Adult Mortality in Slums of Karachi, Pakistan

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Abstract

Objective: Cause-specific death rates are rarely available to guide health interventions for adults in South Asia. We report mortality patterns among Karachi's urban poor.
Methods: We conducted verbal autopsies for adult deaths under active surveillance during 1990-1993 in five urban slums of Karachi. Two physicians assigned underlying cause of death h consensus. Analysis included cause- and category-specific rates, 45Q15s and comparison with 1991 Japanese national statistics.
Results: All 345 adult deaths (15-59 years) in the 5 slums (total population 45,389) were included. Male mortality exceeded female (4.4 vs 3.3/1000, p=.02). Noncommunicable diseases claimed 59% of deaths, communicable and reproductive 27% and injuries, 15%. The leading identified death rates (/100 000) among women were: circulatory disorders (66), maternal causes (33), tuberculosis (30), and burns (23); and among men they were: circulatory disorders (124) tuberculosis (30) and road traffic accidents (30). Overall Karachi adult mortality was 3.7 times Japanese rate. Compared to Japan, adults in Karachi had one to two orders of magnitude excess mortality due to maternal causes, tuberculosis and burns. Circulatory disorders and tuberculosis accounted for 47% of excess male mortality; these plus maternal causes and burns accounted for 55% of excess female mortality.
Conclusion: These mortality levels and patterns compel interventions and research for poor urban adults beyond maternal health. Women's health would equally benefit from tuberculosis control or bum prevention. Men need safer travel. Both need improved cardiovascular health (JPMA 50:300, 2000).

Introduction

In the developed world, death in adulthood (defined as 15-59 years) is uncommon: ovefall adult males and females experience 12% and 5% risks of death, respectively, compared to an estimated 25% and 22% in developing countries[1]. Although there are many sensible interventions[2,3], choosing among them and monitoring their effect should be guided by reasonable estimates of cause-specific mortality. Population-based cause of adult death statistics in the developing countries of South Asia are uncommon. India maintains a lay-reported rural sentinel site system[4] findings from verbal autopsy at Matlab, Bangladesh have recently been reported[5], Thailand and Sri Lanka are unique in maintaining a vital registry[6] although limited by completeness[7] and reporting frequency. Singapore has denominator-based statistics, but its circumstances are atypical of most of Asia.
Comparable data from Pakistan are sparse. The national Pakistan Demographic Survey had a secondary objective of determining causes of adult death[8]. However, the flndings had limited value for this purpose because the interviewer asked a single question regarding cause of death ("What was the nature of sickness or accident?") from surviving family members without seeking supporting evidence. The validity is likewise suspect as ischemic heart disease was not recorded for any of approximately 85 deaths among 40-49 year olds[8].
Given the dual challenges that: (1) adult health in developing countries is a neglected but legitimate public health concern and (2) more information is needed particularly from the countries of South Asia, we present the levels and causes of adult death in Karachi slum communities under surveillance by The Aga Khan University and a comparative analysis with Japan, a regional country with the best indicators of adult health.

Methods

Setting: Approximately 40°/s of Karachi's estimated 10,000,000 persons lives in 400 slums characterized by poverty, lack of education, contaminated environment, political instability, ethnic violence, and drug running[9]. Government services are fragmented, skewed toward large hospitals, and unable to meet the needs of the poor.

Since 1986 the Aga Khan University has implemented Primary Health Care programs in five slums of total population 45,389 (December 1989). The programs target children under five and women of child bearing ages. Health teams keep each household under active monthly surveillance (quarterly for the rare household without children under age five years).

The communities were selected as likely to represent Karachi slums in terms of socio-economic and health status and ethnicity. A 1991 survey of a random sample of one in seven households in these five sites revealed a median family income of Rs 1000-2000/month (USS 40-80) and a median. family size of 6. Of adult males, 60% worked as day-laborers. House construction was semi-permanent (60%) with 52% lacking in-house water. Forty percent of males and 65% of females were illiterate. Ethnically, most were Mohajirs (descendants of migrants from India at 1947 independence), Sindhis or Punjabis. Marked variation occurred among and between settlements. Comparable data for aggregated Karachi slums are not available.

Sample: As all families are monitored by a community health worker for vital events, this is a complete sample of all adult deaths (15 to 59 years) in the area covered during the four years from 1 January 1990 to 31 December 1993.

