Chapter 6
Well-Child Care

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INTRODUCTION

"Well-child care" encompasses a variety of preventive health services offered by physicians or other health professionals at defined points in a child's life (227). Beginning as early as the second or third week after birth and extending into adulthood, well-child care services include physical examinations and other tests that screen for illness or developmental problems, immunizations against polio and other diseases, health education, and parental guidance.

The most obvious objective of well-child care is to prevent morbidity[2] or premature death by immunizing a child or identifying an illness early enough to intervene with effective therapy, Other goals that have been proposed for well-child care include support and reassurance for families of young children and the provision of a "medical home" in the event that illness develops ***(103).***

The extent to which these intermediate objectives ultimately affect children's health status is difficult to trace. Nevertheless, it is widely believed that a continuous relationship between the patient and a single source of medical care has beneficial effects ***(103,179),*** including greater patient satisfaction, improved adherence to medical regimens, and more effective and less costly acute care when it is needed ***(103,179).***[3]

The provision of well-child care and other medical services (e. g., acute and ill child care) at the same site potentially enhances a child's continuity of care. Conversely, access to a continuous source of medical care may increase the likelihood that a child will get the full complement of well-child care (10,67,68). Thus, it is difficult to untangle the effects of well-child care from the effects of improved continuity of care.

Well-child care services can be, and often are, delivered in settings that are completely separate from physician practices. School-based screening programs and immunization clinics are examples of such settings. The effectiveness of specific procedures may vary with the setting and system of care in which they are provided. For example, screening in schools may be less effective than screening in physicians' practices if the schools' linkages with necessary followup medical care are weak. On the other hand, not all physicians may use the most effective screening techniques. The evidence on the effectiveness of well-child care should be interpreted in light of these potential differences by setting. In any case, delivery of well-child care in settings that are unconnected with the delivery of other primary care services does not promote continuity of care and whatever health benefits or satisfaction it confers.

This chapter summarizes a variety of professional recommendations on the content of well-child care from birth through 11 years of age. It also reviews the evidence on the effectiveness of well-child care as a whole and of five specific components of well-child care. The five components were selected to illustrate the kinds of evidence available on the effectiveness of commonly *rec*ommended procedures and are not a comprehensive list of well-child care components. The chapter also examines evidence on the cost-effectiveness of childhood immunizations, Most other aspects of well-child care have not been scrutinized for cost-effectiveness because of the difficulty of establishing their effectiveness. Finally, the chapter addresses issues in the financing and delivery of these services to young children and their implications for children's access to effective well-child care.

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[1] Parts of this chapter are based on a paper prepared under contract to OTA by Charles Homer, entitled "Evaluation of the Evidence on the Effectiveness of Well-Child Care for Children" (284).

[2] In recent years, morbidity has increasingly come to include not only physical illness but also any deviation from a child's full physical, cognitive, emotional, and social health potential (247).

[3] Evidence to support this contention is equivocal. Patient satisfaction and adherence to prescribed medical regimens appear to increase with greater continuity of care, whereas a significant effect of cent in uit y on health outcomes and costs has not been demonstrated. For a comprehensive review of the literature on continuity of care, see S.S. Flint, "The Impact of Continuity of Care on the Utilization and Cost of Pediatric Care in a Medicaid Population" (170).

Photo credit: Scottish *Rite* Children's *Hospital*

A well-child care visit includes a review of the child's medical history, a physical assessment, a developmental and behavioral assessment, immunization when necessary, and anticipatory guidance.

RECOMMENDATIONS REGARDING THE FREQUENCY AND CONTENT OF WELL-CHILD CARE

A typical well-child care visit to a health care provider takes approximately 10 to 12 minutes (521). The American Academy of Pediatrics (AAP) recommends that a well-child care visit include the following components:

1. an initial or interval medical history,
2. a physical assessment,
3. a developmental and behavioral assessment, and
4. anticipatory guidance (17).

At some well-child care visits, immunizations are administered. Following the visit with the health care provider, a number of specific screening measures may be undertaken. These include such things as vision screening and tuberculosis testing.

Several professional bodies in the United States and selected other Western nations have made recommendations regarding the frequency and content of well-child care and immunizations. Their recommendations are reviewed below.

Frequency and Timing of Periodic Well= Child Care Visits

Recommendations concerning the frequency and timing of well-child visits vary substantially among Western nations, among States within the United States, and even over time within any particular recommending organization. The specific recommendations of a variety of groups—AAP, the Canadian Task Force on the Periodic Health Examination, the Canadian Pediatric Society, and three British groups concerned with well-child care—are outlined in table 6-1.4

In general, the various guidelines demonstrate the following characteristics:

[4]The British Pediatric Association Working Group is in the process of formulating its recommendations. Those presented here are based on the judgment of the chairman and vice-chairman of that group, These are their personal views and not those of the British Pediatric Association Working Group.

Table 6-1.— Recommendations Regarding the Number of Well-Child Care Visits (for children 1 month to 11 years of age)

	Number of well-child visits recommended by age of child			
	1-6 months	7-12 months	1-4 years	5-11 years
United States:				
AA?, 1977[a]	4	1	4	3
AAP, 1981[b]	4	2	5	4
AAP, 1985[c]	4	2	5	4
Canada:				
Task Force on the Periodic Health Examination, 1979[d]	4	2	3	2
Canadian Pediatric Society, 1983[e]	4	2	4	4
Great Britain:				
Court Committee, 1976f	1	1	3	Not included
Royal College of General Practitioners/British Medical Association, 1984[g]	1	1	2	Not included
Chair and Vice Chair of Working Party on Developmental Surveillance in Childhood, 1987[h]	1	1	2 †[i]	Not included

[a]Committee on Standards of Child Health Care, American Academy of Pediatrics, *Standards of Child Health Care*, 3rd ed. (Evanston, IL 1977)
[b]Committee on Practice and Ambulatory Medicine, American Academy of Pediatrics, "Guidelines for Health Supervision of Children and Youth, " **Information sheet, Elk Grove Village, IL, 1981**
[c]American *Academy* of Pediatrics, *Guidelines for Health* Supervision (Elk Grove Village, IL: 1985).
[d]Task Force on th, Periodic Health Examination, Health Services and Health promotion Branch, Canadian Department of National Health and Welfare, *The Periodic Health Examination, 1979* (Ottawa, ON Canadian Department of National Health and Welfare, 1979)
[e]Canadian Paediatric Society, *Child Health* Care *Guidelines* (Ottawa, ON: March 1983).
[f]British Committee on Child Health Services (S D M Court, Chair), *Fit for the Future* (London, England Her Majesty's Stationery Of fice, 1976)
[g]Royal College of General Practitioners and the General Medical Services Committee of the British Medical Association, *Handbook of Preventive Care for Pre-school Children* (London, England. Royal College of General Practitioners, 1984)
[h]D Hall, Chair, and A Macfarlane, Vice Chair, British Paediatric Association Working Party on Developmental Surveillance In Childhood, personal communication, London/Oxford, England, February 1987 (These are the personal opinions of Drs. Hall and Macfarlane and do not reflect the final position of the working party)
[i]Full physical evaluation recommended at age *31/2,* home assessment by nurse of walking and language use at 2 also recommended; screen ing tests for hearing and vision recoin mended before school entrance, with physical examination on ly if not performed at earlier time

SOURCE Office of Technology Assessment, 1988

- more visits recommended in the United States than in Great Britain (although most likely fewer visits in the United States than are commonly provided in other Western European nations);
- recommendations for a more focused physical examination than in the past;
- increased concern with identifying behavioral and developmental problems, coupled recently, especially in Great Britain, with increased recognition of the difficulties in reliably and validly identifying such problems; and
- a lack of consensus, especially apparent among the States, concerning the appropriate populations for screening procedures, the optimal age for the administration of such procedures, and the frequency of their use.

Several caveats should be kept in mind when making comparisons between recommended American and British schedules. Infants and children in the United Kingdom do not routinely receive immunizations from their physician; the British schedules, therefore, do not include immunization visits. In England, from the time of the creation of the National Health Service until the mid-*1970s,* preventive child care services were provided separately from other medical services. Since the mid-1970s, however, there has been more emphasis on the provision of well-child care and other medical care in a common setting (e.g., a general practitioner's office).

In comparing recommendations within the North American continent, one must consider the dramatically differing perspectives of the recommending bodies. In the United States, for example, the expenses of Medicaid's Early and Periodic Screening, Diagnosis, and Treatment (EPSDT) program are partly borne by the States. Thus, EPSDT recommendations for frequency of visits and mandated screening reflect not simply medical judgment but political and economic judgments of what each State is willing to spend for child health services for the poor.[5] In recent years, the number of EPSDT screening visits recommended for children from 1 month to 11 years of age has

[5]See p, 136 for a description of Medicaid's EPSDT program.

ranged from 7 visits in Alaska to as many as 18 visits in Indiana and West Virginia ***(284).***

Whereas State EPSDT administrators may have a tendency to restrict services, AAP is likely to be expansive. Though primarily seeking to advance the health of children, AAP also represents the professional needs of its pediatrician members. AAP has relied on expert judgment to formulate its recommendations. It admits that its recommended schedule is rather arbitrary in nature but contends that the recommendations constitute a minimum desirable standard for normal children. Nevertheless, AAP's recommendations have stirred controversy even within the pediatric community ***(275).***

The Canadian Task Force on the Periodic Health Examination represents an entirely different perspective on the provision of preventive care. This body, which included representatives from a variety of disciplines, was charged with making recommendations for periodic health examination by the Deputy Ministers of Health of Canada. The only recommended child health interventions for children beyond the neonatal period that the task force considered to have good evidence to support inclusion in well-child care visits were immunizations and dental examinations. Other recommended interventions, including anticipatory guidance and developmental evaluation, were considered to be backed by poor evidence in support of their inclusion in a periodic health examination, although they might be recommended on other grounds (89).

The recommendations of the Canadian Pediatric Society were strongly influenced by the AAP recommendations (402); they were also influenced by the recommendations of the Canadian Task Force on the Periodic Health Examination.

The existence of wide variations in recommended well-child services, although understandable in light of the differing health care systems and varied organizational perspectives, nonetheless reflects the lack of good evidence supporting any one program of care over another.

Immunization

Immunization is perhaps the most fundamental component of well-child care. AAP and other groups recommend that children in the United States be routinely vaccinated against eight diseases:

- polio,
- diphtheria,
- tetanus,
- pertussis (whooping cough),
- measles,
- mumps,
- rubella (German measles), and
- Haemophilus *influenzae b* (Hib).

