November 1993

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Cause-Specific Child Mortality In A Mountainous Community In Pakistan By Verbal Autopsy

Pages with reference to book, From 226 To 229

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Abstract

In Pakistan's rural areas population-based cause of death data from systematic verbal autopsies are rare. Using verbal autopsy algorithms with multiple coding and decision rules, we assigned causes of death among 79% of children under age five years dying between July, 1988 and December, 1991 in Oshikhandass, a remote mountainous community in Pakistan's Northern Areas. Main causes of death were pneumonia (44%), diarrhoea (35%), and neonatal sepsis (6%). Combined (main plus associated) analysis revealed 48% died with diarrhoea, 46% with malnutrition, 44% with pneumonia, 15% with neonatal sepsis, and 15% with low birth weight. Median age of death with pneumonia was 2 months, with diarrhoea 8 months. Half died by month 4. The inquiry was well received by villagers. Population-based verbal autopsy surveillance is a cost-effective strategy to guide health managers. Plans are underway to institute it for the surrounding population of 400,000. Creative ways to access, treat and reduce risk among young infants are needed (JPMA 43: 226, 1993).

Introduction

Knowing the causes of childhood deaths in a community helps population-based health providers. The information guides central policy makers, local planners, and programme evaluators[1]. Most developing countries, including Pakistan, lack vital registration systems. Moreover, when death certificates are completed, there is often inadequate clinical information. Many forms do not allow entry of the multiple associated. factors (for example, co-infections, malnutrition, and low birth weight) typical of children dying in the Third World[2]. In addition, seventy percent of Pakistan's population lives in rural areas where proper diagnostic workup with documentation is even less likely. The verbal autopsy is a useful, affordable method to ascertain cause of death in developing countries. It has been most commonly used to evaluate interventions targeting children under five[3-5]. The technique involves conducting detailed postmortem interviews with bereaved relatives using a structured questionnaire. The premise of the technique rests on distinct clinical syndromes that are recognizable and recallable by family members[1,6]. The validity of the technique has been confirmed for diagnosing diarrhoea, measles, acute lower respiratory infection, and neonatal tetanus in two Philippine studies[7,8]. In a coastal Kenyan malaria-endemic setting, a study[9] found the technique to be good for detecting measles, neonatal tetanus, malnutrition and trauma, but less sensitive for malaria, anemia, acute respiratory infection, gastroenteritis and meningitis. Decision rules have been proposed[10] for assigning cause of death and additional validity studies are required. Even by South Asian standards, Pakistan fares poorly in infant, child and maternal mortality, especially given its per capita GNP as second only to Sri Lanka[11]. It has the lowest percent of central government expenditure allocated to health (1%) in the region (range 1-10%). Fifty-eight percent of all mortality affects children under five years old.[11] Given the reluctance to allocate resources, the high child mortality and the dispersed population, the verbal autopsy method is well suited to Pakistan. Oshikhandass is an isolated, mountainous community in Gilgit District of Pakistan's Northern Areas. It was chosen as a site to pilot the verbal autopsy method

because of ongoing surveillance for childhood diarrhoea and dysentery since 1989 and because of institutional linkages between the Aga Khan University and the Aga Khan Health Services, Pakistan.

Methods

Site

Oshikhandass is a mixed Ismaili and Shia subsistence agricultural village of 415 households (population 4000). The health system is limited to the provision of immunizations, a few trained birth attendants and a government civil dispensary staffed by male dispensers. Baseline data collection including census and on-going registration of vital events was begun in July, 1989 by the Oshikhandass Diarrhoea and Dysentery Research and Surveillance Project. While the numbers were small, the infant mortality rate declined from 105 to 42/1000 during the study period; and the under five mortality rate declined from 154 to 65/1000.

Sample

Record and survey review revealed 66 child deaths in the village during the three and one half years from July, 1988 to December, 1991. These were the subjects about whom detailed information was sought.

