Table 6
Mean Height for Age (HAP) and Weight for Age Percentiles (WAP) by Monitoring Number for Case and Control Children in Montero

		monitoring number		
		1	2	3
HAP	cases	32.0%	30.5%	19.9%
	(n)	(12)	(7)	(3)
	controls	52.9%	50.1%	31.1%
	(n)	(20)	(15)	(10)
	% difference	-20.9%	-19.6%	-11.4%
WAP	cases	42.2%	34.0%	11.4%
	(n)	(16)	(12)	(7)
	controls	63.9%	51.5%	45.2%
	(n)	(33)	(22)	(19)
	% difference	-21.7%	-17.5%	-33.8%

Classifying children as to whether or not they fell below the third percentile of weight for age on their first weighing yielded no significant difference between cases and controls. Comparing cases and controls for the second weighing, one-third of the children who died were below the third percentile compared to only 5% of the controls (see Table 7). There were only three children below the third percentile at the third weighing, so the differences between the case and control children was not statistically significant at the 0.05 level.

Table 7
Numbers of Case and Control Children in Montero
Below the Third Percentile of Weight for Age
at the Second Weighing

	below 3rd percentile		
	yes	no	total
cases	4	8	12
controls	1	21	22
total	5	29	34

uncorrected Chi-Square = 5.13
Fisher's exact 2-tailed p value = 0.042

Even though only one of three comparisons between case and control children of severe malnutrition was statistically significant, there was nonetheless a notable and persistent difference between case and control children as shown in Table 8. For the first three monitorings, only 3-5% of the controls had a mean WAP less than 3% while 19-33% of the cases were in this category. The percentage of either case or control children with severe malnutrition did not appear to increase with each successive monitoring.

Table 8
Percentage of Case and Control Children With Severe Malnutrition
(Weight for Age Malnutrition Less than 3%) by Monitoring Number

	monitoring number		
	1	2	3
cases	19%	33%	29%
(n)	(3/16)	(4/12)	(2/7)
controls	3%	5%	5%
(n)	(1/33)	(1/22)	(1/19)
% difference	-16%	-28%	-24%

Each child was classified on the basis of the last recorded weight and height as to whether or not he or she was below the 25th percentile. Comparison of the classifications of the height for age percentile and the weight for age percentile yielded no significant differences between the two groups. However, the weight for height percentile classification between the two groups did differ, as shown in Table 9. Two-thirds of the cases (4/6) compared to only 9% (1/11) of the controls were below the 25th percentile of weight for height at the time of the last recorded weighing.

Table 9
Numbers of Case and Control Children in Montero Below the 25th Percentile of Weight for Height at the Last Weighing

	below 25th percentile		
	yes	no	total
case	4	2	6
control	1	10	11
total	5	12	17

uncorrected Chi-Square = 6.20
Fisher's exact 2-tailed P-value = 0.028

Although only one of the three differences were statistically significant, there was a consistent trend between case and control children with respect to being moderately malnourished (as defined as being below the 25th percentile for any of the nutritional indices). The percentage of children below the 25th percentile of height for age, weight for age, and height for weight was consistently higher for cases than for controls (see Table 10).

Table 10
Percentage of Case and Control Children in Montero Below the 25th Percentile in Height for Age, Weight for Age, and Height for Weight at Their Last Recorded Weighing

	percentage of children below the 25th percentile		
	height for age	weight for age	height for weight
cases (n)	67% (4/6)	56% (9/16)	67% (4/6)
controls (n)	36% (4/11)	42% (14/33)	10% (1/10)
% difference	31%	14%	57%

Each child was also classified as to whether or not weight loss was observed between the next to last and the last recorded weighing. Although there was no significant difference between the case and control children in this respect, 33% (4/12) of the case children compared to 18% (4/22) of the control children had lost weight.

Vaccination Status

There were no significant differences between case children and control children as to whether or not any of the standard vaccinations had been administered (BCG, OPV1, OPV2, OPV3, DPT1, DPT2, DPT3, or measles). There was no significant difference in the number of vaccinations received by the case and control children either.

Family Status

There was no significant difference between cases and controls in the mean age of the mother at the time of birth of the child. When mothers were classified as to whether or not they were under the age of 18 at the time of death of the child (or at the time of completion of the control child's review), no significant differences were observed either.

