

# Evaluation of Public Health Preschool Child Developmental Screening: The Process and Outcomes of a Community Program

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**Abstract:** We conducted a randomized controlled trial of a public health and education screening program aimed at all 4,797 four to five year old children registering for kindergarten in three school districts of southern Ontario, Canada. Children received either the Denver Developmental Screening Test (DDST) with a community health intervention program for positive screenees; the DDST with no intervention for positive screenees; or no screening test. The intervention program consisted of referral to the child's physician for assessment; a review conference between the child's teacher and the school health nurse; parent counseling; and monitoring of the child in school by the school health nurse.

At the end of the third school year, no differences were found

between positive screenees in the community health intervention group and the "no intervention" groups using individual academic achievement, cognitive, and developmental tests. Parents' reports revealed no differences between groups in children's mental, social, and behavioral well-being. However, parents of intervention program children had more worry about their child's school progress suggesting a potentially harmful labeling effect. In comparison to a random sample of children with normal DDST results, or a random sample of children who had randomly not been screened, the children with positive preschool DDSTs had substantially more school problems three years after screening. (*Am J Public Health* 1987; 77:45-51.)

## Introduction

Screening—the activity of searching for potential health problems among apparently healthy people—has a history of both spectacular successes and sobering failures. The promise of accurate, early detection of treatable and preventable causes of illness and suffering has frequently led to enthusiasm for organized community programs directed at large numbers of individuals. This approach has enjoyed considerable success, for example, in the prevention of the phenylketonuria<sup>1</sup> and breast cancer in older women.<sup>2</sup> On the other hand, mass screening for scoliosis<sup>3</sup> or tuberculosis<sup>4</sup> has been less effective, and may not be a good investment of limited community health care resources. Moreover, programs which may be efficacious in ideal circumstances, such as screening for cervical cancer or hypertension, have often been difficult to implement optimally in practice, because of problems of noncompliance by citizens and professionals alike.<sup>5-7</sup> If community screening is to be worthwhile, several prerequisites must be met, including: a burden of morbidity sufficient to warrant mass screening; a screening test which is accurate in the general community; compliance with the recommendations for post-screening follow-up by positive screenees and community professionals; and, most importantly, efficacious treatments or preventive interventions.<sup>8</sup>

Problems of child development, behavior, and school progress are major components of pediatric morbidity in North America.<sup>9-12</sup> Estimates of the prevalence of these problems vary from 15 to 30 per cent and large amounts of health, education, and social services are used in their treatment.<sup>10,12</sup> These problems may have considerable long-term impact on the well-being of children and their families, and often prove difficult to treat once established.<sup>13-15</sup>

Screening, early detection, and prevention have thus become important and popular goals for both authorities in child development<sup>16-18</sup> and those who administer community health and education services.<sup>19,20</sup> An easy to use, relatively inexpensive, preschool child development screening test first became widely available to public health services after publication of the Denver Developmental Screening Test (DDST).<sup>21,22</sup> Other tests have followed, and mass screening of preschoolers' development has become worldwide.<sup>23</sup> In 1980, in Ontario, Canada's most populous province, 18 of the 43 regional public health departments reported that they screened at least 75 per cent of children in their catchment areas with the DDST during the year prior to school entry, and most other departments used in the DDST but with less complete community coverage.<sup>24</sup> The general goal of these community health programs is to reduce the incidence of subsequent problems in development, learning, and behavior.

Despite its popularity, we are unaware of any previous attempts to rigorously evaluate, in an actual community setting, the effectiveness of public health developmental screening followed by a program of community health nurse counseling and referrals for diagnostic, therapeutic, and preventive help for children with positive screening test results. The purpose of this paper is to report the findings of a randomized controlled trial of such a program.

## Methods

An overview of the study design is presented in Figure 1: a randomized controlled trial was initiated in 1980 and the final outcomes were measured in 1983 and 1984. All 4,797 children who were brought by a parent or guardian to mandatory public health school registration clinics in three of the four school districts in the Region of Niagara during 1980 and 1981 were eligible for the study. The fourth school district could not ensure compliance with randomization procedures and was therefore not included in this study. The Region of Niagara is a well defined 750 square mile geographic and administrative area in southern Ontario adjacent to New York State with a mixed urban and rural population of 368,288; the median family income (in 1981 Canadian dollars) was \$25,790.<sup>25</sup>