Measurements

Two verbal autopsy instruments (Neonatal and Child: 1-59 months) were adapted with permission from the SEARCH (Society for Education, Action and Research in Community Health) Group in Gadchilroli, Maharashtra, India. [10] The forms consisted of an open-ended section for verbatim history transcription followed by a symptom checklist with skip questions addressing the 11 most common, recognizable, fatal syndromes affecting newborns and children in South Asia. The instruments were translated from English into Urdu. The interviews were conducted by medical students (NM, KM) of the Aga Khan University assisted by female Community Diarrhoea Workers who translated between Urdu and the local languages, Brusheski and Shina, which are not commonly written. The last 6 forms were completed by a lady health visitor and a community health doctor.

Analysis

Rules for assigning cause of death accompanied the SEARCH instruments. The recommended combinations of essential, pathognomonic, circumstantial and/or supportive factors were followed exactly. Rules for coding diagnoses were modified, however. A format of main and associated cause(s) was chosen to minimize loss of information. The main cause was the condition temporally closest to death. Rules were devised for several situations, such as co-infections or infection with malnutrition. We allowed for listing multiple associated causes of death given the multifactorial nature of child death in developing countries.

Results

Of 66 deaths identified, verbal autopsies were completed in 52 (79%); other families had either moved or were unavailable despite one or more re-visits. One family refused. Informants were almost always mothers. All 52 interviews were done over a total of 10 days. Each interview took 45 to 60 minutes. Travel time included 60 minutes daily to reach the village from Gilgit town and averaged 20 minutes walking to and from households. Additional time was spent in many households where tea was offered. The interval between date of death and date of interview ranged from 3 days to 37 months with a median of 13 months. Place of death was usually the home (33/52) or Gilgit District Headquarter Hospital (16/52) approximately 20 km away. The source of treatment included the District Headquarter Hospital (22/52) and private doctors or dispensers (20/52). Nine children (6 females and 3 males) received no treatment before death. The age-sex distribution of deaths is presented in Table 1.

Table I. All <5 deaths: age-sex distribution.

Sex	Age				
	<28 days (a)	1-11 months (b)	0-11 months (a+b)	1-4 years (c)	Total (a+b+c)
Male	8	16	24	4	28 (54%)
Female	5	12	17	7	24 (46%)
Total (%)	13 (25%)	28 (54%)	41 (79%)	11 (21%)	52 (100%)

Of the 52 deaths in children under five, 28 were males and 24 females. Infant deaths (41/52) compriseu 79% of all under five deaths, while neonatal deaths made up 32% of infant deaths. Total and sex-specific cumulative mortality is shown in Figure 1.