The birth interval between study children and their next

oldest sibling was compared. The mean birth interval did not differ for the two groups. When birth intervals were classified into less than 24 months and 24 or more months, no significant differences were observed either. There was also no significant difference between cases and controls in the number of siblings in the family.

Mothers were classified as to whether or not they were married. No significant differences were observed between cases and controls.

Maternal education was classified into three groups: none, elementary (six years or less), and post-elementary. Among the 23 case children for whom the mother's education was known, five (22%) had mothers with no formal education compared to only 4% of the controls. In contrast, only 17% (4/23) of the cases had mothers with a post-elementary education while 39% (18/46) of the controls had mothers with this higher level of education (see Table 11).

Table 11
Classification of Case and Control Children in Montero by Maternal Education

	maternal educational level			
	none	elementary	higher	total
cases	5	14	4	23
controls	2	26	18	46
total	7	40	22	69

Chi-Square = 6.89
p value = 0.031

The language spoken in the home was classified as either indigenous along with Spanish, Spanish only, or unknown. The indigenous language spoken was almost always Quechua but in several cases it was Aymara. No families were reported as speaking only an indigenous language. As Table 12 indicates, case children were less likely than control children to have been in homes in which no indigenous language was spoken. Only four percent (1/25) of the cases came from homes in which Spanish was the only language spoken compared to 20% (10/50) of the controls.

Table 12
Classification of Case and Control Children in Montero by Language Spoken in the Home

	language spoken			
	indigenous and Spanish	Spanish only	unknown	total
case	14	1	10	25
control	32	10	8	50
total	46	11	18	75

Chi-Square = 7.08
df = 2
p value = 0.029.

The father's occupation was recorded and classified into three categories: unskilled laborer, skilled laborer, and higher level worker (technician, seller, or desk worker). There was no statistically significant difference between cases and controls in the father's occupational classification.

Household Characteristics

Information was available in the family health folders regarding several characteristics of the house. These included whether the house was owned or rented, the general condition of the home (bad or good), whether water was obtained from a well or from a running faucet, whether or not water was boiled before consuming it, whether there was an outdoor or an indoor toilet, and the condition of the toilet (bad or good). None of these characteristics differed significantly between the cases and the controls.

A summary of comparisons between cases and controls of household characteristics are shown in Table 13. The only characteristics in which there was a notable percentage difference in the expected direction (that is, a greater percentage of case children with poorer housing conditions) was related to the condition of the house, the presence of indoor plumbing, and the condition of the bathroom. When the analysis of these three household characteristics was limited to only cases dying of diarrhea and their controls, the percentage differences were not notably increased and in fact decreased for two of the three variables.

Table 13
Comparison of Housing Conditions Between Case and Control Children in Montero

	cases	controls	percentage difference
% of families who owned their homes (n)	35% (8/23)	24% (11/46)	11%
% of homes in good condition (n)	43% (9/21)	55% (27/49)	-8%
diarrhea cases and controls only (n)	46% (6/13)	59% (16/27)	-13%
% of homes with running water (n)	78% (18/23)	77% (38/49)	1%
% of families who boil their water (n)	35% (8/23)	35% (17/49)	0%
% of homes with indoor plumbing (n)	13% (3/23)	32% (16/49)	-19%
diarrheal cases and controls only (n)	7% (1/14)	22% (6/27)	-15%
% of homes with bathroom in good condition (n)	43% (9/21)	56% (27/48)	-13%
diarrheal cases and controls only (n)	33% (4/12)	44% (12/27)	-11%

DISCUSSION

The findings from this case-control study of infant and child deaths in the Villa Cochabamba Health Program in the city of Montero provides strong evidence that children who are more malnourished are at greater risk of death. These differences also appear early in life, since the initial height for age and weight for age percentiles were lower for case children than for control children. Both moderately malnourished children (defined as height for age, weight for age, and height for weight percentiles less than 25%) and severely malnourished children (defined as weight for age percentile less than 3%) were consistently more prevalent among cases than among controls at the time of the last recorded weighing, although only several of these differences were statistically significant. There also was evidence that case children were more likely to have lost weight between the next to the last and the last weighing, but again this difference was not statistically significant.

The number of nutritional indices which did differ significantly between cases and controls together with the additional findings which were similar but not statistically significant all point to the strong role nutrition in child survival in the Villa Cochabamba/Montero Health Area.