In two of the participating school districts, registration

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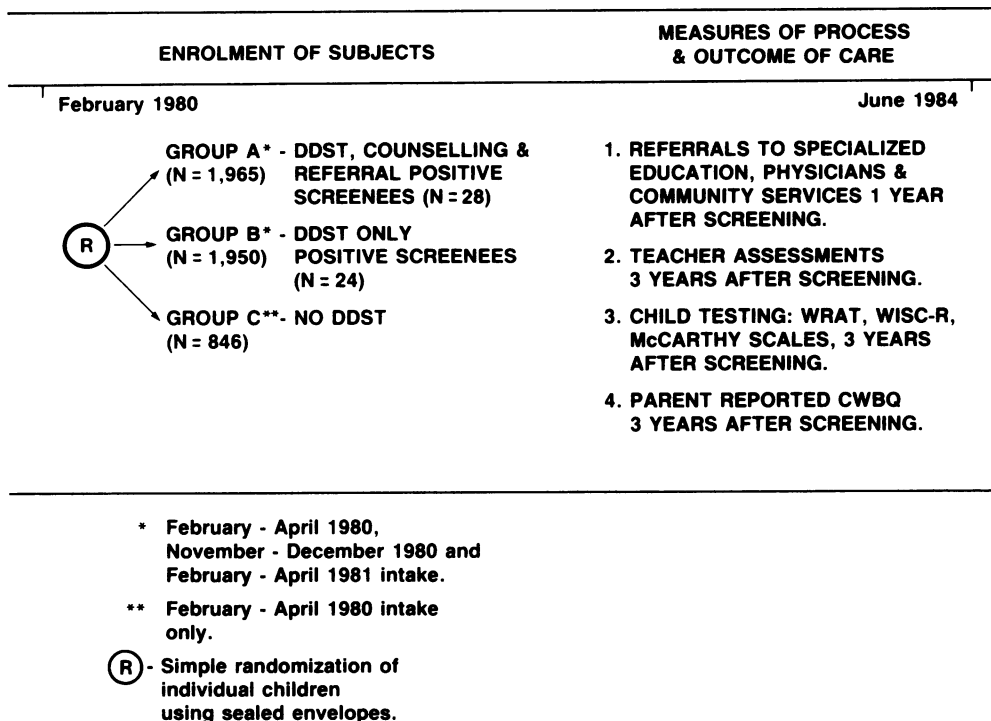


FIGURE 1—Schedule of Study Events

clinics were held during February through April in the neighborhood school at which the child was scheduled to begin the following September. In the third district, a pre-kindergarten school program for all children was operating, and the clinics took place in the school the child was attending during November and December of that year.

The registration clinics had been conducted with the same procedures since 1975. Community health nurses administered a general health interview, determined immunization status, tested hearing and vision, and administered the DDST. The nurses had been trained in DDST administration and scoring on an annual basis. Children already known to have problems of development severe enough to preclude their attendance in a regular classroom were not targets of screening, and were not brought to these clinics. The number of such children was estimated to be about 3 to 5 per cent of all children starting school.

Written informed consent of the child's parent (which met ethical standards of both the Chedoke-McMaster Hospital and the provincial governmental granting agency) was obtained at the clinic DDST "station", after which children were individually randomized, using sealed envelopes, to one of two main study groups, or to a third, smaller, group which was not screened. Consent was obtained by one of six specially trained nurses who had no other duties at the school registration clinics. Equal numbers of children were randomized to each of the three study groups during the spring 1980 intake; however, to increase the number of positive screenees in the two main study groups—the public health department screening, counseling, and referral program (study group A described below) and the primary control group (study group B)—no children were allocated to study group C (not screened) during the fall 1980, or the spring 1981 intake periods.

#### Study Group A: DDST, Counseling and Referral Program

A public health nurse administered the DDST in a quiet area of the school according to the procedures recommended in the test manual.<sup>26</sup> All children with "abnormal", "questionable", or "untestable" DDST results were given a second DDST several weeks later (as recommended in the manual) by one of two nurses who did all in-home testing and who had not participated in the initial testing. All children with non-normal test results on the second occasion received the following interventions: the nurse counseled the parent regarding the DDST results and the need for diagnostic assessment; a letter of referral was sent to the child's physician requesting further investigation and that the physician's report be sent to the public health department; a conference with the school public health nurse and the child's teacher was held at the beginning of the school year to review the DDST finding and any further assessments; the school nurse monitored the child's progress, and was available to advise parents or initiate referrals to appropriate community services available outside the school system.

