ACUTE ILLNESS IN DAY CARE: HOW MUCH DOES IT COST?*

RON HASKINS, PH.D.
Committee on Ways and Means
United States House of Representatives
Washington, D.C.

PRESCHOOL children attending day care have more acute illnesses than children reared at home. This excess illness imposes costs on both families and society. Worse, at least some of these illnesses may be preventable. My task is to support these assertions and to suggest modest steps that would both make day care safer for children and save families and the economy money.

DAY CARE AND ACUTE ILLNESS

The table summarizes the state of evidence on the link between day care attendance and increased incidence of respiratory conditions, gastrointestinal conditions, hepatitis A, meningitis, and cytomegalovirus. Entries in each cell represent the strength of data linking day care attendance with excess illness in children, in day care staff members, and in household contacts of children attending day care.

A table similar to this one was first developed in 1986 when Jonathan Kotch and I reviewed the literature on illness and day care and published the results of our review in a *Pediatrics* monograph.[1] Since that time several studies and reviews have been published that are consistent with the conclusions summarized in the table.[2–4] Indeed, three studies—one published,[2] one in press,[46] and one in preparation (see below)—actually required me to upgrade the association between day care attendance and the incidence of respiratory illness.

In the first study Fleming and his colleagues at the Centers for Disease Control in Atlanta conducted a random sample survey of households in the Atlanta area.[2] Of the 3,952 households surveyed, 487 contained at least one child under age five. About 450 (92%) of these provided the researchers with complete information on day care history, demographic and socioeconomic

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STRENGTH OF EVIDENCE LINKING DAY CARE WITH FIVE ILLNESSES IN CHILDREN, STAFF, AND HOUSEHOLD CONTACTS[1]

Illness category	*Groups at risk*		
	Children	*Staff*	*Household contacts*
Respiratory	Strong	Moderate	Weak
Gastrointestinal	Strong	Strong	Strong
Hepatitis A	Strong	Strong	Strong
Meningitis	Strong	Weak	Moderate
Cytomegalovirus	Moderate	Moderate	Weak

characteristics, maternal smoking history, and respiratory illnesses within the previous two weeks.

Several results are of interest. First, upper respiratory tract infections were reported in 32% of the children attending day care as compared with 21% of those not attending—an illness rate elevated by more than 50% among children in day care. The authors also used regression techniques to examine the relative impact of various risk factors on upper respiratory tract infections. Of the risk factors examined, day care attendance and maternal smoking were significant, while family income, number of children less than five, and race were not. Child's age, while not significant by itself, modified the effect of crowding on these infections: living in crowded conditions (more than one person per room) was associated with increased rates of infection in children younger but not older than 36 months.

Results for ear infections were more complex. Here both age of children and full-time versus part-time attendance in day care were significant in determining incidence. For all children, the incidence of ear infection was about 5% for children not attending day care as compared with nearly 12% for children attending day care for at least 40 hours per week. For children under 36 months of age the respective figures were 7% and 18%.

Because their study was based on population data, and because they obtained information on many probable etiologic agents, the authors were able to estimate the fraction of disease occurrence in the entire population attributable to several etiologic agents—including day care attendance. They first computed the etiologic fraction for exposed groups by taking the difference in probability of occurrence between children exposed and not exposed to the agent and dividing by the probability of occurrence in children exposed. In computing this measure for day care attendance, the authors were able to adjust their illness estimates for the effects of other variables (e.g., maternal smoking and age) shown to have an impact on disease occurrence.

About 31% of upper respiratory infections among children under age five in day care were attributable to day care attendance. For ear infections, the etiologic fraction was a striking 66%. Next, because the authors knew the fraction of children attending day care, they were able to estimate the incidence of all upper respiratory disease in the study area directly attributable to day care attendance. These calculations showed that about 10% of all upper respiratory and 12% of all ear infections in the Atlanta area during the study period were attributable to day care attendance.

The second study[46] was conducted using data from the Child Health Supplement of the National Health Interview Survey. Started in 1981, the survey collected health data on about 41,000 households that included 15,416 children, about 5,500 of whom were under age five. Parents were asked to report any medicated respiratory illness that had occurred in the previous two weeks. Parents were also asked whether their child was in day care and if so to describe the day care arrangements.

Presser found that about 30% of the children were reported to have had a medicated respiratory illness during the previous two weeks. However, the rates for children reared at home, in a day care home, or in a center were 25.5%, 34.5%, and 38.5%, respectively. Children in day care, then, were about 40% more likely to have a medicated respiratory illness than children reared at home. More sophisticated analyses of the data showed that, for every age group, children attending day care were significantly more likely to be ill, but that the difference between centers and homes was significant only for children under age three, with children in centers having the higher rate. When statistical procedures were used to control for preexisting differences in age, sex, race, and family income between children staying at home and those in day care, the effect of day care attendance on elevated rates of illness remained strong and significant.

Because this study is based on a nationally representative sample and employed sophisticated methods of data analysis, it would appear to justify a nearly definitive conclusion that day care increases respiratory illness in children under age five.

But if additional evidence is needed to confirm this conclusion, such evidence will soon be forthcoming from the Centers for Disease Control; (E. Hurwitz, personal communication, August 22, 1988). In 1987 the Harris polling organization surveyed more than 28,000 randomly-selected households with children under five years old. As in the National Health Interview Survey, parents were asked about respiratory illnesses during the previous two weeks. Although the results are just now being analyzed, it is already

known that about 20% of children reared exclusively at home, as compared with about 30% of children attending day care outside the home, had a respiratory illness in the previous two weeks. Further analyses may show that some age groups or some types of day care show reduced risk of illness. Even so, combined with results from the Atlanta study and the survey reviewed above, these data demonstrate that children below age five in day care have respiratory conditions at a rate around 40% to 50% higher than children reared at home.

