"Child Mortality in The Western Cape Province: Between modernity and developing world issues"

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Introduction

Infant mortality in particular and childhood mortality in general have declined for the last 40 years. Notable progress has been made since the 1970's, with an increase in vaccination campaigns, as well as improvements in health and nutrition. Still today, more than 7 million children aged under the age of 1 die every year, in other words in 2005, 1 child out of every 18 died during his/her first year of life. The majority of children's deaths are concentrated in Africa, for two obvious reasons: first, it is the continent where the most children are born per year (24% of the world total) and secondly, infant mortality is higher n Africa than in any other continent: on average 89 deaths per 1,000 live births.
Infant mortality varies from continent to continent, from country to country and from region to region. The infant mortality rate can vary from as little as 1 to as much as 100 depending on the country. In Iceland 2 newborns out of 1000 will die before their first birthday as in Afghanistan more than 170 infant out of 1000 will die before reaching the age of 1.

Infant mortality is generally low in developed (rich) countries and on the contrary, high in developing (poor) countries. Yesteryears, the infant and childhood mortality were high everywhere, but thanks to amelioration in delivery conditions, maternal care, better living conditions and the battle against infectioous diseases, the phenomena has regressed in many parts of the world.
But in Sub-Saharan Africa, still far too few children are benefiting from these treatments.

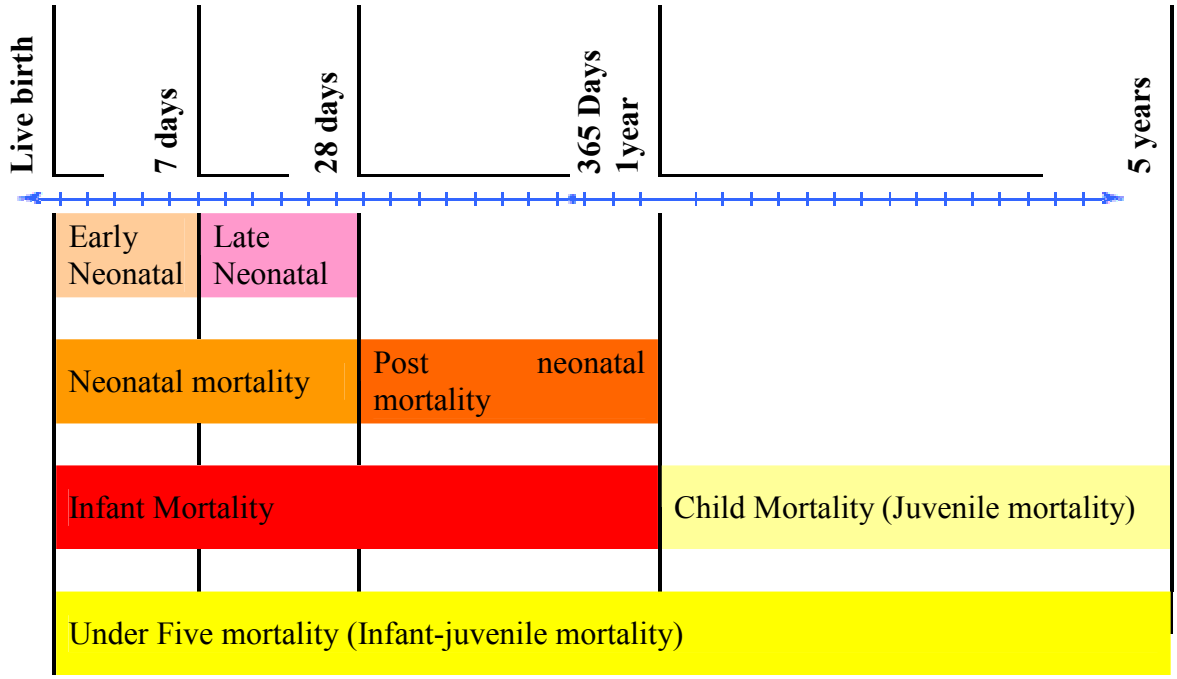
The United Nations went even further regarding the infant and child mortality reduction and the great disparities in childhood's mortality levels across the world. In September 2000, the United Nations launched a new set of targets called the Millennium Development Goals (MDGs). Amongst these different goals, 2 of them explicitly address concerns and set targets of mortality.
Goal 4 focuses on child mortality itself and defines country by country the acceptable levels of children's mortality by year 2015 (under five years old). Goal 4 strives for a global reduction of two thirds in child mortality.
Goal 5 emphasizes on maternal mortality and targets for a reduction in the same two third proportion of maternal mortality by the horizon of year 2015.
Even if it is not directly related, goal 6 targets HIV/AIDS and other infectious diseases which aims at the same results in reducing mortality where health and mortality are interrelated.

The aims of this article.
Knowing the importance of the infant and child mortality, not only as a demographic issue but also as a yardstick for measuring the degree of development of a specific area, one can wonder about the significance of the infant and child mortality phenomena in the Western Cape Province.
After having defined what infant and child mortality is, we will consider its determinants before analyzing the level and trends of childhood mortality in the Western Cape. We will finish by looking at the profile of children who die in the Province and finally we see what can be done to reduce infant mortality in particular and childhood mortality in general.

What is child mortality?

Child mortality is generally understood as child deaths between birth and the fifth birthday. Different types of mortality during 5 year period can be distinguished.

Figure 1. Calendar of mortality of Children under five.



Several useful indicators can be calculated using these definitions.
The two main indicators used to estimate mortality are rates and probabilities (quotients). The death rate (or mortality rate) is used in transversal analysis, (level of mortality in a specific period of time, generally the year), and the probability to die (quotients of mortality) is used in longitudinal analysis (level of mortality in a cohort or generation).

Therefore it is possible to measure the level of infant mortality, child mortality or under-five mortality for a specific year, or to calculate for a specific generation the impact of mortality from birth to 5 years old.

As illustrated by figure1, the mortality of children can be measured at different stages[1]:

- Early neonatal mortality : probability to die between the first and the seventh day of life
- Late neonatal mortality : probability to die between the eighth and 28th day of life
- Neonatal mortality : probability to die within the first month of life
- Post neonatal mortality : probability to die between the first month of life and the first birthday
- Infant mortality : probability to die during the first year of life
- Child mortality : probability to die between exact age one and five
- Under-five mortality (Infant-juvenile mortality): probability to die between birth and exact age five.

These different indicators obviously give measurements of the mortality at different stages of children's life, but also give precious information on the degree of socioeconomic and sanitary development of a specific area at a specific point in time.

Post neonatal mortality is due essentially to infectious sicknesses and/or malnutrition, which in turn due to poverty and low education level. These causes, called "exogenous", can be fought against with an increase in hygiene, education, vaccinations, antibiotics, and social laws.
On the other hand, the neonatal mortality is based on causes called "endogenous". These causes are still poorly known. In the first days of life, one can find three major reasons to these infant deaths: premature birth, malformations, complications during delivery. But somehow these reasons are still clichéd to cover etiological and physiopathological ignorance, even if huge progresses have been made during the last 30 years.

