The Census-Based, Impact-Oriented Approach and Its Application by Andean Rural Health Care in Bolivia, South America

Volume III

Appendices
VOLUME III.

APPENDIX
APPENDIX CONTENTS

Appendix I. Description of Methodology....................page 273
Appendix II. Andean Rural Health Care Program Staffs........page 298
Appendix III. Additional Immunization Coverage Data
              for Carabuco.............................page 311
Appendix IV. Description and Findings of the
             Case-Control Studies of Infant and
             Child Deaths at ARHC's Established
             Program Sites..............................page 315
Appendix V. Additional Financial Information..............page 357
Appendix VI. Description of Methodology for Estimating
             Confidence Intervals for Mortality Rates.......page 375
APPENDIX I. Methodology

Most of the data, qualitative and quantitative, were collected during two trips to Bolivia in January/February and in May, 1993. Considerable information had been collected at the Lake Junaluska office and at various locations in Bolivia, but it had not been centralized and converted into a computer-readable format. Previously conducted evaluations were reviewed and appropriate data extracted from them.

During the January/February trip, field staff were interviewed regarding the day-to-day functioning of program operations and their views regarding the CBIO approach. The birth and death registration data were collected during this trip. The May trip was devoted primarily to collecting information for the case-control studies and also additional information for the cost analysis.

The following pages contain examples of forms which were used to abstract quantitative information from the program monthly reports, from the birth and death registries, and from financial reports. This information was then analyzed using EPI INFO version 5.0 software.

It was necessary to develop a death codification scheme. This is attached. When more than one diagnosis was encountered in the death registry, both were recorded for further analysis. Cause of death was assigned by one of the program staff, often in discussion with the program director, after interviews with the family. No formal verbal autopsy protocol was used. The person assigning the cause of death was in all cases a trained member of the program staff.
CBIO APPROACH  Appendix I.

EXAMPLE OF FORM USED TO RECORD HEALTH ACTIVITIES AT PROGRAM SITES
(for EPI INFO)

SISTEMA DE INFORMACION DE SALUD
CARABUCO

1. Fecha de informe  {fechainf}  <dd/mm/yy>

2. Numero de consultas y otros servicios curativos

   número de consultas nuevas menores de 5 años  {numcnn} ###
   número de consultas nuevas 5 años y más  {numcnm} ###
   numero total de consultas nuevas  {tconnu} ###
   número de consultas repetidas menores de 5 años  {numcrn} ###
   número de consultas repetidas 5 años y más  {numcrm} ###
   numero total de consultas repetidas  {tconre} ###
   número de consultas, menos de 5 años, referidas  {numcpr} ###
   número de consultas 5 años y más, referidas  {numcmr} ###
   numero total de consultas referidas  {tconref} ###
   número de consultas en total  {numcont} ###
   número de inyectables  {numiny} ###
   número de venoclisis  {numvep} ###
   número de suturas  {numsut} ###
   número de curaciones  {numcur} ###

3. Numero de visitas domiciliarias  {numvd} ###

4. Participación Comunitaria
   número de reuniones con clubes de madres  {numreucl} ###
   número de participantes  {parreucl} ###
   número de reuniones con la comunidad  {numreuco} ###
   número de participantes  {parreuco} ###
   número de reuniones con autoridades  {numreuau} ###
   número de participantes  {parreuau} ###
   número de reuniones con escuelas  {numreues} ###
   número de participantes  {parreues} ###
5. Número de vacunas por grupo etario

- Polio 1 menos de un año \{OPV1a\} ###
- Polio 1 1-4 años \{OPV1b\} ###
- Polio 2 menos de un año \{OPV2a\} ###
- Polio 2 1-4 años \{OPV2b\} ###
- Polio 3 menos de un año \{OPV3a\} ###
- Polio 3 1-4 años \{OPV3b\} ###
- Polio refuerzo menos de un año \{OPVRa\} ###
- Polio refuerzo 1-4 años \{OPVRb\} ###

- DPT 1 menos de un año \{DPT1a\} ###
- DPT 1 1-4 años \{DPT1b\} ###
- DPT 2 menos de un año \{DPT2a\} ###
- DPT 2 1-4 años \{DPT2b\} ###
- DPT 3 menos de un año \{DPT3a\} ###
- DPT 3 1-4 años \{DPT3b\} ###

- Sarampión menos de un año \{SARAMPa\} ###
- Sarampión 1-4 años \{SARAMPb\} ###

- BCG menos de 1 año \{BCGa\} ###
- BCG 1-4 años \{BCGb\} ###

- Toxoidé tétánico,
  - Primer dosis \{TT1\} ###
  - Segundo dosis \{TT2\} ###
  - Tercer dosis (o más) \{TT3\} ###

6. Actividades en Nutrición

- Número de niños en total (menos de 5 años) recibiendo control de crecimiento \{numcc\} ###

- Número de niños nuevos menos de dos años en control nutricional \{nnncn\} ###

- Número de niños repetidos menos de dos años en control nutricional \{nnrcn\} ###

- Número de niños menos de dos años con lana roja \{nnlr\} ###

- Número de niños menos de dos años con lana amarilla \{nnla\} ###
CBIO APPROACH  Appendix I.
número de niños menos de dos años con lana verde (nnlv) ###
número de niños de 2 - 4 años en control nutricional (nnncn) ###

7. Número de casos de diarrea tratado en niños menos de 5 años:
número total de niños tratado con diarrea (numtodia) ###

sin deshidritación (numdiars) ###
con deshidritación (numdiarc) ###

número de casos en niños menos de un año (numdiinf) ###
número de casos en niños 1 - 4 años (numdinin) ###

número de niños menos de dos años con signos de deshidritación (diamen2d) ###
número de niños 2-4 años con signos de deshidritación (diamas2d) ###

8. Número de casos de infección respiratoria aguda tratado en niños menos de 5 años:
número total de niños tratado con IRA (numtoIRA) ###

no neumonia (neum1) ###
oídos y gargantas (neum2) ###
neumonia moderado (neum3) ###
neumonia grave (neum4) ###

número de casos en niños menos de un año (numneinf) ###
número de casos en niños 1 - 4 años (numnenin) ###

número de casos de IRA con neumonia en niños menos de 2 años (neume2) ###
número de casos de IRA con neumonia en niños 2-4 años (neuma2) ###
9. Atención obstétrica

controles prenatales
   primer control \{primconpr\} ###
   segundo control \{segconpr\} ###
   número total de controles \{numcontn\} ###

partos
   parto a domicilio \{partodom\} ###
   parto institucional \{partoins\} ###
   número total de partos \{numparto\} ###

control puerperio
   fisiológico \{conpuefi\} ###
   patológico \{conpuepa\} ###
   numero totales de controles puerperios \{numpueto\} ###

10. Programa de tuberculosis

   número de pacientes en
   tratamiento al inicio
   del mes (antiguos) \{TBantig\} ###

   PACIENTES INCORPORADOS EN EL MES
   número de pacientes nuevos \{TBnuev\} ###
   número de pacientes reingresados \{TBantig\} ###
   número de pacientes transferidos \{TBreing\} ###
   número total de pacientes
   incorporados \{TBincor\} ###

   PACIENTES EGRESADOS EN EL MES
   número de pacientes curados \{TBcur\} ###
   número de pacientes que
   abandonó su tratamiento \{TBanab\} ###
   número de pacientes transferidos \{TBtrans\} ###
   número de pacientes que murió \{TBMurio\} ###
   número de fracasos terapéuticos \{TBfrac\} ###
   número total de egresados \{TBegres\} ###

   PACIENTES CONTINUANDO SU TRATAMIENTO \{TBcon\} ###

11. Exámenes del laboratorio

   total exámenes del laboratorio \{tel\} ###
12. Servicios de Odontología

número de consultas nuevas \{ncon\} ###
número de consultas repetidas \{nccr\} ###
número de consultas en total \{ncot\} ###

Anotaciones

1. Si dice neumonía leve, se puede notar como "no neumonía."
2. Antes de Enero, 1990, el número de las IRAs es para los grupos etáreos menores de 15 años, no solamente los menores de 5 años.
3. Antes de Enero, 1990, el número de las diarreas es para los grupos etáreos menores de 15 años, no solamente para los que son menores de 5 años.
CBIO APPROACH Appendix I.

EXAMPLE OF FORM USED TO RECORD BIRTHS

Registro de Nacimientos

Programa de Salud, Villa Cochabamba/Montero
— Consejo de Salud Rural Andino

1. nombre de niño que nació

{nOMBRE} 

2. dirección

barrio {barrio}

{CODBAR} ##

{MANSA} ###

{NUMVIV} ###.#

3. fecha de nacimiento {fechanac} <dd/mm/yy>

4. sexo {sexo} _ (m o f)

5. ubicación del parto {ubicpar} (d=domiciliario)

{HOSP} (h=hospital)

6. peso al nacer {pesonac} ###.### kilogramas

7. fechas de vacunas puesto al nacer

{BCG} <dd/mm/yy>

{POLIO1} <dd/mm/yy>
Guía Para el Uso del Questionario

2. Comunidad

Código para los barrios:

Villa Cochabamba.....1
Barrio San Jose.....2
Villa Verde.........3
Villa Barrientos....4
Pampa de la Madre...5
Villa Virginia......6
Barrio Porvenir.....7
Barrio Fabril.......8

2. Número de la casa:

Si el número de la familia es 1, el número de la vivienda es xx.1. Entonces, el número de la vivienda 49, familia 2 debe entrar la sistema de información como 49.2.

3. Fecha de nacimiento:

Si tiene el año no más, ponga 01/06/xx.

