*BEHAVIORAL ASSESSMENT FOR PEDIATRIC
INTENSIVE CARE UNITS¹*

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Two studies were conducted to analyze behaviors of staff and patients on a Pediatric Intensive Care Unit (PICU). In the first study, behavioral observation procedures were employed to assess patient state, physical position, affect, verbal behaviors, visual attention and activity engagement, and staff verbal behavior. On the average, one-third of the patients were judged to be conscious and alert but markedly nonengaged with their environment. In the second study, a member of the hospital staff provided alert patients with individual activities to determine whether a simple environmental manipulation could positively affect behavior of children in intensive care. Employing a reversal design, the activity intervention was found to increase attention and engagement and positive affect, and to decrease inappropriate behavior. Both studies demonstrate that behavioral assessment procedures can provide an empirical basis for designing PICU routines affecting children's psychosocial status, and, thus, complement current procedures designed to provide quality medical care.

DESCRIPTORS: behavioral pediatrics, intensive care units, assessment, activity interventions, children

Each year, tens of thousands of children in need of critical care are admitted to intensive care units (ICU). Children may be isolated from parents and other children, be exposed to a number of children with life-threatening illnesses or injuries, witness critical medical interventions, or experience a number of necessary but painful medical procedures. In this environment, children are typically connected to a number of vital-sign monitoring devices, given fluids intravenously, and restrained from moving freely in their beds. Exposure to this

traumatic and unfamiliar environment may result in a decrease of age-appropriate behaviors and an increase in problem behaviors, making good medical care harder to provide and transition to home more difficult (Haller, Talbert, and Dombro, 1967; Lindheim, Glaser, and Coffin, 1972). Despite the importance of the nonmedical problems associated with intensive care, very few studies deal with pediatric populations. Therefore, in referring to previous research the more extensive literature on adult ICU's must also be considered. For example, psychological problems associated with intensive care units have been grouped into four general areas (Kornfeld, 1971): (1) reactions to serious medical-surgical interventions (Blachly and Starr, 1964; Bowden, 1975; Danilowicz and Gabriel, 1971; Davenport and Werry, 1970; Egerton and Kay, 1964; Kornfeld, Zimberg, and Malm, 1965; Sveinsson, 1975), (2) problems associated with the hospital environment (Langford, 1961; McKegney, 1966; Tomlin, 1977), (3) delayed patient re-

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actions, manifested after discharge (Druss and Kornfeld, 1967; Klein, Klinier, Zipes, Troyer, and Wallace, 1968), and (4) adverse reactions of staff working on ICU's (Diaz, 1969; Vreeland and Ellis, 1969).

Nonmedical problems that occur as the result of intensive care have been jointly termed the "ICU syndrome". The syndrome has been related to various parameters of the social and physical environment. These include observation of other patients, exposure to equipment, length of stay in the ICU, decreased sensory stimulation, separation from families, lack of staff attention other than to medical status, and psychological predisposition (Egerton and Kay, 1964; Kornfeld, 1971; Maron, Bryan-Brown, and Shoemaker, 1973; Vernon, Foley, Sipowicz, and Schulman, 1965), and sleep deprivation (Kornfeld *et al.*, 1965; Lazarus and Hagens, 1968).

Despite efforts to document the "ICU syndrome", few empirically based observational studies have been reported. Two exceptions are those by Bruhn, Thurman, Chandler, and Bruce (1970), and Lazarus and Hagens (1968). Bruhn *et al.* (1970) obtained data from the vital-sign monitors of patients observing the death of another patient and found increases in heart rate and blood pressure. Lazarus and Hagens (1968) found that modifications in sensory monotony, sleep deprivation, and physical design decreased the incidence of delirium in post-cardiotomy patients. Other studies have relied on subjective data from ward psychiatrists, staff, and families to describe patient behaviors and their etiologies. Although interesting, these data should be considered anecdotal and the resulting conclusions equivocal.

Investigators have also reported implementation of preventive and treatment strategies to mitigate the traumatic effects of the environment. Preventive interventions have taken the form of environmental redesigning (Abbott, Hansen, and Lewis, 1970; Lindheim *et al.*, 1972), preparation of children for surgery and hospitalization (Petrillo, 1968; Rie, Boverman,

Grossman, and Ozoa, 1968), and normalization of the environment through social interaction and provision of play materials (Blumgart and Korsch, 1964; Hott, 1970; Jolly, 1968). Treatment strategies have involved both behavioral and counselling approaches to such problems as attention seeking (Efthymiou, 1976; Zide and Pardoe, 1976) and verbalizations of stress. Unfortunately, only one of the 12 studies reviewed provided objective data (Rie *et al.*, 1968).

Thus, while many investigators have identified significant psychosocial problems related to intensive care and have even suggested intervention strategies, a methodology for quantifying these problems and their remediation has been notably lacking. To the extent that ICU's are similar to other group-care and educational environments, assessment methods developed for these environments may be adapted to study the ICU environment. In particular, recent studies in applied behavior analysis have demonstrated the feasibility of employing behavioral observation techniques for assessment of and intervention in group settings. These demonstrations have been provided for a variety of settings, including classrooms (Risley and Cataldo, 1973), child day-care centers (Cataldo and Risley, 1974a; Twardosz, Cataldo, and Risley, 1974), geriatric care centers (McClanahan and Risley, 1975), and institutions for the retarded (Cataldo and Risley, 1974b) and mentally ill (Alevizos, De Risi, Liberman, Eckman, and Callahan, 1978).