The infant-juvenile mortality (under-five mortality) shows the status of the population of a defined area, and help to understand easily how effective and available the health care system is, and more importantly who the beneficiaries are of the health care system and who are not, in other words, how evenly the wealth is distributed amongst the population.

Levels and trends of children's mortality (infant and juvenile mortality) are influenced by their parent's geographic, environmental, socio-sanitary and socio-economic contexts. This explains that the under-five mortality rate[2] (infant-juvenile mortality rate) is often considered as one of the best indicator of the economic and social development. Therefore, the infant and juvenile mortality rates constitute essential tools, not only for demographic research, but also for monitoring and evaluations of socio-economic programs in general and of reproductive health programs in particular.

[1] We do not include the perinatal mortality here which covers the period from the 3rd trimester of pregnancy to the first week after delivery.
[2] Under-five mortality rate: U5MR

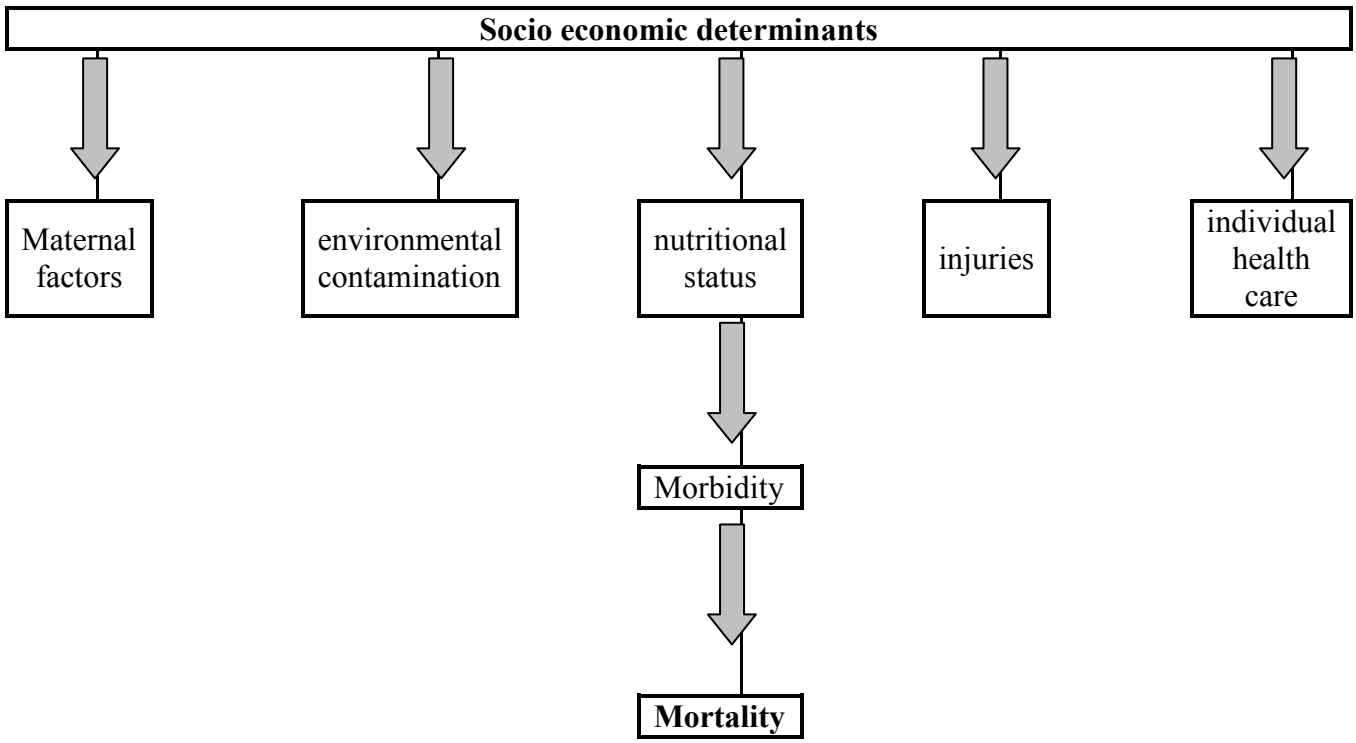
Determinants of child mortality

Factors of children's deaths are numerous and have been the focus of important literature. One of the most used models is the one of Mosley and Chen[3]. This model sorts into two different groups, factors which can possibly influence levels of children's mortality: proximate determinants (or intermediate variables) and socio economic factors.

The proximate determinants are grouped into 5 sub categories:

- maternal factors
- environmental contamination
- nutritional status
- injuries
- household behaviours (individual health care)

Figure 2. Mosley and Chen Model.



Source: Translated from Barbieri Magali, page 10. *Les déterminants de la mortalité des enfants dans le Tiers-Monde,* Les dossiers du CEPED #18, Paris, Octobre 1981, 40 pages.

This model, as explained by Barbieri, has a certain number of practical and theoretical limitations.

The definition of the intermediate variables, itself, is not entirely satisfactory. This group includes factors which influence mortality at very different levels: some have a direct influence while others have not. This remark is particularly true regarding the