4. Sexo:

masculino- "m"
femenino- "f"
EXAMPLE OF FORM USED TO RECORD DEATHS

Registro de Muertes
Programa de Salud, Carabuco
Consejo de Salud Rural Andino

1. nombre de persona que murió
   {nombre}

2. comunidad
   {comun}
   código para el nombre de la comunidad {codcom} ##
   número de casa ###.

3. fecha de nacimiento {fechanac} <dd/mm/yy>

4. sexo {sexo} — (m o f)

5. fecha de muerte {fechamue} <dd/mm/yy>

6. edad al morir
   edad al morir en años {edadmora} ###.## años
   edad al morir en meses {edadmorm} ###.## meses
   edad al morir en semanas {edadmors} ###.## semanas
   edad al morir en días {edadmord} ###.## días
7. causa de muerte

{caumuert}

código 1 de causa de muerte {codmuer1} ###
código 2 de causa de muerte {codmuer2} ###
código 3 de causa de muerte {codmuer3} ###
código 4 de causa de muerte {codmuer4} ###
código 5 de causa de muerte {codmuer5} ###

8. hallazgos de autopsia verbal

autopsia hecho {authech} (si o no)

{autverb}
Guía Para el Uso del Cuestionario

2. Comunidad

Código para las comunidades:

Agua Calientes........ 1
Cacachi.............. 2
Cavinchilla.......... 3
Chaguaya........... 4
Challapata Belen.... 5
Challapata Grande... 6
Centro Putina....... 7
Cojatapampa......... 8
Huajasia............ 9
Huancatapi.......... 10
Jokopampa........... 11
Karkapunco.......... 12
Marcañilata......... 13
Mermapata........... 14
Mollipongo.......... 15
Ollasjantía......... 16
Omacuyo............. 17
Quinasca........... 18
Quilima............ 19
Quiriquiati......... 20
Sacuco.............. 21
Santiago de Okola... 22
Sañuta.............. 23
Sayuapampa......... 24
Sisasaní........... 25
Tilacoca........... 26
Villa Cojata........ 27
Villa Karcuyos...... 33
Villa Molino.......... 29
Yaricoa Alto........ 30
Yaricoa Bajo......... 31
Mollipongo A.......... 32
Mollipongo B......... 33
Huayñacota.......... 32

Número de la casa:

Si el número tiene también un "A" o "B," ponga en lugar de "A" un "1" y en lugar de "B" un 2. Entonces, el número de la casa de 49.B debe entrar la sistema de información como 49.2.
3. Fecha de nacimiento:

Si tiene el año no más, ponga 01/06/xx.

4. Sexo:

masculino- "m"
femenino- "f"

4. Fecha de muerte:

Si tiene el año no más, ponga 01/06/xx.
Si tiene el año y mes pero no el día, ponga 15/xx/xx.
FORM USED TO COLLECT FINANCIAL INFORMATION FOR PROGRAM AREAS

Questionario Sobre Costos y Ingresos

1. Nombre del Programa: {nombprog} 
   código del programa: {codprog} 

2. fecha del informe: {fechainf} <dd/mm/yy> 
   período del informe: de {perpri} <dd/mm/yy> a {perfin} <dd/mm/yy>

3. gastos de inversión
   a. infraestructura
      suministros y materiales 
      para construcción relacionado al programa de salud ‘(5400)  
      {sm5400} $######## 
      suministros y materiales 
      para construcción relacionado al desarrollo comunitario  
      {smcrdc} $#####
      suministros y materiales 
      para construcción relacionado al agua y saneamiento  
      {smcras} $#####
   b. transporte
      compra de vehículos (5140)  
      (incluye compra de motos)  
      {cv5140} $#####
   c. equipos
      equipo de oficina (5100)  
      {eo5100} $#####
      equipo de educación (5120) 
      {ee5120} $#####
      equipo de comunicación (5130) 
      {ec5130} $#####
      equipo médico (5110)  
      (incluye equipo dental y equipo del laboratorio)  
      {em5110} $#####
   gasto total de inversión  
   {gtinv} $#####

285
4. gastos recurrentes

a. personal
   salarios (5200) {s5200} $####
   beneficios sociales (5210) {bs5210} $####
   gasto total de personal {gtper} $####

b. consultores
   consultores locales (5510) {cl5510} $####
   consultores del exterior (5520) {ce5520} $####
   contratos (5540) {c5540} $####
   gasto total de consultores {gtcon} $####

c. suministros

  c.1. suministros para atención en salud

   suministros y materiales supervivencia
      infantil (5410) {sms15410} $####
   medicinas (5420) {m5420} $####
   suministros medicos (5425) {sm5425} $####
   suministros dentales (5430) {sd5430} $####
   suministros del laboratorio (5440) {s15440} $####
      incentivos a voluntarios (5465) {sv5465} $####

   gasto total de suministros para atención en salud {gtspas} $####

c.2. suministros para apoyar el programa

   fotografías (5580) {f5580} $####
   libros, publicaciones, y subscripciones (5590) {lgs5590} $####
   cuotas a asociaciones (5595) {ca5595} $####
   suministros y materiales de oficina (5740) {smo5740} $####
   suministros y materiales del campo (5745) {smc5745} $####
   uniformes (5865) {u5865} $####

   gasto total de suministros para apoyar el programa {gtspap} $####
d. gastos de servicios directos
  subvenciones de pacientes indigentes (5570) {spi5570} $####
  relaciones con la comunidad (5570) {rcc5780} $####

gasto total de servicios directos {gtsd} $####

e. gastos administrativos (no personal)
  gastos legales/
    formularios (5750) {glf5750} $####
  servicio teléfono (5760) {st5760} $####
  correo (5765) {c5765} $####
  radio comunicaciones (5770) {rc5770} $####
  fotocopias (5775) {f5775} $####
  impresión (5739) {i5739} $####
  reuniones de directorio (5790) {rd5790} $####
  reclutamiento personal (5795) {rp5795} $####
  agua y luz (5800) {al5800} $####
  seguros (5810) {s5810} $####
  intereses (5820) {i5820} $####
  cargos bancarios (5825) {cb5825} $####
  impuestos sobre ventas (5830) {isv5830} $####
  servicios de té y refrigerios (5850) {str5850} $####
  traducciones (5855) {t5855} $####
  lavandería (5860) {l5860} $####
  vario {miscel} $####

  gasto total de administración (no personal) {gtanp} $####

f. gastos de viaje
  transporte local (5300) {t15300} $####
  transporte interior (5310) {t15310} $####
  viaticos en el país (5320) {vp5320} $####

  gasto total de viaje {gtv} $####

g. transporte
  uso y mantenimiento de vehículos (5720) {umv5720} $####
  depreciación de vehículos {dv} $####

  gasto total de transporte {gtttran} $####
h. capacitación
  reuniones nacionales (5550) \{rn5550\} $#######
  matrícula seminarios (5560) \{ms5560\} $#######
  materiales de entrenamiento para el personal (5450) \{mepp5450\} $#######
  materiales de entrenamiento para voluntarios (5460) \{mepv5460\} $#######
  materiales educativos (5470) \{me5470\} $#######
  diseño de materiales educativos (5475) \{dme5475\} $#######
  materiales audiovisuales (5480) \{ma5480\} $#######
  educación radial (5485) \{er5485\} $#######
  curso de capacitación al personal \{cucapp\} $#######
  capacitación de voluntarios \{capvol\} $#######
  gasto total de capacitación \{gtcap\} $#######

j. mantenimiento de equipo e infraestructura
  mantenimiento de equipos (5705) \{me5705\} $#######
  mantenimiento edificios (5715) \{me5715\} $#######
  alquiler de equipos (5700) \{ae5700\} $#######
  mantenimiento de computador (5730) \{mc5730\} $#######
  alquiler de edificios (5710) \{ae5710\} $#######
  depreciación (no incluyendo vehículos) (5840) \{dniv5840\} $#######
  gasto total de mantenimiento \{gtmant\} $#######

k. desarrollo comunitario
  desarrollo comunitario aparte del programa de salud \{dcaps\} $#######

l. evaluación
  auditoría (5500) \{a5500\} $#######
  evaluación \{eval\} $#######
  gasto total del evaluación \{gteval\} $#######

GASTO TOTAL DEL PERIOD \{gtper\} $#######

288
INGRESOS

Puentes de Ingresos

<table>
<thead>
<tr>
<th>Fuente</th>
<th>Importe</th>
</tr>
</thead>
<tbody>
<tr>
<td>USAID (incluyendo PROCOSI)</td>
<td>$####</td>
</tr>
<tr>
<td>otros donaciones</td>
<td>$####</td>
</tr>
<tr>
<td>CSRA</td>
<td>$####</td>
</tr>
<tr>
<td>MPSSP</td>
<td>$####</td>
</tr>
<tr>
<td>locales</td>
<td>$####</td>
</tr>
<tr>
<td><strong>INGRESOS TOTALES</strong></td>
<td>$####</td>
</tr>
</tbody>
</table>

NOTAS:

---------

Anotaciones Sobre el Cuestionario

código del programa:
1. Carabuco.......................... 01
2. Ancoraimes........................ 02
3. Malloco Rancho.................... 03
4. Sipe Sipe.......................... 04
5. Villa Cochabamba/Montero... 05

todos los costos deben ser asignado a uno de tres categorías:
dedicado al supervivencia infantil
dedicado al atención primaria
dedicado al desarrollo fuera de salud
CODING CLASSIFICATION FOR CAUSE OF DEATH

