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TEACHING SELF-CATHETERIZATION SKILLS TO CHILDREN WITH NEUROGENIC BLADDER COMPLICATIONS

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We examined the effects of simulation training on the acquisition of self-catheterization skills in 2 female children with spina bifida. Based on a task analysis, the children were taught to perform on a doll each of the components of preparation, and, using a mirror to locate the urinary meatus, to insert and remove the catheter and to clean-up. Before, during, and after training, the children's performance of the skills on the doll and on themselves was assessed. Results of a multiple baseline design across subjects and skill components showed that doll training facilitated the children's acquisition of self-catheterization skills.

DESCRIPTORS: self-catheterization skills, simulation training, behavioral pediatrics, spina bifida, generalization

Individuals with chronic illness or disability often require routine self-administration of medical regimens that can range from relatively simple procedures (e.g., taking prescribed oral medication) to those that are more complex (e.g., self-injections of insulin by diabetic persons). Proper performance of prescribed medical regimens can obviate the need for more intrusive interventions. As a case in point, intermittent catheterization provides an alternative to ileostomy surgery in persons with neurogenic bladder (Kyker, Gregory, Shah, & Schoenberg, 1977; Lyon, Scott, & Marshall, 1975), including children with myelodysplasia (Drago, Wellner, Sanford, & Rohner, 1977; Hardy, Melick, Gregory, & Schoenberg, 1975; Lapides, Diokno, Gould, & Lowe, 1976). When properly performed, intermittent catheterization improves continence, lowers susceptibility to infection, and provides the child more control over urinary function than surgical diversion permits (Drago et al., 1977; Lapides et al., 1976; Mulcahy, James, & McRoberts, 1977).

Self-performance of required medical regimens can also enable functioning in normal environments by reducing reliance upon caretakers. In *Tatro v. State of Texas* (1984), for example, the school sought to avoid the responsibility of providing clean intermittent catheterization as a related service to a child of normal intelligence with spina bifida, thus making her ineligible to attend school. Ruling in the child's favor, the Supreme Court found that clean intermittent catheterization is a procedure that the student would soon be able to perform herself.

Systematic instruction in the self-administration of medical routines is likely to be important in some cases. Among these are situations in which the routines are complex or are to be performed by children and that are therefore unlikely to be acquired through more simple means. Systematic instruction is also important in establishing early self-reliance in individuals who, because of a chronic disability, require long-term administration of a procedure.

Although often critical to the promotion of health and independent functioning, teaching self-performance of intrusive medical regimens can present

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difficulties if it requires invading the body solely for training purposes or if the trainee is likely to make errors that are potentially hazardous. Such problems might be circumvented through the use of simulation training techniques.

Simulation training with a doll has been shown to be effective in teaching another self-care skill—menstrual hygiene—to mentally retarded adolescents (Richman, Ponticas, Page, & Epps, 1986; Richman, Reiss, Bauman, & Bailey, 1984). The advantages of simulation procedures relative to direct intervention for teaching personal care routines include minimizing embarrassment to the trainees and permitting more frequent training opportunities than would be afforded by naturally occurring stimulus conditions. Simulation training allows errors to be detected and corrected prior to performance of the procedure in situations in which errors may have significant health consequences. Relatedly, simulation training may attenuate stress to the trainee by initially establishing the target behaviors under stimulus conditions that are similar to but less anxiety-provoking than the actual performance.

For these reasons, simulation training procedures may be particularly well suited for teaching children self-performance of medical regimens. Hannigan (1979), for example, reported acquisition of self-catheterization skills by 4 preschool children who were first trained to criterion on a doll. However, as with previous reports of successful training outcomes in this area (Altshuler, Meyer, & Butz, 1977; Hasham et al., 1975; Lyon et al., 1975; Mulcahy et al., 1977), the effects of the procedure on the children's performance were not systematically assessed. We therefore evaluated a variation of the procedure described by Hannigan (1979) to teach self-catheterization skills to 2 female children.