Measurements: Once a death was identified, a team nurse or doctor visited the bereaved family to conduct a verbal autopsy interview, generally 1 to 3 months after the death. The questionnaire had three parts: closed-ended socio-demographic questions, open-ended history and closed-ended clinical questions specifying symptom duration. The interviewer recorded the history verbatim avoiding interpretation. Each case was independently reviewed by 2 physicians who assigned a single main cause of death (the underlying cause) according to pre-determined case definitions. Where there was disagreement, a third physician assisted in reaching consensus.

The case definitions were based on symptoms present during the illness preceding death and history of any long-standing illness. For example: myocardial infarction required sudden death with chest pain and/or shortness of breath; acute respiratory infection required cough, fever, and breathing difficulty of less than one week duration; tuberculosis required any two of: chronic cough, long standing fever, hemoptysis. or history of antituberculosis treatment. "Sudden adult death" was an unexpected, unexplained death evolving over less than 6 hours in an otherwise healthy adult. We relied on the history which often included recollected hospital reports rather than case definitions to diagnose cancer and injury. "Undiagnosed fever" was a death with fever without enough additional information to ascertain a more specific diagnosis. "Ill-defined" was an afebrile death due to unknown cause.

Analysis: Our surveillance monitors vital events and total population size, but not the population's age-sex composition. For the latter we used the 5 year interval, sex-specific, population composition obtained from a 1989 survey[10]. This survey undercounted the actual population by approximately 4% (43,695) compared to the 45,389 ascertained through more complete surveillance without age and sex data. Therefore, we multiplied each survey-derived age group by a correction factor, 1.039, to estimate the age-sex sub-groups. We did not adjust death counts as they were felt to be complete.

Deaths were categorized into (I) communicable and reproductive, (II) noncommunicable, and (III) injuries. Category I included both infectious diseases and maternal causes because both are ecologically associated with under-development. Preston's finding suggest that cardiovascular diseases, neoplasms, and conditions classified as "other/unknown" were highly correlated[11]. We also included "ill-defined" cases in category II. Since otherwise unexplained "sudden adult death" was likely due to myocardial infarction or cerebrovascular accident, we included it also in category II. Cases of "undiagnosed fever"

were added to category I as most were likely infections in our setting.
Sex-specific 45Ql5s (the risk of death for a 15 year old during the subsequent 45 years of adulthood under present mortality conditions expressed as a percent) [4] were calculated from life tables derived from the 1989 survey. A sex-cause-specific 45Ql5 was the product of the sex-cause-specific proportionate mortality ratio and the sex-specific 45Q15.
Standardized mortality ratios were assessed (SMR) by applying Japanese age-sex-specific national rates[12] corresponding sub-group from our sample to derive the expected annual number of deaths. We divided this by the annual number of observed deaths to compute the SMR. We calculated sex-cause-specific 45Q15 risk differences using the corresponding Japanese values[13].
Epi Info[14] and SPSS for Windows, version 6.0[15] statistical software was used for analysis and the chi-square test to compare independent proportions and the Kolgomorov-Smirnov Z (K-S Z) statistic[16] evaluate differences in cumulative frequency distributions. All reported p-values are two-sided. A difference between frequencies was considered to be significant if the probability was <0.05 that the difference was due to sampling error.