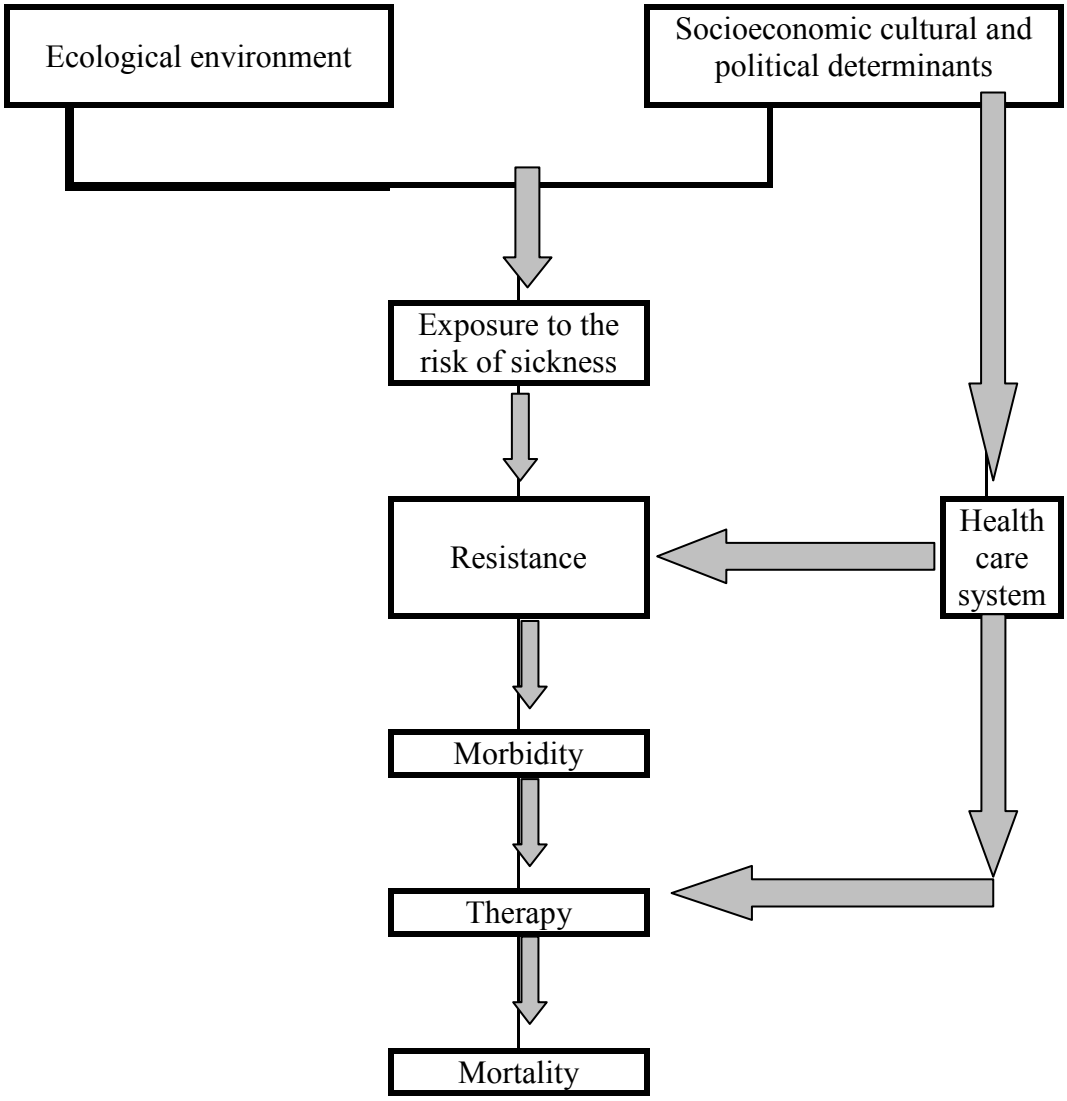
[3] Mosley Henry and Chen Lincoln, "An analytical framework for the study of child survival in developing countries" in Mosley and Chen , "Child survival: strategies for research"*, Population and Development Review, #10*. Pages 25-45, 1984.

category “injuries”. This category is the only one to explain the medical cause of death, the other categories present the factors which influence the causes of death rather than the causes of death themselves.
The different categories which are not homogeneous, Barbieri proposed a modification to the initial model by regrouping the intermediate variables into three categories:
exposure to risk (potential presence of a pathogen agent, transmission, etc.)
resistance (immunity)
therapy and health careThe model proposed is limited in terms of its usefulness. Babieri proposed a modification to the original model in order to make it mnore user friendly. In this model, Barbieri insists on the following socio economic characteristics:

- Individual characteristics: tradition, customs and attitudes, level of education of the parents and of the mother in particular
- Household’s characteristics: income, household’s organization, accessibility to drinking water and food, adequate sanitary installations
- Community characteristics: health system, socioeconomic organization, transport, industrial infrastructures, ecological, environment, political and historical context. This last point being particularly important in the South African context.

Many other studies went even further regarding the possible factors playing a role on child mortality. After scientific publication of, for instance, Pison, Tolno, Akoto and Tabutin in Europe and Africa and Nadine Nannan or Debie Bradshaw in South Africa, we can list these different factors in sub-categories.

Figure 3. Mosley and Chen Model modified by Barbieri.



Source: Translated from Barbieri Magali, page 32. *Les déterminants de la mortalité des enfants dans le Tiers-Monde,* Les dossiers du CEPED #18, Paris, Octobre 1981, 40 pages.

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Demographic factors.

- *Age of the mother*. In South Africa, as in the rest of the world, babies born from young mothers, before the age of 20, or from old mothers, after 40 years of age, have a greater risk to die before the age of 5 than babies born from mother aged 20 to 40 years old.

- *Rank of the birth*. Similarly as with the age, the analysis by rank of birth shows a U-shape pattern. In other words, firstborns have a greater chance to die before the age of 5 than children from rank 2 and 3, after which the mortality increases as the birth rank increases.

- *Intervals between births*. The less time between children, the higher the probability is to die before 5 years of age. When the interval from one birth to the following is less than 2 years, the probability to die is twice higher than if the interval is between 2 to 3 years. This is valid not only for the under-five mortality, but also for the infant mortality (neonatal and post neonatal) and the child mortality.

- *Multiple births.* Gilles Pison showed for several African countries, that the risk of dying was higher for twins than for single births. Twins had 3 to 6 times the chance to die during the first month of life (neonatal period) than a single born. They had 2 to 4 times higher probabilities to die during the post neonatal period or within the first and the fifth birthday (child or juvenile mortality) than single born, and finally they had 1.5 to 3.5 greater chances to die before the age of 5 (under-five or infant-juvenile mortality) than a single born.

- *Sex of the child*. As in the rest of the world, one can find in South Africa a higher mortality in male children than in female children, and this being true at every age, because of biological reasons, with baby boys being naturally more vulnerable to infections than baby girls. In a study of 1996[4] the under-five mortality was 1.08 times higher for boys than for girls at the national level, and 1.12 times for the Western Cape.

- *Marital status of the mother.* Single mothers have a greater chance to lose their new born than a married mother.

- *Size of the family*
- *Size of the household*

Socioeconomic factors.

- *Place of residence*. Usually, we can observe a differential mortality between urban and non-urban zones, where the mortality of children is usually higher in non-urban areas than in urban areas. If we refer to data from the South Africa Demographic and Health Survey of 1998 (the data from the 2000

[4] Bradshaw D, Nannan N, Laubsdher R, Groenewald P, Joubert J, Nojilana B, Norman R, Desiree P and Schneider M (2004) South African Burden of Disease Study 2000 – *Estimates of Provincial Mortality*. Cape Town: Medical Research Council, Burden of Disease Unit.

surevey not being accessible yet), the infant and under-five mortality in non-urban areas was 1.6 times higher than the ones in urban zones.
Still in the study of 1996[4], Bradshaw and al. compared the infant mortality rate in the Western Cape according to the place of residence. The probability to die before the age of 1 in informal areas of urban zones was almost 2.5 times greater than in formal urban areas. The infant mortality rate was also higher in rural towns than in formal urban areas.