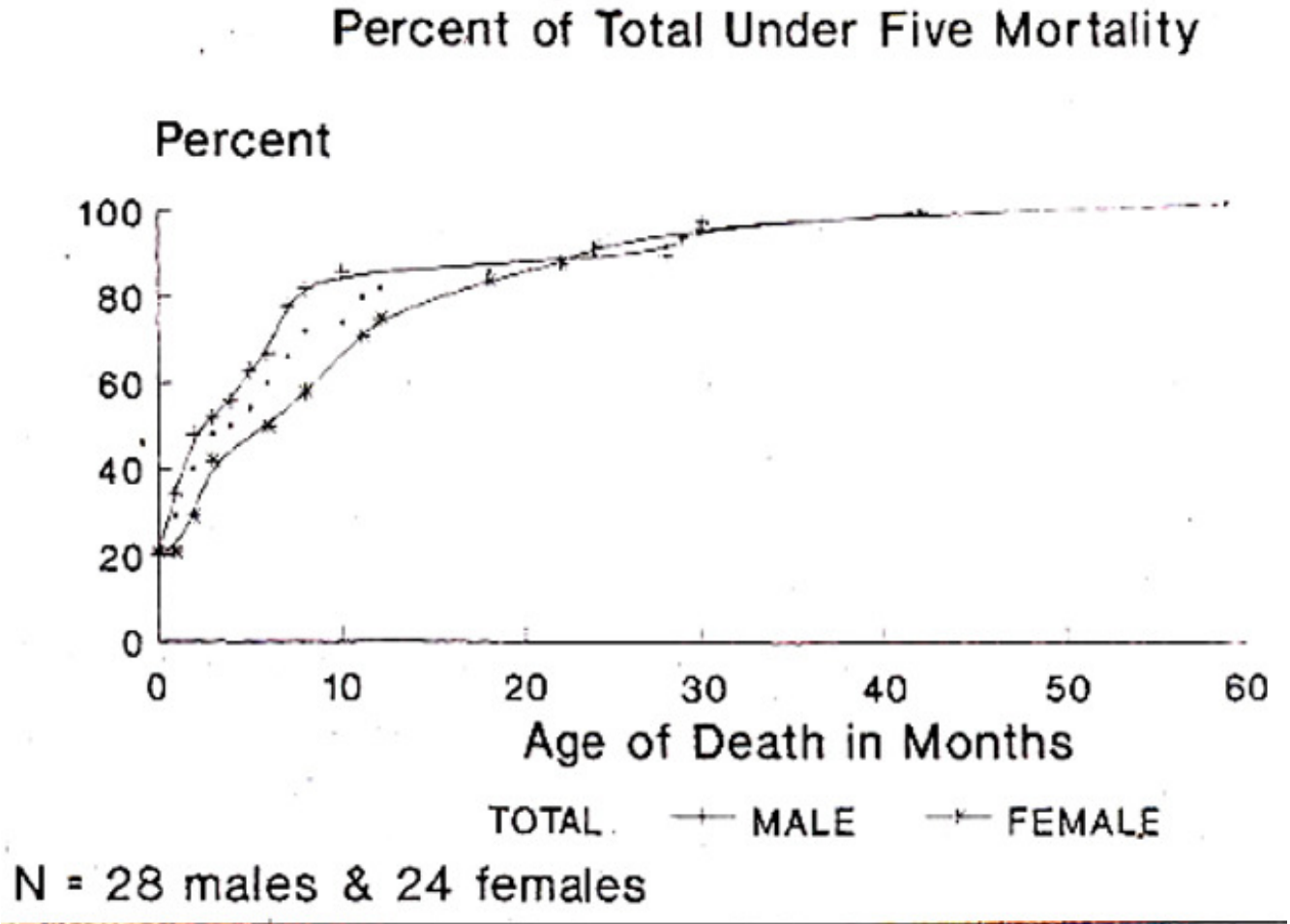

Figure 1. Cumulative under five mortality by age of death and sex.

Fifty percent of total child mortality occurred by the fourth month, 79% by year one and 96% by year three. Compared to females, males experienced adverse mortality until age 2 years. The main causes of death are seen in Table II.

Table II. Main cause of death by age.

Main cause of death	Age			
	<28days	1-11 months	1-4 years	Total (%)
Pneumonia	8	12	3	23 (44)
Diarrhoea	-	13	5	18 (35)
Neonatal sepsis	3	-	-	3 (6)
Injury	-	-	2	2 (4)
Pertussis	-	-	1	1 (2)
Other	-	2	-	2 (4)
Unknown	2	1	-	3 (6)
Total	13	28	11	52 (100)

Pne Umonia and diarrhoea were the most common main causes of death yielding proportionate mortality ratios of 44% and 35% respectively; 6% of causes of death (3/52) were unknown. The agreed coding rules assigned malnutrition as a main cause only if a child died of inadequate calories in the absence of any apparent other cause; this was not observed. Main and associated causes were cross-tabulated in

Table III. Main versus associated causes of death: neonates.

