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Training Residents in Developmental Pediatrics: Results from a National Replication

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ABSTRACT. This investigation examined the extent to which a structured curriculum in developmental pediatrics could be applied effectively to a wide range of pediatric residency training programs. Residents drawn principally from sites not involved in the original development of a curriculum in developmental pediatrics were assigned randomly to prerotation control or postrotation experimental groups. Based on an objective case management test, residents who had participated in the rotation defined by the curriculum scored significantly higher than those who had not. Differences between experimental and control groups were similar for both the first and second evaluation years and for residents drawn from the original and new sites (total $n = 161$). Subjective evaluations by residents and faculty preceptors confirmed the utility of curriculum. *J Dev Behav Pediatr 8:260–265, 1987.* Index terms: *resident training, developmental pediatrics, curriculum evaluation.*

Primary care pediatricians have expressed considerable concern with regard to the adequacy of their training in areas related to child development, developmental pediatrics, and behavioral pediatrics.[1-4] The field of developmental pediatrics, with a focus on children with chronic central nervous system and/or sensory handicapping conditions,[5] has had special problems. Reports have identified a number of significant organizational, political, and economic issues[6] that have prevented the necessary expansion of training programs to accommodate to these perceived inadequacies and to changing patterns of practice in contemporary pediatrics.[7,8] Indeed, a survey of all accredited pediatric residency programs in the United States revealed that, although training in various aspects of developmental pediatrics was available, it was loosely organized, generally lacked specific goals and objectives, and failed to provide a comprehensive approach to evaluating and managing children with a broad range of developmental disabilities.[9]

In response to this state of affairs, a "Curriculum in Developmental Pediatrics" was developed[10] under the guidance of a National Task Force on Developmental Pediatrics. The curriculum contains a description of a clinical rotation for a 1- to 2-month period, an integrated set of educational goals and objectives, and a series of clinical activities, protocols, and lecture outlines that correspond to the goals and objectives. In addition, extensive bibliographic and supplementary educational materials were developed to support curriculum implementation. Ten interrelated units were agreed upon by the National Task Force as representing the core content of the field of developmental pediatrics, and were as follows: (1) basic principles of child development and screening, (2) knowledge of handicapping conditions, (3) aspects of prevention, (4) developmental diagnosis and assessment, (5) interdisciplinary process and team functioning, (6) families, (7) management of developmental disabilities, (8) attitudes toward handicapping conditions, (9) community service and resources, and (10) controversial research issues. The knowledge and clinical components of the curriculum were organized according to the major developmental disabilities, i.e., mental retardation, motor handicaps (especially cerebral palsy), central communication disorders, autism, learning disorders, and major sensory impairments and multiple handicaps. A more detailed description of this curriculum is given elsewhere.[9-11]

After extensive field testing, the curriculum was implemented and evaluated in seven pediatric training programs that participated actively in its development. These

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programs will be referred to as demonstration sites in this report. In addition, other training programs interested in implementation received assistance through the National Task Force in the form of workshops and related activities. When those programs, here referred to as replication sites, met specific criteria, they were included as part of the evaluation. Criteria included the availability of minimum teaching resources to allow a supervised 1-month rotation, a sufficiently diverse patient population, collaboration with clinical staff from medical and nonmedical specialties, and documentation that all major components of the curriculum were covered in their program. A small number of replication sites, most having fairly large programs, met these criteria during the first evaluation year (1982–83) and were included in the initial evaluation of the curriculum.[11]

As part of that initial evaluation (year I), an objective assessment comparing residents in a prerotation control group with those in a postrotation experimental group revealed that the clinical decision-making skills of residents working with at-risk or handicapped children can be enhanced significantly through participation in a developmental pediatrics rotation guided by the curriculum. In addition, residents rated their particular rotation as being well organized, that knowledge and clinical skills related to handicapped children and their families were important to their future pediatric careers, and that this particular rotation was critical in acquiring these skills and knowledge.[11]

Despite these positive outcomes, the critical test of the usefulness of the curriculum must extend beyond the original demonstration and replication centers, as these sites may not be representative of the full spectrum of training programs. There is a wide range in the size and scope of pediatric training programs, and the corresponding variability in clinical experiences, local constraints, and faculty training in developmental pediatrics make it essential that any curriculum expecting widespread use must be sufficiently flexible to accommodate to this diversity. The intention of the National Task Force was, in fact, to develop a single structured curriculum that could be adapted to a wide range of training programs. The inclusion of core cases, suggestions for alternative clinical experiences, the provision of supportive didactic material, and the offering of strategies to enable programs to adapt to local conditions all were designed with this intent.