- *Living conditions*. The living conditions are mechanically linked to the household income and show how important living factors can be in children's mortality. The under-five mortality rate can vary from the simple to the double when the household has no access to piped water, when the household has no proper sanitation system, when the floor of the household is made of mud rather than covered cement, when the walls are made of mud rather than plastered, and when the cooking fuel is wood or charcoal rather than electricity.

- *Level of education of the mother and father*. The higher the level of education, the lower is the probability for a child to die before the age of 5. In South Africa, the 1998 DHS shows that it is particularly true for the under-five mortality, as the chance to die is almost 3 times higher for a child of a mother without education than for a child of a mother who has completed standard 10.

- *Household's and parents' income*. As a mechanical effect, the more the household income increases the more the children mortality decreases. The more the income increases the more the household will have access to good living conditions, health care and services.

Medical factors.

- *Antenatal care and delivery assistance*. The antenatal care, as well as the place of delivery, the delivery assistance and the mode of delivery, are major issues in the level of child mortality, especially in the infant mortality. The neonatal, post neonatal and infant mortality are very sensitive to the medical maternal care. The difference was from 1 to 2 for the neonatal mortality rate in 1996 in South Africa when no maternity care was provided. In a similar study in Guinea in 1999, one can see that the neonatal mortality rate was 33.2%o when antenatal care and delivery assistance was provided, compared to 79.7%o when neither care nor assistance were provided. Regarding the infant mortality, the rates were increased from 63%o in the first case to 159.8%o in the second scenario.

- *Weight of the child at birth*. The weight of the newborn plays a key role in the infant mortality because it has a huge impact on the neonatal mortality (and more specifically the early neonatal mortality). As the weight of the baby at birth increases the chance to die decreases. In an article of 2000-2002, Pattinson[5] shows that the neonatal death rate for a metropolitan child between

[5] Pattinson RC, *Why babies die – a perinatal survey of South Africa, 2000-2002*, in SAMJ, Vol.93. #6, June 2003.

1000 g and 1499 g was 117‰. At the same time, the same rate for a child between 2000 g and 2499 g was 10‰, and 3‰ when the newborn was over 2500 g. The same calculations were done for children born in cities and towns as well as children born in rural areas. In these cases one can observe the same patterns but with higher rates due to the place of residence itself: for instance, the neonatal mortality rate for infants, born in a city or a town, between 1000 g and 1499 g was 238‰, but dropped to 14‰ for newborns between 2000 g and 2499 g, and to 5‰ for infants over 2500 g.

- *Vaccination*. Implementation of vaccination programs and distribution of vaccinations have played an important role in the decrease of the infant and infant-juvenile mortality. If we take the case of Senegal for instance, one can see that vaccination programs had a positive impact on child mortality. Vaccination campaigns started in the 1970's and they were widely implemented by 1981, providing vaccinations for children against 7 sicknesses and for pregnant women against tetanus. These programs helped to accelerate the decrease of child mortality as well as reducing the differences between rural and urban areas during the 1970's and 1980's. In the early 1990's the vaccination cover was reduced, and the amelioration of health infrastructures were slowed down. During the same period, the decrease of child mortality came to a halt. When considering the time frame in which these events occurred , one can think, as Pison[6] rightly pointed out, that vaccinations have had a key role in the acceleration of decrease of children's deaths.

- *Nutrition.* It seems that breastfeeding increases the chances for children's survival. In South Africa in 1998, only 7% of infants under 6 months of age were exclusively breastfed. But with one of the highest HIV infection rate of pregnant women in the world, the question of breastfeeding babies and the transmission of the HIV virus is a debated issue.

- *Case management of childhood illnesses and epidemic diseases.* Three major diseases lead to death amongst children after the first month of life: malaria, pneumonia and diarrhoea. If South Africa is not under the malaria threat as is the case for the rest of the continent, the two other sicknesses are not to be ignored as for example, pneumonia accounted in 1996 for 10.7% of the infant deaths in the country, and gastroenteritis for 12.3%.
  Furthermore, as is the case for the majority of countries in Africa, South Africa has to deal with the HIV/AIDS challenge. This illness has repercussions on children's mortality, and even if it is still a bit hard to gauge exactly the impact of HIV/AIDS on infant and under-five mortality, it leaves no doubt that this disease has a major role to play in the deceleration of child deaths.

[6] Pison G, *Pourquoi la mortalité des enfants ne baisse t'elle pas plus depuis une quinzaine d'années en Afrique du Sud du Sahara ? Le cas du Sénégal , un pays peu touché par le SIDA*. Seminar of the IUSSP Committee « Emerging Health Threats ». HIV, Resurgent Infections and Population Change in Africa.

Political and cultural factors.

- *Inequalities within population*. Regarding inequalities within a population, the case of South Africa is unique. The apartheid regime in place until 1994, was characterized by a segregated society divided into legally defined racial groups holding different rights and statuses in this society. These different population groups were treated differently at all levels of society: discrimination in civil rights, education, occupation, health, income, place of residence and place of work.
  Even tough South Africa made its transition to democracy in 1994, the society is still very non-equalitarian, and was ranked third of the most unequal countries in the world in 2000
  In an article of 2006[7] Nannan and colleagues, showed that "*infant mortality rates in the early 1980s were estimated at 13, 20, 57 and 68 per 1000 live births for White, Asian, Coloured and African children respectively*".
  This unbalance between population groups at the end of the 1990's was still of great importance. Using the Poisson regression, Nannan et al. by modelling variables to estimate the relative risk of dying before 5 years old, found that Black African Children had about a 3 times higher chance to die within the first month of life than their White counterparts, and more than 6 times after the neonatal period. Children from Mixed Descent were also at a disadvantage compared to White children, as they had a probability to die before their 5 fifth birthday 2.5 times higher.

- *Preferences for specific gender*. In certain countries of the world, baby boys and baby girls receive different treatment and care. Such differences can lead to over-mortality of infants or children of one of the two sexes. China is a typical example, where girls are less welcome than boys (Also true in Nepal , India and Pakistan). A one child policy leads to an unbalanced treatment of boys and girls. The sex ratio (new born boys/new born females in a generation) for example was much higher than the biological norm of 105 per 100. For births of rank 2 for instance the sex ratio was 122, and 131 for births of rank 3. Such an unbalanced sex ratio shows undoubtedly that girls were giving far less attention than boys. The risk for a baby girl to die is 33% higher than a baby boy. During the 1980's, the abandonment of girls increased rapidly, and the mortality of these children placed in centers could reach 900‰.

[7] Nannan N, Timaeus I, Laubsher R, Bradshaw D, *Levels and differentials in childhood in South Africa, 1977-1998*, J.Biosoc.Sci, page 1-20

The Child mortality in the Western Cape

The main problem with child mortality in South Africa in general, and its provinces in particular, is, apart the phenomena itself, the challenge to find data.
One can get some residual data from one department or another, with different degrees of details and different information, but it is impossible to have access to a comprehensive data set which would enable one to do a proper direct analysis of infant, child or infant-juvenile mortality.
However, the efforts of governmental institutions, as the Department of Health or StatSA, and the will to provide the researchers with data was appreciated.

