

Maternal Mortality in Latin American Urban Areas: The Case of São Paulo, Brazil¹

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This article describes maternal mortality trends in São Paulo, Brazil, from 1960 through 1990. In so doing, it compares mortality rates derived from death certificate data with rates suggested by three independent surveys conducted in the city of São Paulo in 1962–1963, 1974–1975, and 1986. In general, these data indicate that a substantial share of all maternal deaths in the city have been ascribed to other causes on death certificates, that prevailing maternal mortality levels are far higher than those found in the urban areas of most developed countries, and that in recent years levels of maternal mortality in the city have been rising. Various measures are suggested for improving the accuracy of available data and reducing the maternal mortality they describe.

About 30 years ago, during 24 months in the 1962–1964 period, the Pan American Health Organization undertook a major project known as the “Inter-American Investigation of Mortality.” The project consisted of an in-depth, standardized, data-adjusted study of mortality among adults 15 to 74 years old in 12 urban areas—10 in Latin America, one in the United States (San Francisco), and one in England (Bristol). The results, published in *Patterns of Urban Mortality* (1), revealed worthwhile information, especially when the Latin American study areas were compared with the other two.

Regarding maternal mortality, these results clearly demonstrated much higher rates in the 10 Latin American study areas. Indeed, the authors stated that “Few causes of death showed greater variation from city to city than those attributable to the complications of pregnancy, deliv-

ery, and the puerperium. Among women of childbearing age, from 15 to 44 years, death rates per 100 000 population varied from low levels of 1.1 in San Francisco and 1.6 in Bristol to high levels of 33.7 in Cali (Colombia) and 40.9 in Santiago (Chile). The wide range in mortality from these causes, as indeed from any other cause, points strongly to the existence of adverse factors in the environment which might be susceptible of modification.

“The magnitude of the problem is illustrated also by the relative importance of maternal causes of death . . . Among females at ages 15–44 years in San Francisco only one death in 174 was due to maternal causes, compared with one in seven in Cali and Mexico City and one in five in Santiago. The immensity of the challenge implicit in these figures lies in the fact that more than 90 percent of the maternal mortality in several of these cities was preventable, judging by the most favorable experience. In the 10 Latin American study cities, during the 2-year period covered by the investigation, about 1 600 women died from complications of pregnancy, childbirth, and the puerperium who would not have died had ma-

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Table 1. Deaths from maternal causes per 100 000 live births among study populations in each of the indicated cities during the relevant study period of the 1962–1964 Inter-American Investigation of Mortality. The codes shown below “pregnancy,” “abortion,” “delivery,” and “puerperium” are for relevant categories in the *International Classification of Diseases, Seventh Revision* (6).

City	Total	Complications of:			
		Pregnancy (640–649)	Abortion (650–652)	Delivery (660–678)	Puerperium (680–689)
Bogotá	126	38	46	25	18
Bristol	18	9	—	—	9
Cali	218	49	80	57	32
Caracas	97	14	45	17	21
Guatemala City	159	31	75	41	12
La Plata	133	37	31	60	5
Lima	156	60	21	44	32
Mexico City	171	42	34	48	48
Ribeirão Prêto	57	19	11	13	15
San Francisco	11	—	11	—	—
Santiago	316	41	166	88	21
São Paulo	87	28	17	23	19

Source: Puffer RR, Griffith GW (1).

ternal mortality been as low as it was in Bristol and San Francisco.”³

Table 1 shows mortality from maternal causes that the project found in the 12 study cities, by type of complication. These data demonstrate a clear difference between the situations prevailing in the 10 Latin American study cities and those prevailing in San Francisco and Bristol.

While these data are over 30 years old, it is distressing to note that maternal mortality in São Paulo and Latin America generally still greatly exceeds that found in San Francisco and Bristol. Moreover, analysis of maternal mortality in the Americas has shown declines in only a small number of countries over the past two decades. These declines occurred mainly in countries that already had relatively low rates of maternal mortality—namely Canada and the United States in North America, and the Bahamas, Chile, Costa Rica, Cuba, and Puerto Rico in Latin America and the Caribbean (2).