Accordingly, the primary purpose of the current investigation was to evaluate the effectiveness of the curriculum for training programs consisting mainly of replication sites that participated during a recent evaluation year (year II). In addition, since objective and subjective evaluation data were available from both demonstration and replication sites during both year I and year II, a number of other comparisons could be carried out. Specifically, it was possible to determine not only whether the curriculum was effective for a diverse and extensive group composed primarily of residents from new training programs, but also whether the original demonstration sites were able to maintain the quality of their rotations from year to year and whether any differences existed between demonstration and replication programs.

METHOD

Subjects

Sixty-four pediatric residents participated in the comprehensive evaluation of the project during the first evaluation year, 1982–83 (year I). Residents were drawn from the seven demonstration (n = 44) training programs (University of Cincinnati, Howard University, University of Iowa, The Johns Hopkins University, The Ohio State University, Rutgers University, and University of Washington), as well as from replication (n = 20) training programs that were able to meet the criteria for full implementation. These programs were at Dartmouth College, University of Oregon, University of Pennsylvania, and University of Utah.

In year II (1983–84), 97 pediatric residents participated in the full evaluation. Since four additional replication training sites began full implementation during year II (University of Arizona, University of Massachusetts, University of South Florida, and University of Tennessee), most residents were drawn from replication programs (n = 58). The remaining 39 residents represented the demonstration sites. Overall, then, a total of 161 residents participated in the evaluation of the curriculum across year I and year II and across demonstration and replication programs.

Of the 15 participating programs, 12 had mandatory block rotations. Thirteen had 1-month rotations; the other two programs had 2-month rotations. Nearly two-thirds of the residents participated during their second year of training. Approximately 42% indicated that they anticipated a career in primary care, 36% had selected a subspecialty area, and 22% were undecided. A small proportion of residents (less than 3%) selected developmental pediatrics as a subspecialty area of interest. Overall, demographic characteristics were distributed in similar proportions across training years and type of site.

Objective Evaluation

Experimental Design and Procedure. Since most residents participated in the rotation on a monthly basis, it was possible to take advantage of this schedule and assign residents in an unbiased manner to either an experimental group or a control group. Specifically, before the first month of both year I and year II evaluation periods, residents from all participating sites who were scheduled for the rotation were assigned randomly to either a postrotation experimental group or a prerotation control group. At the end of the month, after completion of the rotation, the experimental group residents were administered the Evaluation Case Study questions (see next section). At the same time, residents scheduled to begin the rotation during the second month were administered the same test (constituting prerotation control group scores). This procedure was followed for successive months as prerotation control and postrotation experimental group residents were alternated within sites. To prevent any confounding from assignment of experimental or control groups to specific months, at any one time, half the programs as-

signed residents to the control group and half to the experimental group.

Although a different cycle was used for sites with longer rotations, the same design principles and procedures were followed. By alternating participation in experimental and control groups within and across sites and through random assignment of residents, this procedure had the effect of randomizing all possible confounding variables, including prior resident experiences and self-selection factors. In addition, this procedure did not interfere with rotation schedules or prevent any resident from participating in the rotation.[12] Accordingly, this experimental design permitted us to compare differences between residents who had participated in a rotation guided by the curriculum and those who had not, but were scheduled to do so. It also allowed comparisons of outcomes between year I and year II and between demonstration and replication sites.

Assessment Instrument. A set of four clinically oriented Evaluation Case Study questions designed to test residents' knowledge and clinical decision-making skills was developed. Each question and subquestion was keyed to the content of the curriculum and was finalized only after extensive field testing. These four cases, representing different developmental disorders, were as follows: (1) a 3-year-old with Down syndrome, (2) a 2-year-old with the spastic diplegia type of cerebral palsy, (3) a 7-year-old with school learning and attention problems, and (4) a 3-year-old, born 10 weeks prematurely, with significant language delay. Case material was presented in a sequential format, as residents were given additional clinical information and were requested to make specific judgments at various points within each question. Residents had a maximum of 2 hours to complete the four cases without reference materials.

The answer key and scoring system were determined through consensus involving many of the developmental pediatricians from participating sites. To evaluate the reliability of the scoring system, two independent raters scored 22 of the protocols from year II. Pearson product-moment correlations were very high (average $r = 0.96$) for each of the four case study questions. Differences between raters across questions averaged less than one point. (The case study questions are available from the first author.)