The approach here, is not to repeat the work of other researchers, as N.Nannan, D. Bradshaw, I. Timaeus, R. Dorrington , T. Moultrie, Ria Laubsher, M. Bachman, L. London or P. Barron, who have already done remarkable work on estimating the level of childhood mortality in South Africa, using mainly indirect methods.
The point here, is first to state what type of data is available at this moment in the Western Cape Province, and to use this limited data to understand the calendar of occurrence of the phenomena, levels and trends.

Level and trends of childhood mortality in the Western Cape: Longitudinal analysis.

In order to measure the level of infant and childhood mortality and to see the trends, we worked with the total number of births registered for a specific year and the number of deaths by age during a specific year between 1998 and 2004.
In order to have the most accurate total of live births for each year, we reconstructed the population by taking in consideration the number of births registered during the year of birth as well as the number of births of a specific year register after the year of births. In other words, the total number of live births for a specific year corresponds to the registration of the specific year plus the late registrations. We assume that this estimation is correct as the process of registration in the Western Cape was about 97% complete in the Province[8].

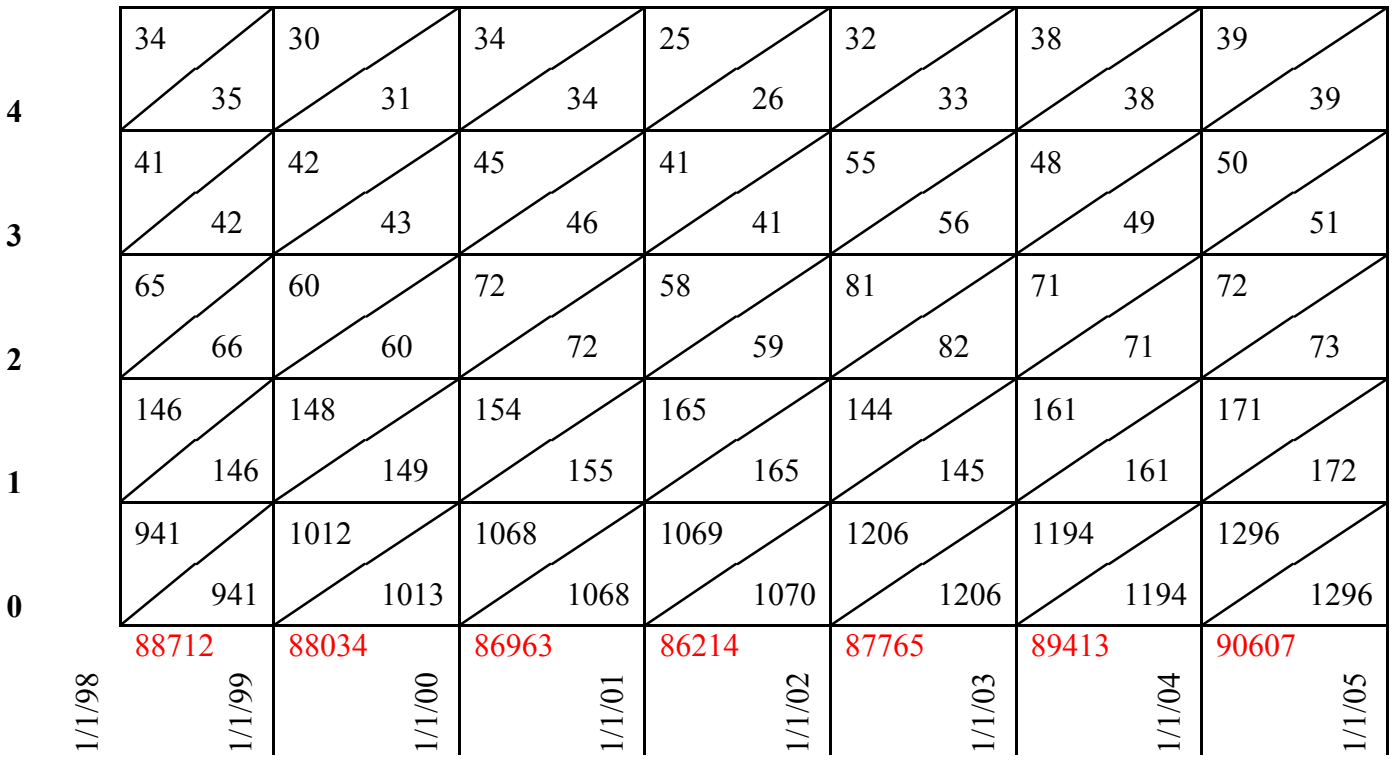
As the data on live births and deaths are both available by age and year, it is possible to calculate probabilities to die (or to survive) by age for a specific year or in a specific generation. The second possibility was chosen as the longitudinal cohort analysis will provide the picture of the real trends inside generations.
For each generation, the probability to die was calculated at each age as well as the probability to die before the fifth birthday, for the generations where it was possible (the youngest generation not been old enough).

In order to calculate period mortality tables (or life tables) we had to sort the data into generations as shown in the Lexis Diagram below.

[8] Statistics South Africa. *The coverage and quality of birth registration data in South Africa, 1998-2005*. Report #06-03-01. 2007. Page 16.

In order to sort the data by cohort, we made the assumption that events (deaths) were evenly distributed throughout the year, and using this hypothesis of homogeneity, we distributed the deaths of a year into 2 equal semesters.

Figure 4. Lexis Diagram. Live births and deaths in the Western Cape from 1998 to 2004



This figure helped resorting the number of deaths by cohort in order to calculate period mortality tables by generation.

In the mortality tables below, we can see how infants from a specific generation die or survive. Each life table is expressed for a 1000 live births.
The Age is the exact age, the Survivals are the number of babies who have not faced the phenomena under study (death) at each exact age, the Deaths are the number of deaths between two exact ages, and the quotient of mortality (QMx), the probability to die between two ages.

