Publ. Hlth, Lond. (1985) **99**, 142–145

Evaluating Water Supply and Other Health Programs: Short-Run *vs* Long-Run Mortality Effects

John Briscoe

Ph.D., P.E.
Assistant Professor

Department of Environmental Sciences and Engineering, School of Public Health, University of North Carolina at Chapel Hill, NC 27514 U.S.A.

Development agencies use "cost-effectiveness" analyses for setting priorities among Primary Health Care programs, with "effectiveness" often measured by the short-term impact on young-child mortality. Using data on the long-term effects of water supply and sanitation improvements on mortality in urban France in the 19th century, it is shown that use of this criterion introduces systematic and serious biases in favour of specific medical interventions and against systemic environmental interventions.

Background

Health planners in developing countries face difficult decisions in allocating scarce resources among competing health programs. To assist planners in making rational decisions, the use of "cost-effectiveness" analysis has been advocated. Since the health problems of young children are considered most serious and most amenable to change, the most common measure of effectiveness used by international agencies (including USAID,[1] UNICEF[2] and WHO[3]) is "infant deaths averted".

A particular, although by no means the only[4, 5], concern with the methodology is that the "cost-effective" interventions are largely medical programs which have immediate impacts on mortality of young children (including DPT vaccinations, treatment for febrile malaria, ORT and tetanus toxoid for mothers), while more systemic interventions which have cumulative effects on mortality and morbidity of all age groups (such as water supply and sanitation) are excluded as being "not cost-effective".[6] A major problem in analyzing this concern is that it has generally been accepted that data on the "long-run" effects of systemic interventions are impossible to collect.

Data

In a remarkable study of the determinants of urban French mortality, Preston and van de Walle[7] make a cogent case for attributing all mortality declines in Lyon in the latter half of the 19th century to improvements which took place in the 1850s in water supply and sanitation conditions. The age-specific mortality rates for Lyon (presented for the 30 years prior to 1845 and for four 15-year periods after 1845) (Table 1) therefore provide data for comparing the "short-term" and "long-term" effects of the improvements on a variety of mortality measures.

0033-3506/85/030142+04 $02.00/0

TABLE 1: Age and cohort patterns of declining death rates in Lyon, France (after Preston and van de Walle)

Age (years)	Average $_5q_x$ in interval 1816–45 ($\times$ 10,000)	Ratio, average value of $_nq_x$ in period to that in 1816–45			
		1846–60	1861–74	1875–90	1891–1905
5–19	643	0·845	0·644	0·565	0·376
20–34	616	0·936	0·945	0·752	0·628
35–49	710	0·929	0·938	0·817	0·747
50–64	1344	1·035	1·018	0·903	0·899
65–79	3606	1·144	1·069	1·061	1·076

Note: $_nq_x$ is the probability of dying between age n and age $x+n$.

TABLE 2. The effect of different interventions on short- and long-term mortality

	Intervention type (%):			Impact of B
	None	Type A	Type B	Impact of A
Deaths averted in youngest age group:				
(i) In initial 15-year period	0	15·5	15·5	1·00
(ii) In fourth 15-year period	0	15·5	62·4	4·03
Life expectancy of cohort:				
(a) born in the first period following intervention:				
(i) Assuming that age-specific mortality rates have stabilized 15 years after the intervention	100·0	102·7	103·7	1·37
(ii) Using true mortality rates experienced by the cohort	100·0	102·7	105·4	2·00
(b) born in the last (4th) 15-year period, assuming that mortality rates have stabilized	100·0	102·7	118·7	6·93

Analysis

Based on the data in Table 1, the effects of two different types of health interventions were simulated. The level of each of the interventions is set so that the impact on mortality of the youngest age group in the first period is identical in each case.

The effects of the first (hypothetical) intervention (Type A) are similar to those of many of the medical interventions which constitute the "cost-effective" health care package: only the youngest age group is affected, and the impact on mortality is complete in the first period (i.e. the age-specific mortality rates in the nth period are identical to the age-specific mortality rates in the first period). For the second intervention (Type B), the actual age-specific and period-specific mortality rates for Lyon are used. For this intervention (Type B), all age groups are affected by the intervention, and the mortality reductions proceed in a cohort-specific fashion throughout the period of observation.

The results of the simulation analyses are presented on Table 2. The implications of the Table can best be understood by answering a series of questions:

(1) How many deaths are averted in the youngest age group in the first period for interventions A and B?

Since the level of intervention "A" was chosen such that the impact on the youngest age group in the first period was the same as the impact of the actual water supply and sanitation intervention in Lyon ("Type B"), the number of deaths averted in the youngest age group in the initial period is the same in each case (line 1 of Table 2).

(2) If it is assumed that age-specific mortality rates have stabilized 15 years after the intervention (a correct assumption for A, an incorrect assumption for B), what is the effect of each program on life expectancy of the youngest cohort?

As shown by line 3 of Table 2, the increase in life expectancy is 37% greater for intervention B than for intervention A.

(3) What are the true increases in life expectancy for the cohorts born in the first year following each intervention?

As shown by line 4 of Table 2, the increase in life expectancy is twice as large for intervention B than for intervention A.

(4) Assuming that the effects of intervention B are complete after 60 years, what are the effects of the interventions on the number of young-child deaths in the last period of analysis, and what are the effects on life expectancy of these cohorts?