More clearly than ever, the studies summarized in the table show that we have a public problem worthy of serious attention. As in all public policy problems, citizens and policymakers want to know what should be done, who should do it, and how much money government should spend trying to solve the problem.

POLICY CONSIDERATIONS

In trying to answer these and similar policy questions, analysts often try to use evidence from medical and social science research to clarify the problem and evaluate potential solutions. Although I plan to follow this approach, it seems worthwhile to begin by emphasizing four problems with the research at hand.

First, we have enough information to know that families are experiencing a problem, but there is still a lot more that would be helpful to know to formulate effective policies. Are some families more likely to experience elevated rates of illness than others? Are some types of care more risky than others? What is the role of age and age composition of children in the day care setting? Are there seasonal or geographic effects? And what costs does this problem impose on families and society?

Of these questions, perhaps cost is the most important to policymakers. In conducting research, social scientists look for statistically significant group differences or significant correlations. Their view of the world is that differences or correlations unlikely to be observed by chance tell us something about cause and effect. But statistical relations departing from chance that are the coin of the realm in social science are by no means satisfactory in public policy. Indeed, policymakers, like average citizens, have only the haziest conception of what statistical significance is. By contrast, everyone understands money and the simple financial principle that guides much of modern life: more is better. Thus, good policies are ones that save money or produce financial returns. Any policy problem that can be cast in these terms is much easier to explain and to justify both to citizen and policymakers.

The second problem with research on day care and illness is lack of nationally representative survey data. The best way to establish the frequency of a national condition, event, or problem is to conduct random sample surveys. But in the case of day care illness, unlike that of many other social problems such as teen-aged pregnancy, school dropout, crime, infant mortality, and so forth, we are just beginning to collect reliable national incidence data. For this and a variety of other reasons, determining the incidence of illness in day care is trickier than establishing the incidence of many other social problems.

In the first place, the term "day care" refers to a bewildering range of child care facilities. At the very simplest level, the day care market has three major components: day care centers, family day care homes, and sitters in the child's own home. Studies by the U.S. Bureau of the Census[5] and others[6–8] provide reliable information that we have about 8.2 million preschool children with working mothers in some form of child care, that about half of these children are cared for by parents or relatives, that about 1.9 million are in centers, and that about 3 million (including those cared for by a relative) are in family day care homes. These studies also show that the nation has about 40,000 centers and perhaps 1.5 million day care homes.

In addition to showing the diversity of the day care market, these studies suggest that discovering the effects of day care will be a difficult undertaking. Several studies have shown that centers and homes might have very different impacts on children.[9] Thus, to estimate day care effects it is necessary to have a representative sample of these various types of care. So far, this enterprise has proved difficult or even impossible because at least 80% of family day care homes, containing perhaps 30% of the preschool children whose mothers work, are not licensed and are therefore difficult to locate for purposes of sampling or data collection.

The Centers for Disease Control has occasionally responded to this problem by trying to survey all centers in a particular county,[10] but this valiant attempt to estimate prevalence shows how formidable the problems of a national survey would be. This is especially the case since the Centers for Disease Control surveyed only centers; yet nearly 40% of America's children with working mothers are in family day care homes, which are about 35 times as numerous as centers.

Another methodological difficulty is that even if good data on illness in the various types of day care settings were at hand, it would still be difficult to establish base rates among children reared exclusively at home. Unless we are to rely on parents both to record symptoms and to diagnose acute ill-

nesses, children reared at home must be visited on a periodic basis by medical personnel. To my knowledge, the major attempt to perform this daunting task was the Cleveland Family Study.[11] Given that many acute illnesses vary greatly in incidence across geographical regions of the country, a national sample of illnesses in home-reared children would be essential for estimating prevalence. The Cleveland Family Study, in short, was much simpler than the national study needed to establish base rates of acute illness among children reared at home.

These difficulties lead me to conclude that we are unlikely to have extensive survey information on the rate and variety of illnesses in homes and day care facilities for many years. We do, however, have a growing number of small-scale studies and a few survey studies, all on limited geographic areas or single acute illnesses. These studies may not yield an accurate estimate of the impact of day care on rates of acute illness for the nation, but if many studies show the same general effects, we can at least reach worthwhile conclusions.

The third status condition on day care and illness research concerns knowledge about treatments that might be expected to reduce illness. The most useful research for public policy, like the best basic research, is experimental. A surprising number of policymakers have come to appreciate the conventional wisdom that a statistically significant difference between groups randomly assigned, one of which received some experimental treatment and the other of which did not, is the most dependable type of information for both science and public policy. In any case, social scientists know that data from experiments are the only data truly decisive in establishing effects.

Unfortunately, as is so often the case in public policy, we have very few experimental studies of ways to reduce the introduction, spread among children, staff and household contacts, or effects of acute illness in day care.[12] Even though there is now enough information to conclude that the nation is experiencing a serious problem with acute illness in day care, policymakers might have trouble selecting good policies to attack the problem because we can tell them so little about what works. This minor inconvenience, of course, does not stop a wide variety of medical researchers, state and federal policymakers, and advocates from taking strong stands on the issue—and particularly in favor of regulations aimed at improving health among children in day care. As sensible as regulations and similar actions might appear, the purpose of a link between research and policy is to test whether particular policy actions actually have an impact, to determine the likely cost of the

policy, and to provide some gauge of the value of the effects produced by the policy.