Table 1. Period life table. Western Cape

Generation 1998			
Age x	Survivals x	Deaths (x,x+1)	QMx ‰
0	1000	22	22.02
1	978	0.3	0.35
2	978	0.1	0.15
3	977	0.1	0.11
4	977	0.1	0.08
5	977		

Table 2. Period life table. Western Cape

Generation 1999			
Age x	Survivals x	Deaths (x,x+1)	QMx ‰
0	1000	24	23.64
1	976	0.4	0.37
2	976	0.2	0.16
3	976	0.1	0.12
4	976	0.1	0.09
5	976		

Table 3. Period life table. Western Cape

Generation 2000			
Age x	Survivals x	Deaths (x,x+1)	QMx %o
0	1000	25	24.57
1	975	0.4	0.36
2	975	0.2	0.18
3	975	0.1	0.12
4	975	0.0	0.05
5	975		

Table 4. Period life table. Western Cape

Generation 2001			
Age x	Survivals x	Deaths (x,x+1)	QMx %o
0	1000	26	26.40
1	974	0.4	0.36
2	973	0.2	0.17
3	973	0.1	0.12
4	973		

Table 5. Period life table. Western Cape

Generation 2002			
Age x	Survivals x	Deaths (x,x+1)	QMx %o
0	1000	27	27.35
1	973	0.4	0.39
2	972	0.2	0.17
3	972	0.0	

Table 6. Period life table. Western Cape

Generation 2003			
Age x	Survivals x	Deaths (x,x+1)	QMx %o
0	1000	28	27.85
1	972	0.4	0.40
2	972		

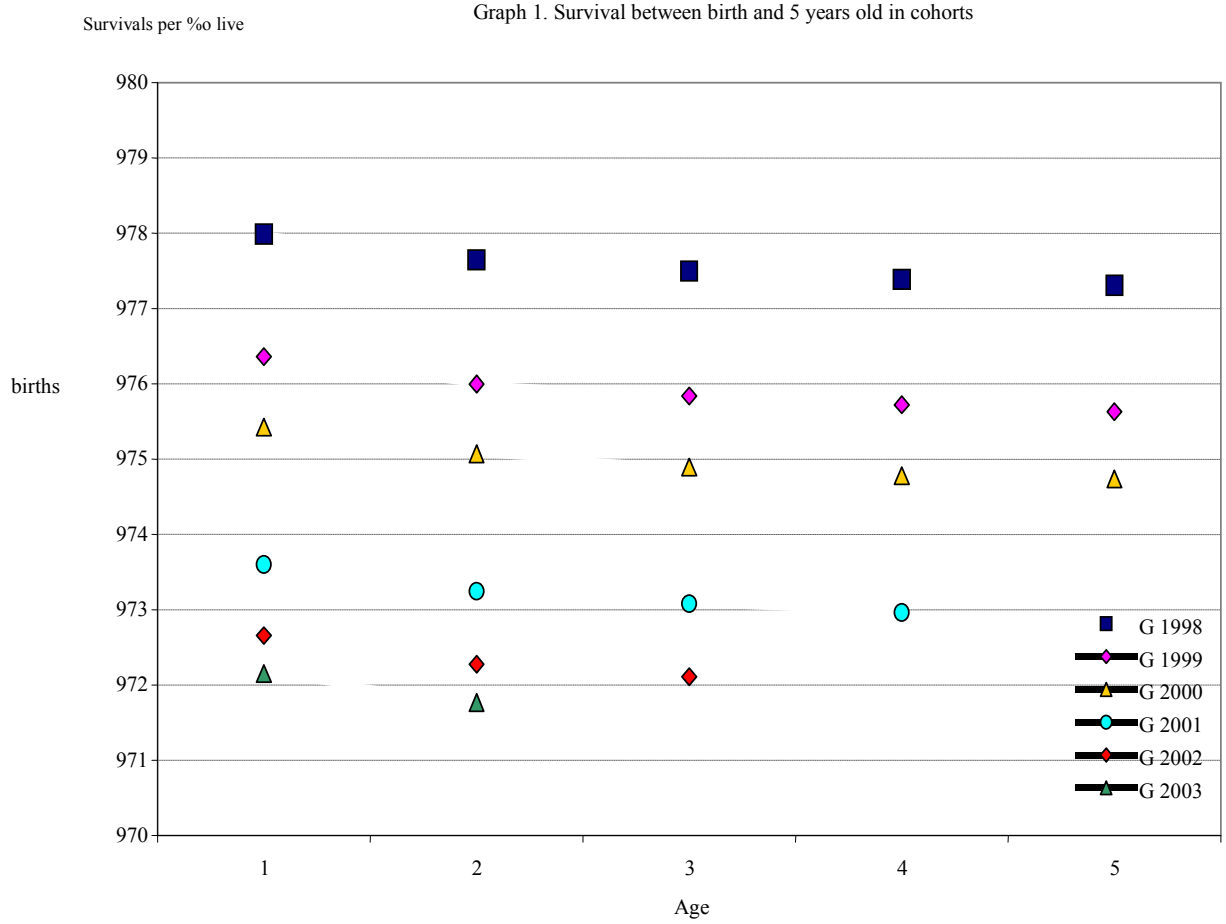
Table 7. Period life table. Western Cape

Generation 2004			
Age x	Survivals x	Deaths (x,x+1)	QMx %o
0	1000	29	28.61
1	971		

As we can observe, the highest probability to die is, for all generations, between 0 and 1 year old. This result shows a normal pattern and allows being optimistic regarding the consistency of the data. Indeed, the mortality of children is normally concentrated during the first year of birth (itself divided in neonatal and post neonatal mortality) if not exceptional external events.