A problem of applying behavior observation procedures that require a precategorized set of behaviors is that the investigators may not be able to determine the behaviors objectively before the data are collected and analyzed. For situations in which little information is available on what is likely to occur during an observation, behavioral assessment can be based on subcomponent categories of behaviors, as demonstrated by the Resident Activity MANIFEST (Cataldo and Risley, 1974b). The MANIFEST was designed for use in residential in-

stitutions where few planned activities occurred and children's behaviors were often restricted or bizarre. Use of the MANIFEST in the assessment of institutions for the retarded allowed observations to be made on subcomponent categories consisting of residents' location, bodily position, focus of visual attention, and what residents were touching. Unlike behavioral observation procedures in which observers note specific precoded behaviors (*e.g.*, hitting, out-of-seat behavior, attending to teacher), observers using the MANIFEST note in a descriptive phrase what the resident is doing. The only restriction is that a phrase or word be provided for each category. In this manner, the broadest possible latitude is permitted for behavioral assessment, with validity based on the degree of agreement between observers when making simultaneous but independent observations. By observing each of the residents in succession at numerous times during the day (time sampling), a quantitative profile of activities and interactions can be obtained. Further, the measure is economical in terms of staff time, taking usually 3 to 4 min to observe and record the behavior of each individual.

In the present study, an assessment methodology similar to the Resident Activity MANIFEST was employed on a pediatric intensive care unit. After a period of data collection to obtain an analysis of the behavioral characteristics on the ward, a simple activity intervention was conducted with a subsample of the children from the demographic study. Demonstrating a reliable and convenient quantitative methodology for assessing aspects of PICU's can be useful in analyzing the effects of a variety of intervention strategies. Demographic analyses are important, not only in providing empirical documentation for that which is already known and to serve as a baseline for future interventions, but also in identifying conditions and relationships on intensive care units which may not be readily apparent. Based on demographic findings, interventions can be designed and then tested employing objective measures simi-

lar to those during demographic studies, thus providing a correspondence between studies and demonstrating the utility of an assessment procedure for both correlational and causal investigations.

STUDY I

METHOD

Subjects and Setting

Ninety-nine patients, ranging in age from two days to 22 yr (mean 6 yr, median 4 yr), were observed over a two-month period on the Pediatric Intensive Care Unit (PICU) of the Johns Hopkins Hospital. The PICU is an 11-bed, acute-care pediatric setting composed of two four-bed rooms, each with a satellite nursing station, and three one-bed rooms for patients requiring isolation. On the day shift, during which time observations were taken, the staff consisted of eight to nine nurses, two nurse technicians, two respiratory therapists, two residents, the director and/or the assistant director of the PICU, and one half-time Child Life teacher. (The Child Life Department is responsible for providing psycho-social support to the children, in the form of social interaction and play, in an attempt to normalize the hospital environment.) Patients are admitted to the PICU for trauma (*e.g.*, skull fracture, abdominal injury, poisoning), surgery (*e.g.*, repair of cardiac defects, kidney transplantation, facial reconstruction), or medical disease requiring cardiopulmonary monitoring and/or assistance (*e.g.*, use of the ventilator) or vital-sign monitoring. Of the 99 patients in the present investigation, 18% were admitted as the result of cardiac surgery, and 13% as the result of head trauma. The remaining 69% of the patients fell into 30 different diagnostic categories, with no category accounting for more than 6% of the patients. The length of stay for the observed patients ranged from one day to 11 months (mean 4.9 days, median two days).

Table 1
Definitions of Behaviors for Demographic Analysis

<i>Category</i>	<i>Symbol</i>	<i>Definition</i>
Waking State	Al	Alert: the child's eyes are open and the child is not in a coma; or the child's eyes are closed or not visible, as with bandages, but the child is engaged in some verbal or physical activity.
	A	Awake: the child's eyes are open but fixed on one thing with no accompanying verbal or physical activity, and the child is not in a coma; or the child is waking up and falling asleep, opening and closing eyes.
	S	Asleep: the child's eyes are closed and the child is not engaged in any verbal or physical activity, and the child is not in a coma.
	C	Coma: the child is in a coma, as indicated by a verbal report from a nurse or other medical person.
	Pav	Pavulon: the child has been administered the drug Pavulon, which relaxes all the muscles of the body, as indicated by a verbal report from the medical people.
Position	S	Sitting: the child is in an upright or semi-upright position, at least 45 %, even if being supported by the bed. This includes infants in an infant seat, or being held in an upright position.
	L	Lying: the child is in a prone or supine position, or is flat on the bed on side, or is being held in a prone or supine position.
Verbalizations: From the Child	✓	Verbalization: the child utters any words during the interval.
	—	No verbalization: the child does not utter any words during the interval.
Verbalizations: To the Child	✓(T)	To: if the statement is directed to the child.
	✓(A)	About: if the statement is to someone else about the child, and the interaction occurs in close proximity to the child.
	—	No verbalization: no verbal interaction occurs from others during the interval.
Attention on/Eye Contact	Scan	Scanning: the child's eyes are moving about and do not fixate on any object or person.
	Space	Space: the child does not appear to be looking at any object or person, but eyes are open.
	Other Words	Record whatever object(s) or person(s) the child makes eye contact with during the interval.
Affective State	P	Positive: the child smiles or laughs during the interval.
	N	Negative: the child cries or whines during the interval, or verbalizes fear or unhappiness (VF), or pain (VP).
	Nu	Neutral: the child exhibits no overt behavioral response to indicate an affective state during the interval.
	Unknown	Unknown: the child has tape or bandages on face, or is wearing a face mask or other respiratory apparatus that interfere with determination of an affective state.
Number and Type of People Within 1m of Bedside	M	Medical: doctors, respiratory and physical therapists, laboratory and X-ray technicians
	N	Nurses and nurse aides (nursing staff were scored as a separate category of medical staff because of the significant degree of their interaction with PICU children)
	P	Parents and grandparents
	C	Child Life workers
Activity	O	Others: any person not otherwise categorized
	✓	Occurs: the child engages in a play activity during the interval— <i>e.g.</i> , painting, puzzles, blocks, reading books or being read to, watching TV, looking at or touching a mobile. This also includes the presence of a radio or other musical toy that is turned on and in the bed of an alert child.
	—	Does not occur: the child does not engage in a play activity during the interval.