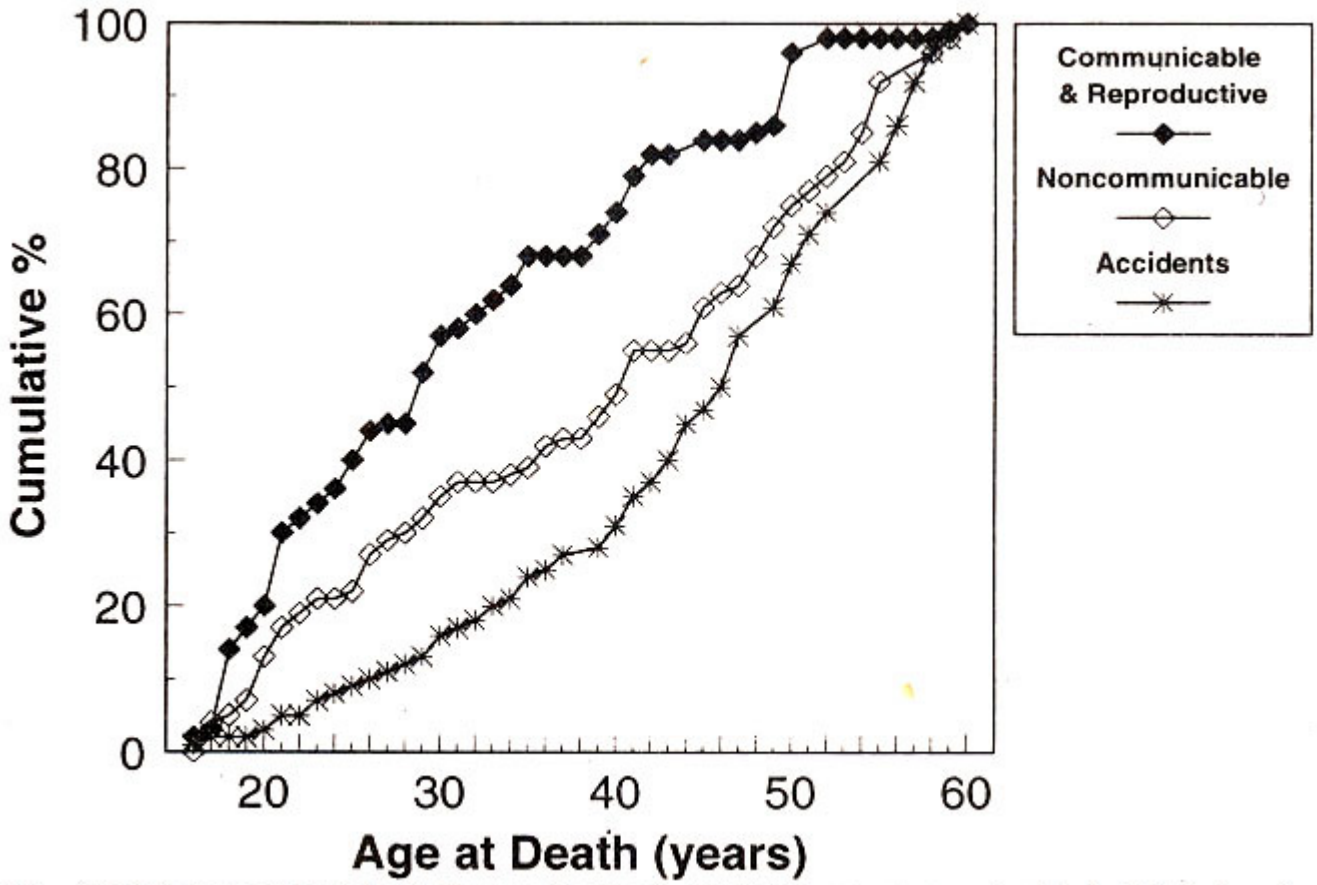
Results

During the 4 year period, 345 of 22,208 adults died (3.9/1000/year, 95% confidence interval [CI]:3.5-4.3), 201 males qnd 144 females (Table 1).

Table 1. Adult Deaths by Category (numbers)
Five Karachi Slums: 1990-93.

Category of Death	Males	Females	Total (%)
I. Communicable and Reproductive	42	50	92 (26.7)
II. Noncommunicable	128	74	202 (58.6)
III. Injury	31	20	51 (14.8)
Total	201	144	345 (100.1)

Male morality exceeded female morality (4.4/1000 [95%CL: 3.8-5.0) vs 3.4/1000[95%CI:2.8-4.0], p=.017). Median age of adult death was 44.5 years. Younger adult, age 15-39 years, experienced lower mortality than older adults, age 40-5 9 years (2.0/1000 vs 9.7/1000 , p<.001).
Women of reproductive age (15-49 years) had an all-cause mortality rate of 2.7/1000 (95%Cl: 2.2-3.2). Comparably aged males had statistically similar mortality, 3.0/1000 (95%CI: 2.5-3.5, p.42).
Specific diagnoses were made in 83% of cases (286/345). Of the 59 others, 29 had ill-defined causes, 15 had undiagnosed fever, and 15 had unexplained sudden adult death. Overall 244 (71%) had received allopathic medical care for the final illness including 152 who died in a hospital.
Fifty-nine percent of the total deaths were due to no communicable causes, 27% due to communicable or maternal causes, and 15% due to injuries. Deaths among younger adults were more likely due to injury while deaths among older adults were more likely due to no communicable diseases.
Communicable and reproductive deaths occurred steadily throughout adulthood (Figure)



N = 92 (Communicable & Reproductive), 202 (Noncommunicable), 51 (Injury)

(K-S Z for category I and II: 1.959, p=.00l; K-S Z for category I and Ill: 1.604, p~.012; K-S Z for category II and Ill: 3.108, p<.001).