Clasificación de Causas de Muertes

<table>
<thead>
<tr>
<th>CLASIFICACION</th>
<th>CODIGO</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 infecciones respiratorias</td>
<td></td>
</tr>
<tr>
<td>01 infección respiratoria aguda (IRA)</td>
<td>0101</td>
</tr>
<tr>
<td>(incluye &quot;neumonía,&quot; &quot;tos,&quot; &quot;tos</td>
<td></td>
</tr>
<tr>
<td>seca&quot; en niños, &quot;neumonía,&quot; &quot;pulmonía,&quot; y</td>
<td></td>
</tr>
<tr>
<td>bronconeumonía)</td>
<td></td>
</tr>
<tr>
<td>02 tuberculosis</td>
<td>0102</td>
</tr>
<tr>
<td>(incluye &quot;hemoptisis,&quot; tuberculosis</td>
<td></td>
</tr>
<tr>
<td>pulmonar)</td>
<td></td>
</tr>
<tr>
<td>03 asfixia</td>
<td>0103</td>
</tr>
<tr>
<td>(incluye &quot;dificultad respiratoria&quot;)</td>
<td></td>
</tr>
<tr>
<td>04 enfermedad pulmonar</td>
<td>0104</td>
</tr>
<tr>
<td>05 coqueluche</td>
<td>0105</td>
</tr>
<tr>
<td>02 infecciones gatrointestinales</td>
<td></td>
</tr>
<tr>
<td>01 diarrea</td>
<td>0201</td>
</tr>
<tr>
<td>(incluye &quot;vomitos y diarrea,&quot; &quot;gastroenteritis,&quot;</td>
<td></td>
</tr>
<tr>
<td>&quot;deshidratación,&quot; &quot;enterocolitis,&quot; &quot;infección</td>
<td></td>
</tr>
<tr>
<td>gastrointestinal&quot;)</td>
<td></td>
</tr>
<tr>
<td>02 colera</td>
<td>0202</td>
</tr>
<tr>
<td>03 salmonella</td>
<td>0203</td>
</tr>
<tr>
<td>04 hepatitis</td>
<td>0204</td>
</tr>
<tr>
<td>05 disentería</td>
<td>0205</td>
</tr>
<tr>
<td>Código</td>
<td>Descripción</td>
</tr>
<tr>
<td>--------</td>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td>0301</td>
<td>Sarampión</td>
</tr>
<tr>
<td>0302</td>
<td>Tétano (no neonatal)</td>
</tr>
<tr>
<td>0303</td>
<td>Omfalitis</td>
</tr>
<tr>
<td>0304</td>
<td>Septicemia</td>
</tr>
<tr>
<td>0305</td>
<td>Meningitis</td>
</tr>
<tr>
<td>0306</td>
<td>Fiebre</td>
</tr>
<tr>
<td>0307</td>
<td>Tuberculosis extrapulmonar</td>
</tr>
<tr>
<td></td>
<td>(incluye tuberculosis renal)</td>
</tr>
<tr>
<td>0308</td>
<td>Osteomielitis</td>
</tr>
<tr>
<td>0309</td>
<td>Absceso</td>
</tr>
<tr>
<td>0310</td>
<td>Rabia humana</td>
</tr>
<tr>
<td>0401</td>
<td>Retención de placenta</td>
</tr>
<tr>
<td>0402</td>
<td>Hemorragia vaginal</td>
</tr>
<tr>
<td></td>
<td>(en mujer embarazada)</td>
</tr>
<tr>
<td>0403</td>
<td>Obstrucción de parto</td>
</tr>
<tr>
<td>0404</td>
<td>Infección puerperal</td>
</tr>
<tr>
<td>0405</td>
<td>Desprendimiento de placenta</td>
</tr>
<tr>
<td>0406</td>
<td>Eclampsia</td>
</tr>
<tr>
<td>0407</td>
<td>Otra enfermedad obstetrica</td>
</tr>
<tr>
<td></td>
<td>(incluye &quot;complicación de embarazo no especificado&quot;)</td>
</tr>
</tbody>
</table>
05 enfermedades perinatales

01 anomalía congénita 0501
02 asfixia neonatal 0502
03 mortinato
(muerte del feto durante el trabajo de parto o al momento antes de dar luz) 0503
04 obito
(muerte de feto intrauterino antes de empezar el trabajo de parto) 0504
05 nacio muerte
(no se puede distinguir si fue mortinato u obito) 0505
06 prematuro 0506
07 pie zambo 0507
08 desnutrición intrauterina
(incluye nacidos de bajo peso) 0508
09 hidrocefálico 0509
10 sepsis neonatal 0510
11 sufrimiento fetal por parto prolongado 0511
12 laporino 0512
13 tetano neonatal 0513
06 accidente/trauma

01 ahogado
   (incluye "asfixia en agua,"
   "accidente fluvial")

02 intoxicación alcohólico
   (borracho)

03 accidente

04 relámpago

05 accidente eléctrico

06 accidente del transito
   (incluye "accidente de transporte")

07 accidente con animal

08 asfixia en cama

09 suicidio

10 envenenamiento
    (incluye intoxicación)

11 intoxicación accidental

12 intoxicación química
    (incluye intoxicación con
    insecticida)

13 traumatismo
    (incluye "politraumatismo,"
    "trauma")

14 tóxico

15 descuido de los padres
    (incluye "padre borracho," o
    "madre borracha")

16 trauma encefalocranial (TEC)

17 accidente con arma de fuego

18 quemadura

19 ahorrado
07 enfermedades nutricionales

01 desnutrición

02 anorexia

08 enfermedades abdominales

01 abdomen agudo

02 appendicitis

03 ascitis

04 colicistitis
   (incluye "vesicula," "vesicula biliar," calcu biliar)

05 dolor del estomago
   (incluye "dolor abdominal," "gastritis," "enfermedad del estomago")

06 hemorragia interna

07 esofagitis

08 obstrucción intestinal
   (incluye empacho)

09 ulcer a peptica
   (incluye "ulcer a en el estomago," y "ulcer a hepatica")

10 volvulo

11 pancreatitis

12 cólico

13 hemorragia digestiva alta

14 vomitos (sin otro sintome digestiva)
enfermedades cardíacos

01 ataque cardíaco
(incluye "paro cardíaco")

02 insuficiencia cardíaca
(incluye "cardiopatía," "insuficiencia cardiorespiratoria," "mal de corazón")

03 edema pulmonar

enfermedades musculares

01 articulaciones hinchadas

02 reumatismo
(incluye artritis reumática)

enfermedades neurológicas

01 accidente cerebrovascular
(incluye "embolia," "aire")

02 epilepsia

03 tumor cerebral

04 parálisis
(incluye parálisis)

05 secuela de meningitis

06 dolor de la cabeza

desordenes hematológicos

01 anemia

02 epistaxis

03 purpura

04 discrasia sanguínea

05 linfoma maligna
(incluye "leucemia")

06 adenopatía aguda
13 vejez

01 vejez
(incluye "edad avanzado," "edad," "senectud")

14 diagnósticos tradicionales

01 ajayu
02 caricari
03 coleron
(incluye "colerina")
04 susto
05 animo
06 curme
07 arrabato
08 tiricia

15 complicaciones postoperatorio

01 muerte postoperatorio

16 enfermedades respiratorias (no incluye infecciones respiratorias agudas ni TB)

01 asma
02 broncoaspiración
03 bronquitis crónica
04 obstrucción respiratoria
(incluye "cuerpo extraño en la laringe")
05 tos crónico
(incluye tos seca en adultos)
17 desordenes varios

01 edema generalizada 1701
02 flatulencia 1702
03 scroptosis (incluye "karachi") 1703
04 alergia 1704

18 cancer no especificado en otro categoría

01 hemorragia vaginal (en mujer de edad avanzada o no embarazada) 1801
02 liposarcoma 1802
03 tumor maligno (incluye "cancer") 1803
04 cancer del higado 1804
05 cancer en los testiculos 1805
06 cancer de la mama 1806
07 cancer de paladar 1807

19 enfermedades genitourinarias

01 glomerulonefritis 1901
02 insuficiencia renal (incluye "insuficiencia hepatorenal") 1902
03 infección urinario 1903
04 problema urinario 1904

20 desconocido

01 desconocido (incluye "se ignora") 2001

21 desordenes endocrinológicos

01 diabetes 2101
APPENDIX II. Staff of ARHC's Established Health Programs in Carabuco, Mallco Rancho, and Villa Cochabamba

STAFF OF THE CARABUCO HEALTH PROGRAM
1983-1992

Carabuco Program Staff, 1983-1992

1983

Dr. Aida Quintanilla—physician
Dr. Henry Perry (part-time)—physician
Sister Mary Elko—graduate nurse
Gloria Laime—accountant
(La Paz office)

1984

Dr. Mirta Morfini—Director
Carabuco Program Staff, 1983-1992  
(continued)

### 1985

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Fernando Acha-</td>
<td>MOH physician</td>
</tr>
<tr>
<td>Mr. Simon Saavedra-</td>
<td>rural health technician</td>
</tr>
<tr>
<td>Ms. Rosa Patiño-</td>
<td>rural health technician</td>
</tr>
<tr>
<td>Ms. Vicky Barron de Zayez-</td>
<td>auxiliary nurse</td>
</tr>
<tr>
<td>Ms. Jorge Zayez-</td>
<td>driver</td>
</tr>
<tr>
<td>Mr. Clemente Fernandez-</td>
<td>groundskeeper</td>
</tr>
<tr>
<td>Mr. Ernesto Mendizabal-</td>
<td>administrator</td>
</tr>
<tr>
<td>Ms. Gloria Laime-</td>
<td>(La Paz office) accountent</td>
</tr>
<tr>
<td>Mr. Jaime Cabrera-</td>
<td>(La Paz office) supplies coordinator</td>
</tr>
<tr>
<td>Mr. Javier Laura(part-time)-</td>
<td>(La Paz office) office assistant</td>
</tr>
</tbody>
</table>