Procedures

Six patient behaviors and three behaviors of caregivers were recorded. Categories of recorded patient behaviors were waking state, position, verbalization, eye contact, activity, and affective state. Behavior categories of caregivers included verbalizations to patients, and number and categories of people at bedside. Definitions of coded behaviors are presented in Table 1. The data sheet was constructed such that there was a separate section for each category. This being the case, the same symbols but with a different meaning could be used, if necessary, in different categories.

Observers recorded behaviors of each child and those interacting with the child, using a 1-min time-sampling technique. Standing approximately 1.5 m from bedside and using a stopwatch, two observers observed one child for 1 min. All coded behaviors that occurred within the 1-min interval were recorded. Both the symbol and a word or phrase describing the behavior were recorded. All children were observed by having the observers make a sweep of the ward, moving from one child to the next until 1-min time samples were obtained on all children. To prevent bias during a sweep of the ward, the order in which the rooms were visited was randomized, while the order in which each child was observed in a room was standardized.

Sweeps of the ward were made approximately once every 2 hr between 9:00 a.m. and 5:00 p.m. on weekdays, except when serious medical conditions existed. Ward problems and the advisability on nonemergency staff on the ward for any particular day were discussed at nursing report between 10:30 and 11:00 a.m. A total of 708 child observations were conducted.

Interobservers agreement was measured by comparing the two observational records for agreement on the occurrence of coded behaviors. Thirty-seven sweeps of the ward were made with two observers on 25 different days

across the two-month period to assess interobserver agreement. Approximately, two to three such reliability checks were made each week of the study. The percentage of agreement was calculated for each behavior by dividing the number of agreements by agreements + disagreements, and multiplying by 100.

RESULTS AND DISCUSSION

Interobserver agreement of the recorded behaviors was 93.5%, with a range of 89 to 97%. Interobserver agreement for each category was: waking state 90%, position 93%, verbalizations from children 97%, verbalizations to children 95%, eye contact 89%, affect 94%, and activity engagement 97%.

Data expressed as a percentage were calculated for each category from the fraction: number of patients about whom the behavior was noted $\div$ the number of patients observed in the sweep for whom the behavior could have occurred. Thus, for "waking state", the denominator was all the patients on the unit. For "affective state", the denominator was the number of awake and alert children. For "position, verbalizations from, verbalizations to, attention on, and activity", the denominator was only those children who were observed to be alert.

Figure 1 presents results for all the children observed in terms of waking state and position, and for those children judged to be awake and alert in terms of their affective state. In Figure 1a, the data indicate that while slightly more than half of the children (54%) were in a sleeping/coma/Pavulon state, a large proportion were judged to be awake (11%) or awake and alert (35%). In Figure 1b, the waking state of patients is analyzed in terms of their position in bed. As would be expected, most were in a lying position (84%); however, of these, 33.6% were judged to be awake or alert. Of the 15% noted to be in a sitting position, most (11.2%) were also awake or alert. Focusing on those children who were most likely to be responsive and influenced by environmental

Fig. 1. Per cent observations of children in each of the (a) waking states, (b) positions, and (c) affective states. In Figure 1b, data for 1% of the children are not presented, as they could not be categorized as sitting or lying. Percentages in Figure 1c do not sum to 100% due to downward rounding.

events, the affects of awake and alert children in Figure 1c indicate many more instances of negative (33%) than positive (3%) affective behaviors. However, the most prevalent category was neutral affect, noted in more than half of the observations (58%). On some occasions, affect could not be determined because of intubation or other respiratory equipment, bandaging, *etc.* These observations were placed in the unknown category and were noted 5% of the time.

Figure 2 presents data on the behaviors of alert (*i.e.*, awake and alert) children and staff in terms of their interactions and activities. Figure 2a shows the extent of verbalization to alert children, indicating that on 55% of observations, verbalization to children was noted, with nurses verbalizing the most (21%) and medical staff the least (1%). Parents' verbalizations were only 13%, but in many instances this number was biased by the fact that parents were not present at bedside to the same extent as hospital staff. Verbalizations by combinations of individuals, such as parents and nurses, or medical staff and nurses, account for 13% of observations. No verbal interaction

was noted 45% of the time. Figure 2b provides a descriptive analysis of the verbalizations from the alert children to nurses, parents, a combination of people, in the presence of no one, to medical staff, and others. In 82% of observations, no verbal behavior of the alert children was noted. When children were observed to speak, it was most often to parents (6%). Nurses and combinations of people were spoken to 4% of the time, whereas children were noted to verbalize in the presence of no one slightly more often (1%) than noted to verbalize to medical staff (0.4%).