Ischemic heart disease, tuberculosis, cerebrovascular accident, road traffic accidents (RTA), maternal causes, and burns were the leading identified causes of mortality (Table 2).

Table 2. Ten Leading Causes of Adult Death Five Karachi Slums (1990-93)*.

Cause of Death	Rate (95% CI)
Ischemic Heart Disease	43 (30, 59)
Ill-defined	33 (22, 47)
Tuberculosis	30 (20, 44)
Cerebrovascular Accident	21 (13, 33)
Road Traffic Accident	18 (10, 29)
Undiagnosed Fever	17 (9, 28)
Sudden Adult Death	17 (9, 28)
Maternal Causes	16 (9, 26)
Burn	15 (8, 25)
Total	388 (349, 432)

These affected ages and sexes differently, the exception being tuberculosis which was the second or third leading identified cause in all groups: male, female, young, and old. Adults less than 40 had little ischemic heart disease (7/100,000 both sexes combined). Maternal deaths affected younger (31/100,000 adult women) and older women (40/100,000) similarly (p=.6). Among injuries, road traffic accidents were more common among men than among women (30 vs 5/1 00,000, p=.004) while bums were more common among women than among men (23 vs 7/100,000, p=.o4). Many dying with "sudden adult death' likely had ischemic heart disease or cerebrovascular accidents, so these rates are probably underestimated. Because of this likely misclassification, we considered circulatory disorders as a group. The death rate due to circulatory disorders, including sudden adult death, ischemic heart disease, cerebrovascular accident, congestive heart failure and other circulatory disorders, was 96/100,000. Overall, adult Karachi slum dwellers had a 3.7-fold (4. 1 -fold for males; 2.6-fold for females) excess

mortality compared to Japanese adults. The contribution of different diseases to this excess varied by sex (Table 3)

Table 3. Adult Death Rates (/100,000): Five Karachi Slums (1990-1993) and Japan (1991)*.

Cause of Death	Karachi		Japan		SMR	
	M	F	M	F	M	F
Circulatory Disorders	124	66	38	17	3.3	4.0
Tuberculosis	30	30	0.7	0.2	44	163
Road Traffic Accident	30	5	20	5	1.5	1.0
Maternal Causes	-	33	-	0	-	116
Burn	7	23	0.5	0.3	14	90
Total	436	337	167	82	2.6	4.1

Compared to Japan, Karachi adults had one to two orders of magnitude excess mortality due to maternal causes, tuberculosis and bums. In each case, women were at higher risk than men, especially for burns. The ratios also varied by age (Table 4).

Table 4. Standardized Mortality Ratios: Five Karachi Slums (1990-93) and Japan (1991)*.

Cause of Death	Male		Female	
	Young	Old	Young	Old
Circulatory Disorders	1.8	3.8	6.3	3.9
Tuberculosis	108	30	692	78
Road Traffic Accident	1.2	3.1	0.7	2.0
Maternal Causes	-	-	108	327
Burn	18	9.2	121	72
Total	2.5	2.7	5.3	3.4

Table 5. Adult Mortality Risk (%) as 45Q15: Five Karachi Slums (1990-93) and Japan (1991)*.

Category and Cause of Death	Karachi		Japan		Risk Difference	
	M	F	M	F	M (%)	F (%)
I. Communicabel and Reproductive	4.6	6.4	0.4	0.2	4.2 (40)	6.2 (48)
Tuberculosis	1.5	1.7	0.1	0.0	1.4 (14)	1.7 (13)
Maternal Causes	-	1.8	-	0.0	-	1.8 (14)
II. Noncommunicable	13.9	9.4	8.3	4.6	5.6 (54)	4.9 (38)
Circulatory disorders	6.2	3.6	2.8	1.3	3.4 (33)	2.3 (18)
III. Injury	3.4	2.6	2.7	0.9	0.7 (6)	1.7 (13)
Burn	0.3	1.3	0.0	0.0	0.3 (3)	1.3 (10)
Road Traffic Accident	1.3	0.3	0.7	0.2	0.6 (6)	0.1 (0)
Total	21.8	18.4	11.5	5.6	10.3	12.8