The other set of risk factors significantly associated with childhood death in Montero is maternal education and language spoken. Case children were more likely to have had mothers with no formal education, while control children were more likely to have had mothers with education beyond elementary school. Also, case children were more likely to have had mothers who spoke both an indigenous language (generally Quechua) as well as Spanish while control children were more likely to have had mothers who spoke only Spanish.

It might seem a plausible hypothesis that maternal socioeconomic status, as measured by educational attainment and language spoken, influences the child's nutritional status which in turn influences child mortality.

maternal SES ---> child's nutritional status ---> child mortality

This possibility was explored. No statistically significant relationships between either of the two maternal SES variables and any of the many nutritional indices included in the study were found. Thus, these two groups of variables seem to exert their own independent influence on child mortality in Montero.

STUDY QUESTIONNAIRE USED FOR MONTERO
CASE-CONTROL STUDY

número de identificación __

CASO __
CONTROL __

nombre del caso que murio para comparar
_____

edad al morir el caso
_____

Formulario Para Estudio de Muertes con Controles
Villa Cochabamba/Montero

Mayo, 1993

1. nombre del niño: _____
2. barrio, manzana, y familia: _____
_____
3. fecha de nacimiento: _____
4. fecha de muerte: _____
5. edad al morir: _____
6. causa de muerte: _____
7. sexo: _____
8. tenía carnet de salud infantil? ____
9. datos nutricionales

a. fecha1 _____	peso1_____	talla1_____
b. fecha2 _____	peso2_____	talla2_____
c. fecha3 _____	peso3_____	talla3_____
d. fecha4 _____	peso4_____	talla4_____
e. fecha5 _____	peso5_____	talla5_____
f. fecha6 _____	peso6_____	talla6_____
g. fecha7 _____	peso7_____	talla7_____
h. fecha8 _____	peso8_____	talla8_____

10. datos de inmunizaciones

BCG _____
OPVi _____
OPV1 _____
OPV2 _____
OPV3 _____
DPT1 _____
DPT2 _____
DPT3 _____
sarampion _____

11. episodios de enfemedades:_____

_____

12. edad de la madre en la fecha de muerte del niño (caso o control) _____

13. hijos vivos en y su edad en la fecha del nacimiento del niño (caso o control)

hermano 1 _____ meses (el menor)
hermano 2 _____ meses
hermano 3 _____ meses
hermano 4 _____ meses
hermano 5 _____ meses
hermano 6 _____ meses
hermano 7 _____ meses
hermano 8 _____ meses
hermano 9 _____ meses
hermano 10 _____ meses
hermano 11 _____ meses
hermano 12 _____ meses

14. estado civil:_____

15. grado de instrucción de la madre:_____

16. ocupación del padre:_____

17. tenencia de vivienda:_____

18. condición de la vivienda:_____

19. fuente de agua:_____

20. tratamiento de agua: _____

21. eliminación de excremento: _____

22. condición del baño: _____

23. idioma principal: _____

26. anotaciones {anot} _____

APPENDIX V. ADDITIONAL FINANCIAL INFORMATION

We are estimating the cost of a single dose of vaccine to be $0.14, based on data provided by UNICEF (Joseph, 1985), on data from The Gambia (Robertson et al, 1992), and on data for Peru (Pavone et al, 1993, p.11).

None of the costs of program operations are really dependent on foreign exchange except perphaps some of the supplies purchased or parts for vehicle repairs. These items account for less than 10% of the costs.

"Travel costs" are listed as separate from "transportation costs." Travel costs refer to expenses associated with staff travelling within the country or between the program area and La Paz when using transportation other than program vehicles. For instance, there is an annual ARHC national meeting which involves air travel to a central location. Transportation costs, on the other hand, include the costs of operating the program vehicles including repairs, gasoline, depreciation, and so forth.

A Methodology for Estimating the Cost of Specific Program Components for Carabuco

The distribution of costs in 1992 accross functional categories was carried out using the following methodology. An estimate of staff time spent in various activities was carried out by asking the Carabuco Health Program staff to estimate the amount of time they spent in the following categories:

child survival activities vs. other primary care activities (total = 100%)

type of child survival activity (total = 100%)
- immunizations
- nutrition
- diarrhea control
- ARI (acute respiratory infection) control
- home visitation
- HIS (health information system)

When the field staff was asked as a group to estimate the percent of their time devoted to these activities, they agreed on the following as shown in Table 1.