The eye contact of alert children, or what they were judged to be looking at, is shown in Figure 2c. In about one-third of the observations (34%), children were noted to be looking at people in their environment; play activities, 15%; people and play activities, 13%; and miscellaneous objects, such as medical apparatus, 1%. The most frequent descriptive category for children's attention was "nothing" (37%), in which they were judged to be staring into space, scanning the room, or not attending to anything specific. Figure 2d provides data on children's engagement in activi-

Fig. 2. Per cent observations of alert children in each of the subcategories of the following categories: (a) verbalizations to the child, (b) verbalizations from the child, (c) eye contact, and (d) engagement in activities. Percentages in Figure 2b do not sum to 100% due to downward rounding.

ties. Nonengagement was high (54%). When engaged, children were most often with another person (27%), as opposed to alone (6%). Watching TV was noted 13% of the time.

In summary, the results of the demographic analysis indicate that a majority of the patients on this Pediatric Intensive Care Unit were observed to be in a sleeping/coma/Pavulon state, to be lying down, and when awake to exhibit a neutral affect. The majority of verbalizations to alert children were by nurses. On the other hand, the majority of the time children did not verbalize, but when they did, it was most often to parents. Furthermore, alert children were most often noted to be scanning their environment or staring off into space; almost as often, they were watching other people. A majority of the time, children were not engaged in any play activity; however, those who

did usually played in the presence of another person.

Important from a behavioral perspective is that, while a large proportion of the children were quite ill and not conscious, a significant proportion (approximately one-third) were judged to be alert. This implies that alert children have the potential to benefit from environmental modification and programs addressing nonmedical aspects of the ICU—and the potential to be adversely affected by the ICU environment, as well.

The results indicating a high level of neutral and unresponsive affect were not predicted. We are confident that these data are not due to medication because the children would respond much differently when purposefully engaged in a nonmedical procedure by an adult (which served as a basis for designing Study II). Fur-

ther, the data in Study I appear to be markedly atypical of that usually observed with well, nonhospitalized children. We had expected the alert PICU children to display avoidance behaviors or highly negative affect. When approached by a nonthreatening person, we had anticipated approach behaviors and positive affect. The PICU children observed were remarkable in that they neither interacted nor avoided interaction, all with neutral affect.

Analyses across types of adults—nurses, other medical staff, parents—must be considered in terms of access to the children. Nurses may have considerable access because of their primary care responsibilities, while parents are often restricted to particular visiting times.

The notable lack of behavior was striking. Verbalization data, for example, showed that children were *not* verbalizing on 82% of observations, a finding markedly contrary to children's verbal behavior in other settings (*e.g.*, home, school, play). Also, if the verbalization of children in the presence of no one can be considered a free operant rate, the presence of medical staff (excluding nurses) suppresses this rate.

The issue of content should be considered in future investigations. The data here show that verbalizations to and from alert children differed in quantity across categories analyzed. This does not account for the content or quality of these verbalizations.

Data on PICU children's attention and engagement in activities was also markedly different from that usually observed of children in other environments. As noted from the data, children were judged attending to "nothing" during 37% of observations and not engaged during 54% of observations.

To interpret these results, the question of the children's opportunity or ability to engage in interaction with adults and their environment is raised. One possibility is that the staff is not available for interaction, having to attend to emergency medical care and routine procedures. Also, a possibility is that, despite the fact that

they are awake and alert, the children are too sick to wish to interact with their environment. Unfortunately, this first study of children's behavior on a PICU cannot empirically answer these important questions. We anecdotally observed that the operation of this PICU was such that staff had many opportunities to interact with children both during and between medical procedures. We also had observed that the duration of such interaction was often brief and children had some contact with staff for a medical or monitoring procedure every 20 to 30 min. Therefore, the next issue addressed empirically was whether any well-planned interaction could engage children's attention and interest. To assess whether environmental manipulations could positively affect children's behavior, a second study was conducted.

STUDY II

METHOD

Subjects and Setting

Eleven of the patients included in the previous analysis, ranging in age from 1 to 21 yr, served as subjects. All of these patients were judged to be awake and alert during the experimental interventions. Subjects were selected daily on the basis of nurses' recommendations during nursing report that children were capable of interaction and that no major medical procedures were planned for that day. Table 2 lists the reason for each subject's PICU admission, their length of stay on PICU and the day during their admission when an intervention was first attempted. Interventions were conducted on the unit, and no special provisions were made to prepare the subjects other than those provisions described for each condition below. Medical and nursing care occurred as required.