### 1986

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Fernando Acha-</td>
<td>MOH physician</td>
</tr>
<tr>
<td>Mr. Simon Saavedra-</td>
<td>rural health technician</td>
</tr>
<tr>
<td>Ms. Rosa Patiño-</td>
<td>rural health technician</td>
</tr>
<tr>
<td>Ms. Vicky Barron de Zayez-</td>
<td>auxiliary nurse</td>
</tr>
<tr>
<td>Ms. Jorge Zayez-</td>
<td>driver</td>
</tr>
<tr>
<td>Mr. Clemente Fernandez-</td>
<td>groundskeeper</td>
</tr>
<tr>
<td>Mr. Ernesto Mendizabal-</td>
<td>administrator</td>
</tr>
<tr>
<td>Ms. Gloria Laime-</td>
<td>(La Paz office) accountent</td>
</tr>
<tr>
<td>Mr. Jaime Cabrera-</td>
<td>(La Paz office) supplies coordinator</td>
</tr>
<tr>
<td>Mr. Javier Laura(part-time)-</td>
<td>(La Paz office) office assistant</td>
</tr>
</tbody>
</table>
Dr. Fernando Acha-
Mr. Simon Saavedra-
Ms. Rosa Patiño-
Mr. Hernando Quelali-
Mr. Pablo Sñani-
Mr. Sixto Cancarí-
Mr. Clemente Fernandez-
Mr. Ernesto Mendizabal-

Ms. Gloria laime-
Mr. Jaime Cabrera-
Mr. Javier Laura (part-time) -

1988

Dr. Ivan Gonzales-
Mr. Simon Saavedra-
Ms. Rosa Patiño-
Mr. Hernando Quelali-
Mr. Pablo Sñani-
Mr. Eustaquio Apaza-
Mr. Cruz Apaza-
Mr. Justino Condori-
Mr. Leonardo Magnani-
Mr. Ubaldo Quelali-
Mr. Joaquín Pacosillo-
Mr. Francisco Quisper-
Mr. Fermin Quisper-
Mr. Luciano Tintaya-
Mr. Angel Tintaya-
Mr. Ismael Yuque-
Mr. Sixto Cancari-
Mr. Clemente Fernandez-
Mr. Ernesto Mendizabal-

Ms. Gloria laime-
Mr. Jaime Cabrera-
Mr. Javier Laura (part-time) -
Dr. Veronica Camarga - MOH physician
Mr. Simon Saavedra - rural health technician
Ms. Rosa Patiño - rural health technician
Mr. Hernando Quelali - auxiliary nurse
Mr. Pablo Síñani - auxiliary nurse
Mr. Eustaquito Apaza - community auxiliary nurse
Mr. Cruz Apaza - community auxiliary nurse
Mr. Justino Condori - community auxiliary nurse
Mr. Leonardo Magnani - community auxiliary nurse
Mr. Ubaldio Quelali - community auxiliary nurse
Mr. Joaquín Pacosillo - community auxiliary nurse
Mr. Francisco Quispe - community auxiliary nurse
Mr. Fermin Quispe - community auxiliary nurse
Mr. Luciano Tintaya - community auxiliary nurse
Mr. Angel Tintaya - community auxiliary nurse
Mr. Ismael Yuque - community auxiliary nurse
Mr. Sixto Cancari - community auxiliary nurse
Mr. Luis Pacosillo - community auxiliary nurse
Mr. Ernesto Mendizabal - community auxiliary nurse
driver
Ms. Gloria Laime - groundskeeper
Mr. Jaime Cabrera - administrator
Mr. Javier Laura (part-time) -

(accountant
(La Paz office)
supplies coordinator
(La Paz office)
office assistant
(La Paz office)
Carabuco Program Staff, 1983-1992 (continued)

1990

Director
MOH physician
rural health technician
rural health technician
auxiliary nurse
auxiliary nurse
community auxiliary nurse
community auxiliary nurse
community auxiliary nurse
community auxiliary nurse
community auxiliary nurse
community auxiliary nurse
community auxiliary nurse
driver

groundskeeper
accountant
(La Paz office)
supplies coordinator
(La Paz office)
office assistant
(La Paz office)

Dr. Orlando Taja (part-time)
Dr. Veronica Camarga
Mr. Simon Saavedra
Ms. Rosa Patiño
Mr. Hernando Quelali
Mr. Pablo Sifani
Mr. Eustaquio Apaza
Mr. Cruz Apaza
Mr. Justino Condori
Mr. Leonardo Magnani
Mr. Ubaldo Quelali
Mr. Joaquin Pacosillo
Mr. Francisco Quispe
Mr. Fermín Quispe
Mr. Luciano Tintaya
Mr. Angel Tintaya
Mr. Ismael Yuque
Mr. Sixto Cancari
Mr. Luis Pacosillo
Ms. Gloria Laime

Mr. Jaime Cabrera

Mr. Javier Laura (part-time)

1991

Director
MOH physician
rural health technician
rural health technician
auxiliary nurse
auxiliary nurse
community auxiliary nurse
community auxiliary nurse
community auxiliary nurse
community auxiliary nurse
community auxiliary nurse
community auxiliary nurse
community auxiliary nurse
driver
1991 (continued)
Mr. Luis Pacosillo-
Ms. Gloria Laime-
Mr. Jaime Cabrera-
Mr. Javier Laura (part-time) -
groundskeeper
accountant
(La Paz office)
supplies coordinator
(La Paz office)
office assistant
(La Paz office)

1992
Dr. Carolina Hilari-
Dr. William Valencia-
Mr. Simon Saavedra-
Ms. Rosa Patiño-
Ms. Paolina Huanca
Mr. Hernando Quelali-
Mr. Pablo Sñani-
Mr. Cruz Apaza-
Mr. Justino Condori-
Mr. Ubaldo Quelali-
Mr. Joaquín Pacosillo-
Mr. Francisco Quispe-
Mr. Fermin Quispe-
Mr. Luciano Tintaya-
Mr. Angel Tintaya-
Mr. Ismael Yuque-
Mr. Sixto Cancari-
Mr. Luis Pacosillo-
Ms. Gloria Laime-
Mr. Jaime Cabrera-
Mr. Javier Laura (part-time) -
Director
MOH physician
rural health technician
rural health technician
auxiliary based in Carabuco
auxiliary nurse
auxiliary nurse
community auxiliary nurse
community auxiliary nurse
community auxiliary nurse
community auxiliary nurse
community auxiliary nurse
community auxiliary nurse
community auxiliary nurse
driver
groundskeeper
accountant
(La Paz office)
supplies coordinator
(La Paz office)
office assistant
(La Paz office)
Mallco Rancho Program Staff, 1987-1992

1987

Dr. Orlando Taja, Director (part-time)
Ms. Adela Asbun, Field Coordinator
Mr. Sabino Gabriel, rural health technician
Ms. Nelly Coronado, promotor
Ms. Fernando Montan, promotor
Mr. Rolando Guzman, administrator (Cochabamba)
Ms. Marta Quiruga, secretary (Cochabamba)

1988

Dr. Orlando Taja, Director (part-time)
Ms. Adela Asbun, Field Coordinator
Dr. Javier Rafael Arcos, physician
Ms. Marta Escobar, rural health technician
Ms. Nelly Coronado, promotor
Mr. Fernando Montan, promotor
Mr. Fuad Taja, field administrator
Mr. Rolando Guzman, administrator (Cochabamba)
Ms. Marta Quiruga, secretary (Cochabamba)
Mr. Moises Orellano, driver (Cochabamba)

1989

Dr. Orlando Taja, Director (part-time)
Ms. Adela Asbun, Field Coordinator
Dr. Edgar Fuentes, physician
Ms. Marta Escobar, rural health technician
Mr. Fuad Taja, field administrator
Mr. Rolando Guzman, administrator (Cochabamba)
Ms. Carolina Mendoza, secretary (Cochabamba)
Mr. Milton Canedo, driver (Cochabamba)
Staff of the Mallco Rancho Health Program, 1987-1992
(continued)

1990

Dr. Orlando Taja, Director (part-time)
Ms. Adela Asbun, Field Coordinator
Dr. Gilka Lara, physician
Ms. Marta Escobar, rural health technician
Mr. Maclovio Mamani, rural health technician
Mr. Fuad Taja, field administrator
Dr. Pedro Vittorini, dentist
Ms. Catalina Ventura, auxiliary nurse
Mr. Fayez Mostafa, administrator (Quillacollo)
Mr. Ramiro Velasco, accountant (Quillacollo)
Ms. Carolina Mendoza, secretary (Quillacollo)
Mr. Gualberto Virrarroel, driver (Quillacollo)

1991

Dr. Orlando Taja, Director
Ms. Adela Asbun, Field Coordinator
Dr. Edgar Fuentes, physician
Ms. Marta Escobar, rural health technician
Mr. Maclovio Mamani, rural health technician
Mr. Luciano Cespedes, rural health technician
Ms. Nelly Coronado, auxiliary nurse
Ms. Maria Enojosa, auxiliary nurse
Mr. Fuad Taja, field administrator
Ms. Lucy Rojas, auxiliary statistician
Ms. Flora de Saavedra, cook
Dr. Patricia Camacho, dentist
Mr. Fayez Mostafa, administrator (Quillacollo)
Mr. Ramiro Velasco, accountant (Quillacollo)
Ms. Mary Morales, secretary (Quillacollo)
Mr. Mario Vargas, driver (Quillacollo)
Mr. Javier Saavedra, building maintenance (Quillacollo)
Staff of the Mallco Rancho Health Program, 1987-1992
(continued)