Subjective Evaluation

Assessment Instruments. Two instruments were developed to elicit subjective information from both residents and supervising faculty with regard to the effectiveness of the curriculum in changing residents' attitudes, knowledge, and clinical skills, and to evaluate related aspects of the rotation in developmental pediatrics. The perceptions of residents were obtained by means of a Resident Feedback Questionnaire (RFQ), which was completed by all residents at the end of the rotation. The primary section of the RFQ consisted of self-reports of residents' perceived competence in 11 clinical skill areas emphasized in the curriculum. Residents used a seven-point rating scale ranging from 1 (extremely poor skills) to 7 (extremely good skills) to respond to the following question: "Assume you are in general practice and are asked to perform a comprehensive pediatric developmental assessment of a child with handicaps or suspected of having a handicapping condition. Please use the scale below to rate how competent you would feel in carrying out the following clinical activities in your office." Residents were also asked to estimate the percentage of their rated skill levels for each of the 11 areas that could be attributed directly to their participation in the developmental pediatrics rotation.

The self-report questionnaire also asked residents to rate, on a similar set of scales, their knowledge of the major handicapping conditions, to estimate the proportion of that knowledge that could be attributed to the rotation, to evaluate the extent to which the rotation was well organized, and to indicate how important the knowledge and skills that were part of the rotation were in relation to their anticipated pediatric career. The organizational question used a scale ranging from 1 (totally fragmented) to 7 (totally coherent and consistent), whereas the importance question used a scale ranging from 1 (not at all) to 7 (critical).

Faculty members completed a corresponding instrument, the Clinical Skills Checklist (CSC), that paralleled the clinical portions of the RFQ. Attending faculty members who had primary responsibility for resident supervision during the rotation were asked to rate each resident's skills in the 11 clinical areas found in the RFQ using the same numerical scale and private practice framework.

RESULTS

Objective Evaluation

Residents' scores on the four Evaluation Case Study questions were summed and analyzed in accordance with assignment to experimental or control groups, year I or year II of participation, and whether they represented demonstration or replication sites. Accordingly, a 2 (experimental vs. control) × 2 (year I vs. year II) × 2 (demonstration vs. replication) analysis of variance (ANOVA) was carried out on the total scores (maximum = 270 points). Statistically reliable findings were obtained for all three main effects: experimental vs. control, $F(1,153) = 39.14$, $p < 0.001$; year I vs. year II, $F(1,153) = 11.79$, $p < 0.001$; and demonstration vs. replication, $F(1,153) = 5.45$, $p < 0.05$. None of the interaction terms were statistically significant.

As illustrated in Figure 1, postrotation experimental group residents' scores (overall mean = 155.44; SD = 28.6) exceeded those in the prerotation control group (overall mean = 116.79; SD = 33.3), irrespective of year of participation or whether they represented demonstration or replication programs. The overall score for residents from the replication sites (mean = 146.4; SD = 32.7) exceeded that of the demonstration programs (mean = 126.2; SD = 37.5). However, as indicated in Figure 1, this result was due primarily to the fact that residents in replication programs had higher prerotation scores. Overall gains between prerotation control

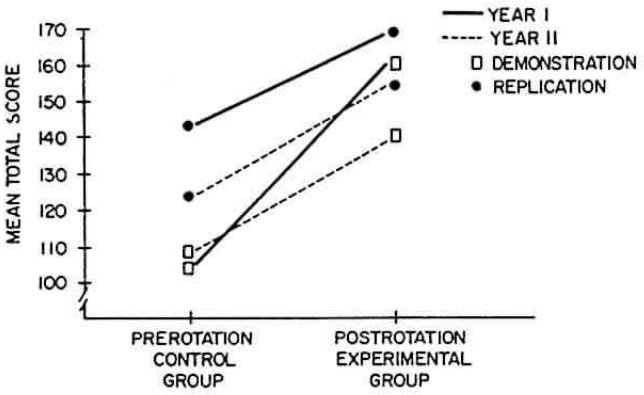

FIGURE 1. Mean total scores on the Evaluation Case Study questions for prerotation control and postrotation experimental groups by year of training and type of program.

and postrotation experimental groups were similar for both the replication and demonstration programs. The most substantial difference between prerotation control and postrotation experimental groups did occur for the demonstration programs during year I but, as noted, none of the interaction terms were significant. The finding that average year I scores (mean = 139.09; SD = 41.2) exceeded year II scores (mean = 133.96; SD = 33.0) appeared to be due to the higher overall scores of the year I replication group. Given the small absolute differences between year I and year II means and the relatively small number of subjects in that first year replication group, this finding should be interpreted cautiously.