METHOD

Subjects, Setting, and Materials

Participants were 2 females, Cathy and Teresa, aged 4 years, 3 months and 8 years, 1 month, respectively. Both children were status post myelomeningocele, with neurogenic bladder managed by intermittent catheterization performed by their parents. Neurodevelopmental examination revealed Cathy to be of average intelligence and Teresa to be of borderline intelligence. Both children exhibited intact upper extremity function, with each demonstrating the fine motor skills prerequisite to self-catheterization. Teresa had an ileal loop urinary diversion and a bladder–vagina fistula. In addition, she was prescribed methylphenidate 5 mg b.i.d. in response to a mild attention deficit disorder. Both girls were to attend regular schools during the ensuing fall term, with Cathy enrolled in a preschool program and Teresa in the second grade. The parents of both children had requested that their child receive self-catheterization training to promote independent functioning and adaptation in the upcoming classroom environments. Furthermore, Teresa was a candidate for undiversion surgery contingent upon mastery of self-catheterization skills.

All training and probe sessions were conducted in either the child's hospital room or an examination room of a pediatric hospital to which the children were admitted specifically for self-catheterization skills training. The rooms contained beds, dressers or cabinets, a table, adult- and child-sized chairs, and bathroom facilities (a toilet and sink). Only the experimenters and occasionally the parent were present in the room with the child during the sessions.

Catheterization materials, including an appropriately sized silk catheter, storage container, paper towels, urine container, lubricant, and compact magnifying mirror with suction stand, were stored in the room in a location familiar to the child. Other training materials consisted of a plastic doll (40.6 cm) with female genitalia and moveable arms and legs, and a 3F or 5F clear plastic feeding tube that served as the doll's catheter.

Task Sequence and Response Definitions

A task analysis of self-catheterization yielded four basic skill components: (a) preparation (collecting the necessary materials and practicing appropriate hygiene), (b) mirror use (involving placement and adjustment of a mirror to permit location of the urinary meatus during catheter insertion), (c) catheter

Table 1
Correct Responses for the Four Components of Self-Catheterization

1. Preparation	
1.1	Obtains silk catheter, paper towel, mirror, and urine container (if toilet is not used) from storage.
1.2	Washes complete surface of hands with soap and water so that no dirt or residue is visible, and dries.
1.3	Rinses alcohol from catheter with running water, without contact between catheter and sink (if catheter contacts nonsanitary surface, rewashes with soap and water).
1.4	Places catheter on paper towel.
1.5	Removes underclothes and frees garment from at least one leg.
1.6	Sits on chair or toilet with legs spread apart at least 90°.
2. Mirror placement and adjustment	
2.1	Places mirror in front of self on chair or toilet seat.
2.2	Positions mirror with red mark facing self.
2.3	Applies pressure to top of compact to secure suction cup.
2.4	Opens compact mirror.
2.5	Adjusts angle of mirror.
2.6	Rests mirror on stand.
3. Catheter insertion and removal	
3.1	Lifts clitoris to expose urinary meatus and/or moves finger downward between labia to urinary opening and separates labia by spreading index finger and middle finger in opposite directions while applying pressure against labia.
3.2	Holds labia apart until catheter is inserted.
3.3	Grasps catheter between tip and 2 in. from end of pincer grasp.
3.4	Looks in mirror at urinary opening.
3.5	Touches genital area with appropriate end of catheter for insertion.
3.6	Inserts catheter into urinary opening.
3.7	Uses hand to assist in insertion of catheter.
3.8	Places free end of catheter in container or toilet.
3.9	Pushes catheter upward until urine starts to flow (or past marked point on catheter for training purposes if bladder is nonfunctional).
3.10	Holds catheter in place until urine stops flowing (or for at least 5 s for training purposes if bladder is nonfunctional).
3.11	Withdraws catheter.
4. Clean-up	
4.1	Closes mirror.
4.2	Releases suction on mirror.
4.3	Removes mirror.
4.4	Puts on underclothes.
4.5	Washes catheter with soap and water inside (water flows through catheter) and outside.
4.6	Returns mirror and catheter to appropriate storage.

Table 1
(*Continued*)

4.7	Empties container into toilet and flushes toilet.
4.8	Disposes of container and used paper materials in appropriate trash receptacle.
4.9	Washes all surfaces of hands with soap and water so that no dirt or residue is visible, and dries.

insertion and removal, and (d) clean-up (proper disposal and storage of materials). The target responses (steps) for each skill component are shown in Table 1.