1992

Dr. Orlando Taja, Director
Ms. Adella Asbun, Field Coordinator
Dr. Roberto Flores, physician
Ms. Marta Escobar, rural health technician
Mr. Maclovio Mamani, rural health technician
Mr. Luciano Cespedes, rural health technician
Ms. Nelly Coronado, auxiliary nurse
Ms. Maria Enojosa, auxiliary nurse
Ms. Lucy Rojas, field administrator
Ms. Flora de Saavedra, cook
Dr. Miriam Casal, dentist
Mr. Faye Mostafa, administrator (Quillacollo)
Mr. Ramiro Velasco, accountant (Quillacollo)
Ms. Mary Morales, secretary (Quillacollo)
Mr. Mario Vargas, driver (Quillacollo)
Mr. Javier Saavedra, building maintenance (Quillacollo)
Staff of the Villa Cochabamba Health Program, 1988-1992

1988

Dr. Dardo Chavez- Director (part-time)
Ms. Juana Zeballos- graduate nurse
Mr. Pedro Simone- statistician (part-time)

1989

Dr. Dardo Chavez- Director
Dr. Ramiro Bravo- physician
Ms. Juana Ceballos- graduate nurse
Mr. Pedro Simone- statistician (part-time)
Ms. Gloria Suarez- administrator
Ms. Corina Echeverria- auxiliary nurse
Mr. Edwin Claure- groundskeeper

1990

Dr. Dardo Chavez- Director
Dr. Ramiro Bravo- physician
Dr. Javier Baldomar- physician
Ms. Mitma de Chavez- graduate nurse
Ms. Teresa Ruiz- health promoter
Mr. Carlos Chavez- groundskeeper

1991

Dr. Dardo Chavez- Director
Dr. Javier Baldomar- physician
Dr. Walter Munoz- physician
Ms. Mitma de Chavez- graduate nurse
Mr. Pedro Simone- statistician
Ms. Mirta Sanjines- administrator
Mr. Juan Carlos Guarapia- health technician
Mr. Edwin Claure- laboratory auxiliary
Ms. Sara Mercado- auxiliary nurse
Ms. Marta Heredia- auxiliary nurse
Ms. Teresa Ruiz- health promoter
Ms. Maria Esther Claros- health promoter
Mr. Carlos Chavez- groundskeeper
Staff of the Villa Cochabamba Health Program, 1988-1992
(continued)

1992

Dr. Dardo Chavez- Director
Dr. Javier Baldomar- physician
Dr. Maria Bravo- physician
Ms. Mitma Sanjines- administrator
Mr. Pedro Simone- statistician
Mr. Juan Carlos Guaribia- health technician
Ms. Olympia Maldonado- auxiliary nurse
Ms. Marta Heredia- auxiliary nurse
Ms. Inez Herbas- auxiliary nurse
Ms. Ester Andia- auxiliary nurse
Ms. Armanda Vargas- auxiliary nurse
Ms. Teresa Ruiz- health promoter
Ms. Silvia Pantoja- health promoter
Ms. Jacquelin Rosado- accountant (part-time)
Ms. Ana Maria Sosa- secretary
APPENDIX III. Additional Vaccination Coverage Data for Carabuco

Table 1.
DPT 3 Coverage in Carabuco, 1988-1992

<table>
<thead>
<tr>
<th>type of assessment</th>
<th>date of assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>57% 77% 86% 91%</td>
</tr>
<tr>
<td>percentage of children 12-23 months of age with complete vaccinations (rhpr*)</td>
<td>na na 89% 88%</td>
</tr>
<tr>
<td>percentage of children 12-23 months of age with all vaccinations completed by 12 months of age (rhpr**)</td>
<td>na 64% 72% 69% (***)</td>
</tr>
</tbody>
</table>

* css: cluster sample survey
** rhpr: review of health post records
*** 7 communities were randomly selected for this analysis from the 31 communities in the area
na not assessed
Table 2.

OPV 3 Coverage in Carabuco, 1988-1992

<table>
<thead>
<tr>
<th>type of assessment</th>
<th>date of assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-23 months of age with complete vaccinations (CSS*)</td>
<td>1988 1989 1990 1992</td>
</tr>
<tr>
<td></td>
<td>57% 77% 86% 89%</td>
</tr>
<tr>
<td>percentage of children 12-23 months of age with complete vaccinations (RHPR*)</td>
<td>na na 89% 88%</td>
</tr>
<tr>
<td>percentage of children 12-23 months of age with all vaccinations completed by 12 months of age (RHPR**)</td>
<td>na 64% 72% 69% (***</td>
</tr>
</tbody>
</table>

* CSS: cluster sample survey
** RHPR: review of health post records
*** 7 communities were randomly selected for this analysis from the 31 communities in the area
na not assessed
Table 4.

BCG Coverage in Carabuco, 1988-1992

<table>
<thead>
<tr>
<th>Type of Assessment</th>
<th>Date of Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>80% 93% 92% 97%</td>
</tr>
<tr>
<td>Percentage of children 12-23 months of age with complete vaccinations (rhpr*)</td>
<td>na na 92% 98%</td>
</tr>
</tbody>
</table>
| Percentage of children 12-23 months of age with all vaccinations completed by 12 months of age (rhpr**) | na 90% 89% 97% (***), na not assessed

* css: cluster sample survey
** rhpr: review of health post records
*** 7 communities were randomly selected for this analysis from the 31 communities in the area.
APPENDIX IV. DESCRIPTION AND FINDINGS OF THE CASE-CONTROL STUDIES OF INFANT AND CHILD DEATHS AT ARHC'S ESTABLISHED PROGRAM SITES

CASE-CONTROL STUDY OF INFANT DEATHS IN CARABUCO

METHODOLOGY

In May, 1991, the health post records were reviewed for those infants who had died in 1991 or 1992 and whose death had been registered in the Carabuco health information system. Only children who had died before their first birthday were included in the study.

Twenty-five infants were included, and their ages at death ranged from one hour to six months. Thus, there were no deaths encountered between seven and 12 months of age.

For each infant death identified, two controls were selected. A child qualified as a control if he or she lived in a nearby house and was born within six months (either before or after) of the child who died. The family folder for the house closest to the house of the child who died was first examined for the presence of a suitable control. If none was found, then the family folder for the next closest house was examined until a suitable control was encountered. Two control children were selected for each death. For the control children, information was abstracted relevant for that child up until the age at which the comparison child had died.

Information was abstracted from the family health folder for each child who died and for each of the two control children. The attached questionnaire was used for this purpose. This information was then computerized using EPI INFO software.

RESULTS

There were 25 infant deaths and 50 controls in this study. There was no significant difference between the two groups in terms of sex distribution.

The causes of death for the 25 children are shown in Table 1. Pneumonia and asphyxia accounted for almost one-half of the deaths. Diarrhea and malnutrition accounted for one-quarter, and neonatal causes, trauma, and unknown causes accounted for the remainder.
Table 1
Causes of Death Among Infants in Carabuco Case-Control Study

<table>
<thead>
<tr>
<th>cause of death</th>
<th>number</th>
<th>percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>pneumonia</td>
<td>6</td>
<td>24%</td>
</tr>
<tr>
<td>asphyxia</td>
<td>5</td>
<td>20%</td>
</tr>
<tr>
<td>neonatal causes*</td>
<td>4</td>
<td>16%</td>
</tr>
<tr>
<td>diarrhea</td>
<td>3</td>
<td>15%</td>
</tr>
<tr>
<td>malnutrition</td>
<td>2</td>
<td>10%</td>
</tr>
<tr>
<td>trauma</td>
<td>1</td>
<td>5%</td>
</tr>
<tr>
<td>unknown</td>
<td>4</td>
<td>16%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>25</td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

* neonatal sepsis (2), prematurity with sepsis (1), fetal distress associated with prolonged labor (1).

Although this study was limited to children who died in Carabuco before their first birthday, it can be readily seen in Table 2 that most of the deaths were among very young infants. In fact, two-thirds of the deaths were among infants dying before completing their first month of life. Only one infant (4% of the cases) died between six and 12 months of age.
Table 2
Ages at Death of the 25 Cases Included in the Carabuco Case Control Study

<table>
<thead>
<tr>
<th>Age</th>
<th>Number of Children</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than 24 hrs</td>
<td>2</td>
<td>8%</td>
</tr>
<tr>
<td>1-3 days</td>
<td>1</td>
<td>4%</td>
</tr>
<tr>
<td>4-7 days</td>
<td>5</td>
<td>20%</td>
</tr>
<tr>
<td>8-14 days</td>
<td>4</td>
<td>16%</td>
</tr>
<tr>
<td>15-30 days</td>
<td>4</td>
<td>16%</td>
</tr>
<tr>
<td>1-&lt;2 months</td>
<td>4</td>
<td>16%</td>
</tr>
<tr>
<td>2-&lt;4 months</td>
<td>4</td>
<td>16%</td>
</tr>
<tr>
<td>4-&lt;6 months</td>
<td>1</td>
<td>4%</td>
</tr>
<tr>
<td>6-&lt;12 months</td>
<td>3</td>
<td>12%</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>4%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>25</td>
<td>100%</td>
</tr>
</tbody>
</table>

Nutrition

There was no significant difference between case and control children in the percentage who had growth charts. Birth weights were available for only two of the case children and seven of the control children. There were 34 children (cases and controls) weighed during the first month of life. Only two of these had their first weight recorded at less than 2.5 kilograms and six children had their first weight at less than 3.0 kilograms. There were no significant differences observed between case and control children in the numbers with low weights (defined either as less than 2.5 or 3.0 kilograms) during the first months of life.

There was no significant difference in the number of growth monitorings between the cases and the controls. The weight and height for each nutritional monitoring along with the date of the monitoring and the date of birth was used to calculate the percentile of height for age, weight for age, and weight for
height using EPI INFO nutritional software. These percentiles are based on the National Center for Health Statistics norms. There was no significant difference between cases and controls in the mean percentiles for these three nutritional indices for the first and second monitorings. There were so few children with three or more monitorings that comparisons between cases and controls were not meaningful. Only three case children and six control children had three or more monitorings. As noted previously, nutritional information was recorded for control children up until the ages at which the control child died.