Procedures

A reversal design was employed to evaluate the effects of planned play-related activities on seven patient behaviors. Three patients were

Table 2

Subject	Reason for PICU Stay	Duration of Stay (in days)	Day of Inter- vention
S.L.	Thoracotomy, neuroblastoma	5	3
J.F.	Cardiac surgery, diaphragm paralysis	184	176
M.T.	Cranial facial plastic surgery	17	4
H.G.	Monitoring for irregular HR	4	2
D.F.	Removal of bowel obstruction	3	1
L.S.	Tachycardia and PVCs (monitoring)	16	1
B.P.	Removal of thyroid	2	2
A.F.	Cardiac surgery and respiratory dysfunction	24	6
M.C.	Cardiac surgery	8	1
L.H.	Renal failure and head trauma	6	5
T.J.	Spinal fusion	4	3

observed during conditions of "no toys", "person + toys", and during a return to the "no toys" condition. Six children were observed during conditions of "no toys", "person + toys", and "toys available" conditions. Finally, five children were observed during "toys available", "person + toys", and "toys available" conditions. Three patients served as subjects in more than one type of intervention. During "no toys" conditions, the child was observed as during the previous study; that is, as encountered by the observer. No attempt was made to provide activities for the child; however, if materials were available to the child, they were not removed for the purposes of the "no toys" observation. During "person + toys" conditions, the member of the Child Life staff, who was assigned to the PICU, provided play intervention of an educational or recreational nature. Activities and materials were chosen by the Child Life staff member taking into consideration the patient's age, mobility, and medical status. "Toys available" conditions differed from "person + toys" conditions in that activity materials chosen by the Child Life staff were pro-

vided but no Child Life teacher or other person was present to interact with the child until the "person + toys" condition. Each intervention lasted 15 min, 5 min for each condition and the conditions were presented consecutively with no interruption between conditions. Sessions were 15 min in length because sessions of longer duration were often interrupted by necessary medical procedures. The time of the day each session was conducted depended on the child's Child Life staff member's and observer(s)' schedules coinciding, but usually occurred between 11:00 a.m. and 4:00 p.m.

Four categories of coded behavior were used in Study II. *Affect* and *attention on/eye contact* were used as described in the first study. Two new categories were defined as follows: *interaction*—manipulation of materials or watching the Child Life teacher manipulate materials if that were part of the activity; *inappropriate*—behaviors considered to be detrimental or potentially harmful to the child were noted, as well as behaviors considered to be self-stimulation. Behaviors were coded using a 20-sec interval recording method: 10 sec of observation followed by 10 sec for recording the occurrence of the coded behaviors. Interobserver reliability was obtained on approximately one-half of all observations and was conducted in the same manner as described in the demographic analysis.

RESULTS AND DISCUSSION

Reliability of the behaviors recorded during Study II ranged from 71 to 100%, with a mean of 92%. Interobserver agreement for each category was: affect 99%, attention 71%, interaction 98%, inappropriate behavior 100%. For each minute of the 5-min intervention, data were calculated as a percentage from the fraction: number of 10-sec intervals of observation in which a particular behavior occurred ÷ number of 10-sec intervals of observation.

The effect of providing even a brief, planned

Table 3

Group means of per cent observations for attention on person or activity, and interaction with materials, across conditions for each of the interventions.

Intervention	N	Condition 1		Condition 2		Condition 3	
		Att. ^a	Int. ^e	Att.	Int.	Att.	Int.
A NT/P+T/NT ^a	3	26.60	0	97.80	93.40	24.46	8.90
B NT/P+T/T ^b	6	24.43	0	95.10	79.16	52.63	48.93
C T/P+T/T ^c	5	67.96	53.64	96.04	68.08	75.24	68.00

^ano toys/person + toys/no toys

^bno toys/person + toys/toys

^ctoys/person + toys/toys

^dattention on person or activity

^einteraction with materials

play-related activity for children on an intensive care unit was to increase positive child appropriate behaviors. The results for all subjects in the psychosocial intervention are summarized in Table 3. Comparison of conditions in the "no toys/person + toys/no toys" sequence (Intervention A) indicates that when play materials were provided and activity prompted by the Child Life teacher, children's attention and interaction with the activity were greatly increased (from 26.6% and 0 during "no toys" to 97.8% and 93.4% during "person + toys"). This comparison also shows that this increase in attention and interaction was specific to the "person + toys" condition, since the subjects' behavior in the subsequent "no toys" condition returned to levels comparable to the first "no toys" trial. The effects of leaving the play materials with the child, as shown in Intervention B ("no toys/person + toys/toys"), was that the child's attention and interaction were higher than during the "no toys" condition. The extent to which the introduction and prompting of interaction with materials by an adult contributes to the subjects' behavior is, in part, addressed by Intervention C ("toys/person + toys/toys"). Simply providing materials to the children results in attention and interaction on more than half of the observations, both *before* and after the Child Life teacher's presence in the "person + toys" condition. When she was present, attention to her and/or the materials was greater than during

the "toys" alone conditions (e.g., 67% before, 96% during, and 75% after), while interaction with the materials was comparable across all three conditions.