Polio vaccinations are administered by an oral vaccine that is commonly referred to as "OPV" (oral polio vaccine). Diphtheria, tetanus, and pertussis vaccinations are usually administered in one shot known as "DTP," and measles, mumps, and rubella vaccinations are similarly administered in a shot known as "MMR." The new Hib vaccine is a polysaccharide vaccine for the prevention of Hib infection, the leading cause of bacterial meningitis. It has been licensed since April 1985 (109). A varicella (chickenpox) vaccine maybe licensed for use within the next year (287).

Table 6-2 charts the schedules for active immunization of normal infants and children recommended by various U. S., Canadian, and British sources. Immunization schedules are recommended in the United States by the three groups:

- the Immunization Practices Advisory Committee (ACIP) of the U.S. Public Health Service (690);
- the Committee on Infectious Diseases of AAP (17); and
- the Commission on Public Health and Scientific Affairs of the American Academy of Family Physicians (14). [b]

Until September 1986, when ACIP announced a slight change in its schedule (discussed below), all three U.S. groups recommended identical childhood immunization schedules. The schedule recommended by the Canadian National Advisory Committee on Immunization was identical to that of the United States prior to 1986, but the

[b] A fourth U.S. body, the U.S. Preventive Services Task Force recently published its recommendations for immunization, but did not recommend specific schedules. It found that "there is good evidence to support recommendation" of childhood immunizations for poliomyelitis, DTP, MMR, and Hib (358).

Table 6-2.— Recommendations Regarding Schedules for Active Immunization of Normal Infants and Children

	Recommended schedule by type of vaccine			
	MMR	OPV	DTP	Hib
United States:				
ACIP, 1986[a]	15 months	4 doses— 2, 4, and 15 months, and 4-6 years	5 doses— 2, 4, 6, and 15 months, and 4-6 years	24 months
AAP, 1985[b]	15 months	4 doses— 2, 4, and 18 months, and 4-6 years	5 doses— 2, 4, 6, and 18 months, and 4-6 years	24 months
AAFP, 1987[c]	15 months	4 doses— 2, 4, and 15 or 18 months, and 4-6 years	5 doses— 2, 4, 6, and 15 or 18 months, and 4-6 years	24 months
Canada:				
Task Force on the Periodic Health Examination, 1979[d]	12-15 months	5 doses— 2, 4, 6, and 18 months, and 5-6 years	5 doses— 2, 4, 6, and 18 months, and 5-6 years	
National Advisory Committee on Immunization, 1984[e]	12 months	5 doses— 2, 4, 6[f], and 18 months, and 4-6 years	5 doses— 2, 4, 6, and 18 months, and 4-6 years	24 months[g]
Great Britain:				
Joint Committee on Vaccination and Immunisation, 1984[h]	Measles—at 1-2 years Rubella—all girls at 10-14 years	4 doses— 3, 4½ to 5, 8½ to 11 months, and at school entry	4 doses— 3, 4½ to 5, 8½ to 11 months, and at school entry	—

Abbreviations ACIP = Immunization Practices Advisory Committee; MMR = measles, mumps, and rubella live virus vaccine, OPV = oral poliovirus live vaccine, DTP = diphtheria, tetanus, and pert ussis vaccine, Hib = *Haemophilus influenzae b* polysaccharide vaccine; AAP = American Academy of Pediatrics, AAFP = American Academy of Family Physicians

[a] Centers for Disease Control, Public Health Service, U S. Department of Health and Human Services, "New Recommended Schedule for Active Immunization of Normal Infants and Children, " *Morbidity and Mortality* Weekly *Report* 35(37)577-579, Sept 19, 1986.

[b] American Academy of Pediatrics, *Guidelines for Health Supervision* (Elk Gove, IL: 1985)

[c] American *Academy of Family physicians, Recommended Immunization Schedule for Children* brochure, revised January 1987

[d] Task Force on the Periodic Health Examination, Health Services and Promotion Branch, Canadian Department Of National Health and Welfare, *The Periodic Health Examination, 1979* (Ottawa, ON: Canadian Department of Health and Welfare, 1979)

[e] National Advisory Commission on Immunization, A *Guide to /immunization for Canadians (Ottawa,* ON: Ministry of Supply and Services, 1984)

[f] This dose may be omitted if live (oral) polio vaccine is being used.

[g] Added to *recommendations* on Mar 1, 1988, Canadian Diseases Weekly Report, "National Advisory *Committee* on Immunization (NACI) Statement on *Haemophilus* b Polysaccharide Vaccine," *Canadian Diseases Weekly Report* 12(9) "33.35. 1988

[h] Joint Committee on Vaccination and Immunisation for the Secretary of State for Social Services, the Secretary of State for Scotland and the Secretary Of State for Wales, Welsh Office, Scottish Home and Health Department, British Department of Health and Social Services, *Immunisation Against Infectious D/s'ease* (London, England" Crown Copyright, 1984),

SOURCE Of fice of Technology Assessment, 1988

British schedule differed (e.g., the British did not recommend vaccination against mumps).

In September of 1986, ACIP announced a new recommended schedule calling for the simultaneous administration of MMR, DTP, and OPV to all children at 15 months of age, rather than the administration of MMR at 15 months and DTP and OPV at 18 months (690). ACIP cited three potential benefits from the revised childhood immunization schedule:

1. a decrease in the number of health-care provider visits required for immunization during the second year of life,
2. an accompanying decrease in costs, and
3. an increase in the percentage of children who are fully or partially immunized by **24** months of age (690).

After ACIP revised its schedule, the American Academy of Family Physicians revised its recommended schedule to allow the administration of DTP and OPV at 15 or 18 months of *age* (289). AAP did not change its recommended schedule, but it will be noting that MMR, DTP, and OPV can be administered simultaneously at 15 months (19).

The Hib polysaccharide vaccine was added to the list of childhood vaccines recommended by ACIP and AAP in 1985 (111). ACIP and AAP

groups recommend Hib immunization of all children at 24 months of age and immunization of older children up to 5 years of age who have not already received the Hib vaccine at 24 months. On the basis of clinical trials, ACIP has recommended Hib immunization of children in known high-risk groups (e.g., immunocompromised children, children who attend day care) at 18 months of age (684). AAP has not formally recommended use of the vaccine in high-risk groups of 18 to 23 months of age (109).

As of February 1987, over 8 million doses of the Hib polysaccharide vaccine had been distributed in the United States (108). The availability and use of this vaccine is an important initial step toward eliminating Hib infections. Each year Hib accounts for an estimated 12,000 cases of bacterial meningitis, primarily in children under 5 years of age, and also accounts for 6,000 other invasive Hib infections, such as pneumonia and epiglottitis (99). A 5-percent Hib mortality rate results in approximately 900 deaths each year to children under 5 years of age (684).

Because three-fourths of all Hib cases occur in children under 24 months of age, the current Hib polysaccharide vaccine is only an interim measure until a new Hib vaccine that is fully effective for children under 24 months of age can be developed and licensed (684). A Hib polysaccharide-protein-conjugate vaccine, currently under development, may meet this need. Clinical studies in infants have demonstrated that the conjugate vaccine appears to be safe and more effective than the current Hib vaccine (109,161).

Screening Tests

Specific screening tests are often performed at well-child visits.[7] Table 6-3 summarizes the physical and developmental evaluations recommended by AAP and other professional groups for children 1 month to 11 years of age. A physical examination involves a series of diagnostic tests intended to detect a variety of medical conditions. Some specific physical diagnostic procedures are the Ortalani maneuver for identification of congenital dysplasia of the hip, forward bending for detection of scoliosis, patch testing for discovery of strabismus, and abdominal palpation for detection of tumors. The developmental screening tool most widely used and recommended for use by child health personnel is the Denver Developmental Screening Test (DDST) or one of its adaptations—the DDST-S or the Parents' Developmental Questionnaire (96,184).

Table 6-4 lists the schedules recommended by U. S., Canadian, and British groups for specific hearing, vision, blood count, tuberculosis, and urinalysis screening tests recommended in well-child care.

Anticipatory Guidance

In the context of well-child care, anticipatory guidance is the provision of education, information, or counseling in order to influence a parent's or child's behavior and thus favorably influence the child's health. It includes everything from traditional medical guidance (e.g., admonitions to avoid contact with children with certain communicable diseases) and nutritional advice to suggestions for appropriate management of the child at specific developmental ages and information about behaviors (e.g., smoking and alcohol use) that adversely affect health.

Medical practitioners traditionally do not spend much time in providing anticipatory guidance. One study found that pediatricians spent 8.4 percent of the time of a well-child visit (only 50 to 60 seconds) providing anticipatory guidance; furthermore, the percentage diminished with increasing patient age (521).

[7] For a discussion of newborn screening, see ch. 5 and app. H.

Table 6-3.—Recommendations Regarding Physical and Developmental Evaluations for Well-Child Care (for children 1 month to 11 years of age)

	Physical evaluation	Developmental evaluation
United States:		
AAP, 1981[a]	"At each visit, a complete physical examination is essential"	"By history and appropriate physical examination. If suspicious, by specific objective developmental testing . . ."
AAP, 1985[b]	Specific evaluations recommended at each age. No mention of exam at 9, 12, and 15 month visits other than growth measurements	Detailed developmental and behavioral guidelines provided at each age, with note of specific items for concern.
Canada:		
Task Force on the Periodic Health Examination, 1979[c]	Specific physical exam measures recommended for most visits. Complete exams not recommended	PDQ or DDST recommended most visits before age 2½; review history of behavior problems ages 2½, 4, 5, 10; assess parent-child interaction 18 months to 21/2 years
Canadian Pediatric Society, 1983[d]	Complete physical exam recommended at each visit. Specific items emphasized at particular times	Behavioral history each exam. Language screening 7 times. School performance evaluation yearly beginning age 5.
Great Britain:		
Court Committee, 1976e	Full examination at 6 weeks and pre-school; focused exams at other times	Review development at age 7 months, 18 months, 2½ and 4½ years
Royal College of General Practitioners/British Medical Association, 1984[f]	Complete physical exam at first visit; brief exam thereafter. Specific points at each visit	Milestone-oriented developmental exam included in each visit
Chair and Vice Chair of Working Party on Developmental Surveillance in Childhood, 1987[g]	Complete exam at 6 weeks, 8 months, and 3½ years. Focused measures at other times	Brief developmental assessment at 8 months. Home visit at 2 years with brief gross motor and verbal developmental evaluation. "Grave doubts about the value of the neurodevelopmental exam . . ."