Classifying children as to whether or not they fell below the third percentile of weight for age yielded no significant difference between cases and controls.

The last recorded weight and height for each child was examined to determine if the percentile of height for age, weight for age, or weight for height fell below 25. No significant differences were noted between cases and controls.

For those children with more than one nutritional monitoring, the weight data was examined to determine if there had been weight loss between the next to last weighing and the last one. There were only six deaths and 10 controls with more than one weighing. However, between these deaths and controls there was a notable difference. Two-thirds of the cases (4/6) compared with none of the controls demonstrated weight loss (see Table 3).

<table>
<thead>
<tr>
<th></th>
<th>lost weight</th>
<th>yes</th>
<th>no</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>cases</td>
<td></td>
<td>4</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>controls</td>
<td></td>
<td>0</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>total</td>
<td></td>
<td>4</td>
<td>12</td>
<td>16</td>
</tr>
</tbody>
</table>

uncorrected Chi Square $= 8.89$
Fisher's exact 2-tailed P-value $= 0.008$
Vaccination Status

There were no significant differences between cases and controls with respect to immunization against BCG, DPT1, OPV1. Because of the young ages of the cases and controls, very few had received additional immunizations beyond these. When the total number of vaccinations received were calculated for each child, there was no significant difference between cases and controls.

Family Status

There was no significant difference between cases and controls in the average age of the mother at the time of birth of the child. After dividing mothers into two groups, those under 18 years of age and those 18 and older, a level of statistical significance of 0.054 was obtained. Twenty-four percent of the case children had mothers under 18 years of age compared to only 6% of the control children.

The birth interval between study children and their next oldest sibling was compared. There was no significant difference in the average birth interval between cases and controls. When these data were dichotomized into intervals of less than 24 months and 24 months or more, no significant differences were observed either.

The total number of siblings in the family in addition to the study child was compared. The case children had a mean of 2.5 siblings while the control children had an average of 3.8 siblings, a statistically significant difference (see Table 4).

<table>
<thead>
<tr>
<th></th>
<th>Mean Number of Siblings Among Case and Control Children in Carabuco</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mean number of siblings</td>
</tr>
<tr>
<td>case</td>
<td>2.48</td>
</tr>
<tr>
<td>control</td>
<td>3.80</td>
</tr>
</tbody>
</table>

df (1/73) $t = 6.50$ $p = .012$

319
At the time of a routine home visit, the marital status of each person of marriage age is noted. This information was abstracted from the family health folder. As shown in Table 5, one can readily see that 28% (7/25) of the deaths were among children with unmarried mothers while only 8% (4/50) of the controls had unmarried mothers.

Table 5
Marital Status of Mothers of Case and Control Children in Carabuco

<table>
<thead>
<tr>
<th>maritial status of mother</th>
<th>cases</th>
<th>controls</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>unmarried</td>
<td>7</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td>married</td>
<td>18</td>
<td>46</td>
<td>64</td>
</tr>
<tr>
<td>total</td>
<td>25</td>
<td>50</td>
<td>75</td>
</tr>
</tbody>
</table>

uncorrected Chi Square = 5.33
Fisher's exact two-tailed P-value = 0.035

Discussion

This analysis of infant deaths in Carabuco points to three dominant factors associated with greater risk of infant death. From the standpoint of statistical significance, the strongest risk factors are evidence of weight loss before death and having fewer siblings (see Table 6). The mother being unmarried is the third risk factor, with a level of statistical significance not quite as strong as the first two.
Table 6
Risk Factors for Infant Deaths in Carabuco
Listed by Level of Statistical Significance

<table>
<thead>
<tr>
<th>factor</th>
<th>level of statistical significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. evidence of weight loss before death</td>
<td>.01</td>
</tr>
<tr>
<td>2. fewer siblings</td>
<td>.01</td>
</tr>
<tr>
<td>3. mother unmarried</td>
<td>.04</td>
</tr>
</tbody>
</table>

The rationale for weight loss as a risk factor is readily apparent. Either acute primary malnutrition or acute infection aggravating nutritional status is presumably the explanation for this finding.

Why having fewer siblings is a risk factor for death is less clear. A greater percentage of the case children had no siblings than did the control children (24% versus 10%), but the differences between case and control children extended beyond this particular comparison as Table 7 and Figure 1 indicate. For instance, one can see that 72% of the case children had fewer than four siblings compared to 38% of the control children. When displayed in a 2 x 2 table, these differences are highly significant statistically with a p value of 0.01 (see Table 8).

Table 7
Number of Siblings Among Case and Control Children in Carabuco

<table>
<thead>
<tr>
<th>number of siblings</th>
<th>cases</th>
<th>(percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>9</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>11</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>total</td>
<td>25</td>
<td>100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>number of siblings</th>
<th>controls</th>
<th>(percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>17</td>
<td>34</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>8</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>total</td>
<td>50</td>
<td>100</td>
</tr>
</tbody>
</table>

321
Figure 1: Percentage of Children in Carabuco With Given Number of Siblings

Percentage of children

Number of siblings

Series 1

Series 2

Series 1: case children
Series 2: control children
Table 8
Comparison of Numbers of Case and Control Children in Carabuco by Family Size

<table>
<thead>
<tr>
<th>family size</th>
<th>0-3 siblings</th>
<th>4+ siblings</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>cases</td>
<td>18</td>
<td>7</td>
<td>25</td>
</tr>
<tr>
<td>controls</td>
<td>19</td>
<td>31</td>
<td>50</td>
</tr>
<tr>
<td>total</td>
<td>37</td>
<td>38</td>
<td>75</td>
</tr>
</tbody>
</table>

Yates corrected Chi Square = 6.41
P = 0.011

One might have anticipated a totally different result. One would think that perhaps diminished parental motivation or perhaps biological fatigue of the mother would lead to a higher risk of death for children with greater numbers of siblings, but we see no evidence to support such a hypothesis.

The above data support an alternative hypothesis: once there are four or more siblings, there is sufficient additional help in the family for chores and child caring activities that a survival advantage is provided to newborns. This could be due to the siblings caring for the child or to possibly the mother having more time and energy to devote to the wellbeing of her newborn.

The significance of not being married as a risk factor for infant death is understandable, although the strength of this relationship is surprisingly strong. When one compares only those infants with no siblings, marital status becomes an even stronger risk factor for infant death. In Table 9 we see that all six of the case children without other siblings had an unmarried mother. In contrast, only 17% (1/6) of the control children with no siblings had an unmarried mother.
Children born to unmarried mothers may not be "wanted" to the same degree as those born to married mothers. Furthermore, the social and financial support available to the mother may be far more limited when the mother is unmarried.

Table 9
Marital Status of Mothers of Case and Control Children in Carabuco Without Other Siblings

<table>
<thead>
<tr>
<th>Marital status of mother</th>
<th>Unmarried</th>
<th>Married</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cases</td>
<td>6</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Controls</td>
<td>1</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>7</td>
<td>4</td>
<td>10</td>
</tr>
</tbody>
</table>

Uncorrected Chi-Square = 7.54
Fisher's exact 2-tailed P-value = 0.015
número de identificación __

CASO __

CONTROL __

nombre del caso que murio para comparar

edad al morir el caso

Formulario Para Estudio de Muertes con Controles en Carabuco

Mayo, 1993

1. nombre del niño:____________________________

2. comunidad: ________________________________

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
OPV1
OPV2
OPV3
DPT1
DPT2
DPT3
sarampión

11. episodios de enfermedades:

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. anotaciones:
CASE-CONTROL STUDY OF INFANT AND CHILDHOOD DEATHS IN MALCO RANCHO, BOLIVIA

In May, 1993, family health folders were reviewed for those infants and children under five years of age who died in 1991 and 1992 in Malco Rancho and whose deaths were registered in the health information system. Thirty-one children and 62 controls were included in this study, and their ages at death ranged from one hour of life to 36 months of age.

For each death identified, two controls were selected. A child qualified as a control if he or she lived in a nearby house and was born within six months (either before or after) of the child who died. The family folder for the house closest to the house of the child who died was first examined until a suitable control was found. Two control children were selected for each death. For the control children, information was abstracted relevant for that child up until the age at which the comparison child had died.

Information was abstracted for the family health folder for each child who died and for each of the two control children. The attached questionnaire was used for this purpose. This information was then computerized using EPI INFO software.

RESULTS

There were 31 infant and child deaths and 62 controls in this study. There was no significant difference between the two groups in terms of sex distribution. The causes of death for the 31 cases are shown in Table 1. Approximately one-third of the deaths were caused by diarrhea. A variety of other diagnoses were encountered with malnutrition and pneumonia being the most common. Two children drowned and a third died from head trauma. Meningitis was diagnosed in the two children who died from tuberculosis.
Table 1
Causes of Death Among Infants and Children in Mallco Rancho
Included in the Case-Control Study

<table>
<thead>
<tr>
<th>cause of death</th>
<th>number</th>
<th>percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>diarrhea</td>
<td>9</td>
<td>29%</td>
</tr>
<tr>
<td>malnutrition</td>
<td>4</td>
<td>13%</td>
</tr>
<tr>
<td>pneumonia</td>
<td>3</td>
<td>10%</td>
</tr>
<tr>
<td>tuberculosis</td>
<td>2</td>
<td>7%</td>
</tr>
<tr>
<td>fever (unspecified)</td>
<td>2</td>
<td>7%</td>
</tr>
<tr>
<td>drowning</td>
<td>2</td>
<td>6%</td>
</tr>
<tr>
<td>asphyxia</td>
<td>2</td>
<td>6%</td>
</tr>
<tr>
<td>trauma</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td>prematurity</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td>unknown or traditional</td>
<td>5</td>
<td>16%</td>
</tr>
<tr>
<td>cause given*</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>31</td>
<td>100%</td>
</tr>
</tbody>
</table>

* arrebato (soul loss) in three cases, agitation in one case, and unknown in one case.