Compared to Japan, young (15-39 years) adults of both sex were at relatively greater risk than older (40-5 9 years) adults for death due to burns and tuberculosis. Indeed, young females experienced a dramatic 692-fold increase in tuberculosis mortality compared to Japanese counterparts. On the other hand, younger Karachi females compared favorably to their Japanese counterparts regarding death due to RTA. The moderately increased risk for circulatory diseases was seen among both sexes and age groups.

The adult mortality risk for males was higher than for females (45Q15: 21.8% vs 18.4%, p< .001) (Table 5). Fifteen year old males had a 13.9% chance of dying in adulthood of a no communicable cause (vs 9.4% for females). Each sex had approximately 1 .6% chance of dying of tuberculosis. Although the female chance of dying due to communicable and reproductive causes exceeded that of males, the difference could be explained by maternal causes. Under present conditions one in 55 (1.8%) female 15-year-olds would die a maternal death. One in 78 girls (1.3%) would die of a bum; an equal number of boys would die in a road traffic accident.

Karachi slum dwellers' adult mortality compared unflivorably with their Japanese counterparts among all categories, both. male and female. Overall, 47% of the excess male mortality, as measured by 45Ql5, was attributed to circulatory diseases (33%) and tuberculosis (14%). Similarly, circulatory diseases (18%) and tuberculosis (13%) as well as maternal causes (14%) and bums (10%) accounted for 55% of excess female mortality.

Discussion

Adult Karachi slum dwellers die excessively from chronic diseases, infectious diseases, maternal

causes, and injuries. Karachi mortality rates, standardized mortality ratios of these rates compared to Japan, and risk differences compared to Japan, all point to the same causes. Circulatory diseases are by far the leading killers. Tuberculosis mortality is high, one third the level of circulatory disorders. Tuberculosis mortality is equivalent to maternal causes alone or road traffic accidents and burns combined.

A 1983 report of deaths, aged 15-44, from Madras, India hospitals, clinics and nursing homes showed proportionate mortality consistent with ours[7]. Maternal female deaths (1.8/18.4 from Table 5). Their relatively lower contribution from cardiovascular conditions (13% vs 28% for males and 20% for females in Karachi) and higher contribution from tuberculosis (16% vs our finding of 7% for males and 9% for females) could be explained by the younger age group and a facility-based bias which might undercount rapidly fatal heart diseases, such as myocardial infarction. The Office of the Registrar General, India reported (Murray et al 1993) [18] that injuries accounted for 16.1% and 19.8% of adult deaths to 15-54 year old women and men, respectively, comparable to our figures of 14% and 16%. Moreover, burns caused 4.9% and 1.6% of death among women and men, respectively (compared to 7% for women and 1% for men in Karachi). Likewise, motor vehicle accidents caused 6.5% and 1 .0% of death among men and women, respectively (compared to 6% and 2% in our setting).

Our age-specific mortality rates for young and old adults (2.0 and 9. 1/1000) were slightly higher than findings from the national Pakistan Demographic Survey (1989) which sampled both squatter and regularized, presumably healthier, urban communities yielding mortality rates of 1.7 and 7.2/1000, respectively[17]. This survey showed women, age 15-49, with lower mortality than men, 1.94 vs 2.26/1000 which was consistent with our findings, 3.2 and 4.3/1000, respectively.

China has Disease Surveillance Points in a growing number of both rural and urban communities (71 by 1987). Although the sample is not randomly selected, the findings are weighted to represent the population as of the 1982 census. Reported 45Q15 calculations from 1988 differ from our findings[4]. Overall, Chinese males experienced a 14.3% chance of dying in adulthood, two thirds of the risk we found. The injury risks were almost identical, but the risk of death from communicable disease for Chinese men was one fourth our figure (1.11% vs 4.6%). As in Karachi slums, the leading communicable cause of male death in China was tuberculosis (0.54%) which was one third of our finding (1.5%). Like their male counterparts, Chinese females' overall 45Q15 (11.9%) was two thirds of our risk. Chances of death due to maternal causes, tuberculosis, and burns were 0.21, 0.42 and 0.0 1%, respectively, all far lower than ours. Moreover, when disaggregated, the 45Q1 5s for both sexes in urban China were 3 percentage points less than in rural areas, thereby heightening the contrast with our findings. Even by regional standards, Karachi slums experience many preventable deaths.