Abbreviations: AAP = American Academy of Pediatrics; PDQ = Parents' Developmental Questionnaire; DDST = Denver Developmental Screening Test

[a] Committee on Practice and Ambulatory Medicine, American Academy of Pediatrics, "Guidelines for Health Supervision of Children and Youth," information sheet, Elk Grove Village, IL, 1981

[b] American Academy of pediatrics, *Guidelines for Health Supervision* (Elk Grove Village, IL 1985)

[c] C T,sk Force on th, periodic Health Examination, Health Services and promotion Branch, Canadian Department of National Health and Welfare, *The Periodic Health Examination*, 1979 (Ottawa, ON: Canadian Deptarfment of National Health and Welfare, 1979).

[d] Canadian pediatric Society *Child Health* Care *Guidelines* (Ottawa, ON: March 19@

[e] British Committee on Child Health Services (S. D M. Court, Chair), *Fit for the Future* (London, England: Her Majesty's Stationery Office, 1976)

[f] Royal College of General practitioners and th, General Medical Services Committee of the British Medical Association, *Handbook of Preventive Care for Pre-school Children* (London, England: Royal College of General Practitioners, 1984)

[g] D Hall, Chair, A Macfarlane, l/ice Chair, British Paediatric Association Working Party on Development Surveillance in Childhood, personal communication, London/Oxford, England, February 1987. (These are the personal opinions of Drs Hall and Macfarlane and do not reflect the final position of the working party)

SOURCE Off Ice of Technology Assessment, 1988

Table 6-4.— Recommendations Regarding the Performance of Specified Screening Tests in Well-Child Care (for children 1 month to 11 years of age)

	Hearing screening	Vision screening	Blood count (Hgb/Hct)	Tuberculosis testing	Urinalysis
United States:					
AAP, 1981[a]	4, 5 years[b]	3-6, 8 years[c]	Once each infancy, preschool, school	12 months, then 1-2 years	Once each infancy, preschool, school
AA F', 1985[d]	5 years[b]	3, 6, 8 years[c]	Optional 9 months	High risk 9, 15 months, 3-5 years	5, 7, 9 years
Canada:					
Task Force on the Periodic Health Examination, 1979[e]	2½ , 5, 10 years[f]	2-5 years	Low SES 9 months	High risk 5 years BCG age 5	Not recommended
Canadian Pediatric Society, 1983[g]	4, 5 months[h] 3, 5 years	6 months 3-6 years	High risk 9 months 5 years	High risk 9 months	Not recommended
Great Britain:					
Court Committee, 1976[i]	7 months 4½ years	7 months 2½, 4½ years	Not mentioned	Not mentioned	Not mentioned
Royal College of General Practitioners/British Medical Association, 1984[j]	7 months 2½ years 4½ years	7 months 2½ years 4½ years	Not mentioned	"BCG when appropriate"	Not mentioned
Chair and Vice Chair of Working Party on Developmental Surveillance in Childhood, 1987[k]	8 months 4½ years	4½ years	Not mentioned	Not mentioned	Not mentioned

Abbreviations: AAP = American Academy of Pediatrics; SES = socioeconomic status, BCG = Bacillus Calmette-Guerin vaccine for tuberculosis, Hgb/Hct = hemoglobin/hematocrit.

aAmerican Academy of pediatrics, Committee on Practice and Ambulatory Medicine, "Guidelines for Health Supervision of Children and Youth," information sheet, Elk Grove Village, IL, 1981.

bSubjective hearing assessment at all visits and hearing evaluation suggested with speech delay.

cSubjective assessment at all visits.

dAmerican Academy of pediatrics, *Guidelines for Health Supervision* (Elk Grove Village, IL: 1985),

eTask Force on the periodic Health Examination, Health Services and promotion Branch, Canadian Department of National Health and Welfare, *The Periodic Health Examination, 1979* (Ottawa, ON: Canadian Department of National Health and Welfare, 1979).

f"Clinical exam for hearing" —not clearly specified.

gCanadian pediatric Society, *Child Health Care* Guidelines (Ottawa, ON: March, 1983),

hMonth not specified.

iGreat Britain, Committee on Child Health Services (S, D.M Court, chair), *Fit for the Future* (London, England: Her Majesty's Stationery Office, 1976).

jRoyal College of General practitioners and the General Medical Services Committee of the British Medical Association, *Handbook of Preventive Care for Pre-school Children* (London, England: Royal College of General Practitioners, 1984).

kD. Hall, Chair, and A. Macfarlane, Vice Chair, British pediatric Association Working Party on Development Surveillance In Childhood, London/Oxford, England, personal communication, February 1987. (These are the personal opinions of Drs. Hall and Macfarlane and do not reflect the final position of the working party.)

SOURCE: Office of Technology Assessment, 1988.

EFFECTIVENESS OF WELL= CHILD CARE

The effectiveness of well-child care can be considered in two ways. One way is to consider the effectiveness of well-child care as a whole. The other is to consider the effectiveness of specific components of well-child care.

Effectiveness of Well= Child Care as a Whole

The literature on the effectiveness of well-child care has been reviewed repeatedly over the past 30 years (95,103,353,379,549,578,770). Although the body of literature on which the reviews have been based has changed little, available reviews have drawn dramatically different conclusions, ranging from profound doubts about the effectiveness of well-child care to ringing endorsements. This difference in conclusions probably reflects the political context of each review more than the considered body of knowledge.

Although the appropriate goal for well-child care is improvement in a child's health status, positing such a goal presents a substantial risk of failure in judging the effectiveness of such care. The health status of children in particular (and the population in general) is far more strongly determined by social and economic factors than by the nature of medical care ***(60,66,549);*** hence, the contribution that well-child care can make to

health outcomes is likely to be modest, and studies to detect these modest contributions must be based on very large samples. Few available studies of the effectiveness of well-child care have had very large samples.

Studies that provide insight into the effectiveness of well-child care as a whole fall into five categories:

1. studies of the effect of varying schedules for the frequency of well-child care visits,
2. studies of the effect of comprehensive care programs that offered well-child care and other health services to poor children in the 1960s and early 1970s,
3. evaluations of Medicaid's well-child care program—the EPSDT program,
4. comparisons of children's health outcomes in different types of health service delivery or insurance programs, and
5. evaluations of services specifically aimed at improving behavioral/developmental outcomes among children.

Studies in each of these categories are discussed in more detail below. None of them directly address the question of the overall effectiveness of well-child care.

The literature evaluating the effectiveness of well-child care as a whole is summarized in the first five tables in appendix J. Overall, a review of available studies suggests three general conclusions. First, there is no evidence to support the contention that well-child care as now performed has an overall effect on childhood mortality or morbidity. On the other hand, one would not expect much evidence because the sample sizes used in these studies have all been inadequate to identify even a 50-percent change in the frequency of mortality. Moreover, the measures of morbidity in most, if not all studies, have been poorly suited to the pediatric population.

Second, some evidence supports the contention that participation in comprehensive child health care, which includes, but is not limited to, well-child care services, can reduce the frequency of hospitalization for acute medical illnesses ***(336).*** The inferences that can be drawn from this observation, however, are limited. From a cost perspective, the decreased frequency of acute hospitalization may be balanced by an increase in surgical admissions for "corrective" procedures.

Third, few studies have adequately considered the effect of well-child care on developmental/social functioning outcomes, but the evidence that exists suggests that well-child care as performed exerts little influence on these outcomes (97,102, 121,232). Some studies with substantial limitations in generalizability or internal validity[8] imply that modifications in the practice of well-child care may have a positive effect on some measures of social functioning.

Studies of the Effect of Varying the Frequency of Well-Child Care Visits

The impact of reducing the frequency of recommended well-child care visits for low-risk children has been specifically considered in two studies (204,274). Neither study found any ill health effects associated with **a** decrease in the frequency of scheduled well-child visits.

There is a major difficulty in interpreting both of these studies, however—namely, additional unscheduled well-child visits by the children randomized to the lower number of scheduled visits. In one study, infants scheduled for fewer visits were seen three additional times by the office nurses for immunizations and the parents were given informal advice and consultation **(274).** In the other study, families randomized to the lower frequency group made an average of 1.25 unscheduled well-child visits in the first 2 years of life; at the same time, families randomized to the higher frequency group averaged almost three fewer visits than scheduled. Thus, the average number of well-child visits in the first 2 years of life was 6.19 for the lower frequency group and 7.89 for the higher frequency group—a smaller difference than anticipated in the study design (204).

Studies of the Effect of Comprehensive Care Programs in the 1960s and 1970s

A dramatic expansion in health services for the poor found concrete expression during the 1960s

*Internal validity is a measure of the extent to which study results reflect the true relationship of a risk factor (e. g., treatment or technology) to the outcome of interest in study subjects (660).

in the creation of a variety of "comprehensive care" programs for low-income children. The precise character of comprehensive care programs varied, but in most instances, they consisted of personal health services provided by a pediatrician in concert with a social worker and nurse and often included availability of after-hours consultation and continuity of provider over time. Some programs included augmented outreach activities, such as home visiting and case management.

Evaluating comprehensive care programs, which provide diagnosis and treatment of acute and chronic illness, is not the same as evaluating well-child care. Several evaluations of comprehensive care programs did find, however, that children's use of well-child care services increased with participation in comprehensive care programs; therefore, evaluations of the effectiveness of comprehensive care programs have some bearing on the overall issue of the effectiveness of well-child care.

The net result of the studies of comprehensive care programs is ambiguous. Some studies found improvement in school attendance (315), hospitalization rates (336), incidence of rheumatic fever (214), and greater parental satisfaction with care (10). Other studies, however, found conflicting results, showing that comprehensive care programs had no effect on school attendance ***(432),*** utilization of health services ***(540),*** or immunization, or health status (10,69,215).

Evaluations of Medicaid's EPSDT Program

Medicaid's EPSDT is a federally funded, State-administered program that mandates screening of Medicaid-eligible infants and children for any illnesses, abnormalities, or treatable conditions and referral for definitive treatment (544). Because most State EPSDT programs follow guidelines similar to the AAP's 1981 Guidelines *for Health Supervision* (though with fewer scheduled visits) ***(20),*** one would expect that evaluations of the effectiveness of EPSDT in improving the health of poor children would reflect on the effectiveness of well-child care generally.

Unfortunately, the outcome measure used in the two available evaluations of EPSDT—the number of "abnormalities" detected in a screening or the number of "referrals" made (i. e., the number of abnormalities which are deemed to merit a referral for treatment)—is difficult to interpret. Both evaluations reported a decline in the detection of abnormalities with a child's time in the EPSDT program (298,321), although in one study (298), the decline became apparent only after adjusting for a general trend toward increased case finding. Because no specific information is provided about the precise nature or remediability of these "abnormalities, " the importance of a reduction in abnormalities / referrals is difficult to interpret. [9] Thus, the evidence regarding the effectiveness of well-child care that these two studies of the EPSDT program can contribute is limited at best.