All of which raises the fourth and most serious problem in the scientific art of applying research to day care policy. As in the case of day care and acute illness, we usually lack compelling experimental data on effects; we usually lack data on the cost of particular interventions; and we almost always lack data on the value—financial and otherwise—of benefits produced by a given intervention. And yet, if we are convinced a problem exists, if there is unnecessary human inconvenience or suffering, if children's long-term development is threatened, if families and society are losing money or, what amounts to the same thing, missing an opportunity to save money, then some type of action may be in order.

But not just any action. The first law of social policy is: Thou shalt do no harm. Some actions designed to reduce the problem of acute illness in day care could actually produce losses that exceed those currently experienced. They may not reduce illness, they may cost too much money for many parents, or they may reduce illness, but at the same time have unintended consequences that cost more than the benefit of reduced illness.

Bearing these four issues in mind, let us see whether research will help us make even a rough estimate of the costs imposed on families and society by excess illness in day care.

Costs of Excess Illness in Day Care

Extensive data on costs are not available. But, in the spirit of providing preliminary and tentative estimates to be regarded primarily as an attempt to identify the order of magnitude of the problem, we can divide costs into three parts: medical costs of treating excessive acute illness, the cost of missed work, and the cost of long-term effects that remain after the acute phase of illness has passed.

Medical costs. Studies and reviews of acute illness among children[11,13] have consistently shown that pathogens of the respiratory tract are by far the leading cause of acute illness among children. In the Cleveland Family Study, for example, children under age five had an average of seven or eight acute respiratory illnesses per year. Averaged across all ages, more than 60% of all acute illnesses were respiratory tract conditions; gastrointestinal conditions were a distant second at 16%.[11] For infants and young children, respiratory conditions constituted nearly 70% of all illnesses.

Similarly, the evidence on frequency of respiratory illnesses in day care

has been consistent since the 1920s. In the first study of illness and day care, Anderson[14] found that "colds and cough" were by far the most common cause of absences among 30 children attending preschool at the Institute of Child Welfare at the University of Minnesota. More recent studies[15] have amply confirmed this original finding.

So the cost of office visits associated with excess respiratory illness would seem to be an important cost. Keeping in mind the tentative nature of our enterprise, we can perform a few calculations that may provide a very rough estimate of the cost of pediatric visits associated with day care-induced respiratory illnesses.

To perform these estimates of illness costs, it is first necessary to estimate the number of preschool children who are involved in day care outside their own home. The Census Bureau publishes excellent national data on day care for children of working mothers. But families with working mothers are not the only ones that use day care. Many families take their preschool children to nursery school even when the mother does not work. Because most experts agree that families with a nonworking mother do not begin taking their children to nursery school until age three or four, it seems appropriate to claim that nearly all children in day care below age three have working mothers. Census Bureau[5] data for 1985 show that the total number of such children under age three in all types of out-of-home day care is about 2.7 million.

The national Center for Education Statistics[16] collects information on the number of three and four year olds attending nursery school. Combining these children with the three and four year old children of working mothers who are in family day care or day care centers (as distinguished from nursery schools), we find a total of 4.5 million older preschool children in group care arrangements. Thus, of the 18 million children under age five in 1985, a total of about 7.2 million (2.7 million plus 4.5 million) were in group care outside their homes and were therefore at risk for excess acute illness.

There are at least two ways to estimate the excess respiratory illness among these children. First, according to data from the National Ambulatory Medical Care Survey, respiratory illness resulted in about 18 million pediatric visits in 1985. In addition, there were about 32.5 million visits to general and family practitioners for respiratory disease, a number of which probably involved preschool children (T. McLemore, personal communication, August 22, 1988). Given the lack of reliable information on the age of patients making these visits, let us assume that around two thirds of the pediatric visits, or 12 million, were by preschool children. Ignoring the visits to general

and family practitioners seems likely to make our estimate of 12 million office visits for respiratory illness somewhat conservative.

The National Health Interview Survey[46] put the rate of excess respiratory tract illness at 40% greater among children in day care; the Atlanta survey by the Centers for Disease Control[2] put the excess illness rate at about 50%. Using the more conservative estimate of 40%, the following calculations can be performed. First, the mean number of physician visits per preschool child due to respiratory conditions is 12 million divided by 18.005 million children under age five or 0.667. If children not attending day care have a rate X of physician visits with respiratory complaints, children in day care have a rate of 1.4 X (because they have 40% more visits).

Given the overall rate of 0.667 physician visits per child, we can weight the probabilities of X and 1.4 X by their proportion in the population, and solve for X. This algebraic calculation reveals that X is 0.575 and 1.4 X is 0.805. The excess rate of physician visits among children in day care is therefore 0.805 minus 0.575 or 0.230 visits per child. It follows that the 7.2 million preschool children in day care had a total of 1.66 million (0.230×7.2 million) additional physician visits attributable to respiratory symptoms. If the cost of an average physician visit is put at $55 (based on data from the National Medical Care Expenditure Survey, M. Dicker, personal communication, August 22, 1988), the total cost of physician visits for excess respiratory illness among children in day care is about $90 million.

A second way to perform this estimate is simply to accept the Fleming et al.[2] calculation that about 10% of upper respiratory illness in the Atlanta area was attributable to day care attendance and to apply this estimate nationwide. Using this approach, we can calculate that the total cost of 12 million physician visits at $55 per visit is $660 million; 10% of this amount is $66 million. Thus, it seems reasonable to conclude that the cost of physician visits for upper respiratory tract illnesses attributable to day care is between about $66 and $90 million. Several million additional dollars would undoubtedly be spent on drugs.

Nor would office visits and drugs be the only medical costs associated with respiratory conditions. There is strong evidence that children in day care have excess otitis media. Bluestone[17] states that the cost of treating otitis media was estimated at $2 billion in 1980—or about $3.5 billion in 1988 medical dollars. If we make the assumption, supported by data from the Centers for Disease Control,[2] that roughly 12% of the cases of otitis media can be attributed to day care, we can estimate that treatment of acute otitis media among children in day care costs the nation another $420 million each year.