This study group followed the existing screening, counseling, and referral program which was first introduced in the health department in 1975.

#### Study Group B: DDST but no Counseling or Referrals

The same DDST procedures as in Group A were carried out. However, if the second DDST was positive no intervention was undertaken and the test form and results were forwarded to the study data center at McMaster University without being revealed to parents or anyone involved with the child in the community. Children's future kindergarten teachers had no involvement with the screening program for this group, and were "blind" to the results of screening. Similarly, the nurses who administered the screening test were not the school health nurses who were involved with

follow-up of positive screenees in the program, and they were also blind to the results of screening.

#### Study Group C: No DDST

A smaller sample of children was randomly assigned not to receive the DDST. The purpose of this group was to allow us, as a secondary analysis, to determine if the mere fact of DDST administration in the parent's presence (without regard to any discussion of the formal test result or subsequent follow-up) had any effect on children's outcomes. Although we felt this was an unlikely possibility, group C was included so that the study results would have better credibility to planners in the Niagara region who had raised this issue.

For purposes of secondary analysis, random samples of 170 children with normal DDST results and 170 children from group C were selected to be eligible for the measurements described below.

#### Measures

- Teachers were asked to provide global ratings of learning problems, behavior problems, need for special attention, and referrals made to school special education services at the end of the child's first and third years in school. In order to maintain blindness to control children's study status, and for the purposes of other related studies which we were conducting, kindergarten teachers were asked to rate all children in their class regardless of study group or DDST result. Teachers at the end of the third school year were judged very unlikely to be aware of a child's preschool DDST result. A standard self-administered rating form described earlier was used.<sup>24</sup>

- All parents of positive screenees and random samples of those who had children with normal DDST results, and parents of children from study group C (who had not been screened), were asked to complete a mailed self-administered Child Well-being Questionnaire (CWBQ) three years after their child had entered the study. The items were closely adapted from several scales of the Rand Corporation Child Health Measure.<sup>27,28</sup> Areas covered included parent ratings of behavior, mental and emotional well-being, social skills, and school progress. Family function, a potential confounding variable, was measured in the CWBQ using the General Family Measure<sup>29</sup> of the Family Assessment Device.<sup>30</sup> Sociodemographic items adapted from the Census of Canada (1981) were also included.

- After renewal of parental consent, all positive screenees and the same random samples of the other children were individually tested by trained individuals who were unaware of the children's study group or DDST result working under the supervision of an experienced psychologist (NJ) at the end of their third school year. The Wide Range Achievement Test (WRAT) of arithmetic, spelling and reading<sup>31</sup>, four scales of the Weschler Intelligence Scales for Children (Revised) (WISC-R)<sup>32</sup> and the perceptual motor scale of the McCarthy Scales of Children's Abilities<sup>33</sup> were administered.

- Referrals of study children to all seven major community services,\* where diagnostic evaluation and management of developmental, behavior, and school problems were

provided, were documented one year after screening. During collection of these data each service was "blind" as to study group and DDST result. Primary care physicians were contacted and asked to complete a questionnaire regarding the outcome of the public health department referral for children in group A.

- Community health nurses participating program completed a confidential questionnaire regarding their training and experience with the DDST, and their compliance with procedures recommended for follow-up of positive screening test results.

#### Results

Eight hundred and forty-six children were randomized to group C and did not receive the DDST. Of the 3,915 children who did receive the DDST (groups A and B) 207 (5.3 per cent) were found to have an "abnormal", "questionable", or "untestable" (AQU) result at the time of school testing, and all received an in-home retest; 52 of these children (25 per cent) then had a second AQU result. These 52 children (1.3 per cent of all children screened) were the positive screenees of the program. Twenty-eight of the children had been randomly allocated to group A prior to screening, and 24 to group B. *In the remainder of this report the terms groups "A" or "B" are used with reference to these positive screenees, not the entire group of children randomized prior to screening.*

#### Participation and Follow-up Rates

Four thousand seven hundred and sixty-one (99 per cent) parents agreed to randomization and their child's participation in the research. Of the 52 children with positive DDST results, six (11.5 per cent) were lost to follow-up: three from each of groups A and B. Three children had moved from the area and three parents declined to give renewed consent for psychometric testing or complete the CWBQ. Children lost to follow-up were similar in age and gender to the remaining children. All teachers completed rating forms for children in their class.