Comparisons of Child Health Outcomes in Different Health Service Delivery Systems and Insurance Programs

Different systems of care—e.g., solo or group practices, fee-for-service systems, or prepaid health maintenance organization (HMO) type programs—offer different levels of well-child care. If health outcomes are improved in systems that provide more well-child care, one could infer, at least within limits, that well-child care is effective. Two major studies have sought to evaluate the effectiveness of well-child care by examining health outcomes of children in different health delivery systems ***(329,726).***

The first study was undertaken by Kessner and colleagues in the early 1970s in Washington, DC (329). The health outcome measures used in this study—intended to reflect short-term outcomes that both had intrinsic health significance and were amenable to medical intervention—were iron-deficiency anemia, visual disorders, middle-ear infection (acute and chronic), and hearing loss. The investigators found that, after adjustments were made for social class differences in who used different types of providers, there were no differences in any measure of "health status." [10]

[9] Additional caveats in interpreting the effectiveness of EPSDT are brought to light by Reis's review of unpublished Division of Maternal and Child Health evaluation projects (520). These projects demonstrate great variability in the proportion of the eligible population that is actually screened and in the proportion of those screened who are identified as having a problem.

[10] A reanalysis of the Kessner data found that users of both prepaid programs and outpatient department clinics had slightly better health status measures than users of solo practitioners (144). The differences were small, however, and may have been due more to the characteristics of the practitioners themselves than to the effectiveness of well-child care.

Investigators in the second major study, a Rand study, randomly assigned children to one of several health insurance plans that offered varying percentages of cost-sharing or free care ***(726). "*** Health outcome measures used in the Rand study included measures of physiologic health (anemia, hay fever, middle-ear fluid, hearing loss, and visual acuity); limitations in daily activities; mental health perceptions; and general health perceptions. Among children in the different insurance plans, the investigators found no statistically significant differences for any health outcome. The only potentially clinically significant difference they noted between children in the free care and children in the cost-sharing group was the prevalence of anemia among poor children who were anemic at the start of the study.

The relevance of the Rand report's findings to the evaluation of well-child care depends, as does that of Kessner's findings, on whether the different groups of children received different amounts of well-child care. The partial results of the utilization data for children that have been presented ***(370)*** suggest that children in cost-sharing plans did use fewer well-child services than children in free care.

The Rand study has been extensively critiqued (244,611) because of the substantial attrition (40 percent) of the initial study group and the small sample size. Critics argue that the health outcome measures used in the Rand study (with the exception of anemia) may not be responsive to medical therapy and that the study did not consider social functioning outcomes. Furthermore, although differences in health outcomes between the poor children in free care versus poor children in cost-sharing plans were not statistically significant, the poor children in cost-sharing plans "were in worse health at the end of the experiment than those in the free plan on six of the eight health measures" (611).

Considering both the original reports and the critiques together, one can reasonably conclude that cost-sharing reduces utilization of both preventive and illness-related services and that this reduction is unlikely to affect adversely the physical/physiologic health of low-risk populations. The data are consistent with the hypothesis that cost-sharing adversely affects some measures of health status among the poor, although this is far from definitive. The specific effect of reducing the use of health services on developmental/social functioning remains unexamined.

[1] The Rand study is described further in ch. 2.

Studies of the Effect of Well-Child Care on Child Behavioral/Developmental Outcomes

The studies that have examined the global effectiveness of well-child care have not considered behavioral and developmental outcomes to any significant extent. However, one study did specifically examine how different styles of well-child care as practiced in clinical settings influence behavioral and developmental outcomes; also, a variety of studies have examined how special types of well-child care might affect such outcomes.

One study compared the influence of pediatricians using different degrees of teaching effort in their well-child care on a variety of maternal and child behavioral and developmental outcomes ***(102).*** This study found a strong correlation between teaching effort and maternal knowledge and a small but significant correlation between teaching effort and the mother's self-reported level of positive interaction with her child. On the other hand, the study found that increased teaching was correlated with increased reported behavior problems among children; it found no correlation between teaching effort and formally measured developmental test results, This study is limited by a small sample primarily drawn from middle-class children, but on the whole, its methodological limitations probably minimized the reported effects of the teaching efforts.

The other studies examining the effect of well-child care on developmental and behavioral outcomes are more appropriately considered efficacy studies. In the most methodologically sophisticated of these studies, the intervention consisted of targeted counseling during well-child visits (97). This study found that after ***6*** months, the group that received counseling ranked higher on scales of maternal-infant interaction than the group that did not receive counseling. No differences in Bayley developmental test scores were noted.

Two other studies of augmented behavior counseling also found small effects (121,232). One found fewer fears in the intervention group than in the control group, little difference in developmental test results, and significant worsening in the intervention group in their responses to the "early school personality questionnaire" (121). The other found differences in early IQ tests that increased up to age 3 and decreased thereafter (although sample attrition may have biased these findings) ***(232).*** A variety of measures of self--confidence also showed improved results in the experimental group. However, the extensive nature of the intervention in the latter study—far broader than current ideas of the content of well-child care—makes it incorrect to generalize to the effectiveness of well-child care.

Conclusions About the Effectiveness of Well-Child Care as a Whole

The literature evaluating the effectiveness of well-child care is perhaps more remarkable for its limitations than for its findings. No evidence supports the contention that well-child care (other than immunization) significantly influences mortality or morbidity among children or that it enhances the development of a child's social competence. On the other hand, sample sizes have been uniformly too small and followup too brief to identify mortality changes; the available measures of childhood morbidity have been inadequate and most investigators have not even looked at developmental outcomes. The particular importance of the outcome measures examined to date and their duration of impact have not been evaluated. For these reasons, expert opinion and good intentions rather than scientific data must be used to guide the provision of well-child care. Participation in well-child care does seem to provide substantial satisfaction to both parents and providers, and the value of their satisfaction should not be overlooked.

Effectiveness of Five Specific Components of Well= Child Care

Given that the evidence on the effectiveness of well-child care as a whole is very sparse, it is worth looking at the components of well-child care to ascertain whether evidence on these procedures allows for judgments about their effectiveness. OTA selected five specific components of the well-child visit for a review of the available evidence:

1. the general physical examination,
2. the Denver Developmental Screening Test (DDST),
3. screening to detect iron deficiency (anemia),
4. screening to detect hearing deficits, and
5. anticipatory guidance on child safety restraint use.

The evidence on three of these components—the physical examination, the DDST, and anticipatory guidance on child safety restraints—is summarized in appendix J. Other components of well-child care—including vision screening and dental examinations—are not reviewed in the discussion that follows. The purpose of the discussion of the effectiveness of specific components of well-child care below is not to be comprehensive, but to illustrate the kinds of evidence available on the effectiveness of commonly recommended procedures.

The effectiveness of one component of well-child care—childhood immunization—is well established. Childhood immunizations for poliomyelitis, DTP, MMR, and Hib clearly prevent illness or premature death due to certain diseases (358).

General Physical Examination

The general physical examination is a series of diagnostic tests intended to detect a variety of medical conditions. The literature evaluating the physical examination in well-child care is summarized in table J-6 in appendix J. In general, the literature does not endorse the usefulness of the exam. The exam detected previously unknown abnormalities in 1 to ***3*** percent of routine exams of preschool and 5 percent of school-aged children (30, ***464,770).*** Followup exams resulted in fewer newly diagnosed conditions than initial exams, with 1 out of every 251 exams yielding new information (771). Studies comparing exams by physicians with exams or screening of school-age children by other health professionals (e. g., nurses or technicians) found that many more abnormalities were detected in school-based screening programs than by physicians (129,221,347,746). Many of the abnormalities detected in these studies were vision

or hearing abnormalities on which the physicians may have placed little emphasis, knowing that they would be performed at school.

All but one of the studies examining the effectiveness of the general physical examination (with or without screening measures for hearing or vision defects) concluded the exam has little merit. The most glaring weaknesses of available studies are that none of the studies test the validity of either positive or negative findings obtained on examination and that none examine the clinical usefulness of finding physical abnormalities. (In one study of the physical examination in infants, over one-half of the abnormalities found were already known to the parent.) Therefore, it is not possible to gauge the effectiveness of the exam. 'z

The Denver Developmental Screening Test (DDST)

The most widely used and recommended developmental screening tool for use by child health personnel *is* the DDST or one of its adaptations—the DDST-S or the Parents' Developmental Questionnaire ***(15,96,187).*** The primary purpose of administering the DDST is to identify children likely to have later problems so that interventions can be used early enough to prevent the problems, although other reasons include reassuring parents that their child is normal.

The cumulative evidence suggests that the DDST, when administered immediately prior to school entry, has fair ability to predict developmental abnormalities accurately (87,88,524,629) (see table J-7 in app. J). The very limited evidence presented to date, however, does not support the assumption that detection of a problem will result in improvement in school performance; indeed, the parents of children with problems seem to worry more with no improvement in outcome (87).

OTA found no specific studies on whether identification of developmental delay through the use of the DDST for children of preschool age is a useful effort. The recent results of programs offering early intervention are encouraging (568,587, 749), but eligibility for participation in these programs is usually determined by the socioeconomic and demographic characteristics of the child's family rather than by the child's developmental scores. If the use of the DDST, or comparable tests, is to be recommended in the context of well-child care, this recommendation must be based on intuitive or philosophic rather than scientific grounds.

[12]OTA did not review studies examining the effectiveness of specific physical diagnostic procedures, such as the Ortalani maneuver for identification of congenital dysplasia of the hip, forward bending for detection of scoliosis, patch testing for discovery of strabismus, or abdominal palpation for detection of tumors. Given the focused nature of these examinations, their effectiveness should be easier to clarify than that of the general examination.

Screening To Detect Iron Deficiency (Anemia)

Anemia is **a** condition that exists when the level of hemoglobin in a person's blood drops below 11 grams per deciliter of whole blood (186), signifying a reduction in the oxygen-carrying capacity of the blood. In unselected populations of children, the overwhelmingly predominant cause of anemia is iron deficiency ***(186).*** Indeed, screening for anemia in infancy and childhood is recommended, in large measure, as a screen for iron deficiency.

The prevalence of anemia in a population has long been used as a measure of that population's health status, socioeconomic status, and quality of medical care (186,327). From 10 to 40 percent of infants 12 to 24 months old (depending on race and socioeconomic status) are somewhat anemic (292), although severe anemia is far less prevalent (728).