Table 1.

Carabuco Staff Estimates of Effort by Functional Category

	% of total effort	% of child survival effort
other primary care	20%	--
child survival activities	80%	100%
immunizations		20%
nutrition		25%
diarrheal control		15%
ARI control		15%
home visitation		20%
HIS		5%

source: staff estimates

Apart from this, the 11 community-based auxiliary nurses were asked how many days a month they devoted to the following activities:

home visitation
immunizations
growth monitoring and nutrition
treatment of diarrheal and ARI cases
maternal health and prenatal care
treatment of TB patients
treatment of other patients
training and continuing education
preparing reports
training of volunteers
cleanup of the health post
meeting with volunteers

The total number of days estimated per month by each community auxiliary for each category was calculated and then summed for the entire group. The time for each category was distributed across the functional categories as shown in Table 2. This distribution across functional categories is an estimate based on a general knowledge of program operations.

Table 2.

Estimate of Time Spent by Carabuco Staff In Functional Program Categories

	functional category								
time category	oth pri car	vac	nut	dia	ARI	hme vis	HIS	oth CS	TOTAL
home visitation	20%					80%			100%
immunizations		100%							100%
growth monitoring			100%						100%
diarrhea treatment				100%					100%
ARI treatment					100%				100%
prenatal care	60%							40%	100%
TB treatment	80%							20%	100%
patient care	60%							40%	100%
training and cont. education	20%							80%	100%
preparing reports	20%						80%		100%
volunteer training	20%							80%	100%
cleanup of health post	20%							80%	100%
meeting with volunteers	20%							80%	100%

oth pri car: other primary care (i.e., non-child survival activities)
vac: vaccinations
nut: nutrition
dia: diarrhea
control ARI: acute respiratory infection control
hme vis: home visitation
HIS: health information system
oth CS: other child survival activities

source: staff estimates

The overall percentage of field staff effort for each of the time categories is shown in Table 3 in the TOTAL column. This was calculated using estimates provided by each of the field staff as to how they spend their time. Using the percentage distributions shown in Table 2, the effort for each functional category was then calculated. These results are shown in Table 3.

Table 3.

Estimate of Carabuco Staff Time Spent in Each Functional Category

	functional category								
time category	oth pri car	vac	nut	dia	ARI	hme vis	HIS	oth CS	TOTAL
home visitation	3.3%					13.1%			16.4%
immunizations		11.0%							11.0%
growth monitoring			20.0%						20.0%
diarrhea treatment				3.9%					3.9%
ARI treatment					3.9%				3.9%
prenatal care	2.4%							1.6%	4.0%
TB treatment	0.5%							0.1%	0.6%
patient care	8.4%							5.6%	14.0%
training and cont. education	2.2%							8.6%	10.8%
preparing reports	1.3%						5.3%		6.6%
volunteer training	1.2%							4.8%	6.0%
cleanup of health post	0.4%							1.6%	2.0%
meeting with volunteers	0.2%							0.6%	0.8%
TOTAL	19.9%	11.0%	20.0%	3.9%	3.9%	13.1%	5.3%	22.9%	100.0%

source: derived from Tables 1 and 2.

The 23.1% of the effort devoted to "other child survival activities" was distributed among the remaining child survival categories in proportion to the time alloted in each of these same remaining categories. Having done so, this left a percentage time distribution among child survival categories as follows:

	estimated percent time distribution
vaccinations:	19%
nutrition	35%
diarrheal control	7%
ARI control	7%
home visitation	23%
HIS	9%

The results of these two methodologies for estimating time distribution of staff by functional category are shown in Table 4. An average of the two is calculated for each functional category.

The functional category "home visitation," for the purposes of this analysis, includes all those activities which take place during a home visit aside from vaccination in the home, growth monitoring in the home, and provision of curative care services in the home (including treatment of ARI and diarrhea). Thus, the home visit in the functional category includes the "routine systematic home visit" (RSHV) in which family members are registered or re-registered and health education is provided.

Table 4.