Japan has among the lowest adult mortality in the world[18] Its mortality rates can serve as regional biological benchmarks that have been attained with present lifestyles, health education and health systems, albeit at a cost not generally affordable. Poor Karachi adults are dying at almost three times this "ideal" rate.

The striking tuberculosis SMRs of 44 and 163 for males and females may in part be related to Karachi's crowded slum environment, a weak national tuberculosis control program[19], poor front-line case management and freely available anti-tuberculous drugs. The excess mortality due to burns, particularly among women, is well described in the Asian sub-continent[21,22]. Women cooking with poorly designed stoves, placed at floor level, while wearing loose fitting traditional dress are likely at high risk. Maternal mortality, although low by developing world standards, is dramatically higher than Japan's rate. In our slum communities, about half of poor women deliver at home and their restricted mobility delays potentially lifesaving care when complications arise. The toll from ischemic heart disease may correlate with insulin, or stress from poverty, migration and crowding[23,24].

Death rates due to road traffic accidents are likely to be deceptively low. Although exposure is difficult

to measure in a small population, mortality per vehicle or per vehicle-mile is not so high in Karachi slums which use relatively few motor vehicles per capita. Even these conservative rates show that older Karachi slum-dwellers are at three times the risk of Japanese counterparts. Understandably, these older adults, especially if visually. hearing, or motoricallv impaired, would be at increased risk in the chaotic urban traffic environment.

Although the levels and patterns of death in Karachi slums differ markedly from the present ideal. the mortality risk is not extraordinarily high by global standards. Of 57 countries with vital registration data from the rnid-1980s[25], 13 exceeded the Karachi male mortality risk and one exceeded the female risk. Among these 14 were four Eastern European countries, six from Latin America and two reporting from Africa. Since countries with vital registration systems are more likely to have better health than those without. the relative standing of Karachi's poor compares even more favorably. Another contrast involves whites and blacks in the United States. As a disadvantaged group. the 45Q1 5s for black males and females were 30 and 16% in 1987, respectively, compared to 16 and 9% for whites[25]. American black men, then, have approximately a one third higher mortality than their counterparts in Karachi slums. Black women have about the same risk as their Karachi counterparts.

This report has limitations. The sample is small. However, the cases were a universal sample of the study area, and the 5 slums are in many ways similar to Karachi's urban poor (40% of an estimated 10 million) and more Cautiously the urban poor of Pakistan and South Asia.

Second, verbal autopsy relics on the respondent's. ability to recognize and recall syndromes that are distinct[26]. Thus the injury rates were probably accurate. Other important cause-specific rates may have been underestimated. However, some deaths due to ischernic heart disease were likely to have been misclassified in the "sudden adult death" group and tuberculosis cases may have been assigned to the "undiagnosed fever" group. Maternal deaths due to intentional abortion, for example, were certainly under-reported and assigned as "ill-defined," the second leading diagnosis behind maternal causes among young females. Indirect maternal deaths were certainly under-counted as pregnancy histories were not obtained.

Third, age may be under-reported because of social and economic incentives such as avoiding mandatory retirement although few in these communities were civil servants. This might overestimate Karachi's adult mortality somewhat.

Finally, our method has not been validated to external standards. But several factors support the findings. We report on adults rather than the elderly who more often have multi-system disease complicating both assigning and coding causes(s) of death. Furthermore, the majority of patients reported receiving modern medical care. Although the validity of these accounts could not be examined, the verbatim narratives of drugs, investigations, or diagnoses corroborated clinical histories. Additionally. our findings are consistent with others[4,7,17].

This study has described the levels and causes of adult mortality among five poor communities in a South Asian city. Overall women had slightly lower mortality than men although compared to a regional benchmark, their relative standing was worse. Their health would benefit as much from tuberculosis control or burn prevention as from safe motherhood initiatives. Males, with less restricted mobility, need safer traffic as well as tuberculosis control. Both need cardiovascular health promotion and disease prevention.

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