Studies differ on whether being anemic per se is harmful (388,500). Available studies do suggest —but not definitively—that iron deficiency results in lowered developmental/ intelligence quotients (131,132,386,387,388,474,475,599,737,741). Most studies suggest that iron therapy results in short-term improvement on developmental tests for clearly iron-deficient and anemic children, but some studies have not supported this conclusion, and longer term effects are even more uncertain.

Iron therapy rapidly corrects anemia and the biochemical markers associated with iron deficiency, although for many children, the improvements would occur (though more slowly) *with*-out therapy (132). Various studies have shown that iron therapy sometimes, though not always, reduces deficiencies in mental performance in iron-deficient children (132,386,388).

Even assuming the seriousness of iron deficiency and the effectiveness of treatment, there are problems in establishing a screening criterion for iron deficiency. The accepted standard for diagnosis of iron deficiency is response of at least 1 gram of hemoglobin per deciliter of blood to a therapeutic regimen of iron (517,599). Other tests for identifying iron deficiency also exist, but have not been tested in an unselected American population against the diagnostic standard. A study of anemic children in military families found that no single commonly used cutoff level for hemoglobin identified many more than half of the children who responded to iron therapy (141,517). Another study found that pretreatment hemoglobin level per se was the best indicator (highest sensitivity and specificity) of subsequent response to iron therapy; the FEP (free erythrocyte protoporphyrin) also performed well, especially as a screening test for more severe iron deficiency (331).

Given the potential seriousness of the defects induced by iron deficiency and the ease of addressing the hematologic manifestations, continued early identification of high-risk infants (e.g., those of low socioeconomic status) with either a capillary hemoglobin/hematocrit or FEP appears reasonable, with a liberal threshold (e. g., hemoglobin of less than 11.5 grams or FEP greater than 35 micrograms per deciliter of whole blood) for institution of a trial of iron therapy.

Screening for Hearing Deficits in Preschoolers

AAP and other bodies concerned with hearing-impaired children recommend a threefold approach to the early detection of children with hearing problems (15):

1. identification of high-risk newborns through application of risk criteria,[13]
2. identification of infants and toddlers through monitoring of speech and language development (possibly including use of formal speech and language screening instruments), and
3. identification of preschoolers through the use of some form of formal hearing screening test.

Although the greatest burden of severe hearing loss occurs in the perinatal period, screening newborns is difficult; screening in preschoolers is relatively easy, and the focus here is on the effectiveness of screening for hearing deficits in preschoolers.

Approximately 5 to 10 percent of preschool and early school-age children have at least temporary hearing impairment as a result of the presence of middle-ear fluid (168,174,348,463). Most cases of middle-ear effusion resolve spontaneously or with the help of antibiotics over a period of weeks to months (93,400,478). Surgical drainage is also effective, although it involves risk and expense and the duration of hearing improvement may be brief (73). Whether children who experience middle-ear effusion suffer long-term problems in speech and language skills or are at increased risk for subsequent learning and behavioral disorders remains an open question. Severe bilateral conductive hearing losses, particularly at earlier stages of language development, probably do cause short-term speech and language delays ***(478,730).***

Preschoolers are in most cases screened through the use of pure-tone audiometry, which involves having the children listen to sounds across a range of frequencies and indicating when they hear the sound. A Canadian group that tried to assess the utility of community preschool screening found that such screening was not associated with a significant decrease in the prevalence of hearing deficits (168). The failure of the screening program was ascribed to the limited effectiveness of interventions for the treatment of middle-ear effusion.

Issues surrounding the early identification of hearing deficits through screening in early childhood are surprisingly complex. Pure-tone audiometry, when properly performed, is a sensitive and specific means for detecting hearing deficits. Given the uncertain impact of most of these deficits, and the vagaries of treatment efficacy, however, whether preschool children are better off for having been tested also remains unknown.

[13] AAP and the Joint Committee on Infant Hearing Screening currently recommend a set of criteria for identifying high-risk infants in need of screening for hearing deficits ***(284).*** Infants who meet one or more of the criteria are referred for extensive diagnostic audiologic evaluation. The precise sensitivity and specificity of these screening tests and their optimal combination for early identification of hearing deficits are controversial ***(6,492).***

Anticipatory Guidance on Child Safety Restraint Use[14]

The provision by a health care provider of anticipator-y guidance on injury prevention—specifically, guidance on the use of child safety restraints in motor vehicles—offers an excellent opportunity to evaluate the effectiveness of this aspect of well-child care. First, the outcome measure—proper use of child safety restraints— is objective. Second, the scientific underpinnings of the recommendation are clear—proper use of an approved child safety restraint will almost certainly reduce the child's likelihood of death or injury due to motor vehicle accident ***(538).*** The same degree of certainty does not exist regarding the value of advice about the precise timing and order of introduction of solid foods for infants or about means for preventing or modifying behavioral problems.

Studies of the use of child safety restraints in motor vehicles are summarized in table J-8 in appendix J and discussed in chapter 7. The more methodologically sophisticated studies of the impact of anticipatory guidance on the use of child safety restraints in automobiles failed to demonstrate a substantial effect, although the findings indicate that pediatricians can accelerate use of infant restraints in those likely to use such restraints eventually ***(523).*** Whether the limited efficacy of physician counseling in increasing proper use of infant restraints can be generalized to all of anticipatory guidance as usually performed is doubtful.

[14]For more information on preventing accidental injuries in children, see ch. 7.

COST-EFFECTIVENESS OF CHILDHOOD IMMUNIZATION

The effectiveness and safety of a vaccine is extensive] y tested before it is approved for marketing. Consequently, in contrast to the five components of well-child care discussed previously, the effectiveness of the currently available childhood vaccines is well understood. The remaining question is whether childhood immunization is cost-effective—i.e., whether the costs of immunization are worth the benefits they confer. The literature is richly laden with research on the cost-effectiveness of specific immunization protocols. That literature is discussed below.

Literature Review

Many studies have analyzed the costs and effectiveness of the vaccines that are recommended for routine use in this country. Some of the more recent economic evaluations of childhood vaccination programs are summarized in table J-9 in appendix J. These studies show that childhood immunization not only yields considerable disease-reduction benefits but also offers substantial economic benefits—i. e., savings in costs that would have been incurred had the disease and its complications not been prevented (13,37,62,110,150, ***164,260,272,350,351,404,505,567,748,758)*** .

Photo credit: Bristol-Myers, Evansville, IN

Childhood immunization programs bring about both reduction of disease and substantial economic benefit.

A study of measles vaccination during the first 20 years of the vaccine's licensure (1963 to 1982) found that it provided the United States an estimated net savings[15] of $5.1 billion in direct and indirect costs[16] (62). Pertussis vaccination also

[15]Savings are calculated differently across studies. Some researchers include only medical costs averted, while others also estimate the value of reductions in lost productivity from the disease.

[16]"Direct costs and benefits" refer to medical costs incurred or averted. "Indirect costs or benefits" refer to the economic value of lost productivity incurred or averted.

confers substantial net economic benefits. A recent study found that over a 6-year period for a hypothetical cohort of 1 million children, a pertussis vaccination program prevented over 92,000 cases; in addition, such a program saved a total of $44 million in direct lifetime medical costs for the cohort of 1 million children (272).

Combining single vaccines into one vaccine for multiple diseases improves the economic benefits of vaccination by decreasing the cost of vaccine administration. In 1983, the use of a combined MMR vaccine rather than individual vaccines for measles, mumps, and rubella saved $60 million in direct medical costs and increased productivity (748).

A study of Hib vaccination found net savings in societal medical care costs (110). That study also assessed the cost and effectiveness of administering Hib vaccine to young children at different ages. The most cost-effective Hib vaccination strategy proved to be immunization at 18 months of age, with net medical care savings of $30.7 million. Hib vaccination at 24 months of age was also cost saving, but with a net savings of only $1.1 million. The considerable difference in cost savings was due to the study's assumption that the 18-month Hib vaccination would be administered at the same physician visit as the already routine DTP vaccine, thus avoiding the administrative cost of an additional doctor visit that would be required at *24* months (110). The adoption of ACIP's recent recommendation to move the 18-month DTP and OPV immunizations to the 15-month visit would mean that the cost of an 18-month Hib vaccination would have to include the cost of an additional doctor visit. Assuming a $10 office visit cost, including the cost of a doctor visit would increase the 18-month Hib vaccination cost by about $30 million, which would nearly erase the reported net savings to an 18-month strategy. If the researchers had estimated the office visit fee at $15, Hib vaccination would no longer provide net savings in health care costs at either 18 or 24 months, but would still confer substantial medical benefits in reduced morbidity and mortality.

Critics of the Hib vaccination study have also observed that it is based on the assumption that the Hib polysaccharide vaccine is effective in the 18- to 23-month-old population (220). A randomized controlled trial of clinical efficacy conducted in Finland found that the Hib vaccine was 90 percent efficacious in children 24 months or older (483). However, the data for that study were insufficient to determine efficacy for the subgroup of children immunized at 18 to 23 months (220). The Hib polysaccharide vaccine is clearly not efficacious in children under 18 months of age (482).

A more recent study of Hib vaccination found that universal vaccination at 24 months resulted in net savings of $4 million (260), compared to $1.1 million in the earlier study (110). In broadening the analysis to include indirect costs and benefits (i.e., lost lifetime earnings due to Hib), the investigators found that the 24-month strategy would result in a net savings of $64.8 million.

A newly developed varicella (chickenpox) vaccine may soon be licensed for use in high-risk groups in the United States (505). One study found that over a 30-year period, a childhood varicella vaccination program would result in a net savings of $252 million in direct medical costs (505). However, this study did not consider the possible increased risk of disease in adults, in whom the disease is more serious. 17 If vaccinating all children against varicella does not place adults at increased risk of disease, then there would be substantial direct medical cost savings by implementing such an addition to the childhood immunization program (505).

Impact of Vaccine Costs on Estimates of Net Cost Savings

Over the past few years, as a result of the vaccine liability crisis, vaccine prices have risen dramatically (654). The burden of liability litigation

[17] Concern has been raised about the long-term efficacy of the varicella vaccine (743). Varicella (chickenpox) is much more severe when contracted during adulthood than during childhood. Critics assert that vaccinating all children against varicella could leave those children at increased risk of susceptibility in later years (75).

imposed on vaccine manufacturers has caused several manufacturers to pull out of the market and others to dramatically raise vaccine prices. The primary problem is the uncertain legal environment that manufacturers face regarding lawsuits over adverse reactions to vaccines (three-fifths of which are over the DTP vaccine (654)).