Comparison of Estimates of Carabuco Field Staff Time in 1992 by Functional Category With Two Different Methodologies

	methodology		
	#1	#2	AV
child survival	20%	20%	20%
primary health care	80%	80%	80%
TOTALS	100%	100%	100%

	#1	#2	AV
child survival			
vaccination	20%	19%	20%
nutrition	25%	35%	30%
ARI	15%	7%	11%
ORT	15%	7%	11%
home visitation	20%	23%	21%
information system	5%	9%	7%
TOTALS	100%	100%	100%

methodology 1: based on group discussion and consensus
methodology 2: based on each community auxiliary nurse estimating the amount of time spent per month in the activities shown in Table 2 and the assumptions described in Tables 2 and 3.

Finally, using the relative distribution of effort shown in Table 4, an overall distribution of staff effort is calculated as shown in Table 5.

Table 5.

Overall Estimated Distribution of Staff Effort Among Functional Categories, 1992

functional category		percent of overall effort
other primary care		20%
child survival		
immunizations		16%
nutrition		24%
diarrheal control		9%
ARI control		9%
home visitation		17%
HIS		5%
	TOTAL	100%

source: derived from Table 4.

Using this breakdown of staff effort, it becomes possible to estimate the cost of specific program components as shown in Table 6. Each cost category, such as salaries, was divided into the specific program components according to the percentage breakdowns shown in Table 5. The only exception to this is the health supplies category. Here, all the supplies were placed under other primary care except for the contributions from the MOH, which were all placed in the vaccination category.

Table 6.

Distribution of Carabuco Recurring Program Costs in FY 1992 by Functional Category

type of cost	functional category: oth pri car	vac	nut	dia	ARI	hme vis	HIS	TOTAL
salaries	12,656	10,124	15,187	5,695	5,695	10,757	3,164	63,278
consultants	5	4	7	2	2	4	1	25
health supplies	1,732	1,500						3,232
program support supplies	107	85	128	48	48	91	27	534
direct services costs	91	73	109	41	41	77	23	455
administrative costs (non-personnel)	389	311	466	175	175	330	97	1,943
travel costs	174	139	208	78	78	148	43	868
transportation	2,633	2,105	3,158	1,184	1,184	2,237	658	13,159
training	307	246	370	138	138	261	77	1,537
equipment and infrastructure maintenance	2,174	1,740	2,610	979	979	1,849	544	10,875
TOTALS	20,268	16,327	22,243	8,340	8,340	15,754	4,634	95,906

source: program financial reports and estimates from prior tables

Using the percentage estimates of staff effort by program category shown in Chapter X Table 24 for the Mallco Rancho Health

Program, Table 7 describes the estimated costs of each functional program component.

Table 7.

Distribution of Mallco Rancho Recurring Program Costs in 1992 by Functional Category

type of cost	functional category							
	oth pri car	vac	nut	dia	ARI	hme vis	HIS	TOTAL
salaries	9,089	6,058	6,058	3,702	3,702	3,702	1,347	33,658
consultants	164	110	110	67	67	67	24	609
health supplies	2,925	1,500	0	0	0	0	0	4,425
program support supplies	285	190	190	116	116	116	42	1,055
direct services costs	90	59	59	36	36	36	13	329
administrative costs (non-personnel)	1,220	813	813	497	497	497	180	4,517
travel costs	73	49	49	30	30	30	11	272
transportation	1,516	1,010	1,010	617	617	617	224	5,611
training	202	135	135	83	83	83	29	750
equipment and infrastructure maintenance	1,379	919	919	562	562	562	204	5,107
TOTALS	16,934	10,843	9,323	5,710	5,710	5,710	2,074	56,333

source: program financial reports

Using the percentage estimates of staff effort by program category shown in Chapter XI Table 19 for the Villa Cochabamba/Montero Health Program, Table 8 describes estimated costs of each functional program component.

Table 8.
Distribution of Villa Cochabamba/Montero Recurring Program Costs in 1992 by Functional Category

	functional category							
type of cost	oth pri car	vac	nut	dia	ARI	hme vis	HIS	TOTAL
salaries	16,079	6,667	5,882	3,529	1,176	4,706	1,176	39,215
consultants	0	0	0	0	0	0	0	0
health supplies	8,353	2,000	0	0	0	0	0	10,359
program support supplies	294	122	107	64	21	86	21	715
direct services costs	660	274	242	145	48	193	48	1,610
administrative costs (non-personnel)	1,954	811	715	429	144	573	143	4,769
travel costs	342	142	125	75	25	100	25	834
transportation	1,694	702	620	372	124	496	124	4,132
training	89	37	33	20	7	26	7	217
equipment and infrastructure maintenance	2,126	882	778	467	156	623	156	5,188
TOTALS	31,590	11,638	8,501	5,100	1,701	6,803	1,700	67,033