The averaged data in Table 3 are descriptive of the overall effects noted for the group. To provide examples of interventions for representative individual cases and because assignment of subjects to intervention sequences was not randomized, single-subject reversal design results are presented in Figure 3 for three of the subjects from each sequence. Data for the sequence "no toys/person + toys/no toys" in Figure 3a show the same general effect as the group data. These data also point out the individual differences among children, in that T.J. was more attentive and interactive in all conditions. Figure 3b provides examples of the "no toys/person + toys/toys" sequence. While all three children were observed to have high levels of attention and interaction during the "person + toys" condition, they differed in behavior in the other two conditions. For example, in the "no toys" period, D.F. attended to people and/or activities 51%, whereas B.P. was not observed to engage in any attending behavior. Similarly, in the "toys" condition, while attention varied for all three, D.F. continued to interact with materials during 100% of the observations, B.P. averaged 80%, and L.S. did not interact at all. As shown by the data in Figure 3c, presenting toys to children without adult interaction was for some children

Fig. 3. Per cent observations of attention on people/activities and interaction with activities for each of eight alert children in one of the three types of interventions: (a) no toys, person + toys, no toys, (b) no toys, person + toys, toys, (c) toys, person + toys, toys. For each type of intervention, data are presented on a sample of three children. T.J. served as a subject in two interventions.

not sufficient to initiate or maintain interaction with the materials. L.H., when first presented with play materials, interacted 100%, but by the third minute interaction dropped to 70%; during the "person + toys" condition, interaction remained 100%, but within 3 min of the Child Life teacher leaving, the interaction dropped to zero. S.L., on the other hand, never interacted with the toys when they were first presented, but after the 5-min Child Life teacher visit, she played with the toys almost continuously, and, in fact, more so than when the teacher was present. T.J.'s interaction with the play materials was 100% across all three conditions.

For some children, an activity intervention resulted in positive affective changes and reduced inappropriate behavior. Figure 4a presents data on smiling and interaction with activities for two subjects in two different condition sequences. While each child had quite different levels of interaction, both smiled much more during the 5 min of activity with the

Child Life teacher than during the preceding and following 5-min periods.

Data on inappropriate behavior, and activity, attention, and interaction are presented in Figure 4b. J.F.'s data in the first graph indicated that during the "no toys" baseline there was no interaction with activities and little attention to people or activities in the room, but a high level of finger sucking. During the "person + toys" period, attention and interaction both increased to 60 to 100%, while finger sucking did not occur at all. A return to the "no toys" condition resulted in a return of the previous "no toys" condition behaviors—constant finger sucking, little attention to activities, and no interaction. H.G. was noted to play with the blood pressure equipment that had to remain on her arm. During baseline "no toys", she continually squeezed the blood pressure bulb, interacted with nothing else, and showed attention to people and activities around her approximately 50% of the time. During the "person + toys" activity intervention, interac-

Fig. 4. (a) Per cent observations of smiling and interaction with activities for T.J. in the no toys, person + toys, no toys intervention, and the toys, person + toys, toys intervention; and for M.C. in the toys, person + toys, toys intervention. (b) Per cent observations of attention on people, interaction with activities, and inappropriate or self-stimulatory behaviors for J.F. and H.G. Finger sucking is presented in the top panel for J.F. in the no toys, person + toys, no toys intervention. Squeezing of the bulb on the sphygmomanometer for H.G. in the no toys, person + toys, toys condition is presented in the middle panel. In the bottom panel, finger sucking and manipulation of EKG electrodes is presented for J.F. for the no toys, person + toys, toys condition.

tion and attention increased to 100% and remained high during a return to the "no toys" condition. The child also stopped playing with the blood pressure equipment. J.F. was later noted (in the third graph) to manipulate another type of medical equipment, the EKG electrodes. (These electrodes were attached to equipment that provided the ability constantly to monitor cardiac function and would sound an alarm summoning an emergency team should abnormal cardiac activity or an arrest occur.) Playing with the electrodes could cause the monitoring to be disrupted, and she would alternate between electrode "play" and sucking her fingers in the two "no toys" conditions

shown. However, during a "person + toys" condition, attention to and interaction with activities increased and neither finger sucking nor EKG electrode manipulation occurred.

Unfortunately, not all hospitals have special staff for activity programs, and those that do rarely employ them on all three 8-hr shifts. Further investigation should explore the extent to which activity interventions can be carried out for more meaningful periods of time, how appropriate changes in behavior during an intervention can be maintained in the absence of adult interaction, and how economically and conveniently this can be provided on PICU's. The selection and evaluation of appropriate

play materials based on children's ages and conditions represents a unique challenge to behavioral technology. Further research should be conducted on toy and activity evaluations for hospitalized children similar to that conducted for children in nonhospitalized settings (e.g., Quilitch and Risley, 1973; Quilitch, Christophersen, and Risley, 1977). Also, of future concern should be whether other hospital staff, particularly nurses, can manage activity interventions with equal success, as part of and not competing with their normal routine. On a PICU, this is particularly challenging because of the high percentage of unscheduled, emergency procedures that are necessary. Time and motion studies of nursing staff might help determine strategies, feasibility, and cost-effectiveness for activity interventions carried out by them.

GENERAL DISCUSSION

The findings demonstrate the use of applied behavior analysis in assessing behavioral demographics and the potential of activity interventions on a pediatric intensive care unit. Observations were found to be reliable, as judged by interobserver agreement, and could be conveniently conducted without interfering with the PICU's routine or procedures. The demographic analysis identified important child behaviors that differ from those typical of well children in nonhospital settings. Intervention by a hospital staff member demonstrated that play activities and materials could be used to increase interaction, attention to activities, and positive affect, and to decrease inappropriate behaviors. While the planned play activities were conducted for only 5-min periods, another study recently completed has shown that similar interventions can be successfully employed for the extended periods of up to 20 min between routine medical procedures (Pearson, Cataldo, Bessman, Tureman, Parker, and Rogers, Note 1).