OTA analyzed the sensitivity of the results of the most recent pertussis cost-effectiveness study (272) to assumptions about increased current pertussis-component prices. The 1984 cost-effectiveness study assumed that the cost of pertussis vaccine was $0.03 per dose, and found the ratio of savings in direct medical costs to the costs of a pertussis vaccination program to be 11.1 to 1 (272). Subsequently, as a result of the vaccine liability crisis, the cost of the pertussis vaccine rose sharply. In 1987, the Federal Government paid $7.69 per dose for the pertussis component of the DTP vaccine, and the private sector price was $8.92 (739), most of which was added to cover the costs of legal liability (287). If the study's calculations are adjusted to reflect these current prices, the ratio of savings in direct medical costs to the costs of a pertussis vaccination program drops from 11.1:1 to ***1.29:1*** at the government price and to 1.13:1 at the private sector price (see table ***6-5).*** A ratio of 1.0:1.0 means that a vaccine pays for itself in reductions in direct medical care costs alone. At the government price and even at the private sector price, therefore, DTP still pays for itself in reductions in direct medical care costs alone.

Conclusions About the Cost-Effectiveness of Childhood Immunization

The cost-effectiveness of childhood vaccines is well established in the literature—indeed, such vaccines not only confer medical benefits but are cost-saving. Two recent cost-effectiveness studies demonstrate that the new Hib vaccine is cost-saving as well. Despite a rapid rise in price, the most controversial vaccine—DTP vaccine—continues to be cost-saving. As vaccine prices increase, however, costs saved with childhood immunization programs diminish. Thus, developments with regard to the current vaccine liability crisis will have an impact on whether childhood immunizations continue to be cost-saving.

New technologies on the horizon also will have an impact on the cost-effectiveness of childhood immunizations. Two new DTP vaccines developed by the U.S. National Institutes of Health and Japanese researchers could substantially reduce the number and seriousness of adverse reactions to the pertussis component of the vaccine. A reduction in adverse reactions could decrease the amount of corresponding litigation and ultimately reduce vaccine prices.

Table 6-5.—impact of Vaccine Prices on the Cost-Effectiveness of Pertussis Vaccine

Pertussis vaccine price per dose[a]	Savings-to-cost ratio[b]	Cost reduction in net medical costs attributable to pertussis vaccine
Price estimated by Hinman and Koplan, 1984[c] $0.03	11.1:1	820/o
Federal Government price in 1987 . . . . . $7.69	1.29:1	20 "/0
Private sector price in 1987 . . . . . $8.92	1.13:1	180/0

[a]Price of DTP vaccine minus price of diphtheria and tetanus components of the vaccine
[b]Ratio of savings in direct medical costs to the costs Of pertussis vaccine
[c]A.R Hinman and J.P. Koplan, "Pertussis and Pertussis Vaccine Reanalysis of Benefits, Risks, and Costs, " *J A M A* 251(23) 3109-3113, 1984

SOURCE P Home, Division of Immunization, Centers for Disease Control, Public Health Service, U.S. Department of Health and Human Services, personal communication, Atlanta, GA, January 1987, Washington Report on Medicine and Health, "Lederle, Con naught Drop DPT Prices, " *Washington Report on Medicine and Health 41(20) 2,* May 18, 1987; and OTA calculations.

FINANCING AND AVAILABILITY OF WELL-CHILD CARE SERVICES

Children with private health insurance in the United States, with the exception of children in HMOs, are seldom covered for well-child care services. As discussed below, however, the Federal Government supports well-child care services through a variety of programs, ranging from Medicaid to childhood immunization programs.

The discussion of the availability of well-child services below focuses on the most clearly effective and cost-effective component: childhood immunization. Children in the United States are routinely immunized against polio and several other diseases. In part because States have laws requiring proof of immunization prior to school entry, the percentage of children entering schools who have had their basic immunizations in the United States is very high. In contrast, immunization levels of children at 2 years of age are well below the objectives for 1990 set by the U.S. Public Health Service.

Private Insurance Coverage of Well= Child Care Services

Preventive health services such as well-child care visits or childhood immunizations are infrequently a benefit under private health insurance plans. Only recently have some insurers offered preventive health plans for privately insured children (405). Even when coverage of preventive services is included in a benefit package, however, effective coverage is limited by the nearly universal existence of first-dollar deductible requirements.[18]

In contrast, virtually all HMOs provide preventive health services in their insurance plans. Indeed, the provision of well-child care is required of HMOs for them to be federally qualified. (One-half of all HMOs are federally qualified (297).) As of January 1, 1987, 28 million people in the United States were enrolled in HMOs, accounting for 11.7 percent of the U.S. population ***(264).*** Furthermore, the number of HMO enrollees is growing rapidly (a rate of ***25*** percent per year at the end of 1986) (264).

[18] About 90 percent of all employer-based private health plans have deductibles of $100 or more (768).

Medicaid Coverage of Well-Child Care for Eligible Poor Children

As the major third-party payer for health care of very poor children, Medicaid's policies toward the provision of well-child care have a great deal to do with how much and what kinds of services these children receive. Although under one-half of all children in poverty are eligible for Medicaid (see ch. 3), the children who are eligible are covered for a range of well-child care services that greatly exceeds those services covered by private insurance plans.

Well-child care is provided to Medicaid children through two avenues. In some States, the State covers well-child care visits under its basic Medicaid plan. As of 1985, 32 States explicitly allowed private practitioners to bill for routine pediatric examinations (544), and others may allow this practice by lax utilization controls. " In all States, well-child care services are covered through the EPSDT program. The EPSDT program is a federally mandated program of preventive and comprehensive services that States must make available to all categorically eligible Medicaid children. It is intended to be a comprehensive system that combines screening for health problems with outreach, followup care, and case management to ensure that health problems identified in screening visits are actually addressed.

The EPSDT program was established by Congress in 1967 but was implemented exceedingly slowly by both the Federal Government and the States (10,544). Final regulations governing the implementation of the program did not take effect until January 1985. During this long period, States proceeded at varying speeds to set up EPSDT programs. State EPSDT programs vary in their design and organization, and in most States, EPSDT services have been used by only a minority of Medicaid-eligible children (508).

19 Not much is known about the amount, kinds, or quality of services rendered in this way, but in one State (Michigan) about 7 percent of physician and ambulatory care visits reimbursed by Medicaid for children in families receiving Aid to Families With Dependent Children in 1983 were for routine checkups (469).

Photo credit. March of Dimes Birth Defects Foundation

Medicaid's Early and Periodic Screening, Diagnosis, and Treatment program is the major third-party payer for well-child care of very poor children.

The legislative mandate and Federal regulations for EPSDT do not require a particular organization, but they do specify requirements such as the following for the structure of the delivery of care and, to a lesser extent, the content of that care:

- informing eligible clients of the availability of EPSDT services;
- providing transportation and appointment scheduling assistance;
- providing screening services to children that include regularly scheduled examinations and evaluations of physical and mental **health;**
- providing diagnostic and treatment services for any problems uncovered in a child's screening visit, if the services are covered in the State's Medicaid plan;[20] and
- setting standards and a system for achieving timeliness of provision of EPSDT services.

In all 50 States, the families of children eligible for EPSDT are informed at the point at which application is made for Medicaid benefits, but 30 States make additional outreach efforts such as scheduling a visit at the time of initial application or recruiting through Head Start programs, day-care centers, and hospitals (508). Such outreach efforts were originally encouraged by EPSDT legislation, which paid at a higher Federal matching rate for administrative costs associated with EPSDT than the Federal matching rate for the regular Medicaid program. In 1981, however, that extra match was eliminated.

Despite many innovative attempts by States to enhance children's participation in the EPSDT program, it remains unclear what approaches work for specific kinds of populations. An evaluation of 15 demonstration programs in both 1972 and 1978 **was** unable to identify strategies that were particularly successful in increasing the low rates at which children were screened (519). In fiscal year 1985, only 18 percent of the eligible population was screened, the same percentage as had been screened in fiscal year 1981 (508).

Once a child is entered into the EPSDT program, the first encounter is the screening visit. Depending on the State, the screening visit may be to a private physician's office (in Wisconsin, 70 percent of all screens are performed by private physicians), a health department screening clinic (in Michigan, over 90 percent of all screens take place in public clinics), or some other provider (508). If a health problem is identified in a screening visit, the child is referred for further diagnosis and treatment. Referrals requiring a followup visit, either to the screening clinic or to another provider, tend to reduce the rate of resolution of problems identified on the screen (519).[21]

The 1985 Federal EPSDT regulations gave States incentives to develop arrangements with "continuing-care providers, " who would be required to provide the full range of EPSDT screening, diagnosis, treatment, and referral for followup services as well as all physician services under

[20] Vision, dental, and hearing treatment must be supplied to screened children regardless of whether they are covered in the State's plan (49 FR 43654),

[21] Federal regulations require that immunizations be Provided at the time of screening if medically necessary and appropriate.

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Medicaid.[22] The goal of the regulations was to improve the continuity of care provided to Medicaid children. States appear to be entering into these continuing-care agreements as part of a more general effort to enroll Medicaid recipients in primary care case-management plans authorized by the Omnibus Budget Reconciliation Act of 1981 (Public Law 97-35) (544). Most of these continuing-care arrangements are with private physician practices or HMOs, although some States are recruiting publicly funded clinics (544). About 8 percent of EPSDT eligible children were enrolled in continuing-care arrangements in 1986 (273).

Several important issues regarding Medicaid's policy with respect to EPSDT have been raised by critics of the program. Several of them are discussed in turn below.

Adequacy of State EPSDT Protocols.—Most States (42 of ***46*** surveyed in ***1985)*** have established schedules for well-child care visits under EPSDT that involve fewer visits than the number currently recommended by AAP (544). Little is known about the impact of fewer well-child visits on health outcomes. Indeed, most nonpoor children do not receive the full complement of well-child visits recommended by AAP. However, it is impossible to say whether a schedule with less frequent visits is acceptable for poor children, who are more likely than nonpoor children to have health problems.

Discontinuity of Care Due to Volatility of Eligibility for Medicaid.—A large proportion of the children eligible for Medicaid are eligible for only a part of a year (86). If a lapse in Medicaid eligibility prevents a child from continuing in the care of a health care provider that the child has been using while under Medicaid, this situation may disrupt continuity of care. Some observers argue that States should make greater efforts to enlist publicly funded clinics that serve Medicaid-ineligible populations—e.g., community health centers or public outpatient clinics—as EPSDT continuing-care providers (544). If such clinics were EPSDT continuing-care providers, then when children lost their Medicaid eligibility, their continuity of care could be maintained with the same clinic. Of course, this approach would mean channeling Medicaid children to a health care delivery system separate from that used by other, more affluent children.