source: program financial reports

Tables 9-11 give the detailed costs of the operation of the Carabuco, Mallco Rancho, and Villa Cochabamba/Montero Health Programs. These are broken down into capital costs and recurring costs. It should be made clear again, as was pointed out in the text, that these costs do include all identifiable costs of operation, including all capital expenses, training and continuing education, and depreciation of buildings, vehicles, and equipment. These costs do not include the costs of operation of the La Paz and Lake Junaluska ARHC offices nor do they include the value of a small amount of donated supplies and equipment.

Table 9
Carabuco Health Program Costs
1987-1992

CAPITAL COSTS	1987, ARHC	1987, MOH	1987, TOTAL	1988, ARHC	1988, MOH	1988, TOTAL
health facilities	$1,200	0	$1,200	$5,700	0	$5,700
transportation equipment/ medicines	0	0	0	$17,500	0	$17,500
total capital costs	0	0	0	$1,482	0	$1,482
	$1,200	0	$1,200	$24,682	0	$24,682
RECURRENT COSTS						
salaries	$36,082	$1,707	$37,789	$46,238	$3,002	$49,240
consultants	0	0	0	0	0	0
health supplies program support	$2,209	$5,234	$5,234	$13,563	$2,162	$15,725
supplies direct services	$5,390	0	$5,390	$1,505	0	$1,505
costs administrative	$1,548	0	$1,548	$350	0	$350
costs (non-personnel)	$3,167	0	$3,167	$1,798	0	$1,798
travel costs transportation	$3,651	0	$3,651	$1,540	0	$1,540
(including vehicle depreciation)	$22,026	0	$22,026	$15,546	0	$15,546
training equipment and	$11,974	0	$11,974	$4,177	0	$4,177
infrastructure maintenance (including depreciation)	$2,350	$3,000	$5,350	$2,120	$3,000	$5,120
total recurrent costs	$88,397	$7,732	$96,129	$86,837	$8,164	$95,001

Table 9
(continued)
Carabuco Health Program Costs
1987-1992

CAPITAL COSTS	1989, ARHC	1989, MOH	1989, TOTAL	1990, ARHC	1990, MOH	1990, TOTAL
health facilities	$116,453	0	$116,453	$16,037	0	$16,037
transportation equipment/ medicines	0	0	$17,500	0	0	0
total capital costs	$20,990	0	$20,990	0	0	0
RECURRENT COSTS	$137,443	0	$137,443	$16,037	0	$16,037
salaries	$50,166	$5,727	$55,893	$50,802	$5,802	$56,604
consultants	0	0	0	$1,373	0	$1,373
health supplies	$8,586	$811	$9,397	$9,980	$793	$10,773
program support supplies	$1,609	0	$1,609	$1,550	0	$1,550
direct services costs	$670	0	$670	$417	0	$417
administrative costs (non-personnel)	$1,643	0	$1,643	$1,993	0	$1,993
travel costs	$1,311	0	$1,311	$812	0	$812
transportation (including vehicle depreciation)	$19,033	0	$19,033	$18,996	0	$18,996
training	$1084	0	$1,084	$8,753	0	$8,753
equipment and infrastructure maintenance (including depreciation)	$2,049	$3,000	$5,049	$7,025	$3,000	$10,025
total recurrent costs	$86,151	$9,538	$95,689	$101,701	$9,595	$111,296

Table 9
(continued)
Carabuco Health Program Costs
1987-1992

CAPITAL COSTS	1991, ARHC	1991, MOH	1991, TOTAL	1992 ARHC	1992, MOH	1992, TOTAL
health facilities	$4,035	0	$4,035	0	0	0
transportation equipment/ medicines	$0	0	$0	$17,400	0	$17,400
total capital costs	$0	0	$0	$1,896	$2,400	$4,296
	$4,035	0	$4,035	$19,296	$2,400	$21,696
RECURRENT COSTS						
salaries	$69,450	$7,000	$76,450	$57,233	$6,045	$63,278
consultants	$700	0	$700	$25	0	$25
health supplies	$250	$1,500	$1,750	$1,732	$1,500	$3,232
program support supplies	$3,506	0	$3,506	$534	0	$534
direct services costs	$285	0	$285	$455	0	$455
administrative costs (non-personnel)	$1,398	0	$1,398	$1,943	0	$1,943
travel costs	$1,012	0	$1,012	$868	0	$868
transportation (including vehicle depreciation)	$16,308	0	$16,308	$13,159	0	$13,159
training	$2,659	0	$2,659	$1,537	0	$1,537
equipment and infrastructure maintenance (including depreciation)	$10,863	$3,000	$13,863	$7,875	$3,000	$10,875
total recurrent costs	$106,431	$11,500	$117,934	$85,361	$10,545	$95,906