Main causes (number)		Associated causes					
		None	LBW*	NS*	BLD*	OTH*	Total
Neonatal sepsis	(3)	-	2	-	1	-	3
Pneumonia	(8)	2	6	3	1	1	11
Unknown	(2)	2	-	-	-	-	0
Total	(13)	4	8	3	2	1	14

LBW* = Low birth weight/prematurity
NS = Neonatal sepsis
BLD = Bleeding
OTH = Other

Table III (neonates) and Table IV (post-neonates).

Table IV. Main vs associated causes of death: Post-neonates (1-59 months).

Main causes (number)		Associated causes					
		None	MLN*	DIA*	PER*	OTH*	Total
Diarrhoea	(18)	6	12	-	-	-	12
Pneumonia	(15)	5	9	6	1	1	17
Injury	(2)	2	-	-	-	-	0
Pertussis	(1)	-	1	1	-	-	2
Other	(2)	1	1	-	-	-	1
Unknown	(1)	1	1	-	-	-	1
Total	(39)	14	24	7	1	1	33

MLN* = Malnutrition
DIA = Diarrhoea
PER = Pertussis
OTH = Other

Among neonates with pneumonia, 75% (6/8) were low birth weight. Among post-neonates, malnutrition was associated with both diarrhoea (12/18 = 67%) and pneumonia (9/15 = 60%). Of post-neonates with pneumonia, 40% (6/15) also had diarrhoea. Low birth weight played a role in 62% (8/13) of neonatal death; and malnutrition played an identical role (62% = 24/39) in post-neonatal deaths. Tables III and Walso show that although diarrhoea was considered the main cause of death in 18, an additional 7 children died with it. Overall, the 52 children had a total of 99 diagnoses. When math and associated causes of death were combined (Table V),

Table V. Combined causes of death (main and associated) by age.

Causes	Age							
	<28 days (n=13)		1-11 months (n=28)		1-4years (n=11)		Total (n=52)	
	No.	%*	No.	%*	No.	%*	No.	%*
Diarrhoea	-	0	19	68	6	54	25	48
Malnutrition	-	0	18	64	6	54	24	46
Pneumonia	8	62	12	43	3	27	23	44
Neonatal sepsis/ bleeding	8	62	-	0	-	0	8	15
LBW/Prematurity	8	62	-	0	-	0	8	15
Injury	-	0	-	0	2	18	2	4
Pertussis	-	0	1	4	1	9	2	4
Other	1	8	3	11	-	0	4	8
Unknown	2	15	1	4	-	0	3	6
Total	27	209	54	194	18	162	99	190

*Percent of cases (denominator, n) dying with the given cause (total > 100%).

diarrhoea, malnutrition, and pneumonia ranked similarly, occurring in 48%, 46% and 44% of all deaths respectively. The total exceeded 100% because of multiple diagnoses.