One hundred and fifteen of 170 parents (68 per cent) of the randomly selected children who had a normal DDST completed the CWBQ and gave consent for academic and psychometric testing of their child. One hundred of 170 parents (59 per cent) of the randomly selected group C children provided consent for testing; 91 parents (54 per cent) in this group completed the CWBQ. Teacher ratings for children whose parents had provided consent for individual testing were compared to ratings obtained for children where individual testing was not carried out: 32 per cent of non-tested children had teacher-reported learning problems while 20 per cent of children who were individually tested had learning problems reported.

All seven community service agencies cooperated and identified all study children who had been referred in the year after screening. All 44 community health nurses involved in the screening, counseling, and referral program in the three participating school districts completed the mailed questionnaire concerning their knowledge of and compliance with the community health and education program for positive screenees.

#### Description of Study Children

Overall the composition of study groups A and B was very similar. The mean age in study group A was 55.3 months, and 55.5 months in study group B. The gender distribution was also similar in groups A (65 per cent male)

\*St. Catharines General Hospital Mental Health Clinic; Niagara Falls General Hospital Mental Health Clinic; Welland County Hospital Mental Health Clinic; Child Development Center, Welland; Niagara Peninsula Children's Center; Developmental Assessment and Treatment Services, Chedoke Child and Family Centers; Ambulatory Pediatric Clinic, McMaster University Medical Center.

**TABLE 1—Referrals to Specialized Diagnostic and Treatment Services of Positive Screenees in the Year Following Screening**

Service	Group A (N = 28) N	Group B (N = 24) N	Difference in Proportions Group A–Group B (95% Confidence Interval)
In-Community Agency	7	1	+21% (+2%–+40%)*
In-School Special Education	5	7	-11% (-34%–+12%)
Both Services	3	2	+3% (-13%–+19%)
TOTAL	15	10	+12% (-15%–+39%)

\*Significant difference in proportions between groups A and B.

and B (67 per cent male). Maternal education and the General Family Function scores, obtained from the CWBQ administered at the conclusion of the study, were similar for both groups.

Age, gender, maternal education level, and family function score were also compared between the positive screenees, the 115 randomly selected children with normal DDSTs, and the 91 randomly selected children from group C. Except for the highest level of maternal education completed where the mothers of positive screenees had achieved lower levels than other mothers, no differences were found.

#### Community Care Process Following Screening

Forty-four community health nurses participated in the screening and prevention program in the three school districts where the study was conducted. Their mean length of experience with the DDST in public health settings was five years, and all nurses had completed an annual training course in its administration and scoring. Ninety-three per cent reported compliance with the program component of discussing children with positive DDST results with the teacher; 91 per cent continued to monitor the child in school; and 80 per cent reported counseling parents.

The referral rates for groups A and B in the year following screening are shown in Table 1. In addition, substantially more children in group A were seen for assessment in community services. Just over half (54 per cent) the children in group A actually received specialist diagnostic or management services; 41 per cent of children in group B received services. The majority of services used by group B children were within the school system.

The fate of referrals to the primary care physicians was determined in group A (but not group B, in order to maintain blindness): 19 (68 per cent) of 28 children were seen for assessment in the primary care physician's office. Of these 19 children, three were felt to have no developmental problems, six were felt to have a problem but no further assessment or help was sought by the physician, and 10 were referred on by their physician for more definitive diagnostic work-ups. Only seven of the 28 physicians (25 per cent) replied to the first written request by the health department for a report which could be discussed with the child's teacher. Mailed and telephone reminders resulted in 23 replies for an overall compliance rate of 82 per cent. In some cases the reply simply stated that the child had not been seen in the doctor's office.

#### Children's Outcomes

Comparisons of the academic achievement, cognitive and perceptual-motor as well as behavioral, emotional and social outcomes for children in groups A and B are presented in Table 2.