Table 10
Malico Rancho Program Costs
1991-1992

CAPITAL COSTS	1991, ARHC	1991, MOH	1991, TOTAL	1992, ARHC	1992, MOH	1992, TOTAL
health facilities		0	0	$21,057	0	$21,057
transportation equipment/ medicines		0	0	0	0	0
total capital costs	$6,099	0	$6,099	$22,140	0	0
RECURRENT COSTS						
salaries	$58,877	$5,133	$64,010	$39,744	$5,133	$44,877
consultants	$1,016	0	$1,106	$812	0	$812
health supplies	$4,497	$1,000	$5,497	$4,400	$1,500	$5,900
program support supplies	$1,869	0	$1,869	$1,406	0	$1,406
direct services costs	$791	0	$791	$439	0	$439
administrative costs (non-personnel)	$4,174	0	$4,174	$6,023	0	$6,023
travel costs	$339	0	$339	$363	0	$363
transportation (including vehicle depreciation)	$11,012	0	$11,012	$7,481	0	$7,481
training	$3,312	0	$3,312	$1,000est	0	$1,000
equipment and infrastructure maintenance (including depreciation)	$5,867	0	$5,867	$6,809	0	$6,809
total recurrent costs	$91,754	$6,133	$97,887	$68,477	$6,633	$75,110

Table 11
Villa Cochabamba Health Program Costs
1990-1992

CAPITAL COSTS	1990, ARHC	1990, MOH	1990, TOTAL	1991, ARHC	1991, MOH	1991, TOTAL
health facilities	$1,610	0	$1,610	$20,036	0	$20,036
transportation	0	0	0	0	0	0
equipment/ medicines	$537	0	$537	$7,549	0	$7,549
total capital costs	$2,147	0	$2,147	$27,585	0	$27,585
RECURRENT COSTS						
salaries	$14,407	0	$14,407	$31,687	0	$31,687
consultants	0	0	0	$77	0	$77
health supplies	$1,613	$1,500	$3,113	$4,533	$1,250	$5,783
program support supplies	$183	0	$183	$1,793	0	$1,793
direct services costs	0	0	0	$16	0	$16
administrative costs (non-personnel)	$83	0	$83	$3,235	0	$3,235
travel costs	0	0	0	$81	0	$81
transportation (including vehicle depreciation)	$2,191	0	$2,191	$3,415	0	$3,415
training	0	0	0	$1,676	0	$1,676
equipment and infrastructure maintenance (including depreciation)	$82	0	$82	$4,536	0	$4,536
total recurrent costs	$18,559	$1,500	$20,059	$51,049	$1,250	$52,299

Table 11
Villa Cochabamba Health Program Costs
1990-1992
(continued)

CAPITAL COSTS	1992 ARHC	1992 MOH	1992 TOTAL
health facilities	$1,566	0	$1,566
transportation equipment/ medicines	$300	0	$300
total capital costs	$7,375	0	$7,375
	$9,241	0	$9,241
RECURRENT COSTS			
salaries	$46,135	0	$46,135
consultants	0	0	0
health supplies	$10,181	$1,500	$11,681
program support supplies	$841	0	$841
direct services costs	$1,894	0	$1,894
administrative costs (non-personnel)	$5,610	0	$5,610
travel costs	$981	0	$981
transportation (including vehicle depreciation)	$4,861	0	$4,861
training	$255	0	$255
equipment and infrastructure maintenance (including depreciation)	$6,104	0	$6,104
total recurrent costs	$78,862	$1,500	$80,362

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APPENDIX VI. Description of Methodology for Calculation of Confidence Intervals for Mortality Rates

The methodology for estimating 95% confidence intervals for mortality rates has been obtained from the document entitled Healthy Communities 2000: Model Standards published in 1991 by the American Public Health Association. Pages 458 and 459 describe this methodology in more detail and it is reproduced on the following pages.