As shown by line 1 of Table 2, the number of deaths averted is 4 times greater for intervention B than for intervention A, while, as shown by line 5, the increase in life expectancy is almost 7 times greater for intervention B than for intervention A.

Discussion

The "effectiveness" of two different types of interventions, one of which is typical of medical interventions to prevent mortality (Type A) and one of which is typical of more systemic environmental interventions (Type B), has been compared. Although the interventions are (by calibration) equally effective in averting infant deaths in the youngest age group in the first 15-year period of analysis, Type B is substantially more effective in increasing life expectancy in the short term, and vastly more effective in both reducing infant deaths and extending life expectancy in the long term.

Conclusion

The use of the cost-effectiveness technique for setting priorities in the health sector is now advocated and practiced by most major international agencies, and has resulted in substantial increases in funds allocated to interventions designed to reduce mortality in specific age groups and in large reductions in funds allocated to more systemic interventions. This analysis has shown that, if the focus of concern is shifted from specific groups to the population as a whole, and from short-term to long-term effects, then systemic interventions such as water supply and sanitation become relatively much more effective than medical interventions specifically designed to affect rapid mortality reductions in certain age groups.

References

1. United States Agency for International Development (1984). *AID Sector Strategy: Health*, pp. 8. Washington DC.
2. UNICEF (1982). *The State of the World's Children*, Pp. 12. New York.
3. Feachem, R. G., Hogan, R. C. & Merson, M. H. (1983). Diarrhoeal disease control: reviews of potential interventions. *Bulletin of the World Health Organization* **61**, 637–40.

4. Berman, P. A. (1982). Selective primary health care: Is efficient sufficient? *Social Science and Medicine* **6**, 1054–9.
5. Briscoe, J. (1984). Water supply and health in developing countries: selective primary health care revisited. *American Journal of Public Health* **74**, 1009–13.
6. Walsh, J. A. & Warren, K. S. (1979). Selective primary health care: an interim strategy for disease control in developing countries. *New England Journal of Medicine* **301**, 967–74.
7. Preston, S. H. & E. van de Walle (1978). Urban French mortality in the nineteenth century. *Population Studies* **32**, 275–97.

Publ. Hlth, Lond. (1985) **99**, 146–153

Sanatorium Admissions in a Boys' Boarding School

J. H. D. Briscoe

MRCGP, DObst RCOG Medical Officer

Eton College and Ex Hon. Secretary, Medical Officers of Schools Association

A survey of sanatorium admissions in a boys' boarding school covering 11 "school years" from 1971 to 1982 is presented. Nine-hundred-and-seventy boys accounted for 1500 admissions. The average length of admission was 3·8 days. Classification of the three main groups – infections (57%), injuries (32%) and miscellaneous (11%) are given. The factors causing boys to be illness- and injury-prone are discussed. The value of a school sanatorium is stressed. The views of the boy patients are given.

Introduction

Comprehensive information about the incidence of illness and injury in adolescents is not easily obtained. Most of the cases are nursed at home and may not even be seen by a general practitioner. The school doctor who looks after a boarding school is in a unique position to collect such information as these cases will be admitted under his care to the school sanatorium.

Historical Note

Eton College was founded by King Henry VI in 1440. It has increased in size steadily over the centuries from the original 70 poor scholars to a total of 1292 boys, aged 12–18 years, in 1982. The Eton College sanatorium was built in 1845 and originally provided 24 beds for boys suffering from infectious fevers. In 1897 an addition was built giving 10 more beds and an operating theatre. Any ill or injured boy was accepted for admission. In 1971 as a result of economies the total number of beds was reduced to 18 and the staff of matron, 3 day-nurses and 1 night-nurse reduced to Sister-in Charge and 2 day-nurses. Major surgery was no longer carried out in the operating theatre but it was maintained for casualty work. Cases requiring constant night attention or major surgery were admitted to hospital or nursing home locally.

The Survey

The survey covers 11 "school years"from September 1971 to July 1982. During these years the total boy population varied from 1247 in 1972 to 1292 in 1982 with a peak of 1309 in 1979. About half of the boys were under the author's personal care; of his boy patients 970 accounted for 1500 admissions during this time. This total does not cover all illness and injury as a few boys with, for example, appendicitis, eye injury, concussion or serious fracture were admitted direct to hospital and later discharged home or straight back to school thus avoiding admission to the sanatorium; some boys with influenza were sent straight home in time of epidemics; boys with short-lived upper respiratory tract infections were sometimes nursed in boys' houses.

0033-3506/85/030146+08 $02.00/0

2859 22

9. John. T. J. (1984). Immune response of neonates to oral poliomyelitis vaccine. *British Medical Journal* **289**, 881.
10. Anonymous (1984). Vaccines used in the E.P.I.: indications and contra-indications. *WHO Chronicle* **38**, 95–8.
11. Taranger, J. & Rabo, E. (1985). Scandinavian model for eliminating measles, mumps and rubella. *British Medical Journal* **290**, 242–3.
12. McConnell, W. W. M. & Tohani, K. (1984). Measles in the Southern Health Board – implications for resources. *British Medical Journal* **289**, 293–6.
13. Adjaye, N., Azad, A., Foster, M., Marshall, W. C. & Dunn, H. (1983). Measles serology in children with a history of measles in early life. *British Medical Journal* **286**, 1478.
14. Editorial. (1974). The price of perinatal neglect. *Lancet* **i**, 437.