Turning to hepatitis A and meningitis, the rates are much lower, but the consequences and costs per case are more severe than in the case of diarrhea and most respiratory conditions. In 1979 Storch and his colleagues estimated that the average case of hepatitis in adults cost about $1,300 (in adjusted 1988 dollars) for treatment.[18] There are about 22,000 cases of hepatitis A in the United States each year,[19] nearly all of them in adults. If the Storch et al.[18] estimate is correct, the total medical bill would be about $29 million. Unfortunately, we do not know what portion of these costs was incurred by people exposed to a child in day care, but research is unequivocal that parents of children in day care are at increased risk for hepatitis A.

Regarding *Haemophilus influenzae* type b (Hib), Stephen Cochi and his associates at the Centers for Disease Control estimated the medical cost of treating a child with Hib meningitis at $5,590 in 1984.[20] This estimate is the basis for tentative calculations on the magnitude of medical expenses associated with excess Hib meningitis contracted in day care. Several studies have shown that the incidence rate of Hib meningitis among children under five years of age is around 60 per 100,000.[20] This attack rate translates to about 10,800 cases of Hib meningitis in 1988 among children under age five. Inflating the Cochi et al.[20] estimate of $5,590 per case for medical costs in 1984 using the Consumer Price Index for medical care[24] reveals that the per case treatment cost in 1988 was $7,320.

Epidemiologic studies by Redmond and Pichichero[21] and by Istre and his colleagues[22] found that children under age five attending day care, as compared with children under five not attending day care, were at 1.9 and 1.7 times the respective risk for contracting acute cases of Hib meningitis. Given that the overall rate of Hib meningitis infection among preschoolers is 10,800 cases divided by 18 million preschool children or 0.0006, we can calculate the excess rate for children in day care using the same alegebraic approach used with respiratory conditions above.

Based on the more conservative estimate from the Istre et al. study,[22] one can estimate that the risk of Hib meningitis among preschool children in day care is 1.7 times the risk of preschool children not in day care. Given the 1985 estimate of 7.2 million children under age five in day care and 10.8 million children not in day care (see above), we can weight the rate of Hib meningitis, X, among children not attending day care, and the weight of Hib meningitis, 1.7 X, among children attending day care by their relative frequency in the population of preschool children. Setting the sum of these two rates equal to 0.0006, and solving for X reveals that the rate of Hib meningitis among children not attending day care is 0.000469; that among children attending

day care is 0.000797. The excess rate among children attending day care is therefore 0.000328. Multiplying this excess rate by the number of children in group day care (7.2 million) produces the estimate of 2,362 cases of Hib meningitis attributable to day care attendance. Employing Cochi et al.'s[20] cost estimate of $7,320 per case, we can estimate that about $17.3 million was spent on excess Hib mengitis among children attending day care in 1985.

Nor is meningitis the only disease associated with the Hib organism; the other diseases caused by Hib include epiglottitis, pneumonia, septic arthritis, sepsis, and cellulitis. Although there is virtually no evidence on the frequency of these conditions among children in day care, it is known that acute Hib disease follows the ratio of about 1.5 for meningitis to 1 for these other diseases.[20] Thus, the $17.3 million is almost certainly an underestimate of the actual costs of medical treatment associated with excess Hib disease among children in day care.

Missed work. In addition to medical treatment, another major cost imposed on families and society by excess acute illness among children in day care is the value of missed work by parents. Parents are sometimes forced to miss work either to take care of an ill child who has been excluded from day care or because they themselves have contracted an illness from their child in day care.

Absenteeism imposes immense costs on the American economy. According to the National Center for Health Statistics, in 1983 American workers missed 99.7 million days of work.[23] Between 1983 and 1988 the labor force grew by about 7.6%;[24] if we assume that days of missed work grew at a similar rate, Americans missed 107.3 million days of work in 1988. Computed at the average daily rate of total compensation for American workers of $109.23,[24] the loss to the economy caused by missed work was about $11.7 billion in 1988.

Of course, it is not known what portion of this sum was attributable to illness associated with day care. Even so, some rudimentary calculations might be attempted. Let us begin with the simplifying assumption that when children are sick, it is mothers rather than fathers who stay home from work to take care of them. Although men may occasionally stay home with sick children, and although there appear to be no survey data on the issue, I will assume that mothers stay home in all cases both because of traditional practice in American families and because in most two-earner families, the biggest paycheck is earned by men. Census Bureau data show that the average wage of working women is about $60 per day.[24] Thus, each day the average mother misses work to take care of a child or because she herself is ill, we can

estimate that the economy loses about $432 million (7.2 million children in out-of-home care multiplied by $60 per day).

Unfortunately, we do not know how many days the average mother stays home to care for an ill child or because she herself is sick with a day care-associated illness. It seems apparent that a reasonable approach to estimating missed work must account for a continuum of probability that a given illness results in a child staying home. On one end of the continuum, children with slightly runny noses would probably continue attending most day care facilities. Most parents are not alarmed by runny noses—children under age two are likely to have this symptom up to eight times a year[11] and most child care facilities will accept children when they show only mild symptoms of acute illness.

Confirmed cases of hepatitis A and meningitis are on the other end of the continuum. Neither parents nor day care facilities would be likely to want these children in care outside their own homes. Somewhere close to this end of the continuum we have children with elevated temperatures accompanied by very runny noses and difficult breathing or severe diarrhea. Most cases of illness or of illness symptoms probably fall between these extremes. In these intermediate cases, the variables that influence whether the child stays home include the parents' work load, the parents' attitudes about illness, the child's illness history, and the day care facility's policy on admitting children with symptoms. Recent research,[25] to be discussed in greater detail below, shows that day care providers are much more conservative about requiring ill children to stay home than either parents or pediatricians.