Design and Procedures

Probes. Probes assessing the children's performance on each of the steps in the task analysis on the doll and on themselves were conducted before and after training on each skill component; probes were conducted in a multiple baseline design across both subjects and skill components. Posttraining probes occurred when mastery criterion had been met for the first skill component; upon completion of the review sessions after training to criterion for the second, third, and fourth skill components; and after in vivo training on the third skill component for Cathy. The doll probe after training on the final skill component for Cathy encompassed only the steps for the last skill component because of time constraints (her imminent discharge from the hospital) and the difficulties in maintaining her cooperation with repeated assessments.

During each doll probe, the child was asked to show the experimenter how to catheterize the doll. No feedback or consequences were provided for responses. After the child indicated verbally (e.g.,"All done") or nonverbally (by setting the doll and materials down and waiting) that she was finished, the experimenter thanked her for helping the doll.

In vivo (self) probes were conducted after the doll probes to assess pretraining performance and generalization of training effects to self-administration of the catheterization procedure. The child was asked to show how to catheterize herself and to do the best she could but to stop whenever she liked.

A registered nurse (the third author) conducted or supervised these probes; she was responsible for interrupting an incorrect response that was potentially unsafe and performing that response for the child so the next step in the sequence could occur. No feedback or consequences were otherwise provided for responses, although the child was thanked and praised for her efforts at the conclusion of each probe.

Training procedures. Participants were taught individually to perform target responses through training with the doll. By way of introduction, the children were told that they would learn to catheterize themselves, but that a doll with the same urinary problems would need their help first. During each training session, only one skill component was taught, and all steps within that component were performed once. The duration of each session ranged from 1 to 17 min ($M = 6.3$ min), depending on the child's degree of proficiency and the number of steps in the skill component being trained. Two to 10 sessions ($M = 6$) were conducted per day; often a session was immediately followed by another unless the child appeared fatigued (e.g., displayed negative affect, inattentiveness, or performance decrements).

Before the first training session for each skill component, the trainer (one of the first three authors) described and modeled on the doll the steps of the target skill component. After all materials were restored to their normal location and condition, training sessions were initiated with a request to the child to demonstrate and verbalize the steps for that skill component (e.g., "Show me how you can help the doll with her catheter, and tell her what you're doing."). The doll was manipulated from a sitting position on the child's lap, facing forward, to simulate the stimulus conditions for performance of self-catheterization responses. If the child did not perform a step correctly (e.g., began to insert the wrong end of the catheter) or out of sequence (e.g., pushing the catheter upward before placing the other end in the toilet or container), the trainer prompted the correct response (e.g., "Where does that end of the catheter go?"). If the child did not perform the step correctly following a verbal prompt, the trainer presented a visual prompt (by pointing) and, if necessary, manual guidance. Upon completion of the last step in the chain for the target skill component, the trainer praised the child for the steps she had performed correctly.

Following mastery criterion of 100% correct (unprompted) responding on two consecutive training sessions, a review session was conducted during which the child was asked to perform the steps for all previously trained skill components. (Review sessions were not conducted following training on preparation because there were no previous skill components.) The review sessions were conducted in the same manner as training sessions, except that they always began with the first step in the chain.

Cathy was, in addition, given in vivo training on catheter insertion and removal based on her performance on probes (described below) in which she demonstrated correct responding on the doll but had difficulty on several steps in catheterizing herself. One of the experimenters conducted four training sessions in which she provided verbal and physical prompts as needed for performance of the steps involved in self-insertion of the catheter and praised Cathy immediately following prompted or unprompted correct responses.

Data Collection and Reliability

Training performance. Independent observations were conducted by two of the experimenters on 31% and 56% of the training sessions for Cathy and Teresa, respectively. Responses were scored as correct if they were performed independently as defined in Table 1. Observer records were compared on a step-by-step basis, and reliability was calculated by dividing the number of agreements by agreements plus disagreements and multiplying by 100. Mean agreement scores were 97.1% for Cathy (range, 83% to 100%) and 100% for Teresa.

Training time. The duration of training was determined from recordings of the time of onset and offset for each session. Independent observers recorded onset and offset times on 29% and 46% of the training sessions for Cathy and Teresa, respectively. Identical times were recorded by both observers in all instances except one.