It should also be pointed out, however,

that the quality of information about deaths from maternal causes recorded by physicians on death certificates lacks accuracy in most countries (1, 3–5). In this regard it is worth noting that the Inter-American Investigation showed maternal causes were not always properly registered by physicians on death certificates. Indeed, comparison of the original death certificate data with information collected through field inquiries clearly indicated that the mortality from maternal causes was actually a good deal higher (over 50% higher in some Latin American cities) than that indicated by the official statistics.

Of the 10 Latin American study cities, São Paulo was found to have the next to lowest maternal mortality, the lowest being found in Ribeirão Prêto, another Brazilian city also located in the state of São Paulo. (The region studied was the *district* of São Paulo. At the time of the investigation this was the largest of eight districts constituting the municipal area (*município*)⁴ of the city of São Paulo, a

³Puffer RR, Griffith GW (1), p 169.

⁴A political unit roughly equivalent to a county.

district containing 55.7% of this municipal area's territory and 92.5% of its population.)

Since the time of this investigation, the Department of Epidemiology of the University of São Paulo's School of Public Health has monitored maternal mortality patterns in the city.⁵ The continued high level of this mortality relative to levels prevailing in certain other areas has remained a matter of concern.

The purpose of the present article is to describe maternal mortality trends in the city from 1960 through 1990 and to compare official statistical data with data corrected by means of special investigations carried out at three intervals within this period. In general, the aim is to define patterns of maternal mortality rather than to discuss possible factors that may affect it.

MATERIALS AND METHODS

Raw data on live births and deaths from maternal causes during the time period to be covered were obtained from the official agency responsible for collecting vital statistics in the state of São Paulo. Registration of live births and deaths is considered to be in the range of 98%–100% in the state, especially in the São Paulo municipal area and, within that, in the district of São Paulo.

During this period, causes of maternal death were classified according to three different revisions of the *International Classification of Diseases*, as follows: the seventh revision (6) was applied during

1960–1968, the eighth revision (7) was applied during 1969–1978, and the ninth revision (8) was applied during 1979–1990.

Regarding data correction, to calculate corrected rates for maternal mortality and its causes, information was obtained from three mortality studies, all of which employed the same methodology. Each study started with a selected sample of death certificates and examined every fatality by contacting family members, physicians, hospitals, and other health services involved with the recorded deaths. The aim of these examinations was to establish the actual causes of death, derive mortality data, and compare those data with the official data. Further details of these studies can be found in the original publications (1, 9–11).

Maternal mortality was also calculated for other parts of the state (the "interior"⁶) and for the entire state, using official data, in order to compare these data with those for the capital of the state (the city or municipal area of São Paulo) over the 1960–1990 period.

RESULTS

Official mortality data for the municipal area of São Paulo indicate that maternal mortality was around 100 deaths per 100 000 live births in the early 1960s, declined gradually until about 1985, and between then and 1990 experienced a slight increase. Table 2 shows annual maternal mortality figures derived from official data, together with comparative figures for other parts of the state and the entire state, throughout the 1960–1990 period.

These data indicate that until the 1980s

⁵The Inter-American Investigation studied the district of São Paulo, while the official data studied have covered the entire municipal area. Several studies have found no meaningful differences between various health indicators (including maternal mortality) in the district versus the whole municipal area—which is not surprising, considering that the district accounts for some 92.5% of the municipal area's population.

⁶The term "interior" refers to all parts of the state of São Paulo except the state capital. This distinction between the population of a state capital and the population of the rest of the state (referred to as the "interior") is common in Brazil.

Table 2. Maternal mortality (deaths per 100 000 live births) in the municipal area (capital) of São Paulo, other parts of São Paulo State (the "interior"), and all of São Paulo State from 1960 through 1990, according to official death certificate data.