The evidence summarized in the table shows that children in day care have elevated frequencies of respiratory illness, diarrhea, hepatitis A, and meningitis. Given that the incidence of hepatitis A and meningitis is very low, these can be expected to make only a minor contribution to missed work. Respiratory illnesses, however, were shown by Dingle and his associates[11] to average seven or eight cases per year through age four. If, as suggested by several studies reviewed above, day care attendance is associated with a 40% to 50% increase in respiratory disease among preschool children, we can expect children in group care to have three or four additional cases per year. Given that these cases and their associated symptoms would typically last for longer than one day, it seems conservative to estimate that mothers miss an average of two days of work per year because of respiratory disease. Nor does this estimate include any accounting of missed work because the mother herself is afflicted with a day care-associated illness.

It seems certain that mothers also miss work because of excess diarrhea caused by day care. In this case, however, the average prevalence of disease

among children is much lower, averaging perhaps one or two cases per year.[11] In addition, the evidence on rates of increased diarrhea caused by attending day care is less precise. Given these two considerations, it seems unlikely that missed work associated with diarrhea exceeds an average of one day per year.

These rough calculations provide mild support for the conclusion that the average mother misses three days of work per year because of excess illness caused by attending day care. At $432 million per day, we can conclude that such illnesses cost the economy at least $1.3 billion per year in missed work. Some of this loss would also be experienced by families. Only about 70% of the employees of medium and large firms have paid sick leave;[24] small firms, where a disproportionate number of women work, probably have even lower rates of coverage of sick leave. Many mothers, then, lose money when they are forced to care for ill children or when they themselves are ill.

Long-Term costs. A number of acute illnesses produce sequelae that carry substantial costs in medical care, special treatment programs, or lost productivity. For diarrhea, hepatitis A, and most respiratory illnesses, the long-term costs are probably negligible. In any case, if there are long-term costs, they have not yet been carefully studied.[1]

But there are significant long-term costs associated with otitis media, cytomegalovirus, and meningitis. The potential long-term costs of otitis media are somewhat controversial,[26] but well-designed studies have linked repeated cases of otitis media during childhood with hearing loss, lowered IQ, poor school performance, learning disabilities, and even school dropout.[27–29] There is very strong evidence linking day care with otitis media in the Scandinavian countries,[30] and the evidence is growing here in the United States.[2,31] If these claims of long-term effects of otitis media turn out to be correct, otitis media may contribute rather heavily to the day care medical bill.

Though lack of solid information prevents a reasonable estimate of these costs, we can at least review the types of costs that seem likely. First, if otitis media does lead to reduced hearing acuity and in turn to poor speech development and lower school achievement, most school systems or parents will attempt to provide compensatory services. Whether provided privately or through the public schools, the costs of such special services are likely to be substantial. Even the relatively cheap special education offered in the public schools averages about $3,300 above the costs of regular education in 1987 dollars.[32]

If the long-term effects include reduced academic performance and school dropout, we might also find substantial impacts on lifetime earnings. Ameri-

can workers with high school degrees earn salaries about 50% higher than workers without high school degrees. This difference in earnings amounts to several hundred thousand dollars over the course of a lifetime.[33] If otitis media does lead to reductions in educational achievement, the resulting costs in the form of reduced productivity and earnings would add substantially to the costs of treatment, and indeed would in all probability exceed them.

In turning to meningitis, we have a great deal more evidence to go on. First, the case-fatality rate for Hib meningitis in children under age five is about 5%.[20] If our estimate of about 2,350 cases of Hib meningitis due to day care is correct (see above), then well over 100 deaths per year would be attributable to day care.

In addition, studies show that about 30% of the children who survive Hib meningitis have some type of sequelae.[34–36] These sequelae include brain damage, blindness, deafness, and lowered school achievement. Cochi and his colleagues[20] have estimated that 7% of children with Hib meningitis require long-term care, at an average cost of $185,000 per case, because of severe neurological complications. They have also estimated that about 20% of the survivors have milder problems that include retarded school performance. If these children require special education, the costs can be expected to exceed $3,300 per year in 1988 dollars.[32] To be conservative, we might estimate that the 20% of children with milder sequelae would need special education for only half their 12 years of public schooling. Following this assumption, the long-term educational cost for children with mild long-term effects of Hib meningitis would be about $20,000 per case.

Again using our previous estimate of about 2,350 cases of Hib meningitis attributable to day care, we can calculate that the cost of long-term treatment for the severely neurologically impaired and the more mildly handicapped would be nearly $40 million.

Cytomegalovirus (CMV) is a condition more prevalent among mothers of children attending day care[37,38] and that definitely produces long-term costs.[1] Women without antibodies to CMV at the outset of pregnancy can acquire the virus during pregnancy and deliver congenitally infected infants. About 1% of women without antibodies contract the virus during pregnancy, and around 40% of these women will give birth to infected infants. Assuming that about 40% of American women of childbearing age are without antibodies at the beginning of pregnancy, it can be calculated that approximately 18 of every 100,000 infants will have clinically apparent sequelae as a result of CMV infection.