Probes. Each step in the task analysis was scored as correct or incorrect as defined in Table 1. If a step was not performed in a required sequence (e.g., washing hands after vs. before handling the catheter), only that step was scored as incorrect. Reliability was assessed by two of the experimenters on 63% and 56% of the doll probes and on 88% and 46% of the in vivo probes for Cathy and Teresa, respectively, in the same manner as described for training. Mean agreement scores on doll probes were 95.2% for Cathy (range, 90.6% to 100%) and 98.1% for Teresa (range, 96.9% to 100%). Mean agreement scores on in vivo probes were 98.4% (range, 94.8% to 100%) and 99.4% (range, 96.9% to 100%).

RESULTS AND DISCUSSION

Figure 1 shows the number of correct responses across skill components on doll (open points) and in vivo (closed points) probes for the 2 participants. During baseline, the children performed few of the steps correctly either on themselves or on the doll. Only after receiving training and demonstrating competence with the doll did the children's self-performance of the corresponding skill components increase. At the time of discharge, Cathy demonstrated correct performance of all essential steps, but Teresa continued to require assistance with one of the 32 steps in task completion; she occasionally found it difficult to use her nondominant hand to separate her labia while inserting the catheter. Follow-up data reported by parents up to 3 months after discharge indicated that both children were catheterizing themselves independently. Subsequently, Teresa's ileal loop was undiverted.

These results indicate that training on a doll can facilitate acquisition of skills in the self-administration of a medical regimen by young children. Once children acquire fundamental skills through doll training, routine opportunities for catheterization can be used to help the children become more proficient in their performance of the procedure. This was demonstrated with Cathy, whose performance improved further with subsequent guided practice on self-insertion of the catheter. In fact, doll training might be most appropriately considered as an adjunct to the in vivo training opportunities naturally afforded with children who regularly require catheterization. These occasions can be used to determine steps that have generalized and to provide more focused remedial training.

Doll training appears to offer several advantages in preparing children to self-administer medical procedures. First, because for young children dolls are often associated with play activities, their use may enhance children's participation in training. Although the interest and cooperativeness of Cathy and Teresa eventually waned during doll probes, this may be attributable to the demands of the experimental situation and might be minimized in future research by limiting the frequency and intensity of assessments under nonreinforced conditions.

A related advantage of simulation training is that some children may be reluctant to perform on themselves an intrusive procedure with which they are not sufficiently familiar. Allowing children to achieve mastery on a doll before self-application may serve to desensitize them to the process and decrease the likelihood of committing potentially harmful errors when they practice the procedure on themselves. Any errors made on the doll would not be associated with harmful consequences. During baseline, for example, Teresa attempted and correctly performed some of the steps for catheter insertion and removal on the doll but not on herself. Only when she was provided with training and confirmation (through reinforcement) of correct responses on the doll did she perform them during in vivo probes. Similarly, training on the doll can provide children with opportunities to improve their manual dexterity and competence, and for the trainer to assess those skills, before self-catheterization.

Finally, the use of a doll provides more opportunities for training than would be available during routine catheterization of the child. Training on the doll can easily be conducted by nonmedical personnel and by individuals with whom the child