Table 2 shows the ages at death for the 31 case children included in the study. The most frequent age category shown is from 12-23 months when one-third of the deaths occurred. Only 13% of the deaths occurred during the first month of life.
Table 2
Ages at Death for the 31 Cases Included in the Malico Rancho Case Control Study

<table>
<thead>
<tr>
<th>Age</th>
<th>Number of Children</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than 1 week</td>
<td>3</td>
<td>10%</td>
</tr>
<tr>
<td>1-4 weeks</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td>1-2 months</td>
<td>3</td>
<td>10%</td>
</tr>
<tr>
<td>3-5 months</td>
<td>5</td>
<td>16%</td>
</tr>
<tr>
<td>6-11 months</td>
<td>6</td>
<td>19%</td>
</tr>
<tr>
<td>12-23 months</td>
<td>10</td>
<td>32%</td>
</tr>
<tr>
<td>24-36 months</td>
<td>3</td>
<td>10%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>31</td>
<td>100%</td>
</tr>
</tbody>
</table>

Nutrition

The presence of a growth chart was distinctly different between cases and controls. Thirty percent (9/30) of the cases did not have a growth chart compared to only 7% (4/51) of the controls (see Table 3). Not surprisingly, there is also a significant difference in the mean number of nutritional monitorings between cases and controls as shown in Table 4.

Table 3
Presence of Growth Chart Among Case and Control Children in Malico Rancho

<table>
<thead>
<tr>
<th>presence of growth chart</th>
<th>cases</th>
<th>controls</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>yes</td>
<td>21</td>
<td>29</td>
<td>50</td>
</tr>
<tr>
<td>no</td>
<td>9</td>
<td>22</td>
<td>31</td>
</tr>
<tr>
<td>total</td>
<td>30</td>
<td>51</td>
<td>81</td>
</tr>
</tbody>
</table>

uncorrected Chi-Square = 9.03
Fisher's exact 2-tailed p value = 0.008
Table 4
Comparison of the Mean Number of Nutritional Monitorings for Case and Control Children in Malico Rancho

<table>
<thead>
<tr>
<th></th>
<th>Mean Number of Nutritional Monitorings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cases</td>
<td>2.7</td>
</tr>
<tr>
<td>Controls</td>
<td>4.0</td>
</tr>
</tbody>
</table>

SS between 35.3 df 1 t = 4.28
within 749.8 df 91 p = 0.039

Birthweights obtained on the day of birth were recorded in the growth charts for 13% of the children (12/91). Three of these birthweights were 2.5 kilograms or less. Only one of these three children died. Low birthweight children were defined as those weighing less than 3.0 kilograms during the first month of life. Fourteen children had been weighed before completing the first month of life. There was no significant difference between cases and controls in the incidence of low birthweight as has been defined above.

For each height and weight obtained at a growth monitoring session, the National Center for Health Statistics percentile for height for age (HAP), weight for age (WAP), and weight for height (WHP) were determined using the date of the monitoring and the birthdate to determine the age of the child. EPI INFO nutritional software was used for this analysis. The mean percentiles were calculated for case and control children for the first weighing and compared. This was also done for each successive monitoring.

No significant differences were noted for any of the comparisons between the case and control children up through the seventh nutritional monitoring. Beyond this, there were fewer than three children in the case group who had had more than seven nutritional monitorings, so the analysis was discontinued at that point. The only notable finding from this analysis was that for the WAPS, the differences between the case and control children gradually increased with successive weighings. None of the specific comparisons were statistically significant, however. These findings are shown in Table 5. The mean WAP for the control children gradually falls from 49.6 at the initial weighing to 17.1 at the time of the seventh weighing while the control children maintained their WAP mostly in the 30 - 35% range. Thus, the percentage difference in the mean WAP percentiles
between the two groups gradually changed from +4.8% at the time of the initial weighing to -15.1% at the time of the seventh weighing.

Table 5
Comparison of Mean Weight for Age Percentiles (WAP) of Case and Control Children in Malco Rancho by Monitoring Number

<table>
<thead>
<tr>
<th>weiging number</th>
<th>mean WAP* cases</th>
<th>mean WAP* controls</th>
<th>percentage difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40.6 (21)</td>
<td>35.8 (52)</td>
<td>4.8</td>
</tr>
<tr>
<td>2</td>
<td>38.2 (18)</td>
<td>37.3 (46)</td>
<td>0.9</td>
</tr>
<tr>
<td>3</td>
<td>33.0 (14)</td>
<td>38.8 (37)</td>
<td>-5.8</td>
</tr>
<tr>
<td>4</td>
<td>25.3 (10)</td>
<td>33.5 (30)</td>
<td>-8.2</td>
</tr>
<tr>
<td>5</td>
<td>17.8 (7)</td>
<td>32.8 (25)</td>
<td>-15.0</td>
</tr>
<tr>
<td>6</td>
<td>18.5 (7)</td>
<td>28.8 (24)</td>
<td>-10.3</td>
</tr>
<tr>
<td>7</td>
<td>17.1 (3)</td>
<td>32.2 (19)</td>
<td>-15.1</td>
</tr>
</tbody>
</table>

* The number of children on which the means are based are shown in parentheses.
Children were classified as to whether or not they fell below the third percentile of weight for age at each of the specific nutritional monitoring sessions. There were no significant differences between case and control children in the numbers of children falling below the third percentile for any given weighing through the seventh one.

Children were also classified as to whether or not they were below the 25th percentile of height for age, weight for age, or weight for height at the time of the last recorded nutritional monitoring. Again, there were no statistically significant differences when case and control children were compared. Finally, each child was classified as to whether or not there was a loss of weight from the next to the last weighing until the final recorded weighing. Again, there was no significant difference between cases and controls.

Vaccination Status

There was a highly significant difference between cases and controls in the percentage of children who had received BCG vaccination as shown in Table 5. Forty-five percent (14/31) of the cases compared to 84% of the controls had received the BCG vaccination.

Table 5
Comparison of Numbers of Case and Control Children in Malico Rancho Receiving BCG Vaccination

<table>
<thead>
<tr>
<th>BCG vaccination</th>
<th>yes</th>
<th>no</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>cases</td>
<td>14</td>
<td>17</td>
<td>31</td>
</tr>
<tr>
<td>controls</td>
<td>52</td>
<td>10</td>
<td>62</td>
</tr>
<tr>
<td>total</td>
<td>66</td>
<td>27</td>
<td>93</td>
</tr>
</tbody>
</table>

Yates corrected Chi-Square = 13.21
p = 0.0003
There was also a highly significant difference between the case and control children regarding DPT vaccinations. As Table 6 demonstrates, 42% (13/31) of the cases compared to 76% (47/62) of the controls had received the DPT1 vaccination. There was also a highly significant statistical difference for DPT2, as well. Thirty-two percent (10/31) of the cases compared to 65% of the controls had received DPT2 vaccination. There was no significant difference between case and control children regarding DPT3 vaccinations.

Table 6
Comparison of Numbers of Case and Control Children in Mallco Rancho Receiving DPT1 Vaccination

<table>
<thead>
<tr>
<th>DPT1 vaccination</th>
<th>yes</th>
<th>no</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>cases</td>
<td>13</td>
<td>18</td>
<td>31</td>
</tr>
<tr>
<td>controls</td>
<td>47</td>
<td>15</td>
<td>62</td>
</tr>
<tr>
<td>total</td>
<td>60</td>
<td>33</td>
<td>93</td>
</tr>
</tbody>
</table>

Yates corrected Chi-Square = 8.93
p = 0.003

Table 7
Comparison of Numbers of Case and Control Children in Mallco Rancho Receiving DPT2 Vaccination

<table>
<thead>
<tr>
<th>DPT2 vaccination</th>
<th>yes</th>
<th>no</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>cases</td>
<td>10</td>
<td>21</td>
<td>31</td>
</tr>
<tr>
<td>controls</td>
<td>40</td>
<td>22</td>
<td>62</td>
</tr>
<tr>
<td>total</td>
<td>50</td>
<td>43</td>
<td>93</td>
</tr>
</tbody>
</table>

Yates corrected Chi-Square = 7.40
p = 0.007

333
Similar differences were noted for the OPV vaccinations as shown in Tables 8-10. Forty-five percent (14/31) of the case children compared to 81% (50/62) of the control children had received OPV1, and 32% (10/31) of case children compared to 68% (42/62) of control children had received OPV2. There was also a significant difference with respect to OPV3 vaccinations. Twenty-six percent (8/31) of the case children compared to 52% of the control children had received OPV3.

Table 8
Comparison of Numbers of Case and Control Children in Mallco Rancho Receiving OPV1 Vaccination

<table>
<thead>
<tr>
<th>OPV1 vaccination</th>
<th>yes</th>
<th>no</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>cases</td>
<td>14</td>
<td>17</td>
<td>31</td>
</tr>
<tr>
<td>controls</td>
<td>50</td>
<td>12</td>
<td>62</td>
</tr>
<tr>
<td>total</td>
<td>64</td>
<td>29</td>
<td>93</td>
</tr>
</tbody>
</table>

Yates corrected Chi-Square = 10.53
p = 0.001

Table 9
Comparison of Numbers of Case and Control Children in Mallco Rancho Receiving OPV2 Vaccination

<table>
<thead>
<tr>
<th>OPV2 vaccination</th>
<th>yes</th>
<th>no</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>cases</td>
<td>10</td>
<td>21</td>
<td>31</td>
</tr>
<tr>
<td>controls</td>
<td>42</td>
<td>20</td>
<td>62</td>
</tr>
<tr>
<td>total</td>
<td>52</td>
<td>41</td>
<td>93</td>
</tr>
</tbody>
</table>

Yates corrected Chi-Square = 9.17
p = 0.002
Table 10
Comparison of Numbers of Case and Control Children in Mallco Rancho Receiving OPV3 Vaccination

<table>
<thead>
<tr>
<th>OPV3 vaccination</th>
<th>yes</th>
<th>no</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>cases</td>
<td>8</td>
<td>23</td>
<td>31</td>
</tr>
<tr>
<td>controls</td>
<td>32</td>
<td>30</td>
<td>62</td>
</tr>
<tr>
<td>total</td>
<td>40</td>
<td>53</td>
<td>93</td>
</tr>
</tbody>
</table>

Yates corrected Chi-Square = 4.61
p = 0.032

There was no significant difference in measles vaccination status between the two groups. Twenty-three percent (7/31) of the case children had received measles vaccination prior to death compared to 39% of the control children.