Several studies have shown that the most serious form of CMV, called cytomegalic inclusion disease, produces a death rate approaching 25%;

among surviving infants, more than 30% have serious hearing loss, more than 60% show some degree of mental retardation, and nearly 90% will be affected in one of these three ways. Even for CMV-infected infants fortunate enough to avoid cytomegalic inclusion disease, many will show milder symptoms that can still lead to long-term complications. Among this group, the death rate is about 1%, hearing loss is about 16%, and mental retardation is about 8%.[1]

Needless to say, hearing loss and mental retardation usually have a major impact on productivity and lifetime earnings. In addition, both can cause substantial expenditures on treatment and rehabilitation. There is, in short, no doubt that CMV causes very substantial long-term costs for many of its victims.

Unfortunately, given the evidence currently available, it is not possible to estimate the impact of day care attendance on the frequency of CMV. Without this piece of information, any estimate of long-term costs would be mere speculation.

Prudence forces us to confine the estimates of long-term costs to Hib meningitis. The resulting estimate of $40 million can be added to the growing ledger of costs imposed on families and society by excess illness in day care. But this modest sum is notable more for what it does not include than for what it does include. Long-term costs associated with otitis media and CMV have been entirely ignored because there is no way they can be responsibly estimated with the information at hand. In the case of otitis media, there is a basis for estimating excess acute illness associated with day care, but no reliable information on what percentage of acute cases lead to long-term effects, little good information on what these effects might be, and even less information on what costs these effects might entail.

By contrast, there is information to predict the percentage of CMV cases that demonstrate clinically apparent sequelae, and some costs could be attached to many of these sequelae. However, it is not possible to estimate the number of excess cases of CMV associated with day care. But if the Pass et al.[37,38] studies are correct, there are a fairly substantial number of day care-caused cases.

In addition to completely ignoring long-term costs associated with otitis media and CMV, the economic costs of deaths associated with day care illness have not been estimated. I shall not attempt to put any precise estimate on the value of these lives, but economists sometimes estimate the value of averted deaths by calculating the expected lifetime earnings of individuals whose deaths were avoided. Ignoring the effect of inflation, the expected lifetime earnings of the average American male are well over $1 million, with

the average female earning around half that amount.[39] If our calculations are correct, there are about 100 deaths per year associated with excess Hib disease in day care; in addition, there may be excess deaths caused by CMV and a few by hepatitis A and diarrhea.

Nor do the calculations of long-term costs presented above include any estimate of nonmeningitis Hib disease. There is a fairly consistent agreement that meningitis constitutes only about 60% to 65% of the disease caused by the Hib organism. Some of these other conditions have death rates nearly identical to Hib meningitis, and many lead to long-term sequelae.[20]

Finally, no estimate of the value of missed work associated with long-term effects has been attempted. Parents would miss work taking their afflicted children for treatment or providing care during periods of relapse. To this cost must be added the work missed by the children themselves when grown up; as adults they could miss work either to continue treatment or because of the higher rates of acute illness among the disabled.

In short, the estimate of $40 million in long-term costs associated with day care is exceedingly moderate. The true figure is undoubtedly much higher.

Summary of costs. Adding together all the costs that could be reasonably estimated shows that excess day care illness imposes at least $1.8 billion per year in costs on American families and society. In reflecting on this figure, three considerations should be kept in mind. The first is that in every case when presented with a choice between higher and lower estimates, I chose the lower. Similarly, especially regarding long-term costs, many entirely plausible costs have been entirely ignored because data allowing even rough estimates are not at hand.

Second, I do not interpret these figures as cause for alarm or as supporting the case that children should not attend day care. Substantial though these costs might be, they are completely overwhelmed by the economic contribution of mothers who can join the labor force only if someone else cares for their children. Confining our attention to the mothers of the 7.2 million preschool children in out-of-home care, and estimating their average income at only 50% of median female income (because many work part-time and mothers with young children tend to be younger and therefore earn relatively less money), the total economic contribution of these mothers in 1985 was about $45 billion. Any policy designed to keep mothers out of the work force could well end up imposing very substantial costs on the rest of society. Nor could one easily justify the implied crowding of individual choice implied by such government policies.

Third, given both the value that economic choice by mothers is important and the clear fact that mothers' economic contribution to the rest of society is

immense, I take some pains to enumerate the costs of illness and day care to persuade analysts and policymakers that we have a problem, that it does impose costs on families and society, and that everybody would be better off if we could do something to reduce this excess illness.

POLICIES TO REDUCE ILLNESS IN DAY CARE

But what can be done to reduce illness in day care? In evaluating public policy solutions, I begin by putting my values out in the open where they can be taken into account and, if necessary, disputed by others. Policy analysis is mostly values and politics, with a little science thrown in. Beyond simply denying that this analysis is based on anything but science and logic, I wish to frankly state the values that drive much of what follows.

Begin with public and private responsibilities. This distinction is at the heart of the difference between liberals and conservatives on most social policy issues. Given that I currently work for Republicans on the Ways and Means Committee in the U.S. House of Representatives, I shall blame my employers for the relatively conservative stance I adopt on the matters of public and private responsibility.

We must avoid the temptation to which we have capitulated in designing our public schools; namely, the temptation to overprofessionalize, to tell parents professionals are taking care of all the problems. Just pay your taxes, support the schools when bond issues are passed, and help supervise the kids on field trips; then leave the rest to professionals.

In my view, this is the wrong approach to take with day care. Whatever we do, the primary responsibility for the health and safety of children in day care must remain with parents. All disciplines should send the same basic messages to parents: It's your child, it's your responsibility; you must be the central part of the solution; you are responsible for picking the right day care setting; you must be vigilant to make sure providers are doing all they can; you must insure that good health practices are followed. This view may be considered idealistic in some quarters, but I think citizen involvement is the bedrock of American social policy.