Year	Capital	Interior	State
1960	99.3	172.6	152.6
61	104.9	161.2	145.6
62	112.3	142.5	133.7
63	96.4	153.3	136.9
64	104.4	125.4	119.2
1965	87.3	134.6	120.8
66	98.2	134.6	123.7
67	78.7	136.8	119.3
68	73.3	110.2	99.1
69	90.6	128.4	166.6
1970	68.8	104.5	93.0
71	71.6	94.6	87.0
72	65.5	85.5	78.8
73	70.4	99.9	89.7
74	75.2	96.4	88.9
1975	69.2	89.9	82.6
76	63.3	99.4	86.5
77	65.7	78.5	74.0
78	52.4	77.7	69.0
79	49.5	71.7	64.2
1980	53.5	56.1	55.2
81	46.1	53.9	51.3
82	38.2	52.6	47.8
83	45.4	50.0	48.5
84	48.1	48.9	48.6
1985	43.1	49.0	47.0
86	51.6	49.6	50.2
87	46.0	53.4	51.0
88	51.0	47.0	48.3
89	47.5	46.0	46.5
1990	48.0	45.9	46.8

Source: Raw data provided by the SEADE Foundation, the office in charge of collecting, analyzing, and publishing vital statistics within the state of São Paulo.

maternal mortality in the municipal area of São Paulo was generally much lower than in other parts of the state. However, the figures for other parts of the state tended to decline a little faster than the municipal area figures, more or less converging with them during the 1980s. Indeed, from 1988 through 1990 these figures indicate that maternal mortality in the rest of the state was lower than it was in the municipal area.

To better examine levels and trends of maternal mortality, average maternal

mortality during four different 3-year periods was calculated. The specific periods selected were 1960–1962, 1970–1972, 1980–1982, and 1988–1990. Respective rates for each of these periods, based on official data, are shown in Table 3. Percentage changes (+ or –) in these rates between one period and another are shown in Table 4.

As may be seen, the percentage reduction between each 3-year period was greater in other parts of the state than in the state capital. Most notably, during

Table 3. Maternal mortality (deaths per 100 000 live births) in the municipal area (capital) of São Paulo, other parts of São Paulo State (the "interior"), and all of São Paulo State in 1960–1962, 1970–1972, 1980–1982, and 1988–1990 (three-year averages derived from Table 2 data).

Three-year averages	Capital	Interior	State
1960–1962 (1st)	105.5	158.8	144.0
1970–1972 (2nd)	68.6	94.9	86.3
1980–1982 (3rd)	45.9	54.2	51.4
1988–1990 (4th)	48.8	46.3	47.2

Table 4. Percentage differences between the 3-year average rates of maternal mortality shown in Table 3.

Three-year averages	% differences		
	Municipal area	Interior	State
1st–2nd	–35.0	–40.2	–40.1
2nd–3rd	–33.1	–42.9	–40.4
3rd–4th	+6.3	–14.6	–8.2
1st–4th	–53.7	–70.8	–67.2

the years between 1980–1982 and 1988–1990, when data for the state capital showed a 6.3% increase in maternal mortality, a mild reduction of 14.6% was found in other parts of the state. Overall, between the first and last 3-year periods the decline in the state capital (53.7%) was considerably lower than that observed in the rest of the state (70.8%).

The São Paulo surveys of 1962–1963,⁷ 1974–1975, and 1986 (1, 9–11) that provided a basis for adjusting maternal mortality figures derived from official data indicated that maternal mortality in the district of São Paulo (containing 92.5% of the entire population of the municipal

area) was 87 deaths per 100 000 live births in 1962–1963, and that maternal mortality within the state capital was 156 deaths per 100 000 live births in 1974–1975 and 99.6 in 1986. When the later (1974–1975 and 1986) rates are compared with the official rates shown in Table 2, they strongly suggest that maternal mortality was about twice as high as indicated by the official statistics.

Superficially, this does not appear to have been the case in 1962–1963, because the official data indicated that maternal mortality in the São Paulo municipal area was 104.4 deaths per 100 000 live births, while the maternal mortality in the district, indicated by the survey data, was 87. The actual situation, however, is as follows: Until 1968, the agency in charge of vital statistics for the state of São Paulo presented mortality data without refer-

⁷The period covered by the Inter-American Investigation varied somewhat from one study city to another; in São Paulo this period was from 1 January 1962 through 31 December 1963.

ence to the decedent's place of residence. Thus, the mortality recorded was mortality by place of occurrence; and since the medical and hospital facilities in the municipal area of São Paulo always attracted patients from neighboring regions, this practice seems bound to have artificially raised the recorded maternal mortality.

It should also be noted that the Inter-American Investigation found that apparent maternal mortality among district residents (indicated by examining only their death certificates) was 57 deaths per 100 000 live births. This rate was considerably below the 87 deaths per 100 000 found after making field inquiries, reinforcing the idea that the official death certificate data, whether for the district or municipal area, considerably understated maternal mortality.