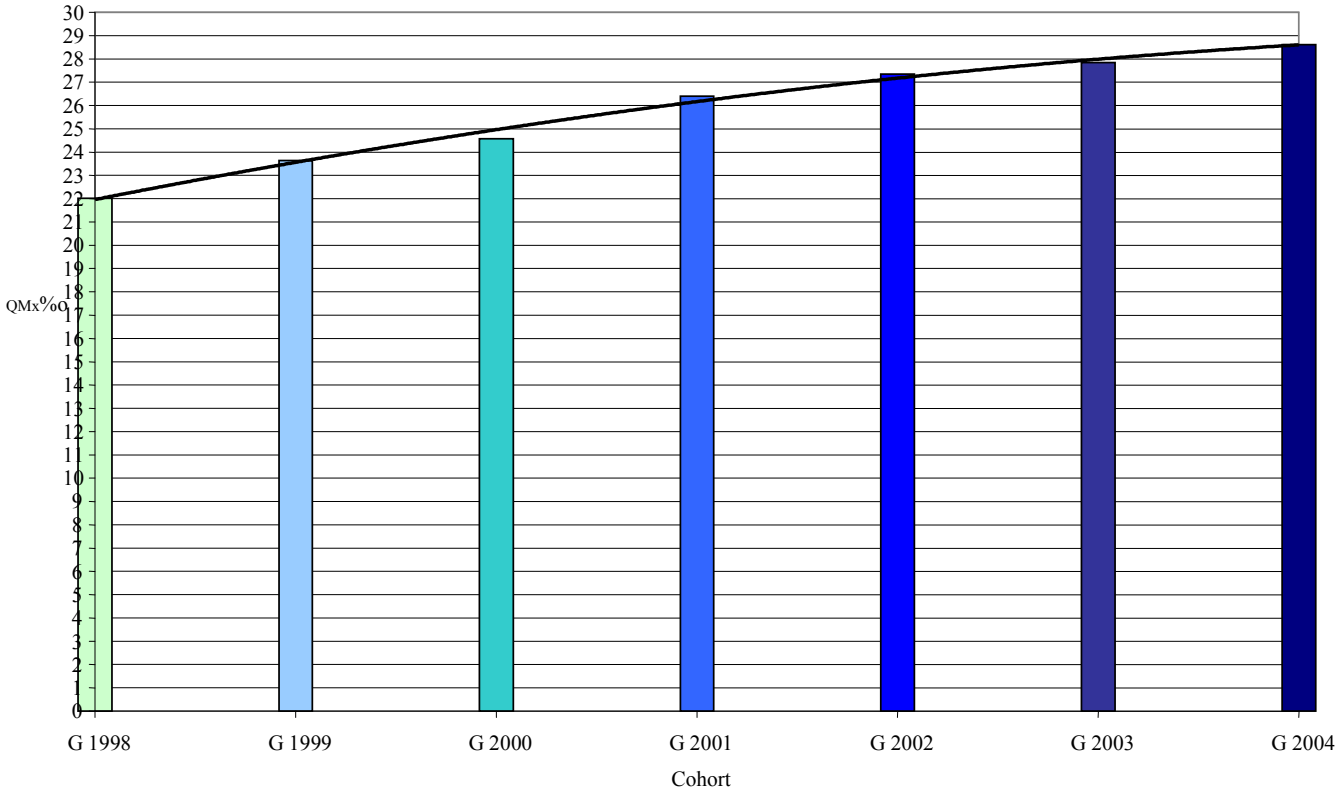
When comparing the probability to die between 0 and 1 year old, we can see that the quotient tends to increase regularly, generation after generation. It is clear that the infant mortality in the Western Cape is not decelerating anymore, but on the contrary infant mortality is increasing slowly by generation.

Graph 1. Survival between birth and 5 years old in cohorts



If we compare the number of survivals aged one exactly in generation 1998 to the number of survivals aged one exactly in generation 2004, we can see that in the first cohort 978 infants reached aged one and in the second cohort 971 infants reached aged one.
In other words out of a 1000 births, 7 infants die more in generation 2004 than in generation 1998.

Graph 2 . Western Cape. Probability to die between 0 and 1 year old exactly, by generation



We can see on the graph that the level on infant mortality in the Western Cape is increasing. It is true that the Western Cape still have the lowest infant mortality rate in the country, but the trend is in any case going up.
Regarding the level of infant mortality, the Western Cape Province was often under the spotlight because of its low childhood probability of dying, which could have been the result of poor data quality, and under-reporting of child deaths. This was particularly true for the 1996 census data as well as the 1998 DHS.
If the same problem was as persistent today, then we should find the opposite results if the infant mortality did not increase. As the birth registration is almost complete, the denominator (live births) should be bigger and therefore, if the numerator (Deaths) was stable or smaller, the probability to die should decrease generation after generation. But it is not the case. Logically, the increase could be an outcome from the calculation itself if the deaths have increase in a bigger proportion than the live births registrations or could be the result of an increase of the mortality itself.

It seems that this last solution is probable; since we can observe that the decrease of childhood mortality has slowed down, 1.8% per year on average for the last 15 years in Sub-Saharan Africa. The first explanation is that some of the vaccination programs were stopped or slowed down in some countries, while some sicknesses like malaria have again become vigorous. But it seems that the Western Cape faces other challenges, such as antenatal care, the place of births and other factors linked to the socioeconomic status of the greatest part of the population of the Province. But not the poverty alone seemed to be responsible for the increase of the infant mortality, HIV/AIDS is always playing a role. In Zambia, Zimbabwe, Botswana, Swaziland and South Africa, where the adult prevalence of HIV/AIDS is above 10%, the under-five

mortality rate not only failed to decline between 1990 and 2003, but even increased. Some studies estimate that by 2015, 90% of the infant-juvenile mortality will be directly on indirectly caused by HIV/AIDS. The sickness worsens maternal health, and if the new born was not vertically infected (Paediatrics AIDS coming from the vertical transmission of the HIV virus from mother to child either during pregnancy, at the time of delivery or through breastfeeding), the chance to die when the mother is HIV positive are greater than if the mother is HIV negative.

The Probability to die before the fifth birthday along the generations shows the same trends as the ones of infant mortality.
The under-five mortality probability (0q5) for the 3 generations where the calculation was feasible is as follows:
0q5 Generation 1998: 28.78‰
0q5 Generation 1999: 30.92‰
0q5 generation 2000: 31.47‰
The infant-juvenile mortality suffers from a steady increase generation after generation, as suffers the infant mortality.

It seems also important to note that the probability of dying did not include migrations, as a quotient should be. We could find in the increase of infant, child and under-five mortality an effect of the immigration in the Western Cape of pregnant women from other regions in South Africa or the rest of the world, and the possible emigration of the pregnant women outside the Western Cape. The figures could gain in quality if such migrations could be taken into account in the calculations, to cancel the effect of migrations on the indicator and to obtain therefore the pure measurement of the phenomena in the area.
Unfortunately, migrations always suffer due to a lack of registration which does not enable us to include them in the calculation of rates, especially at these young ages.
The more the migrations will be important and the differential mortality levels between areas of migration will be great, the more the quotient might be biased.

Even if the quotient stays the best indicator of mortality to understand trends as it is calculated in a generation, the mortality rate is helpful to see the evolution year after year.