Mean standardized WRAT scores for reading, spelling and arithmetic are virtually identical in the two groups, but

**TABLE 2—Outcomes Three Years after Screening**

Outcome	Group A (N = 25)	Group B (N = 21)	Difference in Means or Proportions Group A–B (95% CI)
<b>Mean WRAT Standard Scores</b>			
Reading	92	93	-1 points (-13–+11)
Spelling	92	93	-1 points (-11–+9)
Arithmetic	90	92	-2 points (-12–+8)
N of children with teacher-reported learning problems	18	15	+1% (-25%–+27%)
N of children with parent-reported academic problems	11	6	+15% (-13%–+43%)
N of parents worried about school work	17	7	+35% (+6%–+64%)*
N of children with teacher-reported behavior problems	10	6	+11% (-17%–+39)
<b>Mean CWBQ Scale Scores</b>			
Mental health index	61	61	0 points (-4–+4)
Behavior problems	6	6	0 points (-1–+1)
Social relations	31	27	+4 points (-1–+9)
<b>Mean WISC-R Scores</b>			
Information	8	7	+1 point (-1–+3)
Similarities	9	7	+2 points (0–+4)
Vocabulary	10	10	0 points (-2–+2)
Block design	9	10	-1 point (-3–+1)
Mean McCarthy Perceptual-Motor Index Score	44	47	-3 points (-10–+4)

\*Significant difference in proportions between Groups A and B.

groups have very high and similar rates of teacher-reported learning problems at the end of their third school year. However, more parents of children who had received health department-initiated interventions (group A) reported much higher rates of worry about their children's school performance during the previous three months than did parents of children in group B, who did not receive the prevention program (68 per cent vs 35 per cent). The exact CWBQ item wording was: "During the past three months how much have you been worried or concerned about any problems this child may have had with school work?", and the possible response options were "not at all", "a little", "somewhat", "a great deal". We classified responses in the latter two categories as "worried" in the analyses presented here.

Results of the four WISC-R sub-tests (information, similarities, vocabulary, and block design) and the McCarthy perceptual-motor scale did not demonstrate any substantial between-group differences (Table 2). Behavioral, social and emotional well-being outcomes from both teacher and parent perspectives are also shown in Table 2. No consistent differences between groups A and B were found for any of the outcomes measured. We reasoned that because no beneficial effect of the program was seen in positive screenees, and because the proportion of children with positive DDST results in the target population was relatively small, there would be no detectable aggregate effect of the screening, counseling, and referral program at the level of entire study group comparisons.

Given that the public health program was not effective, and that only a small proportion of children had a positive DDST result, we wished to examine whether or not the group of children with non-normal DDST results was at greater risk of school problems. The data from groups A and B were combined and compared to the academic and school outcomes of the randomly selected group of children with

**TABLE 3—School Outcomes of Children with Positive DDST vs Normal DDST vs No DDST Three Years after Screening**

Outcome	Positive DDST (N = 46)	Normal DDST (N = 115)	No DDST (N = 100, *N = 91)
% of children with teacher-reported learning problem	72%	21%	25%
% of children not in regular grade 2 class	46%	9%	8%
% of children with parent-reported academic problem	37%	5%	9%*
% of parents worried about school work	52%	13%	15%*
Mean WRAT Scores			
Reading	92	114	115
Spelling	92	113	114
Arithmetic	91	103	105

normal DDST results and to the random sample of children who had not received the DDST (group C) as shown in Table 3. All outcomes showed substantial differences between the positive screenees and both other comparison groups indicating that this group, although relatively small in number, was indeed at higher risk of a poor school outcome. No differences were seen between screened, normal, and unscreened children (study group C), indicating a lack of any effect from merely administering the DDST in the parent's presence.

The school outcomes of children within group A who had and had not been seen for diagnostic assessment or treatment in the year following screening were compared. At the end of the children's third school year mean WRAT standardized reading (85 vs 100), spelling (86 vs 99), and arithmetic (83 vs 97) scores were lower in the group who had received services.

### Discussion

It is clear that the screening, counseling, and referral program described in this report was not effective in meeting the goals of improving school performance, developmental attainment, or behavioral/emotional outcomes for children in the early school years. The increased rate of parental worry in the group who received the "prevention" program of referrals, counseling, conferences, and school nurse follow-up may be interpreted either as appropriate awareness or as a potentially harmful "labeling" effect. "Labeling" has been shown to have a harmful effect in mass screening programs for hypertension in the workplace,<sup>34</sup> and may represent a common side effect of mass screening. The question must be asked whether any excess of induced parent worry is justified when there is no evidence of benefits accruing to children. An additional disadvantage of this screening program arises from the community perspective: the lost opportunities and resources within the publicly funded health, education and social service system which could have been used for programs of more certain benefit.