Need To Recruit Private Providers Into the EPSDT Program.—The low screening ratios for Medicaid children under EPSDT appear to result in part from low participation by private physicians in the EPSDT program. Two States found that enhanced efforts to recruit private providers into the EPSDT program increased the screening ratio (401,732). It is not clear, though, whether such changes reflect a real increase in the amount of well-child care provided or merely a switch from the provision of such services under the regular Medicaid program to the EPSDT program. Private physicians' provision of EPSDT screens may reduce physical barriers to these services, enhance the doctor-patient relationship, and improve access to episodic acute care. On the other hand, some private physicians may be less able to provide a comprehensive array of services than a publicly funded clinic.

EPSDT v. Regular Medicaid Coverage of Well-Child Care Services.—The poor rates of participation in EPSDT by eligible children clearly understate the use of and access to well-child care services among these children. Many of these children receive well-child care services through the regular Medicaid program, presumably from a private physician or publicly funded clinic. For children who are not served under EPSDT continuing-care agreements, the use of the regular Medicaid program may enhance the continuity of care and their access to acute care. On the other hand, EPSDT services include augmented vision, hearing, dental, and sometimes other services not available through the regular Medicaid program. Indeed, under EPSDT (unlike the rest of Medicaid), a State may provide virtually any services it wishes on an as-needed basis to children, provided the need for the services was identified through an EPSDT screening examination (49 FR 43654, 42 CFR 441.57).[23]

[22] Provision of dental services under these arrangements is optional, but if the continuing care provider chooses not to provide such services, then the provider must refer recipients to the Medicaid EPSDT agency to obtain these services (49 FR 43654; 42 CFR 441 .60(a) (4)).

[23] "One State uses the EPSDT program to provide home services to technology-dependent children (664),

To some extent, the development of EPSDT continuing-care arrangements by States should mitigate the problems related to the separation of regular Medicaid services from EPSDT services and bring together the two sets of services. In many areas, however, the growth of continuing-care arrangements is likely to be slow, and the choice is between providing well-child care for low-income children through channels that are convenient to private practitioners (i. e., regular Medicaid) or through channels that are subject to more monitoring and control over the quality of services (EPSDT programs).

Public Direct Subsidies for Well= Child Care

A number of public programs provide or support childhood immunization services and other well-child care. A childhood immunization program that is a coordinated Federal, State, and local effort provides vaccines for approximately one-half of the children in the United States. There exists no similar coordinated effort for other well-child care; rather, well-child care for some children is obtained (or financed) through many different Federal programs.

Federal Support for Childhood Immunization

Approximately one-half of all childhood vaccines are delivered by the public sector; the other half are delivered by the private sector (654). Vaccine manufacturers have three primary markets for their vaccines:

1. bulk and consolidated contract sales to the Federal Government,
2. bulk sales to State and local governments, and
3. retail sales to hospitals, clinics, and physicians (654).

Through the purchase of vaccines and through other research, operational, and surveillance programs, the Federal Government plays a leading role in the effort to immunize U.S. children against diseases preventable by immunization. Vaccinations are actually provided to children at the State and local level, however.

The Federal Government became involved in immunization programs for children in the 1950s, when Congress passed the Poliomyelitis Vaccination Assistance Act of 1955 (Public Law 84-377). Since then, the Federal role has been expanded, most notably through the Vaccination Assistance Act of 1962 (Public Law 87-868)—a law which provided for Federal grants to States and localities for vaccination programs. The Communicable Disease Control Amendments of ***1970*** (Public Law 91-464), through a newly created Section 317 of the Public Health Services Act, provided the Federal Government with authority to assist State and local governments in the prevention and control of communicable diseases. Under Section 317, States receive Federal grants for the purchase and delivery of vaccines based primarily on their population, income, public sector involvement in vaccine administration, past levels of disease, and other factors ***(50).*** States then use the grant money to purchase vaccines and deliver the vaccines through their local public health structure or, if no public health structure is available, through private physicians ***(286).*** States may be awarded vaccines in lieu of cash if so requested ***(50).***

Several U.S. Government establishments have vaccine-related responsibilities. The National Institute of Allergy and Infectious Diseases, one of the National Institutes of Health, is involved in vaccine research and development, primarily through funding basic and epidemiological research. The Food and Drug Administration's Center for Drugs and Biologics is responsible for the licensing and testing of vaccine manufacturers and their products ***(658).*** The Center for Disease Control's (CDC) Division of Immunization is responsible for developing and implementing national goals and activities for childhood immunization,

Operating under Section 317 of the Public Health Services Act, CDC coordinates the distribution of Federal funds to State and local health departments for the purchase of vaccines. The level of Federal funding under Section 317 was increased from ***$56.9*** million in 1986 to $87.5 million in 1987—in an attempt to compensate for increases in vaccine costs and births, to include the Hib vaccine in the Federal purchase program, and to establish a 6-month stockpile of childhood vaccines ***(286).*** CDC also negotiates consolidated pur-

chase contracts with manufacturers—contracts that realize savings that States could not achieve on their own. Finally, in addition to making grants to States, CDC 1) provides statistical, promotional, educational, and epidemiological assistance, as well as consultation to State and local health departments; 2) conducts a nationwide disease surveillance program; 3) monitors national immunization levels and adverse events occurring in the public sector; 4) maintains a stockpile of vaccines and injector equipment in case of epidemics or the disruption of vaccine supply; and 5) develops guidelines for the use of vaccines (654,682).

Other Federal Support for Well-Child Care

Federal support for well-child care goes beyond support for childhood immunization. As discussed below, well-child care for children in low-income families or special demographic categories is provided or funded by several Federal programs:

- the Maternal and Child Health (MCH) block grant program,
- the Preventive Health and Health Services (PHHS) block grant program,
- the Head Start program,
- . community health centers (CHCs) and migrant health centers (MHCs), and
- the Indian Health Service (IHS) of the Public Health Service.

Because these programs provide more than well-child care, they are also discussed in more general terms in chapter 3.

The MCH block grant is used to provide health services to mothers and children, including well-child care and immunizations. It is up to each State, however, to decide exactly which services MCH funds are used for. Six States reported using MCH block grant funds for immunization in 1985, spending a total of $670,000 (512). Information on MCH funding of other well-child care services is not available,

PHHS block grant funds are used to provide comprehensive public health services, including well-child care and immunization. Each State retains its own decisionmaking authority over how the funds are distributed for the various services *(512).* Eight States reported using PHHS block grant funds for immunization in 1985, spending a total of $730,000 (512). Information on PHHS funding of other well-child care services is not available.

Medical services provided in the Head Start program include a complete examination, including vision and hearing tests, identification of handicapping conditions, immunizations, and a dental exam. In 1985-86, 96 percent of the children enrolled in Head Start had completed all of the required immunizations and 97 percent of the children enrolled had completed medical screening, including all of the appropriate tests (675).

CHCs and MHCs are part of the Federal primary care program administered by the Bureau of Health Care Delivery and Assistance, an organizational component of the Health Resources and Services Administration. The goal of CHCs is to provide primary health care, including well-child care and immunizations, to medically underserved areas. MHCs provide primary health care, including well-child care services, to migrant and seasonal farm workers and their families.

For Indian children, IHS provides both well-child care and immunizations. IHS has been very successful in immunizing American Indian and Alaska Native children. In 1982, it achieved its goal of immunizing 90 percent of these children, attaining the Federal target level set by the 1977 Childhood Immunization Initiative, and it has maintained that level ever since (513).

Access to Well= Child Care: Children's Immunization Status

There is very little evidence on the use of well-child care services in various segments of society. A study based on the Rand health insurance experiment (see ch. 3) found that 7 percent of infants had received no well-child care in the first 18 months of life, only 45 percent had received three doses of polio and DTP vaccines, and 60 percent had received the MMR vaccine (389); however, this study was based on a very small sample size (97 subjects). Another study based on the 1980 National Medical Care Utilization and Expenditure Survey found that privately insured

individuals "rarely use preventive services at the rates indicated by medical guidelines. Only HMO enrollees are likely to use services at medically recommended levels" (45).

The most direct evidence on the use of well-child care services pertains to children's immunization status. Immunization, of course, is only one component of well-child care. Although it is relatively easy to report on children's immunization status, data on immunization status do not necessarily reflect children's access to the whole array of well-child care services. At least in certain groups of children, though, a lack of immunization—the most clearly cost-effective well-child care service—implies poor access to other well-child services.

The following discussion examines U.S. children's access to immunization services and assesses the immunization status of those children. The areas covered include the U.S. objectives for childhood immunization levels, the present immunization status of U.S. children, comparison to other industrialized countries, and gaps in access to immunization among American children.

Variations in Children's Immunization Status by Age

What level of immunization in a population is enough? The minimum level necessary to maintain herd immunity (the level of immunity that must be attained to prevent epidemics of vaccine-preventable diseases in a specific population) varies for each childhood disease. In general, if a high percentage (80 to 90 percent) of a population is immunized against a disease, there is little likelihood that the disease will be introduced into the population and infect the unimmunized individuals. For tetanus, there is no herd immunity; therefore, immunization of the entire population is necessary for complete protection.

In December 1980, the U.S. Public Health Service laid out the following two objectives as national goals for 1990:

1. that at least 95 percent of children in licensed day-care centers and kindergarten through grade 12 be fully immunized, and
2. that at least 90 percent of children have their basic immunization series by age 2 (679).

A November 1986 midcourse review of the Nation's progress towards these goals found that the immunization status of U.S. children in the 1980s is better than it has ever been before (716).

The goal of immunizing 95 percent of U.S. children in licensed day-care centers and in kindergarten through grade 12 will probably be achieved by 1990. Immunization levels for school-age children for the 1984-85 school year were 88 percent or higher (716). Immunization levels for school-entry-aged children (5- and 6-year-olds) have consistently been in the 91- to 94-percent range throughout the 1980s, very close to the 1990 target level of 95 percent (693) (see table 6-6). This high degree of success is primarily due to the fact that all States have laws requiring proof of immunization prior to school entry (49). Reported immunization levels for children in licensed day-care centers are also nearing the target level of 95 percent. In 1985-86, according to the Licensed Day Care Center Facilities Immunization Survey, day-care centers reported that 93 percent or more children had had their basic immunization series (590).