On the basis of the above findings, it is not surprising to observe that the total number of vaccinations received for case children was significantly less than for control children (see Table 11). Control children had received almost twice as many vaccinations as had case children.

Table 11
Comparison Between Case and Control Children in Mallco Rancho in the Mean Number of Vaccinations Given

<table>
<thead>
<tr>
<th>mean number of vaccinations given</th>
<th>cases</th>
<th>controls</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.7</td>
<td>5.1</td>
</tr>
</tbody>
</table>

SS between 116.2  df 1  t = 12.93  p = 0.001
within 875.0  91

335
CBIO APPROACH  Appendix IV.

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.

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.

Mothers were classified as to marital status, and no significant differences were observed.

DISCUSSION

The highly significant differences observed in the vaccination status of case compared to control children together with the notable differences between them in enrollment in growth monitoring provides strong evidence that the children in Malco Rancho who were dying in 1991 and 1992 were much less likely to have been incorporated into the child survival program. Whether the child survival interventions themselves are the reason for the differences in survival between case and control children or some other characteristic associated with the administration of the child survival interventions cannot be determined at this time.

One wonders if perhaps the deaths are not concentrated among those children whose mothers were not bringing them to the health center in Malco Rancho for growth monitoring and vaccination services to the same degree as were the mothers of control children. In theory, the home visitation program should be identifying those not receiving the appropriate child survival interventions. It does not appear from these data that the home visitation program in Malco Rancho was sufficiently well-developed during 1991 and 1992 to capture those children not receiving basic services or that perhaps the mothers of these children were particularly resistant to efforts of program staff to provide the basic child survival services.
The lack of any association between malnutrition measures and childhood death makes it tempting to speculate again that perhaps many of those children who died who did not receive nutritional monitoring were actually malnourished. Thus, if they had received growth monitoring, differences in nutritional status between case and control children would have been observed.
Formulario Para Estudio de Muertes con Controles en Malico Rancho

Mayo, 1993

1. nombre del niño: ____________________________

2. comunidad: ________________________________

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 _______
   i. fecha9 _______ peso9 _______ talla9 _______
   j. fecha10 _______ peso10 _______ talla10 _______
   k. fecha11 _______ peso11 _______ talla11 _______
   l. fecha12 _______ peso12 _______ talla12 _______
10. datos de inmunizaciones

BCG __________
OPV1 __________
OPV1 __________
OPV2 __________
OPV3 __________
DPT1 __________
DPT2 __________
DPT3 __________
sarampion __________

11. episodios de enfermedades:

________________________

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)

<table>
<thead>
<tr>
<th>hermano</th>
<th>edad</th>
<th>meses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>meses</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>meses</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>meses</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>meses</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>meses</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>meses</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>meses</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>meses</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>meses</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>meses</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>meses</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>meses</td>
</tr>
</tbody>
</table>

14. estado civil: __________________________

15. grado de instrucción de la madre: __________________________

16. ocupación del padre: __________________________

17. anotaciones: __________________________
In May, 1993, family health folders were reviewed for those infants and children under five years of age who had died in 1992 and whose death had been registered in the Villa Cochabamba health information system. In contrast to the Carabuco case-control study, this study did include children older than one year of age since we knew that children in Montero beyond one year of age were also at significant risk of death. Twenty-five infants and children under five were included, and their ages at death ranged from three days to 32 months.

For each death identified, two controls were selected. A child qualified as a control if he or she lived in a nearby house and was born within six months (either before or after) of the child who died. The family folder for the house closest to the house of the child who died was first examined for the presence of a suitable control. If none was found, then the family folder for the next closest house was examined until a suitable control was found. Two control children were selected for each death. For the control children, information was abstracted relevant for that child up until the age at which the comparison child had died.

Information was abstracted from the family health folder for each child who died and for each of the two control children. The attached questionnaire was used for this purpose. This information was then computerized using EPI INFO software.

RESULTS

There were 25 infant and child deaths and 50 controls in this study. There was no significant difference between the two groups in terms of sex distribution. The causes of death for the 25 cases are shown in Table 1. Over half of the deaths were associated with diarrhea, and one-third of the deaths had malnutrition listed as one of the causes of death. Only 16% of the deaths were associated with respiratory causes. The two deaths due to prematurity were among twins, both of whom died at three days of age.
Table 1
Causes of Death Among Infants and Children in Montero Included in the Case-Control Study

<table>
<thead>
<tr>
<th>cause of death</th>
<th>number</th>
<th>percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>diarrhea</td>
<td>7</td>
<td>28%</td>
</tr>
<tr>
<td>diarrhea and malnutrition</td>
<td>6</td>
<td>24%</td>
</tr>
<tr>
<td>malnutrition</td>
<td>3</td>
<td>12%</td>
</tr>
<tr>
<td>pneumonia</td>
<td>3</td>
<td>12%</td>
</tr>
<tr>
<td>fever (unspecified)</td>
<td>2</td>
<td>8%</td>
</tr>
<tr>
<td>prematurity</td>
<td>2</td>
<td>8%</td>
</tr>
<tr>
<td>diarrhea and pneumonia</td>
<td>1</td>
<td>4%</td>
</tr>
<tr>
<td>poisoning</td>
<td>1</td>
<td>4%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>25</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Table 2 shows the ages at death for the 25 cases included in the study. The most frequent age category shown is from 12-23 months of age. Only 12 percent of the deaths occurred during the first month of life.

Table 2
Ages at Death of the 25 Cases Included in the Montero Case Control Study

<table>
<thead>
<tr>
<th>Age</th>
<th>Number of Children</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than 1 week</td>
<td>2</td>
<td>8%</td>
</tr>
<tr>
<td>1-4 weeks</td>
<td>1</td>
<td>4%</td>
</tr>
<tr>
<td>1-2 months</td>
<td>3</td>
<td>12%</td>
</tr>
<tr>
<td>3-5 months</td>
<td>2</td>
<td>8%</td>
</tr>
<tr>
<td>6-11 months</td>
<td>4</td>
<td>16%</td>
</tr>
<tr>
<td>12-23 months</td>
<td>10</td>
<td>40%</td>
</tr>
<tr>
<td>24-35 months</td>
<td>3</td>
<td>12%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>25</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

341
Nutrition

Sixty-four percent of the children who died compared to 86% of the control children had growth charts, but this difference did not quite reach statistical significance ($p = 0.058$). There was no significant difference in the number of nutritional monitorings (weight and height determinations) between the case and the control children.

In an attempt to assess the effect of birth weight on mortality, a child was classified as being of low birth weight if a weight recorded during the first month of life was below three kilograms. There was no significant difference between the case and control children in this respect. Information on weight on the actual date of birth was recorded for only two children.

The weight and height for each nutritional monitoring, along with the date of the monitoring and the date of birth, was used to calculate the percentile of height for age, weight for age, and weight for height using EPI INFO nutritional software. These percentiles are based on the National Center for Health Statistics norms. The mean percentile of height for age (HAP) for the child's first nutritional monitoring differed significantly between cases and controls. The mean HAP for cases was 32% while for controls it was 53% (see Table 3).

<table>
<thead>
<tr>
<th>Table 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comparison of Height for Age Percentiles (HAP) at the Time of the Initial Growth Monitoring for Cases and Controls in Montero</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>mean HAP percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>cases</td>
</tr>
<tr>
<td>32.0%</td>
</tr>
<tr>
<td>controls</td>
</tr>
<tr>
<td>52.9%</td>
</tr>
</tbody>
</table>

SS between 3290.2 1 df $t = 4.41$  
within 22382.7 30 df $p = 0.042$

The initial weight for height percentile (WAP) also differed significantly between cases and controls (see Table 4). For cases, the mean WAP was 42% compared to 64% for controls.
Table 4
Comparison of Weight for Age Percentiles (WAP) at the Time of the Initial Growth Monitoring for Cases and Controls in Montero

<table>
<thead>
<tr>
<th></th>
<th>mean WAP percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>cases</td>
<td>42.2%</td>
</tr>
<tr>
<td>controls</td>
<td>63.9%</td>
</tr>
</tbody>
</table>

SS between 5068.2 df 1  
within 49488.0 df 47  
t = 4.81  
p = 0.031

The weight for height percentile (WHP) at the initial weighing did not differ significantly between cases and controls.

There were no significant differences between case and control children at the second weighing in any of the nutritional percentiles. Comparing the third nutritional monitoring results, a significant difference appears in the weight for age percentile (WAP). For the cases, the mean WAP was only 11% while it was 45% for the controls (see Table 5). The difference in the means of the percentiles of height for weight at the third monitoring approached but did not quite reach statistical significance (p = 0.057). There were 26 children that had been weighed three times but only 13 who had height determinations also at the time of the third weighing. Because of the small number of children who had additional growth monitoring, the differences in percentiles between case and control children at the fourth or later monitoring sessions were not statistically significant.