While staff on a PICU may not interact with children to the extent possible and the children may appear to be too sick to appreciate any

nonmedical intervention, the preliminary results obtained from Study II indicate that an activity intervention can engage children's attention and participation, with possible beneficial results. The extent to which such a strategy will prove of medical and psychological benefit and be cost-effective to patients on PICU's has yet to be demonstrated. However, the merits of this approach can be argued in terms of dependent care environments in general and pediatric intensive care units in particular.

Considerations in the Analysis of Dependent Care Environments

Dependent care environments are designed to meet the specialized needs of those they serve. In geriatric care settings, emphasis is placed on cleanliness, order, and providing physical comfort; institutions for the retarded and mentally ill are concerned with proper categorization and provision of treatment and education programs; day-care centers program activities; and PICU's must monitor, stabilize, and then improve patients' medical status. Unfortunately, attention to particular specialized needs sometimes occurs at the expense of other important considerations. In an attempt to provide comfort and service to the elderly, geriatric settings often ignore personal dignity and promote dependency or helplessness. Costly therapy and education programs for the mentally ill and retarded sometimes occur without provision of activity options for clients when they are not in special programs.

Because of the dependent nature of the population served, dependent care environments determine to a great extent which behaviors will be emitted by clients, patients, *etc.*, and the situations they will experience during their stay. This effect is amplified when restriction is to a single environment and is long term. Without careful consideration of the behavioral and psychosocial effects of care provision, the result may range from mere discomfort to social or developmental delay and regression.

Therefore, dependent care environments should be evaluated on whether or not specialized care provision both meets special needs *and* avoids adversely affecting other important needs.

Behavior Analysis of Pediatric Intensive Care

From a child's point of view, medical procedures are aversive. On PICU's, medical procedures are conducted frequently and on the basis of the patient's medical status, not his/her overt behavior. Usually successful child behaviors such as crying, screaming, and complaining are not effective in avoiding or escaping the aversive aspects of essential medical care. Aversive stimuli are, therefore, response-independent. On the basis of animal studies (Morse and Kelleher, 1977) and research on learned helplessness (Seligman, 1975), children with a history of positive adult interaction would be likely to demonstrate a decrease in behavior under PICU conditions. This is supported by the demographic data in Study I, in which there was a notable lack of behavior—neutral affect, no eye contact with activities on the ward, and little verbal interaction. Further, because PICU staff provide the medical procedures, they can become discriminative for aversive stimuli.

The environmental solution is not to reduce the aversiveness of procedures, but rather to provide positive interactions as a contrast. Under such circumstances, staff become discriminative stimuli for both negative and positive consequences, thereby engendering behavioral repertoires typical of environments with differential consequences. The necessity for this consideration is particularly salient on pediatric ICU's. On adult units, the environment may elicit equal fear and anxiety, and provide as many and as exclusive a proportion of aversive events. However, much behavior of the adult patient can be mediated verbally. The alert adult ICU patient can be told of his/her condition and is much more likely to understand the situation—that the primary goal is to get well enough

to leave the ward. Where such verbal mediation is possible, ICU staff are likely to become discriminative for helping the patient, even though their moment-to-moment assistance is primarily aversive in nature. The necessity for an ICU stay and the primary objective of medical procedures (which justify the nature of the environment to the adult patient) are not easily communicated to children; this is especially true for those children whose critical care has had an acute onset and who have not been prepared for the ICU admission (*e.g.*, trauma cases). For children on a PICU, well programmed contingency procedures can be an effective method for mitigating the unintended results of quality medical care, and consequently help to avoid converting a medical triumph into a psychological trauma.

REFERENCE NOTE

1. Pearson, J. E. R., Cataldo, M. F., Bessman, C. A., Tureman, A., Parker, L. H., and Rogers, M. C. *Pediatric intensive care unit patients: effects of play intervention on behavior*. Unpublished manuscript Johns Hopkins University, Baltimore, 1978.

REFERENCES

- Abbott, N. C., Hansen, P., and Lewis, K. Dress rehearsal for the hospital. *American Journal of Nursing*, 1970, **70**, 2360-2362.
- Alevizos, P., DeRisi, W., Liberman, R., Eckman, T., and Callahan, E. The behavior observation instrument: a method of direct observation for program evaluation. *Journal of Applied Behavior Analysis*, 1978, **11**, 243-257.
- Blachly, P. H. and Starr, A. Post-cardiotomy delirium. *American Journal of Psychiatry*, 1964, **121**, 371-375.
- Blumgart, E. and Korsch, B. M. Pediatric recreation: an approach to meeting the emotional needs of hospitalized children. *Pediatrics*, 1964, **34**, 133-136.
- Bowden, P. The psychiatric aspects of cardiac intensive care therapy: A review. *European Journal of Intensive Care Medicine*, 1975, **1**, 89-91.
- Bruhn, J. G., Thurman, E. Jr., Chandler, B. C., and Bruce, T. A. Patients' reactions to death in a coronary care unit. *Journal of Psychosomatic Research*, 1970, **14**, 65-70.
- Cataldo, M. F. and Risley, T. R. Infant day care. In R. Ulrich, T. Stachnik, and J. Mabry (Eds), *Con-*

