 (10)	33.3 (1)	100.0 (1)	50.0 (33)
6-12 mo.	87.5 (7)	33.4 (7)	42.8 (9)	16.6 (2)	66.7 (2)	--	39.4 (26)
12-18 mo.	--	--	19.0 (4)	--	--	--	6.1 (4)
18-24 mo.	--	--	9.5 (2)	--	--	--	4.5 (3)

Table 11
Motor Impairments for Total and Profile Groups

	Group 1 (n=8)		Group 2 (n=21)		Group 3 (n=21)		Group 4 (n=12)		Group 5 (n=3)		Group 6 (n=1)		Total Group (n=66)	
	%	n	%	n	%	n	%	n	%	n	%	n	%	n
Motor Impairments Including Cerebral Palsy	62.5	(5)	100.0	(21)	76.2	(16)	100.0	(12)	100.0	(3)	100.0	(1)	87.9	(58)
Muscle Tone														
Spastic	40.0	(2)	95.2	(20)	37.5	(6)	66.7	(8)	33.3	(1)	100.0	(1)	65.6	(38)
Hypotonic	20.0	(1)	0.0	(0)	50.0	(8)	8.3	(1)	66.7	(2)	0.0	(0)	20.7	(12)
Ataxic	0.0	(0)	0.0	(0)	0.0	(0)	8.3	(1)	0.0	(0)	0.0	(0)	1.7	(1)
Mixed	40.0	(2)	4.8	(1)	12.5	(2)	16.7	(2)	0.0	(0)	0.0	(0)	12.1	(7)
Degree														
Severe	80.0	(4)	100.0	(21)	18.8	(3)	83.3	(10)	66.7	(2)	100.0	(1)	70.7	(41)
Moderate	20.0	(1)	0.0	(0)	31.3	(5)	8.3	(1)	0.0	(0)	0.0	(0)	12.1	(7)
Mild	0.0	(0)	0.0	(0)	50.0	(8)	8.3	(1)	33.3	(1)	0.0	(0)	17.2	(10)
Anatomical Classification[a]														
Diplegia	0.0	(0)	0.0	(0)	30.8	(4)	0.0	(0)	0.0	(0)	0.0	(0)	7.3	(4)
Quadriplegia	100.0	(5)	100.0	(21)	53.8	(7)	96.7	(11)	100.0	(3)	100.0	(1)	87.3	(48)
Hemiplegia	0.0	(0)	0.0	(0)	15.4	(2)	8.3	(1)	0.0	(0)	0.0	(0)	5.5	(3)
Mobility	%	(n=8)	%	(n=21)	%	(n=21)	%	(n=12)	%	(n=3)	%	(n=1)	%	(n=66)
Limited	75.0	(6)	81.0	(17)	42.9	(9)	83.3	(10)	100.0	(3)	100.0	(1)	69.7	(46)
Walks with Aid	12.5	(1)	9.5	(2)	4.8	(1)	0.0	(0)	0.0	(0)	0.0	(0)	6.1	(4)
Walks Independently	12.5	(1)	9.5	(2)	52.4	(11)	16.7	(2)	0.0	(0)	0.0	(0)	24.2	(16)

Note. [a]Anatomical Classification was not determined for three individuals with motor impairments.

Table 12
Sensory Impairments for Total and Profile Groups

	Group 1 (n=8)		Group 2 (n=21)		Group 3 (n=21)		Group 4 (n=12)		Group 5 (n=2)[a]		Group 6 (n=1)		Total Group (n=65)[a]	
	%	n	%	n	%	n	%	n	%	n	%	n	%	n
Hearing Losses	37.5	(3)	14.3	(3)	23.8	(5)	58.3	(7)	0.0	(0)	0.0	(0)	27.7	(18)
Type of Hearing Loss														
Conductive	33.3	(1)	0.0	(0)	20.0	(1)	0.0	(0)[b]	0.0	(0)	0.0	(0)	11.7	(2)[b]
Sensorineural	66.7	(2)	100.0	(3)	60.0	(3)	83.3	(5)	0.0	(0)	0.0	(0)	76.5	(13)
Mixed	0.0	(0)	0.0	(0)	20.0	(1)	16.7	(1)	0.0	(0)	0.0	(0)	11.7	(2)
Vision Losses	75.0	(6)	76.2	(16)	62.0	(13)	75.0	(9)	0.0	(0)	100.0	(1)	69.2	(45)
Type of Vision Impairment														
Profound	0.0	(0)	25.0	(4)	46.2	(6)	55.6	(5)	0.0	(0)	0.0	(0)	33.3	(15)
Moderate/Severe both Eyes	0.0	(0)	18.8	(3)	7.6	(1)	0.0	(0)	0.0	(0)	0.0	(0)	8.9	(4)
Unspecified[c]	100.0	(6)	56.2	(9)	46.2	(6)	44.4	(4)	0.0	(0)	100.0	(1)	57.8	(26)

Note. [a]Information regarding vision and hearing impairments was not available for one individual.
[b]Information was insufficient for determining type of loss for one student.
[c]The unspecified category includes those individuals with diagnosed cortical vision loss and unclassified vision/hearing losses termed as "functional".