Healthy Communities 2000: Model Standards

Guidelines for Community Attainment of the Year 2000 National Health Objectives

3rd Edition

American Public Health Association
1015 Fifteenth Street, NW, Washington, DC

Statistical Instability

A common problem experienced by community agencies is how to develop rates when the event in question is an infrequent occurrence. A detailed explanation of this problem, and a procedure to address it, follow:

A community health standard is stated as a target that is to be obtained at a certain point in time. For example, by 1998, the infant mortality target rate will be 9.0. For geographic areas that have a large number of events, the process is a matter of comparing the actually achieved rate with the previously established standard. However, for areas where the event is infrequent, consideration needs to be given to the statistical instability of the rate under consideration. For example, if a county selected a 9.0 infant mortality rate as its standard for 1988 and actually achieved a rate of 11.0 in 1998, one might assume the county did not reach its goal. However, if the rate was based upon 50 deaths, the rate has a 95% confidence interval of 8.0-14.0, which includes the goal of 9.0. Even though the 9.0 rate was not reached that specific year, the 11.0 rate is not statistically different from the standard that was set.

In setting standards, one must not only decide what the standard will be and when it is to be reached but also determine what degree of confidence to use as a measure of whether the standard has actually been met. When using point estimates (such as the number of cases or deaths), it is desirable to report the standard error of the statistics so that the reader has some conception of the possible error. The confidence interval specifies the discrepancy between the estimate and actual or true value (for example ± 2). Although one can never be absolutely sure this value is not outside the range of tolerated error, we can specify to what degree we are confident the estimate is reliable (95 or 99%). If it is decided that more precision is needed than knowing that the true rate falls within a 6-point spread, as in the previous infant mortality example, then the standard needs to be changed.

One has two ways of addressing this problem. Both approaches require increasing the number of events in the formulation of the rate. This can be done by increasing the geographic area so more events will be counted. For example, rather than setting the standard for one small county or small state, several adjoining counties or states could be included. A second approach is to change the standard to a multi-year standard. Rather than having the standard focus on 1990, it could pertain to the three-year period 1989-1991.

Both of these approaches have obvious drawbacks. In the first instance, a geographic area that is not under the control of the same jurisdiction might have to be included. The second option requires adding several years' data and limits the ability to easily test program intervention and study time trends.

However, the alternative to these approaches is to use a rate that is very unstable, fluctuates widely from one year to the next, and does not adequately represent the true rate.

The next question is how many events should be used to establish a stable rate. There is no single answer to this question. Obviously, the larger the number of events, the more stable the rate. Unfortunately, a very large number of events is required to create a rate with a small confidence interval. For example, it requires 1600 events to obtain a 95 percent confidence interval whose length is ±5 percent of the rate. While one would prefer to have such a small confidence interval, rare health events and small geographic areas generally preclude such precision.

It is recommended that all standards be based upon 20 or more expected events (infant deaths, low-birth-weight infants, etc.). If a standard can be developed for more expected events, it is preferable. Regardless of the number of events, the confidence interval for the rate should be computed when comparing the actual rate with the standard. If the standard falls within the confidence interval range, then the actual rate and standard are not statistically different. The following table shows the length of confidence intervals based upon the number of events in the numerator of the rate:

Table 1
95 Percent Confidence Intervals for Selected Number of Events

Number of Events	Confidence Interval
20	Rate ± .40 • Rate
30	Rate ± .36 • Rate
40	Rate ± .31 • Rate
50	Rate ± .28 • Rate
75	Rate ± .23 • Rate
100	Rate ± .20 • Rate
150	Rate ± .16 • Rate
200	Rate ± .14 • Rate
300	Rate ± .11 • Rate
400	Rate ± .10 • Rate
800	Rate ± .07 • Rate
1600	Rate ± .05 • Rate

Table 2
Number of Years and Events Needed to Develop a Standard with a Confidence Interval Less Than or Equal to the Rate ±20%

Number of Events Per Year	Aggregate Number Of Years
100	1
50-99	2
33-49	3
25-32	4
20-24	5
17-19	6
15-16	7
13-14	8
11-12	9
10	10
0-9	*

** Standard not recommended for fewer than 10 events per year*