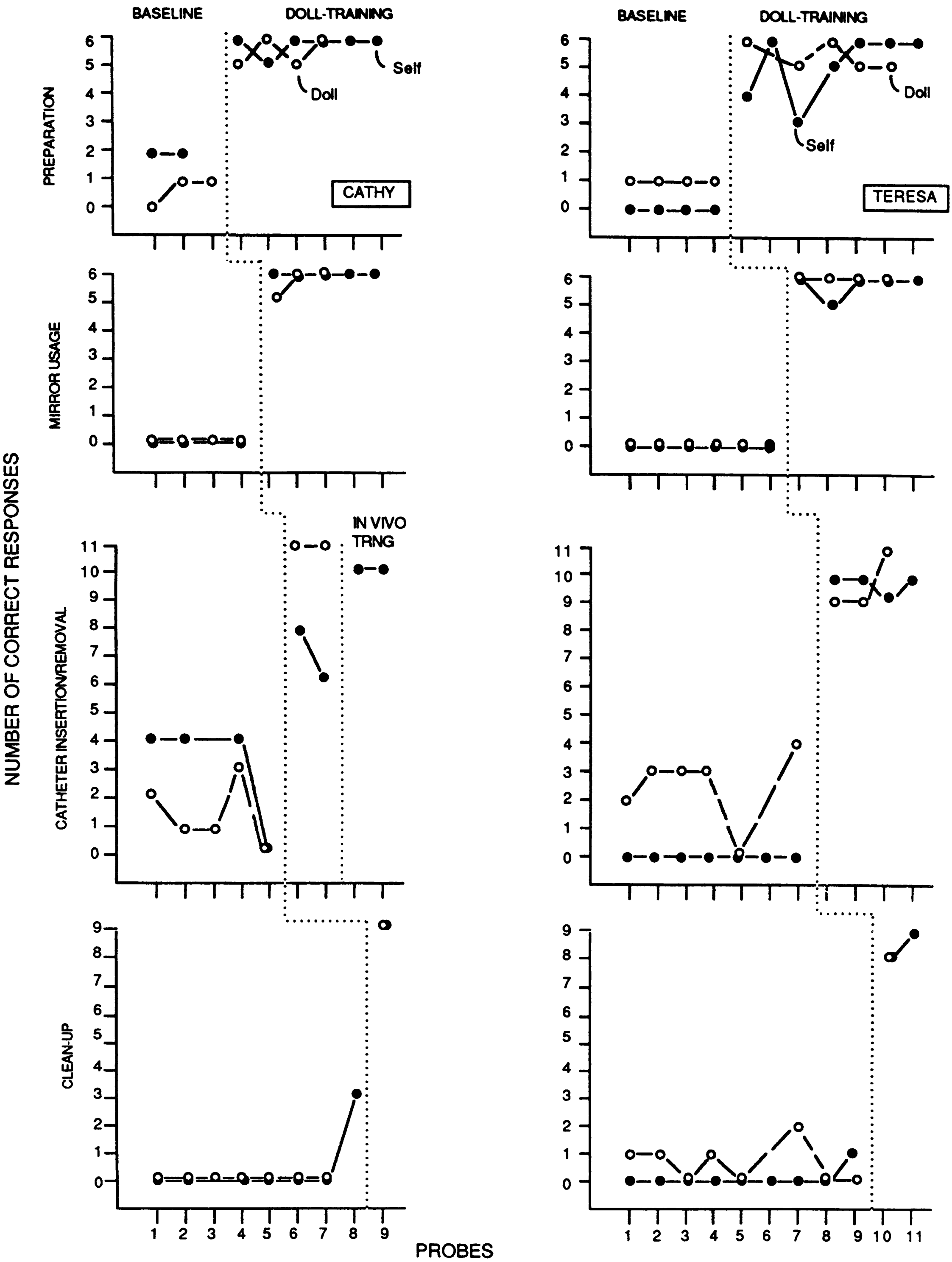

Figure 1. Number of correct responses within skill components on simulation (doll) and in vivo (self) probes for each participant.

might be embarrassed to perform personal care routines. The use of dolls appears to offer an efficient means of training; total training time during the study was approximately 4 hours and 30 min for Cathy and 2 hours and 45 min for Teresa across a 9-day period.

Although we did not conduct direct observations of maintenance of the skills in home and school settings, parental reports unequivocally attested to the children's continued independent practice of the procedure, which was relatively straightforward and had beed acquired with little difficulty. In addition, naturally occurring reinforcers were readily available to sustain successful performance, and given the ages of both children, repeated observations of a personal hygiene regimen seemed to be an unnecessary invasion of their privacy. Nevertheless, follow-up observations would be indicated for many children upon completion of the training program to ensure their routine and proper use of the procedure.

Our procedures and results demonstrate the applicability of behavioral methodologies in issues of medical care, as is now being recognized by the medical profession (Guyatt et al., 1986). Future research might profitably be centered upon formally assessing the extent to which doll training (a) augments training efficiency vis-à-vis other training procedures (cf. Tarnowski & Drabman, 1987), (b) enhances children's willingness to perform the procedure (as determined by measures of trainee satisfaction and data on response latencies or no responses), and (c) can be applied successfully, either in hospital or ambulatory care settings, to facilitate the development of skillful performance of other prescribed medical routines (e.g., suctioning of tracheal tubes). Efforts are currently under way to examine some of these issues.

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