Multivariate analyses of variance (MANOVA), using Wilks' criterion, tested the scores obtained on each of the four Evaluation Case Study questions simultaneously. Significant effects were obtained for control vs. experimental, $F(4,150) = 2.51$, $p < 0.05$; demonstration vs. replication, $F(4,150) = 7.75$, $p < 0.001$; and year I vs. year II, $F(4,150) = 9.60$, $p < 0.001$. No interactions reached significance. Univariate analyses for each of the four cases yielded essentially the same pattern as obtained for the total score results. The most consistent outcomes for those univariate analyses were those related to the differences between the prerotation control and postrotation experimental groups.

Subjective Evaluation

Table 1 presents the mean ratings for each of the 11 clinical skills for the Resident Feedback Questionnaire (RFQ) and Clinical Skills Checklist (CSC), and the percent attributed to the rotation measure. For each clinical skill area, scores in the table were combined across year I and year II and across demonstration and replication site membership, since virtually no differences were obtained as a function of these two variables. Specific discrepancies will be discussed below. As can be seen, residents generally felt they had more than adequate skills in nearly all of the 11 areas (overall mean = 5.14). However, skill areas requiring utilization of community services, long-term management of handicapped children, and vision and hearing screening, received the lowest ratings.

Overall, residents attributed 53.61% of the skills to their participation in the rotation itself. Areas perceived by residents as having provided the largest proportion attributable to the rotation were working with other professionals (mean = 66.72%) and integration of clinical findings (mean = 61.10%). As might be expected, the two areas receiving the lowest ratings were the physical and neurologic exam (mean = 46.95%) and hearing and vision screening (mean = 38.00%), reflecting training obtained in previous rotations. This pattern of ratings was highly consistent across year and program type. Although a significant MANOVA was found for the demonstration vs. replication variable, $F(11,134) = 3.02$, $p < 0.001$, univariate analyses revealed that this effect was entirely due to the developmental screening skill area, with demonstration group residents attributing a larger proportion of this skill to the rotation than replication site residents, $F(1,144) = 4.05$, $p < 0.05$.

Faculty ratings of resident skills on the Clinical Skills Checklist (CSC) closely correspond to the perceptions of the residents themselves (see Table 1). Once again, these ratings were highly consistent across type of program and year. Although a MANOVA revealed that the demonstration vs. replication site variable was significant on the CSC, $F(1,102) = 2.79$, $p < 0.05$, univariate analyses again indicated that the effect was due to the developmental screening skill only, with faculty rating residents in the replication group higher, $F(1,112) = 6.80$, $p < 0.05$.

TABLE 1. Combined Data[a] for Resident and Faculty Subjective Clinical Skills Ratings, Plus Percent of Skills Attributed to Rotation

Clinical Skill Area	Resident Rating (n = 153)	% Attributed[b] (n = 148)	Faculty Rating (n = 116)
1. Developmental screening	5.54	53.07	5.37
2. History and etiology	5.51	53.14	5.73
3. Physical and neurologic examination	5.28	46.95	5.71
4. Vision and hearing screening	4.72	38.00	4.81
5. Motor, language, and socio-emotional assessment	5.27	59.37	5.57
6. Integration of clinical findings	5.04	61.10	5.72
7. Working with other professionals	5.60	66.72	5.81
8. Communicating with parents	5.48	47.62	5.60
9. Management	4.53	51.55	4.99
10. Community services	4.21	55.74	4.81
11. Attitudes/clinical approach	5.43	56.54	5.80
Total	5.14	53.61	5.48

[a]All data are means. The number of fully completed scales varied for this analysis. Data include scores obtained from control and experimental group residents following completion of the rotation, averaged over year and type of program.

[b]Refers to percent of perceived competence in each clinical skill area residents attributed directly to participation in the developmental pediatrics rotation.

Mean rating, by residents, of the factual knowledge of developmental pediatrics, emphasizing the major developmental disorders, was 4.63. Nearly 60% of this knowledge was attributed to the rotation. Residents' perception

of the rotation in terms of its importance to their anticipated pediatric careers was quite high (mean = 5.88). Finally, residents generally rated the rotation as being well organized (mean = 5.01). Separate analyses of variance carried out for each of these four ratings revealed that neither type of program nor year affected the ratings ($p > 0.05$).