This research was designed as an *effectiveness* study in contrast to an *efficacy* study.<sup>35,36</sup> Efficacy studies investigate whether or not interventions *can* work in ideal, highly controlled experimental situations where, for example, all experimental subjects comply with all aspects of a treatment under investigation. Effectiveness studies are designed to determine if an intervention *does* work in real-life situations where, for example, non-compliance is usually commonplace, or nurses may make some errors of DDST scoring in

spite of training. We believe that an effectiveness study is the most relevant and useful to community health and education policy makers who must make decisions on whether to implement a screening program in their community. We have proposed methodologic standards for effectiveness studies of community screening programs and these have been closely adhered to in this project.<sup>8,37</sup>

Relatively few children were lost to follow-up among the 52 positive screenees. The lower follow-up rates and the potential for associated non-response bias among the DDST normals and non-screened children from study group C would be more troublesome to some of our secondary analyses (Table 3) had the differences between positive screenees and other children been less striking. It is unlikely that differences of this magnitude could be explained by differences in lost-to-follow-up rates.

The effectiveness of mass screening has been controversial in many fields of health care.<sup>38</sup> In many instances, including developmental screening, those who are responsible for planning and carrying out community programs have seemingly dismissed these doubts and have provided screening for their community.<sup>19,24,39,40</sup> However, only a very small number of randomized controlled trials of community screening programs, which would assist in resolving the controversies between opinion and practice, have been reported.<sup>8</sup> We are unaware of any previous randomized controlled trial of preschool screening in a community setting. The main goal of our study was to determine the overall effectiveness of a program similar to those available in many parts of Ontario, so that the results might be generalizable and applicable to public health and education policy makers. For this reason, no attempt was made to provide an idealized program; rather we have attempted to describe the process of care in an actual community. We believe the effort, enthusiasm, amount, and quality of care available in the Niagara region for preschool developmental screening is comparable to that found in many North American communities.

All community health nurses administering the DDST in the Niagara preschool registration program had completed annual training in using the test and their average number of years of experience with the test was high. The annual training was supervised by a nurse who had been specially trained in DDST use at the JFK Child Development Center, Denver, where the test was developed. We have previously reported the results of a study in the Niagara region of the intra-nurse agreement for the key in-home retest of children who screened positive at school registration: kappa values for both nurses doing in-home testing were greater than 0.7, indicating excellent agreement.<sup>24</sup>

Only about two-thirds of parents followed the recommendation to have their child seen by his or her physician after a positive screening test result. This rate of compliance is similar to that reported for multi-disciplinary investigation or treatment recommendations given to the parents of children with developmental retardation,<sup>41</sup> and for other health-related advice<sup>42</sup> and may represent the upper limit that can be expected without additional strategies to increase compliance.

Compliance by community health nurses with the program was high. Physician compliance with sending reports to the health department was also good. Studies by Cadman, *et al*, (which were carried out in part in the Niagara Region)<sup>41,43</sup> and by Schour<sup>44</sup> have demonstrated that teacher compliance with the recommendations for children with developmental and learning problems is moderately good following specialist

consultation. While the screening program influenced the type of assessment and management (i.e., in the community vs in the school system), nearly one-half of the children in the DDST, counseling, and referral group did not have a specialist diagnostic evaluation subsequent to a positive test result. If the specialists' advice is efficacious, then a major challenge to the public health and education systems becomes the linking of children with positive screening tests to the best available diagnostic and consultation services in the community.

Our findings suggest that the incomplete use of specialist services after positive screening is not the main reason for the ineffectiveness of the screening program. We speculate that children with the most severe problems are taken to such services, and that the services themselves may be non-efficacious (in terms of diagnosis, treatment, or preventive interventions) in preventing subsequent school achievement problems. However, our study was not designed to test the efficacy of available interventions to treat or prevent school problems: the post-screening service user/non-user groups were not randomized to that status, and their prognostic comparability is unknown. The findings are a stimulus to describe the characteristics of developmental assessment and management as it is practiced in community settings and to rigorously evaluate the preventive efficacy of the more promising interventions. Community planners need to decide whether or not statutory agencies who undertake screening, such as public health departments, can ensure prompt diagnostic evaluation for all children with positive screening tests.

### Conclusion

The prevention of early school problems should be an important goal of community health and education programs. However, services such as public health departments and schools must carefully appraise their roles in preschool developmental screening. From the community health perspective, programs such as the one described in this report appear ineffective; they may even be harmful to some parents, and consume public health care resources.