To help assess the underlying causes of maternal mortality, it is possible to ascribe all maternal deaths to complications relating to pregnancy, abortion, delivery, or the puerperium. Maternal mortality data, adjusted in accordance with the findings of the three aforementioned surveys, are broken down this way in Table 5. The disease classification codes shown for each type of cause are those provided in the ninth revision of the *International Classification of Diseases* (8). Necessary adaptations have been made in the 1962–1963 and 1974–1975 study data, because these studies respectively employed the seventh and eighth revisions of this classification (6, 7).

Table 5 clearly shows an increase in maternal mortality from the period 1962–1963 until 1974–1975, an increase that could not possibly be explained by the

Table 5. Maternal mortality per 100 000 live births and the relative contributions of deaths related to abortion, pregnancy, delivery, and the puerperium, showing the percentage of total mortality attributed to each type of cause. The 1962–1963 data were found for the district of São Paulo by the Inter-American Investigation of Mortality, while the 1974–1975 and 1986 data were found for the municipal area of São Paulo by other surveys (1, 9, 10). The codes shown are those pertaining to the *International Classification of Diseases, Ninth Revision* (8). Adaptations have been made in the 1962–1963 and 1974–1975 study data, which employed the classification's seventh and eighth revisions (6, 7).

Complications from	1962–1963		1974–1975		1986	
	Deaths/100 000	(%)	Deaths/100 000	(%)	Deaths/100 000	(%)
Abortion (630–639) ^a	17	(19.5)	39.0	(25.0)	10.7	(10.8)
Pregnancy (640–648) ^a	28	(32.2)	48.8	(31.3)	64.0	(64.3)
Delivery (650–669) ^a	23	(26.4)	34.1	(21.9)	7.0	(7.0)
Puerperium (670–679) ^a	19	(21.8)	34.1	(21.9)	17.8	(17.9)
Total	87	(100.0)	156.0	(100.0)	99.6	(100.0)

^aAccording to the *International Classification of Diseases, Ninth Revision* (8).

fact that the 1962–1963 survey data referred only to the district of São Paulo, since at that time the district included 92.5% of the entire population of the municipal area.

It is also noteworthy that the 1962–1963 survey attributed only 19.5% of all maternal deaths to abortion complications, while the 1974–1975 survey attributed a considerably higher percentage (25.0%) of maternal mortality to this cause. However, the 1986 data suggest a reversal of this trend, the adjusted 1986 figures indicating a decline in abortion-related maternal mortality to 10.7 maternal deaths per 100 000 live births (10.8% of all maternal deaths). It is hard to tell the reason for the increased mortality caused by abortion between the first and second investigations. This was an actual increase, since the data were corrected. The decrease between 1974–1975 and 1986 could be explained either by a possible reduction in the number of provoked abortions (caused by the recently broadened use of contraceptives) or by the fact that abortions started taking place mostly in hospitals or other medical facilities, and therefore occurred under better conditions.

The survey data indicate that throughout the study period complications during pregnancy accounted for the largest share of overall maternal mortality. However, this type of maternal mortality appears to have increased sharply in the data, rising from 28 deaths per 100 000 live births in the 1962–1963 district data to 48.8 in 1974–1975 and 64.0 in 1986, at which point it was higher than overall maternal mortality in many developing countries.⁸ The 1986 survey (11) also in-

dicated that toxemia of pregnancy and parasitic infectious diseases were leading causes of maternal death arising from complications during pregnancy. Specifically, toxemia of pregnancy appeared to account for 22.2% of the recorded pregnancy-related complications and 14.2% of overall maternal mortality, while infectious and parasitic diseases appeared to account for 8.9% of overall maternal mortality.

Maternal mortality from complications of both delivery and the puerperium appears higher by about the same degree in the 1974–1975 as compared to the 1962–1963 data. However, the available data show that maternal mortality ascribed to delivery then appeared to fall sharply, from 34.1 maternal deaths per 100 000 live births in 1974–1975 to 7.0 in 1986. Maternal mortality ascribed to complications of the puerperium also fell (from 34.1 in 1974–1975 to 17.8 in 1986), but this decline was only slightly greater than the apparent decline observed in overall maternal mortality in this period. As of 1986, pulmonary embolism and puerperal infection were leading causes of puerperium-related maternal mortality.