In contrast, immunization levels for U.S. children at 2 years of age are well below the 1990 objectives and have shown little progress since 1980.[24] With the exception of DTP immunization levels for 3+ doses, the immunization levels for 2-year-olds are well below the 1990 target of 90 percent (see table 6-7). In 1985, just over one-half of 2-year-olds had had four or more doses of DTP as recommended by ACIP's schedule. From 1979 to 1985, immunization levels among 2-year-olds rose the most for the mumps vaccine (which had the lowest level to begin with); immunization levels for rubella vaccine among 2-year-olds actually declined slightly (see table 6-7).

[24] The best available national data for this age group comes from the U.S. Immunization Survey conducted by the Census Bureau for CDC. The total sample for the survey is based on the respondents recall, and there is a subsample based on the respondent referring to an immunization record as the source of immunization history. The subsample constitutes approximately one-third of the total sample (146).

Table 6-6.–Percentage of School-Entry-Aged[a] U.S. Children Immunized, 1980/81 to 1985/86

Vaccination	Percentage immunized by year					
	1980}81	1981/82	1982/83	1983/84	1984/85	1985/86
Polio (3+ doses)	95 "/0	960/o	97%	97 "/0	97 "/0	960/o
DTP (3+ doses)	96	96	96	97	97	96
Measles	96	97	97	98	98	97
Mumps	92	95	96	97	97	96
Rubella	96	97	97	98	98	97
All vaccines[b]	NA	NA	91	93	94	93

Abbreviation: DTP = diphtheria, tetanus, and pertussis vaccine

NA = not available

[a]Five- to six-y ear-olds

[b]Th, percentages shown in this linerepresentthe weighted average of the individualvaccine percentage, but itmay be an Unrepresentative sample because not all States reported overall percentages

SOURCE U S Department of Health and Human Services,Public Health Service. Centers for Disease Control, unpublished data from the U S School Entry Immunization Survey, 1980/81 -1986. Atlanta, GA, 1987

Table 6-7.—Percentage of 2-Year-Old U.S. Children Immunized, 1979 and 1985

Vaccination	Percentage immunized by year	
	1979	1985
Polio (3+ doses)	76.30/o	76.70/o
DTP (3+ doses)	82.1	85.8
(4+ doses)	53.6	55.7
Measles	80.8	81.7
Mumps	70.1	78.9
Rubella	80,0	77.3

Abbreviation: DTP = diphtheria, tetanus, and pertussis vaccine

SOURCE U S Department of Health and Human Services, Public Health Service, Centers for Disease Control, unpublished data from the U S Immunization Survey, 19791986, Atlanta, GA, 1987

The United States has significantly lower immunization levels for infants than several other industrialized countries have. The percentage of infants (0 to 1 year of age) in the United States who are fully immunized against DTP (37.4 percent) is less than one-half the percentage in the United Kingdom ***(84*** percent), Canada (80 percent), Sweden (94 percent, DT only), France (95 percent), Spain (97 percent), Italy (99 percent, DT only), and Israel (95 percent) (723,765).

Why has the United States been so successful at achieving the school-age immunization objectives, yet less successful with the preschool age population? In contrast to school-age children, preschool children lack a universal point (e.g., school entry) at which immunization can be required. Day care is the most common point of access for immunization in preschoolers, and most States have already enacted laws that require proof of immunization in order to attend day care ***(686).*** However, five States do not have such requirements and five other States have no enforcement clause for the requirements that they do have ***(686).*** And even in States where laws exist, their effect is weakened by the fact that the requirements apply only to licensed day-care facilities, which care for an estimated ***20*** percent of children under age ***6*** with working parents (the other ***80*** percent are in informal day care of some kind) ***(526).***

Variations in Children's Immunization Status by Race and Location

Although it is apparent that the United States enjoys high levels of immunization as a whole, though not as high as they should be for very young children, considerable differences persist with respect to race and geographic location. National survey data indicate that differences exist between white and nonwhite as well as between urban poverty areas and suburban and rural areas.

Table 6-8 illustrates that whites have higher immunization levels than nonwhites in both the preschool and school-entry child populations. For children aged 1 to 4 in ***1985,*** the differential ranged from as high as 16 percent for polio vaccination to 10.9 percent for measles and rubella (see table 6-8). For children aged 5 to 6 in 1985, the range was from 12.1 percent for polio (3+ doses) to 8.4 percent for DTP (3+ doses) (table 6-9).25 Immu-

[25]The figures for DTP and OPV (oral polio vaccine) in 5- and 6-year-olds are the percentage of children with three or more doses, the number used in the data as the minimally acceptable level for immunity. In fact, however, three or more doses may or may not

Table 6-8.— Percentage of 1- to 4-Year-Olds and 5- to 6-Year-Olds Immunized by Race, 1985

Vaccine	Percentage Immunized by race: All races	White	Nonwhite
1- to ***4-year-olds:***			
Polio ***(3+*** doses)	75.7 "/0	77,5 "/0	61.5 **0/0**
DTP (3+ doses)	87.0	88.5	75,2
Measles[a] . . .,	76.9	78.1	67.2
Mumps[a] . .	75,5	77.1	62.7
Rubella[a] . . . .,	73,8	75.0	64.1
5- ***to 6-year- olds:***			
Polio (3 + doses) .,	***87.3%***	***88.6 0/0***	***76.5 0/0***
Polio (4+ doses) .	71,3	73.2	54.5
DTP (3+ doses) .,	93.4	94.3	85.9
DTP (4+ doses)	85.1	86.6	71,8
Measles[a] .	89.0	90.0	80.0
Mumps[a] . . .	88.7	89.7	80.4
Rubella[a] ., . . .	84,7	85.9	74.1

Abbreviation: DTP diphtheria, tetanus and pertussis vaccine
[a]Measles mumps and rubella levels are not [dent ical because some Stales do not require vaccination against mumps and/or rubella

SOURCE U S Department of Health and Human Services Public Health Serv ice Centers for Disease Control unpublished data from the U S Im munization Survey 1979 1986 Atlanta GA 1987

be an adequate cutoff, depending on when each dose is admlnls-tered. The primary series of vaccination against polio has three doses. The fourth booster dose may not be necessary if the child has not followed the recommended schedule and received the third dose after the fourth birthday (681). Four doses of DTP make up the primary vaccination series, and the fifth booster shot is required unless the fourth dose was received after a child's fourth birthday which means that the recommended schedule was not toll owed. For a measure of the percentage of children that are following the recommended immunization schedule, therefore, it is appropriate t o look at those who have received four or more doses of DTP and OPV. Although it is possible not to follow the recommended schedule and still be immune to disease, the highest degree of immunity achieved when the recommended schedule is followed.

nization levels for nonwhites with 4 or more doses drops considerably, as low as 54.5 percent for OPV in 1985.

The geographical distribution of immunization levels in 1985 are presented in table 6-9. Immunization levels in central cities are substantiall$_y$ lower than in non-central-cit$_y$ regions for both preschool age and school-entr$_y$ age children. In 1985, 31 percent of preschoolers living in central cities were not adequatel$_y$ immunized against polio; 30 percent against mumps. Almost one-fifth of 5- to 6-year-old children living in central cities have not received three or more doses of polio vaccine, the minimally acceptable level for immunity. Nearly two-fifths of that group have not received the optimal four or more doses of polio vaccine. Many illegal aliens living in central cities are unimmunized (287). The Immigration Reform and Control Act of 1986 (Public Law 99-603) may bring these children into the public health system and improve immunization levels in central cities.

Table 6-9.— Percentage of 1- to 4-Year-Olds and 5- to 6-Year-Olds Immunized by Place of Residence, 1985

Vaccine	Percentage immunized in SMSAs: Central cities	Other SMSA areas	Percentage immunized in non-SMSA areas
1. ***to 4-year-olds:***			
Polio (3+ doses)	68.9%	79,6 0/,	75,9 "/0
DTP (3+ doses), ...	79.6	89.7	88,6
Measles[a].	73.5	76,7	79,0
Mumps[a]	70.5	76.8	77.0
Rubella[a]	70.4	75.0	74.6
5- to ***6-year-olds:***			
Polio (3+ doses)	81.6 **0/0**	91.0 "/0	86.70/o
Polio (4+ doses)	63.8	***74.2***	72,4
DTP (3+ doses), ...	87.5	***96.5***	93,5
DTP (4+ doses), ...	77.1	***88.5***	86.0
Measles[a]. ., ...	81.6	***90.7***	91,2
Mumps[a]	81.4	90.6	90,7
Rubella[a]	75.0	88.7	85.9

Abbreviations: DTP diphtheria tetanus, and pertussis vaccine SMSA Standard Metropolitan Statistical Area
[a]Measles mumps and rubella levels are not Identical because some States do not require vaccination against mum Ps and or rubella

SOURCE U S Department of Health and Human Services Public Health Service Centers for Disease Control u npublished data from the U S Immunization Survey 19791986 Atlanta GA, 1987

The lower levels of immunization in central cities indicate a higher susceptibility to outbreaks of vaccine-preventable diseases. New York City experienced outbreaks of rubella each spring from 1983 to 1985. There were 184 cases reported for 1985 (691). In the first 6 months of 1986, there were 80 outbreaks of measles, the largest occurring in New York City (688). Despite the high overall levels of immunization in the United States, there is a need to close the gap in levels between central cities and non-central cities to better control vaccine-preventable childhood diseases.

CONCLUSIONS

Of the components of well-child care examined in this chapter, immunization is the one proven to be cost-effective and cost-saving. A schedule of well-child care visits that corresponds to at least the recommended schedule for childhood immunization, therefore, is cost-effective and probably cost-saving. Such a schedule would include only 7 well-child care visits for normal infants and children in the first 6 years of life rather than the 13 visits currently recommended by AAP.

Whether more well-child care visits than the number required for childhood immunizations would be cost-effective is unknown, because researchers have yet to be able to document the effectiveness of the nonimmunization aspects of well-child care in terms of improved health outcomes. To formulate recommended schedules of well-child care visits, AAP and other recommending bodies have relied on expert opinion regarding the effectiveness of nonimmunization components of well-child care (284). It may be that well-child care has but a modest effect on health outcomes that is undetectable by the research designs employed to date. Giving a child access to a continuous source of medical care and providing support and reassurance for families of young children are proposed as benefits of well-child care. In the absence of clearer evidence regarding the effects of the nonimmunization aspects of well-child care on children's health outcomes, the effects of these factors on children's health are difficult to evaluate. Consequently, decisions regarding the appropriate number of well-child visits requires consideration of both the objective and subjective factors,