- trol of human behavior, Vol. III.* Glenview, Ill.: Scott, Foresman, 1974. Pp. 44-50. (a)
- Cataldo, M. F. and Risley, T. R. Evaluation of living environments: The MANIFEST description of ward activities. In P. O. Davidson, F. W. Clark, and L. A. Hamerlynck (Eds), *Evaluation of behavioral programs in community residential and school settings*. Champaign, Ill: Research Press, 1974. Pp. 201-222. (b)
- Danilowicz, D. A. and Gabriel, H. P. Post operative reactions in children: "Normal" and abnormal responses after cardiac surgery. *American Journal of Psychiatry*, 1971, **128**, 185-188.
- Davenport, H. T. and Werry, J. S. The effect of general anesthesia surgery and hospitalization upon the behavior of children. *American Journal of Orthopsychiatry*, 1970, **40**, 806-824.
- Diaz, E. J. A death on the ward. *Hospital Topics*, 1969, **47**, 83-87.
- Druss, R. G. and Kornfeld, D. S. The survivors of cardiac arrest, a psychiatric study. *Journal of the American Medical Association*, 1967, **201**, 291-296.
- Efthymiou, G. Management of attention-seeking patients—2. *Nursing Times*, 1976, **72**, 1490-1491.
- Egerton, N. and Kay, J. H. Psychological disturbances associated with open heart surgery. *British Journal of Psychiatry*, 1964, **110**, 433-439.
- Haller, J. A., Talbert, J. L., and Dombro, R. H. *The hospitalized child and his family*. Baltimore: Johns Hopkins University Press, 1967.
- Hott, J. Rx: Play PRN in pediatric nursing. *Nursing Forum*, 1970, **9**, 288-309.
- Jolly, R. H. Play and the sick child. *Lancet*, 1968, **2**, 1286-1287.
- Klein, R. F., Kliner, V. S., Zipes, D. P., Troyer, W. G. Jr., and Wallace, A. G. Transfer from a coronary care unit. *Archives of Internal Medicine*, 1968, **122**, 104-108.
- Kornfeld, D. Psychological problems of intensive care units. *Medical Clinics of North America*, 1971, **55**, 1353-1363.
- Kornfeld, D. S., Zimberg, S., and Malm, J. R. Psychiatric complications of open-heart surgery. *New England Journal of Medicine*, 1965, **273**, 282-287.
- Langford, W. S. The child in the pediatric hospital: adaptation to illness and hospitalization. *American Journal of Orthopsychiatry*, 1961, **31**, 667-684.
- Lazarus, H. R. and Hagens, J. H. Prevention of psychosis following open-heart surgery. *American Journal of Psychiatry*, 1968, **124**, 1190-1195.
- Lindheim, R., Glaser, H., and Coffin, C. *Changing hospital environments for children*. Cambridge, Mass.: Harvard University Press, 1972.
- Maron, L., Bryan-Brown, C., and Shoemaker, W. C. Toward a unified approach to psychological factors in the ICU. *Critical Care Medicine*, 1973, **1**, 81-84.
- McClannahan, L. E. and Risley, T. R. Design of living environments for nursing home residents: increasing participation in recreation activities. *Journal of Applied Behavior Analysis*, 1975, **8**, 261-268.
- McKegney, F. P. The Intensive Care Syndrome: the definition, treatment, and prevention of a new "disease of medical progress." *Connecticut Medicine*, 1966, **30**, 633-636.
- Morse, W. H. and Kelleher, R. T. Determinants of reinforcement, and punishment. In W. K. Honig and J. E. R. Staddon (Eds), *Handbook of operant behavior*. Englewood Cliffs, N.J.: Prentice-Hall, 1977. Pp. 174-200.
- Petrillo, M. Preventing hospital trauma in pediatric patients. *American Journal of Nursing*, 1968, **68**, 1469-1473.
- Quilitch, H. R., Christophersen, E. R., and Risley, T. R. The evaluation of children's play materials. *Journal of Applied Behavior Analysis*, 1977, **10**, 501-502.
- Quilitch, H. R. and Risley, T. R. The effects of play materials on social play. *Journal of Applied Behavior Analysis*, 1973, **6**, 573-578.
- Rie, H. E., Boverman, H., Grossman, B., and Ozoa, N. Immediate and long-term effects of intervention early in prolonged hospitalization. *Pediatrics*, 1968, **41**, 755-764.
- Risley, T. R. and Cataldo, M. F. *The planned activity check: a standardized measure of classroom participation*. Lawrence, Kans.: Center for Applied Behavior Analysis, 1973.
- Seligman, M. E. P. *Helplessness*. San Francisco: W. H. Freeman, 1975.
- Sveinsson, I. S. Postoperative psychosis after heart surgery. *Journal of Thoracic and Cardiovascular Surgery*, 1975, **70**, 717-726.
- Tomlin, P. J. Psychological problems in intensive care. *British Medical Journal*, 1977, **2**, 441-443.
- Twardosz, S., Cataldo, M. F., and Risley, T. R. Infants' use of crib toys. *Young Children*, 1974, **29**, 271-279.
- Vernon, D. T. A., Foley, J. M., Sipowicz, R. R., and Schulman, J. L. *The psychological responses of children to hospitalization and illness*. Springfield, Ill.: Charles C Thomas, 1965.
- Vreeland, R. and Ellis, G. L. Stresses on the nurse in an intensive care unit. *Journal of the American Medical Association*, 1969, **208**, 332-334.
- Zide, B. and Pardoe, R. The use of behavior modification therapy in a recalcitrant burned child: case report. *Plastic and Reconstructive Surgery*, 1976, **57**, 378-382.

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