Non-compliance with necessary diagnostic, therapeutic, and preventive follow-up for children with positive screening tests was a major observation in this study. Community health nurses are usually in an excellent position to provide inter-agency and inter-disciplinary liaison (particularly between medical and other professions), and liaison and counseling to parents through school health programs. The mandate of the community health nurse could usefully include more responsibility for implementing strategies to improve compliance by both parents and professionals in using the best available diagnostic services in the community for every child who is seen as at risk for school and learning problems.

Finally, we hope that our findings stimulate policy makers to determine the effectiveness of diagnostic, therapeutic, and preventive services which are available in their own community for children identified by screening. Unless effectiveness can be demonstrated, there is little likelihood that mass developmental screening will result in more good than harm for the children of the community, or is a sound investment of public health care funds.

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### REFERENCES

1. Scriver CR, Clow CL: Phenylketonuria: epitome of human biochemical genetics. *N Engl J Med* 1980; 303:1394-1400.
2. Shapiro S: Evidence on screening for breast cancer from a randomized trial. *Cancer* 1977; 39:2772-2779.
3. Morais T, Bernier M, Turcotte F: Age and sex-specific prevalence of scoliosis and the value of school screening programs. *Am J Public Health* 1985; 75:1377-1380.
4. Hertzman C, Tugwell P, Sackett DL, Ranbow A, Kahana L, Zylack C: Comparison of two hospital TB surveillance programs: risks and benefits. *Can J Public Health* 1985; 74:000-000.
5. Fruchter RG, Boyce J, Hunt M: Missed opportunities for early diagnosis of cancer of the cervix. *Am J Public Health* 1980; 70:418-420.
6. Warneck RB, Graham S: Characteristics of blacks obtaining papanicolaou smears. *Cancer* 1976; 27:2015-2025.
7. Zinken PM, Cox CA: Child health clinics and inverse care laws: evidence from longitudinal study of 1,878 preschool children. *Br J Med* 1976; 2:411-413.
8. Cadman D, Chambers L, Feldman W, Sackett DL: Assessing the effectiveness of community screening programs. *JAMA* 1984; 251:1580-1585.
9. Nader P: Frequency and nature of school problems. In: Haggerty R, Roghman K, Pless IB (eds): *Child Health and the Community*. New York: John Wiley & Sons, 1975.
10. Nader P, Roy L, Brink S: The new morbidity: use of school and community health care resources for behavioral, educational and social-family problems. *Pediatrics* 1981; 67:53-59.
11. Green M: Coming of age in general pediatrics. *Pediatrics* 1983; 72:275-282.
12. Boyle M, Offord D, Szatmari P, Rae-Grant N, Cadman D, Byles J, Link P: The Ontario Child Health Survey: III. Prevalence and Utilization. Report to the Ontario Ministry of Community and Social Services, Hamilton, 1985 (submitted to *Arch Gen Psychiatry*).
13. DeWild D: Toward a clarification of primary prevention. *Community Ment Health J* 1981; 16:306-312.
14. Trites RL, Fiedorowicz D: Follow-study of children with specific (or primary) reading disability. In: Knights RM, Bakkor DJ (eds): *The Neuropsychology of Learning Disorders, Theoretical Approaches*. Baltimore: University Park Press, 1976.
15. Offord DR: Primary prevention: aspects of program design and evaluation. *J Am Acad Child Psychiatry* 1982; 21:225-231.
16. Gabel S: Screening procedures. In: Gabel S, Erickson MT (eds): *Child Development and Developmental Disabilities*. Boston: Little, Brown and Co, 1980; 85.
17. Rae-Grant N: The State of the Art: A background paper on prevention. Toronto: Ontario Ministry of Community and Social Services, 1979.
18. Goldstein AD: School readiness and achievement. In: Frankenburg WK, Camp BW (eds): *Pediatric Screening Tests*. Springfield, IL: CC Thomas, 1975; 477.
19. Thores A, Philion J: A preschool screening program on central Vancouver Island: a two-year follow-up. *Can J Public Health* 1974; 65:385-387.
20. Nilsson C, Sundelin C, Vaile JC: General health screening of 4-year olds in a Swedish county: an analysis of the effectiveness of the psychological examination program. *Acta Paediatr Scand* 1976; 65:663-668.
21. Frankenburg WK, Dodds JB: The Denver Developmental Screening Test. *J Pediatr* 1967; 71:181-186.
22. Frankenburg WK, Goldstein AD, Camp BW: The revised Denver Developmental Screening Test: its accuracy as a screening instrument. *J Pediatr* 1971; 79:998-1002.
23. Frankenburg WK, Fandal A (eds): *Proceedings of the Third International Conference on the Early Identification of At Risk Children*. Denver: JFK Child Development Center, 1981.
24. Cadman D, Chambers L, Walter S, Feldman W, Smith K, Ferguson R: The