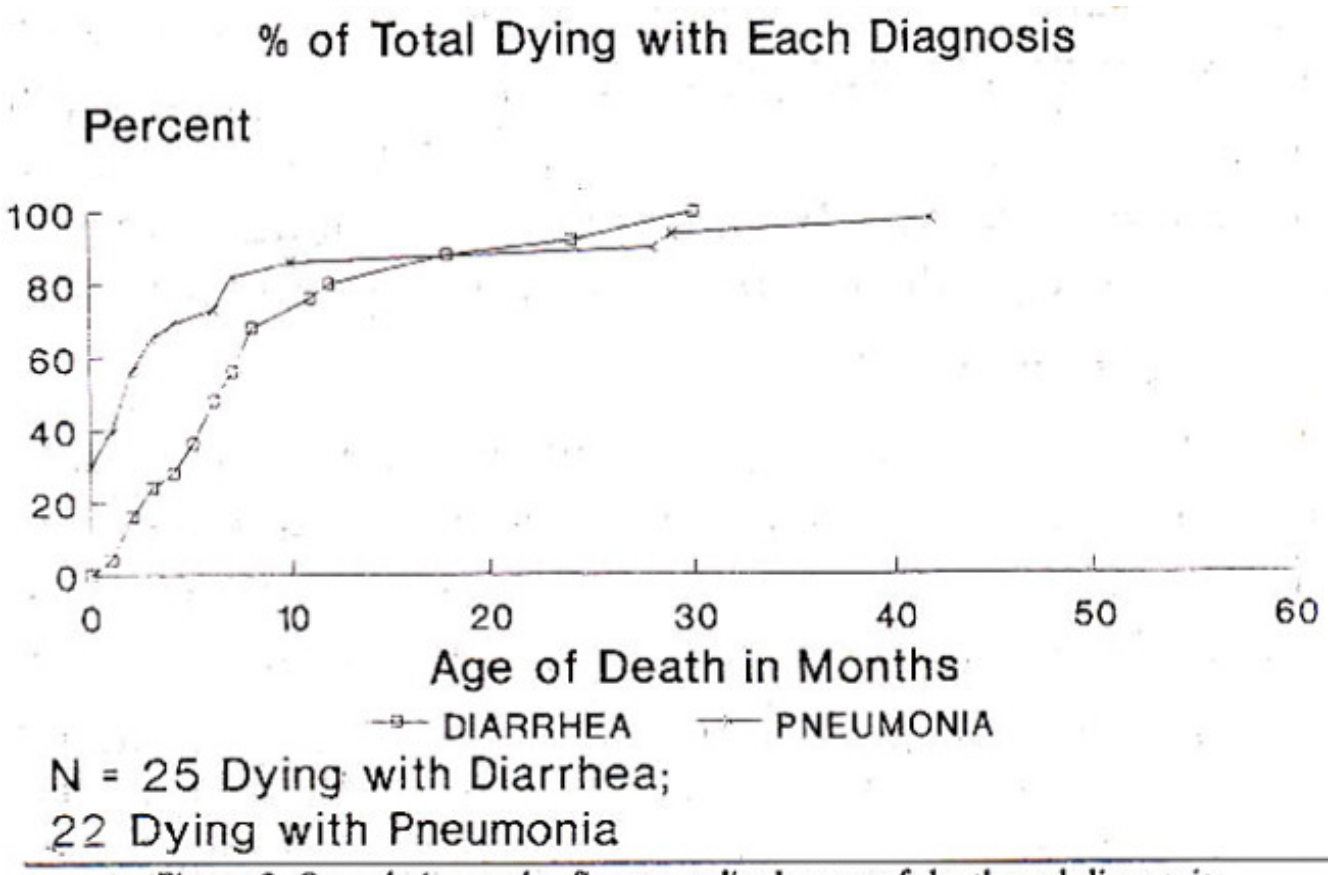

Figure 2. Cumulative under five mortality by age of death and diagnosis.

Figure 2 shows the cumulative mortality by age for children by cause of death. The median ages of death with pneumonia and diarrhoea were 2 months and 8 months, respectively. No diarrhoea, but one third of all pneumonia, occurred in neonates. Growth cards were available on 23 of 52 children who had died. These cards were compared with the verbal auçopsy results to validate the diagnosis by interview of Gomez Classification III malnutrition. Compared to growth card, the instrument showed high sensitivity (1.00 = 2/2) with low specificity (0.29 = 6/2 1) and positive predictive value (0.12 = 2/17).

Discussion

Diarrhoea, malnutrition, and pneumonia alone or in combination played a role in 85% of the child deaths. The decision to allow multiple diagnoses proved useful to retain important information. The true burden of a common killer, diarrhoea, was 39% greater (25 vs 18) than if only a single diagnosis were allowed. In 7 of these cases diarrhoea was not the principal cause of death, but mitigating it might have prevented death. This complex of diarrhoea and pneumonia has been recognized among children dying in Pakistan (AKU: unpublished data) and hospitalized in Bangladesh. Moreover, an ARE intervention programme in Nepal reduced ARI-specific mortality by 30% and diarrhoea-specific mortality by 36%[3]. Thus, multiple diagnoses give community health practitioners a clearer assessment of both the magnitude of risks and the opportunities for intervention. The 6% unknown rate is low. Indeed, the newborn unknown rate was even lower than the child rate. This is exciting in that a great challenge for descriptive mortality studies in developing countries is cause-specific death among neonates. The validity of the instrument in this age group awaits further study. The median age of death for children dying under five is in the fourth month, arid death after age three years was rare. These findings challenge the traditional approach of monthly visits to households with children. Instead,