Neither government nor families are entirely responsible for children's well being. The question is, where does family responsibility end and government responsibility begin? My point is that in addressing the issue of excess acute illness in day care or other equally serious day care issues we do not want to give major responsibility for the child to professionals. Over the decades, government has gradually assumed many of the traditional responsibilities of families: general education, welfare, care of the aged, moral development, sex education—all are now accomplished at least in part by

government programs. In drawing the line dividing parent responsibility from government responsibility for day care, we should keep the line as close as possible to the parental end of the continuum.

GOVERNMENT ROLE

Federal responsibilities. The federal government already provides a surprising amount of support for day care. As is the case for many social policies, the major role of the federal government is funding. In 1988 federal spending on day care reached nearly $7 billion. According to the Census Bureau,[5] total spending on day care in 1985 (in 1988 dollars) was about $12 billion. It is difficult to determine how much of the federal funding is included in the $12 billion figure, but an educated guess is that a very substantial portion of it is. For example, Census Bureau data are based essentially on interviews in which people are asked to tell how much per week or month they spend on day care. But the biggest single federal expenditure on day care, amounting to about $4 billion in 1988, is to reimburse some of this spending through the Dependent Care Tax Credit. However, because this reimbursement is a tax credit claimed on annual tax returns, it seems doubtful that, when asked how much they spend on care, most people would do the mental calculation necessary to subtract the amount they will receive back from the credit at the end of the year. In short, there is some double counting in the estimate of federal spending and total spending on day care.

Even so, let us assume that 75% of federal spending, or about $5.2 billion, is independent of the Census Bureau estimate of $12 billion spent on day care in 1988. This assumption puts total national spending at $17.2 billion, of which $7 billion, or more than 40%, is federal spending. These figures, rough though they may be, show that the federal role in funding day care is very substantial.

A second federal role in day care is subsidizing research. There is virtually no debate about this role. Most people believe that research is something that helps all states and most citizens; therefore, it seems quite appropriate for the federal government to pay some of the costs. No one has produced an estimate of how much the federal government spends on day care research, but there is little question that most day care research is funded with federal dollars. Virtually all the survey studies mentioned above were paid for with federal funds. In addition, a substantial fraction of the studies on day care and illness was supported by federal dollars.

Despite the fact that federal funding of research is already substantial, I

think there is a strong case for spending additional money over the next five years or so. More specifically, the federal government should fund studies using national probability samples to get good estimates of the frequency of the acute illnesses discussed above. These studies should be designed in such a way as to produce information on whether rates vary by type of day care setting, geographical region, ethnic and socioeconomic status of the families with children in care, and age of children.

The federal government should also play the major role in producing a more accurate description of the problems with acute illness in day care. Here it is especially necessary to obtain information on the spread of illness in day care, among household contacts, and even in the local community. Additional information is also needed about missed work and how parents cope when they have an ill child. Such information will permit a much more precise estimate of the costs associated with day care illnesses.

In addition, experimental research on the effects of various interventions are in order. At least one experimental study has shown that hand washing by staff and children has a major impact on spread of diarrhea.[12] Additional studies are needed on treatment of acute illness including the use of rifampin in meningitis, the effect of excluding ill children from centers and day care homes, and the use of isolation of ill children within the center. It might also prove revealing to trace the frequency and types of illness suffered by children with varying amounts of day care experience once they enter the public schools. Finally, research on interventions should include studies of the use of video materials and other approaches to staff training in recognizing and treating illness.

Yet another federal role is providing up-to-date information on what is known about illness in day care, and about recommended procedures for preventing and treating the various acute conditions. The Centers for Disease Control has formed a group called the Child Day Care Infectious Disease Study Group that has produced at least one excellent summary paper.[49] The Centers for Disease Control[41] also produced a superb training kit entitled "Stop Disease in Child Day Care Centers." The kit included separate handbooks for center directors, caregivers, and parents telling them what to do to keep children healthy. One hopes that the Study Group will periodically update these materials and make them available free to any facility, organization, or person interested in day care. Public Health Departments should be encouraged to play an active role in distributing these materials.

State government. State government should, and in many cases already

does, perform a range of functions to support day care. In our federal system of government, many important public responsibilities are given by tradition to state government. The most important role state governments have played in day care is licensing.

The general view on division of governmental responsibility is that when local economic conditions, housing, history, demography, culture, and similar factors have a direct bearing on a given public problem, public attempts to attack the problem should be directed primarily from the state and local level. This guideline is not followed by American government in any slavish way, but the regulation of day care facilities has never taken place at the federal level, and all states now have written regulations that apply to day care centers, and all but four states have written regulations for family day care homes.[47] In addition, nearly all centers and many day care homes must conform to local zoning and safety codes.

States currently regulate a wide variety of health-related conditions in day care. Some of the regulations, such as physical examinations, immunizations, health training, handwashing, diaper disposal, exclusion from care and isolation in the facility during acute illness, and daily health inspections, apply to children and staff; and some, such as the number of toilets, sanitary requirements, standards for play equipment, and presence of fire alarms and extinguishers apply to the physical facility.

Unfortunately, there appears to be little evidence that these seemingly reasonable measures produce effects. But the justification for regulations is not exclusively or even primarily evidence that they produce benefits. Rather, most state and local regulations are based on traditional practice, expert opinion, or consensus among groups with interest at stake.

Let us briefly examine information on four specific regulatory provisions that are thought to prevent or reduce the spread of acute illness in day care. A physical examination of children entering or enrolled in day care is now required by nearly 80% of the states. The most frequently cited reason for physical examinations seems to be that they have value in revealing acute illnesses or progressive physical conditions. However, research shows that routine examinations are not very useful for discovering previously unsuspected conditions of either type.[43] On the other hand, periodic screening, especially of children from low-income families, often reveals sensory, dental, and hematologic disorders, most of which are treatable. Most authorities believe that these advantages of periodic exams more than justify the costs,[1] but one would be hard put to show how physical examinations will reduce the

frequency of the acute illnesses examined here. In short, the rationale for physical examination has little to do with acute illness, nor can the requirement be expected to have much of an impact on the frequency or spread of acute illness.