- usefulness of the Denver Developmental Screening Test to predict kindergarten problems in a general community population. *Am J Public Health* 1984; 74:1093-1097.
25. 1981 Census of Canada. Ottawa, Ontario: Statistics Canada, Publication Sales, 1982.
  26. Frankenburg WK, Dodds JB, Fandal AW: Denver Developmental Screening Test Reference Manual (Rev. Ed.) Denver: Ladoca Publishing Foundation, 1975.
  27. Eisen M, Donald C, Ware JE, Brook R: Conceptualization and measurement of health for children in the health insurance study. Santa Monica: Rand Corporation Pub. No. R-2313-HEW, 1980.
  28. Valdez R, Donald C, Ware JE: Relationships among measures of child health and behavior problems: Working paper. Santa Monica: Rand Corporation, 1981.
  29. Boyle M, Byles JA, Offord DR, Crawford JW, Szatmari P, Rae-Grant NI, Links PS, Cadman DT, Stenerson PE: Ontario Child Health Study: Measurement of disorder. Report to the Ministry of Community and Social Services, Hamilton, 1985. (submitted to *Arch Gen Psychiatry*).
  30. Epstein N, Baldwin L, Bishop D: The family assessment device. *J Mar Fam Therap* 1983; 9:171-182.
  31. Jastak JF, Jastak S: *The Wide Range Achievement Test: Manual of Instructions*. Wilmington: Guidance Associates Inc, 1976.
  32. Weschler D: *WISC-R Manual*. New York: Psychological Corporation, 1974.
  33. McCarthy D: *McCarthy Scales of Children's Abilities*. New York: Psychological Corporation, 1972.
  34. Johnston M, Gibson ES, Terry CW, Haynes RB, Taylor DW, Gafni A, Sicurella J, Sackett DL: Effects of labeling on income, work, and social function among hypertensive employees. *J Chronic Dis* 1984; 37:417-423.
  35. Cochrane A: *Effectiveness and Efficiency*. Oxford: Nuffield Provincial Hospitals Trust, 1972.
  36. Sackett DL, Gent M: Controversy in counting and attributing events in clinical trials. *N Engl J Med* 1979; 301:1410-1412.
  37. Cadman D, Chambers L, Walter S, Sackett DL: Methodologic guides to assessing developmental screening. In: Frankenburg WK, Emde R (eds): *The Early Identification of At-risk Children*. New York: Plenum Press, 1985.
  38. McKeown T, Knox EG: The framework of validation of prescriptive screening. In: *Screening in Medical Care-Reviewing the Evidence*. Toronto: Oxford University Press, 1968.
  39. Government of the Province of Ontario, Toronto: Bill 82, 1980.
  40. Moore B: Implementing the developmental assessment component of the EPSDT program. *Am J Orthopsychiatry* 1978; 48:22-32.
  41. Cadman D, Shurvell B, Davies P, Bradfield S: Compliance in the community with consultants' recommendations for developmentally handicapped children. *Dev Med Child Neurol* 1984; 26:40-46.
  42. Sackett DL, Snow J: The magnitude of compliance and noncompliance. In: Haynes RB, Taylor DW, Sackett DL (eds): *Compliance in Health Care*. Baltimore: Johns Hopkins University Press, 1979.
  43. Cadman D, Rosenbaum P, Walter S, McNamee J: Community professionals' compliance with consultants' advice. *J Dev Behav Pediatr* 1986; 7:21-26.
  44. Schour M, Clemmens PL: Fate of recommendations for children with school-related problems following interdisciplinary evaluation. *J Pediatr* 1974; 84:903-907.

## Directory on Self-Care and Self-Help Groups for the Elderly

As health care costs continue to rise, more older adults are monitoring their health care as a means of cost containment. Through self-care, older people can enhance their sense of well-being and their ability to lead independent, active lives.

In response to a growing need for information, the National Institute on Aging has published *Self-Care and Self-Help Groups for the Elderly: A Directory*. The directory provides details about organizations that deal with the concerns of older people or that have programs relevant to older people, their families, and health professionals who work with them. It is not intended to be all-inclusive, but covers a broad variety of national organizations.

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