creative and culturally acceptable approaches must be explored to gain access to young infants to treat and reduce risk. This includes improved antenatal care, identifying (qualitatively or quantitatively) low oirrnweignt oarnes, repeatectiy gaining access to the home during the first few weeks of life, operationalizing the measurement of well-known risk factors, and devising effective risk-reduction measures. Markedly reducing home visits after the 3rd birthday (if no younger siblings have arrived) will free the health worker to target the more vulnerable ones. Age and sex were powerful risk factors. In Oshikhandass males experienced adverse mortality as newborns and throughout early childhood. The ratio of the neonatal mortality rate/infant mortality rate was 0.33. This was lower than in other Pakistan studies and may reflect under-counting of both births and neonatal deaths. By comparison, a recent survey of infant deaths between 1988-1990 in four representative communities (20,000 households) in Baluchistan (AKU: unpublished data) found a NMR/JMR ratio of 0.43. Among the deaths between 1990-1991 in the five urban PHC sites of Aga Khan University, the ratio was 0.39 (AKU: unpublished data). Sathar[13] reviewed various Pakistan demographic surveys of deaths between 1950-1979 noting ratios ranging from 0.53-0.66. The ratio itself is multifactorial, reflecting perinatal factors, especially birthing practices and post-neonatal factors, such as poverty and child care. The Oshikhandass ratio suggests that relatively greater attention is needed for young infants than for neonates. The interviewers found the form easy to administer within a time frame affordable by respondents. The encounter was well received even those interviews which were obtained acutely during the grieving period. There were limitations to the form and method. First, the criteria for malnutrition lacked specificity in that most fatally ill children "took insufficient food" and "did not grow properly." Thus, malnutrition was over-diagnosed. Similarly, the questionnaire was not strong in discriminatirg between premature and intrauterine growth retarded newborns. Furthermore, rare diagnoses could have been missed although some could be reliably identified through the initial open-ended history section, especially if the child had had a medical work-up. The internal validity of the results may have been threatened given the uncertainty inherent in triple-translations of questions. Although the interval between death and the interview was long in many cases, parental memory was apparently good. Validating recall over time is an area of needed research. Each encounter required 20 minutes walking, 45-60 minutes interviewing, and time for tea. Fifteen percent required re-visits. Interviewing 15 deaths yearly would require 25 hours of health workers' time. However, combining the interview (without the need to translate) with routine visits to the neighbor hood would save time. On the other hand, additional time, skill and resources would be needed for training to assign, code, aggregate, analyze, report, and respond to causes of death. Few verbal autopsy instruments have been formally validated. However, this instrument and method seemed reasonable in that the distribution of causes of death by age and sex was consistent with a near universal sample. And because the community is typical of the scores of surrounding isolated, mountainous villages, the results are cautiously generalizable. In summary, the verbal autopsy technique: confirmed the major child killers in the community, detailed a narrow age of risk, augmented the findings of on-going research, and sensitized health staff and communities to their "child mortality problem." Indeed progressive societal intolerance to avoidable pediatric death is one marker of the health transition[14] . The verbal autopsy method has been shown to have educational, scientific, programmatic and social value. Based on this favourable pilot demonstration, the Aga than Health Services in the Northern Areas and Chitral have recently opted to introduce the technique more widely in community health programmes which serve a population of 400,000.

Acknowledgement

The authors wish to express their appreciation to Dr. Abhay Bang and the SEARCH Team of Gadchilroli, Maharashtra, India, for their valuable guidance in verbal autopsy.

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