DISCUSSION AND CONCLUSIONS

Maternal mortality in the municipal area of São Paulo, one of the most economically developed areas of both Brazil and Latin America, appears extremely high. The rate derived from the 1986 survey is close to 100 maternal deaths per 100 000 live births, and even the unadjusted official data indicate about 50 deaths per 100 000 live births near the end of the 1980s through 1990. Both of these rates are many times higher than maternal

⁸The increase in mortality cannot be attributed to errors on death certificates because the results of the three investigations corresponded to corrected data. Neither can they be attributed to differences in the classification codes of the revisions of

the *International Classification of Diseases*, since elaborate work was carried out to ensure their compatibility.

mortality recorded in many industrialized countries, which typically ranges from 3 to 10 maternal deaths per 100 000 live births (e.g., 7.8 in the United States in 1985, 3.3 in Norway, and less than 2 in Denmark—12, 13).

Even more disconcerting, maternal mortality in the municipal area of São Paulo appears to have risen recently, the official data indicating a 6.3% increase between 1980–1982 and 1988–1990.

Another point that deserves mention is that throughout most of this century, maternal mortality in the capital has consistently been lower than in other parts of the state. However, the late 1980s saw a reversal of this trend. The exaggerated urban growth of the capital, abhorrent living conditions confronting the marginal population residing mostly in shantytowns, and economic deterioration in these years all help to explain these high maternal mortality rates and their continuing upward trend. Even the least favored settlements elsewhere in the state do not have to cope with conditions so precarious as those that can be found in the state capital. At the same time, access to health services in the capital is more limited because of their increasing deterioration, a situation not commonly found outside the city.

However, the conditions observed in São Paulo are similar to conditions seen in other parts of Brazil and Latin America confronted with urban economic troubles. The seriousness of this hemisphere-wide problem prompted PAHO, at the XXIII Pan American Sanitary Conference in September 1990, to give the matter priority by approving a Regional Plan of Action for the Reduction of Maternal Mortality in the Americas.

This plan is a fundamental instrument for improving women's health; if the measures it proposes are not adopted, maternal health is unlikely to improve. In general the measures proposed are not

novel; and indeed, the need for them is well recognized in public health circles. These measures include upgrading the coverage and quality of health services; raising the capacity and quality of institutional care provided for childbirth by strengthening primary health care referral services; creating a system for qualifying low-risk delivery centers and improving the performance of established facilities; strengthening home delivery care through continuing education of traditional midwives and others attending deliveries; and making greater efforts to identify pregnant women and ensure that they receive adequate care.

Within this context, it is essential to improve awareness of the maternal mortality problem. To that end, the following steps have been proposed: (1) Create and maintain operating maternal mortality committees at the national, regional, and local levels. (2) Ensure the existence of a national system for surveillance of mortality among women of childbearing age. (The aim here is to provide information of adequate quantity and quality to permit delineation of the problem's scope, causes, and determining social factors.) (3) Improve the registration and reporting of all health activities relating to pregnancy, delivery, the puerperium, and family planning.

Strategically, establishment of both an epidemiologic surveillance system and a committee to study maternal mortality are priority measures. Besides making it possible to assess the structural causes of death and the conditioning environmental and social factors, they permit correct measurement of existing mortality. (As already noted, three surveys conducted over a period of about 30 years within the municipal area of São Paulo, where quantitative death registry coverage is excellent and considered to be 100%, found that deaths from maternal causes were registered as having other causes about

half of the time. Such circumstances obviously impede efforts to gain a precise grasp of the situation.)

Recognition of high maternal mortality in São Paulo, together with recognition that death certificate data were ascribing many maternal deaths to other causes, led the health authorities of the municipal area of São Paulo to set up a Committee for the Study and Prevention of Maternal Mortality in 1991. This committee makes weekly collections of all death certificates issued for women 10 to 49 years old and separates them into the following three groups: "declared maternal deaths," "possible maternal deaths," and "nonmaternal deaths." The first two groups are investigated, and many in the second group that were not designated maternal deaths are confirmed as having been maternal deaths. The investigations are accomplished through interviews—in hospitals, with physicians, and when necessary in the home. Overall, it has been found that the great majority of these maternal deaths could have been avoided easily and that the quality of medical services was an important factor responsible in many cases.