Table 13
Number of Medications for Students in Total and Profile Groups

Profile	Number of Medications Received by Students																	
	0		1		2		3		4		5		6		7		8	
Groups	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n
1 (n=8)	12.5	(1)	25.0	(2)	50.0	(4)	0.0	(0)	12.5	(1)	0.0	(0)	0.0	(0)	0.0	(0)	0.0	(0)
2 (n=21)	14.0	(3)	33.0	(7)	19.0	(4)	10.0	(2)	14.0	(3)	0.0	(0)	5.0	(1)	0.0	(0)	5.0	(1)
3 (n=21)	52.0	(11)	24.0	(5)	0.0	(0)	14.0	(3)	5.0	(1)	0.0	(0)	0.0	(0)	5.0	(1)	0.0	(0)
4 (n=12)	0.0	(0)	8.0	(1)	50.0	(6)	17.0	(2)	0.0	(0)	8.0	(1)	8.0	(1)	0.0	(0)	8.0	(1)
5 (n=3)	0.0	(0)	67.0	(2)	33.0	(1)	0.0	(0)	0.0	(0)	0.0	(0)	0.0	(0)	0.0	(0)	0.0	(0)
6 (n=1)	0.0	(0)	0.0	(0)	0.0	(0)	100.0	(1)	0.0	(0)	0.0	(0)	0.0	(0)	0.0	(0)	0.0	(0)
Total (n=66)	23.0	(15)	26.0	(17)	23.0	(15)	12.0	(8)	7.0	(5)	2.0	(1)	3.0	(2)	2.0	(1)	3.0	(2)

Table 14
A Listing of Medications with Potential Sleep and Drowse Side Effects for Total and Profile Groups

Medications	Group 1 (n=7) %	n	Group 2 (n=18) %	n	Group 3 (n=10) %	n	Group 4 (n=12) %	n	Group 5 (n=3) %	n	Group 6 (n=1) %	n	Total Group (n=51) %	n
Analgesic	0.0	(0)	0.0	(0)	5.3	(1)	3.7	(1)	0.0	(0)	0.0	(0)	1.8	(2)
Antacid	0.0	(0)	7.0	(3)	0.0	(0)	0.0	(0)	0.0	(0)	33.3	(1)	3.6	(4)
Antibacterial	16.7	(2)	0.0	(0)	10.5	(2)	0.0	(0)	0.0	(0)	0.0	(0)	7.3	(8)
Anticonvulsant	41.7	(5)	34.5	(15)	31.6	(6)	40.7	(11)	66.7	(2)	33.3	(1)	36.4	(40)
Antiemetic	0.0	(0)	0.0	(0)	0.0	(0)	7.4	(2)	0.0	(0)	0.0	(0)	1.8	(2)
Antispastic	0.0	(0)	2.3	(1)	0.0	(0)	3.7	(1)	0.0	(0)	33.3	(1)	2.7	(3)
Antiulcer Agent	0.0	(0)	0.0	(0)	0.0	(0)	0.0	(0)	33.3	(1)	0.0	(0)	0.9	(1)
Diuretic	8.3	(1)	2.3	(1)	0.0	(0)	0.0	(0)	0.0	(0)	0.0	(0)	1.8	(2)
Laxative	0.0	(0)	0.0	(0)	5.3	(1)	3.7	(1)	0.0	(0)	0.0	(0)	1.8	(2)
Sedative/Hypnotic-Anticonvulsant	0.0	(0)	2.3	(1)	5.3	(1)	7.4	(2)	0.0	(0)	0.0	(0)	3.6	(4)
Antihistaminic	0.0	(0)	4.7	(2)	0.0	(0)	0.0	(0)	0.0	(0)	0.0	(0)	1.8	(2)
Other	33.3	(4)	46.5	(20)	42.1	(8)	33.3	(9)	0.0	(0)	0.0	(0)	36.4	(40)
Total Separate Medications	12		43		19		27		3		3		110	