By contrast, the evidence that immunizations produce health benefits in children is overwhelming.[42] Diphtheria, pertussis, tetanus, and poliomyelitis can be virtually eliminated by a series of immunizations plus boosters administered during the preschool years. Measles, mumps, and rubella can be controlled by a single immunization. Despite the impressive effects of immunizations, a large number of preschool children do not receive the complete set of immunizations. By requiring evidence of immunizations and by using available federal programs to pay for the immunizations of poor children, states can play an important role in promoting the health of preschool children. On the other hand, immunizations cannot be expected to play a role in controlling the acute illnesses reviewed here.

Nearly half the states have regulations that require exclusion from day care of ill children with a communicable disease.[1] Though it seems reasonable to exclude children with a communicable disease, this practice is open to serious doubt. First, nearly all the infectious conditions discussed above are communicated by children before they show symptoms and after symptoms recede. Although removing symptomatic children may slightly reduce the probability of spreading the contagious agent among other children, there is no evidence that the reduction is enough to reduce the spread of the offending pathogen and the subsequent acute condition among classmates. Parents, siblings, household visitors, and neighborhood friends may be at least as important in exposing children to pathogens as their preschool classmates. Loda and his colleagues,[15] for example, found that respiratory illness in day care reflected the respiratory illnesses occurring in the general community in epidemicity, age occurrence, and illness expression.

At least three studies have examined the effect of excluding ill children from day care. Loda et al.,[15] Hesselvik,[44] and Strangert[45] all reported either minor or no effects on respiratory symptoms of excluding ill children or allowing ill children to continue attending day care. Against this lack of evidence for benefits of exclusion, we can be certain there are costs. Excluding ill children constitutes a major hardship for working families, especially single-parent mothers. Given that children often have as many as eight cases of respiratory disease and one or two cases of diarrhea each year, a strict exclusion policy would require several days of missed work per year by

parents. As a result, billions of dollars of losses due to reduced productivity would be imposed on the economy, and at least some of the loss would also come out of the pocketbooks of the families themselves.

Certainly, the case of certain costs and uncertain benefits should convince states to provide local day care facilities with flexibility about whether to exclude ill children. A statewide policy requiring exclusion seems difficult to justify.

Hand washing by staff and children to prevent spread of pathogens constitutes an entirely different policy problem. Conventional practice, expert opinion, and research[3,12] are consistent in supporting the effectiveness of hand washing. Unlike most of the other regulatory issues discussed here, there is no doubt that hand washing is exceedingly effective in reducing the spread of illness, particularly diarrhea.

However, to be most effective, children and staff must wash after toilet use, and staff must also wash after diapering and all other occasions of contact with children's bodily fluids. Parents know how difficult it is to persuade children to wash their hands; imagine insuring that 40 to 50 or more children wash their hands after each use of the toilet. Similarly, busy staff members do not always take the time needed to wash thoroughly after coming into contact with children's excretions.

The policy problem here is how to persuade children and adults to do something they know is good practice but often avoid because of the tedium involved. Some may think that strict regulations effectively address this problem; others believe that education and repeated reminders and admonishments are more effective. At the moment, however, there is little evidence on which to choose among these or other approaches to enforcing a technique that is known to be effective.

Parents are the key. Despite all that government and professionals can do to improve the health of children in day care, we must expect the effects to be marginal. In a market with more than 1.5 million outlets, most of which are unknown to government, we should expect only modest success from government initiatives.

All the more reason, then, why parents must remain the first line of defense in maintaining the health of children in day care. Effectively to fulfill this responsibility, parents need three things. First, all states should have regulations giving parents unlimited rights to observe in day care facilities. Any attempts by day care operators to obstruct parents' right to obtain information about the actual child care provided by the facility should result in stiff penalties (fines for first offenses; temporary closure for second and subsequent offenses).

Second, parents need information about what to look for in good day care. More specifically, they need written information about potential health hazards, such as that provided by the Centers for Disease Control[41] and by any number of popular books, magazines, and newspaper articles. They also need information about the day care available at the local level. This information should be provided by local clearinghouses that are supported by state, local, and private dollars. Federal money should be available for two or three years to start local organizations that provide day care information.

Third, the voice of parents in market regulation can be effective only if parents can vote with their feet by rejecting care that does not meet their expectations. In a market with the diversity and quantity that characterizes the American day care market, parents with sufficient money can effectively exercise their right to select quality. Unfortunately, as is often the case in our society, low-income families often do not have enough money to vote with their feet in the day care market. Thus, current federal programs must focus their money on low-income parents. If the billion or so dollars now going to parents with incomes over $50,000 through the Dependent Care Tax Credit were to be refocused on parents with incomes below $20,000, and if the credit were made refundable for the many low-income parents who do not pay any taxes (and hence cannot receive support from a tax credit), the ability of low-income parents to afford good care would be increased.

In formulating social policies, Americans tend to be impatient. The day care market has grown up gradually over many decades and, like all markets, is controlled in part by the profit motive. In addition, unlike most markets, substantial portions of the day care market are influenced by the desire to serve families and children. Even so, the central fact of the day care market is diversity and independence. Given this situation, there is no way that any quick solutions can be imposed by government or any other organization. Rather, market changes must be nurtured over many years. My bet is that the best and least intrusive way to effect improvement is through the joint efforts of government and parents, with parents retaining the major role of informed consumers selecting the best care they can afford.

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