At this point it is to be hoped that the committee's continuing efforts, combined with enactment of its proposed measures, will succeed in reducing maternal mortality in the municipal area of São Paulo.

More broadly, to support the recommendations of the XXIII Pan American Sanitary Conference for reducing maternal mortality in the Americas, a group of experts met with officials representing PAHO/WHO and the United States Centers for Disease Control and Prevention (CDC) in Atlanta, Georgia, in July 1992 and produced a work entitled *Guidelines for Maternal Mortality and Morbidity Surveillance* (14). As noted above, epidemiologic surveillance is strategically essential to attaining the proposed objectives.

In this vein, it should be pointed out that some Latin American countries have already implemented maternal mortality surveillance, even at the national level. In certain cases (Cuba provides a good example) this has contributed substantially to reducing maternal mortality.

At the local level, the first year of the São Paulo committee's work, including surveillance and detailed study of each fatality, gives grounds for hope that the excessive maternal mortality prevailing in that municipal area will be reduced. It is even possible, if this work is suitably followed up, that in the not too distant future São Paulo could find maternal mortality reduced to levels comparable to those observed by the Inter-American Investigation in San Francisco and Bristol nearly a third of a century ago.

REFERENCES

1. Puffer RR, Griffith GW. *Patterns of urban mortality*. Washington, DC: Pan American Health Organization; 1967. (Scientific publication 151).
2. Laurenti R. *A saúde materna na região das Américas*. Organização Panamericana de Saúde; 1992. [Mimeographed document].
3. Royston E, López AD. On the assessment of maternal mortality. *World Health Stat Q*. 1987;40:214–224.
4. Atrash HK, Rowley D, Hogue CJR. Maternal and perinatal mortality. *Obstet Gynecol*. 1992;4:61–71.
5. Allen MK, Chavkin W, Marinoff J. Ascertainment of maternal deaths in New York City. *Am J Public Health*. 1991; 81(3):380–382.
6. World Health Organization. *International classification of diseases (seventh revision)*. Geneva: WHO; 1957.
7. World Health Organization. *International classification of diseases (eighth revision)*. Geneva: WHO; 1967.
8. World Health Organization. *International classification of diseases (ninth revision)*. Geneva: WHO; 1978.
9. Guimarães C, Souza JMP, Jorge MHPM, et al. Mortalidade de adultos de 15 a 74

- anos de idade em São Paulo, Botucatu e São Manoel (Brasil), 1974/75. *Rev Saúde Pública (São Paulo)*. 1979;13(Suppl 3):1-64.
10. Laurenti R, Buchalla CM, Lolio CA, et al. Mortalidade de mulheres em idade fértil no Município de São Paulo (Brasil), 1986: I. metodologia e resultados gerais. *Rev Saúde Pública (São Paulo)*. 1990;24(2):128-133.
 11. Laurenti R, Buchalla CM, Lolio CA, et al. Mortalidade de mulheres em idade fértil no Município de São Paulo (Brasil), 1986: II. mortes por causas maternas. *Rev Saúde Pública (São Paulo)*. 1990;24(6):486-492.
 12. United States, National Center for Health Statistics. *Health, United States: 1987*. Washington, DC: US Government Printing Office; 1988. (DRHS Pub No PHS 88-1232).
 13. Nordic Medical-Statistical Committee (NOMESCO). *Health statistics in the Nordic countries, 1990*. Copenhagen: Nordic Medical-Statistical Committee; 1992.
 14. Pan American Health Organization and United States Centers for Disease Control. *Reducción de la morbilidad y mortalidad materna en las Américas: guía para la vigilancia epidemiológica de la mortalidad materna*. Atlanta: July 1992. [Mimeographed document].



Corrigendum

In the article "Genetic Evidence of a Species Complex in *Anopheles pseudopunctipennis sensu lato*," by José G. Estrada-Franco et al. (*Bulletin of PAHO* vol. 27, no. 1, 1993), photos 1A and 1B on page 28 were reversed. Photo caption 1A applies to the bottom photo, and 1B to the top photo.