DISCUSSION

This report both supports and expands original evidence for the effectiveness of a comprehensive, structured curriculum in developmental pediatrics for pediatric residents. What is most important is the fact that it confirms the educational utility of such a curriculum-based rotation across time and for training programs which were completely uninvolved with the original curriculum development process. The most robust and consistent objective evaluation differences were between the experimental and control groups, irrespective of year or type of program (i.e., demonstration or replication). We feel this finding supports the value of a structured curriculum for new sites, and should encourage further dissemination and replication in other pediatric residency programs. In fact, 18 sites, in addition to the 15 programs in the current report, are at various stages of implementation, and should soon meet the criteria established for inclusion in the continuing formal curriculum evaluation. Informal reports from these most recent replication sites support the major findings of this investigation, as these "newest" programs are finding the curriculum valuable in structuring their developmental pediatrics rotations.

It is our additional observation and continued opinion that this curriculum has clearly defined and demarcated the field of developmental pediatrics to the satisfaction of most participating pediatric programs. The core curricular content pertaining primarily to the broad spectrum of developmental disorders, including identification and management of frequently associated behavioral problems, realistically describes an increasingly recognized subspecialty patient population requiring conceptual synthesis and treatment coordination. As increasing numbers of new replication sites seem to recognize this unique identity, we must reaffirm one of the original goals of the curriculum project, namely, to differentiate developmental and behavioral pediatrics despite their overlaps and shared expertise.[11] Accordingly, we would agree with Cohen's[13] recent observation that developmental pediatrics has established an identity within the practice of pediatrics through the development of a curriculum and more formalized training structures, whereas behavioral pediatrics has not. We would correspondingly disagree with the opinion expressed by Parmelee[14] that this distinction between developmental and behavioral pediatrics is artificial, unwise, and counter-productive to training efforts in both areas. The overall acceptance and success of this curriculum's national replication suggest an ability on the part of both pediatric residents and attending faculty to distinguish these content areas, while still appreciating the broad, intrinsic importance of child development and behavior to all aspects of pediatric care. It may well be that the most effective and meaningful approach is to establish a comprehensive training program, perhaps integrated over the entire 3-year residency period, that incorporates essential components from the fields of developmental and behavioral pediatrics, as well as child development. Although it is beyond the scope of this article to discuss this issue, we would certainly encourage such collaborative training efforts.

Despite the efforts and achieved progress of the national curriculum project, difficulties persist in realizing widespread, substantial change in developmental pediatrics training at the pediatric residency level. Fiscal, administrative, philosophical, and faculty constraints act separately or in combination to interfere with sufficient training in this area and to maintain its relatively low priority in many pediatric programs.[15] Weinberger and Oski,[16] for example, surveyed 29 pediatric residency programs and, 5 years after the Task Force report, found few if any changes in the traditional emphasis on inpatient and neonatal training. The survey failed to demonstrate any trend indicating increased emphasis on training experiences in developmental or behavioral pediatrics. In other words, although partly related to the relative scarcity of faculty trained in developmental pediatrics,[17] the consistent message from the Pediatric Education Task Force and from the practitioner surveys cited in the introduction have not resulted in programmatic reassessment and alteration in nearly enough training programs.

We did not attempt to evaluate systematically the effects of various program factors, such as the relative contributions of a 1- or 2-month rotation, or the extent to which the availability of clinical resources affected the outcomes of the training process. Most program factors overlapped with one another across sites, and no pattern was apparent in our data. In addition, it was not possible for us to monitor compliance to the curriculum at each of the sites. However, faculty from each program did attend workshops conducted by staff associated with the curriculum project and provided specific plans for implementing each of its goals and objectives for their block rotations. Although compliance certainly varied from site to site, there is no reason to expect that the groups participating in this study were differentially affected by this or any other factor not associated with the curriculum.

Overall, then, the most reliable and consistent finding of this replication investigation was the significantly improved objective evaluation performance of the postrotation experimental residents, compared to prerotation control residents. Future evaluations must monitor any trends toward an attenuated effect over time as the rotation becomes more routine, as might be suggested by our year I-year II differences. Even though replication site residents generally outperformed demonstration site residents, programs showed highly significant and similar experimental-control differences overall. Subjective curriculum evaluation ratings also consistently supported these positive results across both type of program and year of participation. Follow-up data, currently being

gathered for those residents who participated in the rotation and who are now in pediatric practice, should contribute to our understanding of the longer-term impact of this structured curriculum. To summarize, these data reinforce the overall goal of increasing the number of pediatric training programs which regularly offer residents a well-defined, curriculum-based rotation in developmental pediatrics.

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