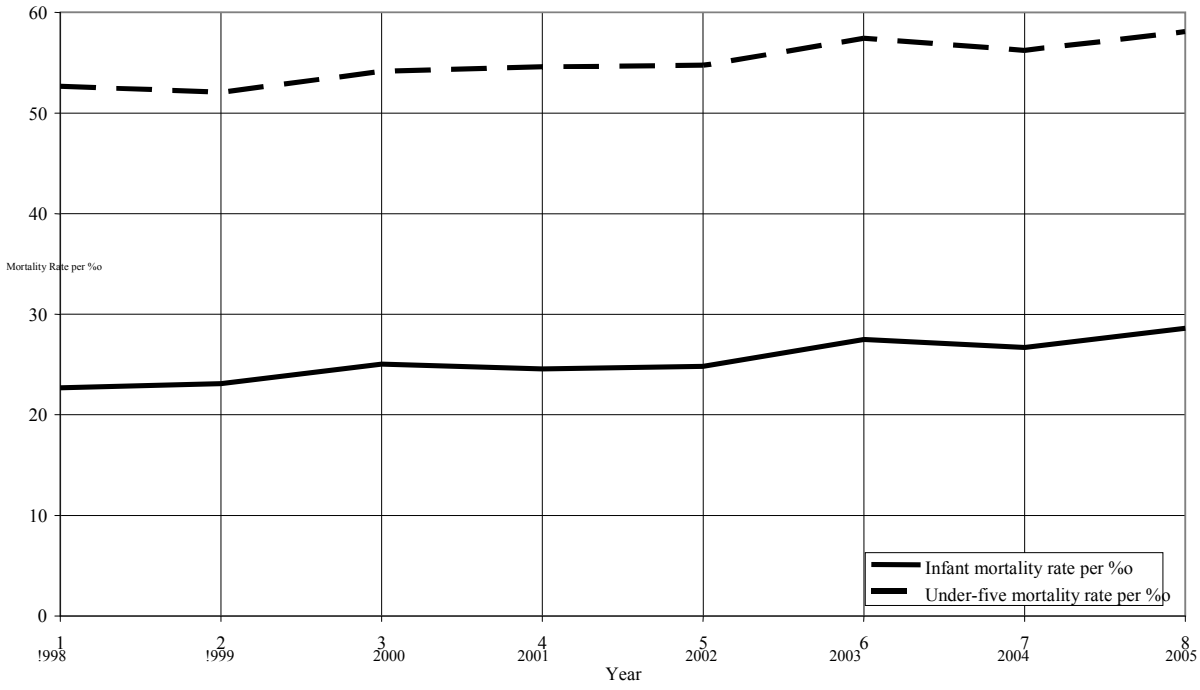
Level and trends of childhood mortality in the Western Cape: transversal analysis.

When calculating the transversal indicator from year 1998 to 2004, the same trends appeared, as when calculating into generations.

Table 8. Western Cape, infant mortality rate and under-five mortality rate from 1997 to 2004

Year	Infant mortality rate per ‰	Under-five mortality rate per ‰
1997	22.68	52.64
1998	23.09	52.09
1999	25.05	54.15
2000	24.56	54.60
2001	24.81	54.75
2002	27.48	57.45
2003	26.71	56.23
2004	28.61	58.09

Graph 3 . Western Cape Infant mortality rate and under-five mortality rate per ‰



The Under-five mortality rate is still lower than the national average of 67‰ in 2004[9], as in the Western Cape the U5MR was 58‰ for the same year. Such a result

[9] Source: Division of Health Policy and Planning, UNICEF, December 2005.

seems consistent regarding the structure of the population of the Province. Even if the Western Cape regroups huge pockets of poverty, the province benefits from a specific structure with the biggest part of the White population of the country.
Even tough the U5MR in the Western Cape is lower than the national average and its neighbouring provinces, the Western Cape is still far from approaching the target of the Millennium Development Goals (MDGs), which targets for South Africa an infant-juvenile mortality rate of 20%o by 2015.Continuously since 1998 the infant mortality rate and the U5MR increased, to move a little more away from the MDGs year after year.

Characteristics of infant deaths using the latest available data: neonatal mortality in the Western Cape in 2006 and 2007.

The Department of health has developed a form which summarizes the type of intervention by month done in each institution. This form provides information of the weight of the children at birth, the type of delivery (natural, assisted, caesarean), the outcome of the delivery (still birth, live birth), if the mother was belonging to a group at risk (age below 18 years old or over 35 years old, parity over 4), and registers as well the births which took place outside the facility but where the newborn was brought after delivery.

This data obviously suffers from a couple of limitations, as they concern only the births which took place in a medical institutions, and are only valid until infants leave the hospital. However, such information is of great interest as they at least permit to analyse certain determinants of the problems.
Once again, it is not said here that the results are valid for all births in the Western Cape, but they are to be treated as births that occurred in a medical institutions.

Thavailable data was for 2006 and for the first six months of 2007, and covered several fields like the weight of the baby at birth, the type of medical sector, the type of medical institution, as well as the period of death of the infant, classified in early neonatal and in late neonatal period.

Table 9. Western Cape 2006.
Neonatal infant rate by period

Period	Rate per 1000 live births
Early neonatal	9.23
Late neonatal	0.64
Neonatal	9.86

Table 9 shows clearly that the early neonatal mortality is much higher than the late neonatal mortality. The first explanation lies in physiological reasons: the newborn is more vulnerable during the very first days of life, and outcomes of perinatal complications tend to die rapidly after delivery. Therefore the rapport early/late neonatal mortality is biologically in disfavour of the early neonatal mortality.

Such a difference lies also in the fact that the data reflects only the births and deaths within the institution. This is not a universal registration of births and deaths as we can expect from the vital statistics. This data suffers from selection effects: the first selection is registered deliveries which happened inside the institution and the second selection effect is that the institution can only register events until the baby leaves the so-called institution. In order words, it is normal that we observe such a great difference between early and late neonatal mortality as babies can stay more easily inside the institution for 7 days than for a full month. The data regarding early neonatal mortality is therefore more reliable than the data concerning the late neonatal mortality as a certain proportion of events cannot be registered after the child has left the institution. For example, if the average stay after delivery is 9 days, then the early neonatal mortality could potentially be correctly captured but the late neonatal mortality,it would only cover 2 days out of the 21 days, hence, if the child dies back home 15 days after birth, in the late neonatal period, such a figure will not be counted in the statistics of the hospital as late neonatal death. This child would be counted as alive live birth.

This issue might lead in certain proportions to the underestimation of late neonatal mortality and over estimation on the proportion of survival children.

Table 10. Western Cape 2007*.
Neonatal infant rate by period

Period	Rate per 1000 live births
Early neonatal	7.22
Late neonatal	2.27
Neonatal	9.49

* The data for 2007 only covers the first 6 months of the year and therefore can be influenced by potential seasonal variations.

The same pattern can be observed, when using the same type of data for 2007, but in smaller proportion. The neonatal rate is similar for 2006 and for 2007, but its constitution differs from one year to another. In 2007 it seems that the late neonatal mortality increased and the early neonatal mortality decreased compared to 2006.

Table 11. Western Cape 2006. Distribution of dead infants, by period, during first month of life per 100 neonatal deaths

Period	Proportion per 100 neonatal deaths
Early neonatal	93.54
Late neonatal	6.46
Neonatal	100.00
Number	*61522*

Table 12. Western Cape 2007*. Distribution of dead infants, by period, during first month of life per 100 neonatal deaths

Period	Proportion per 100 neonatal deaths
Early neonatal	76.12
Late neonatal	23.88
Neonatal	100.00
Number	*37917*

When looking at the distribution of deaths during this first month of the life period, we can see that the greater proportion of deaths occur during the first 7 days of life as the smaller proportion occur during the 3 following weeks, for reasons already explained as a mixture of biological factors and under registration of events after the first week of life.

Table 13. Western Cape 2006. Proportion of dying infants less than one month old per thousand live births by weight

Weight at birth in grams	Proportion of dying babies per thousand live births	*Number*		
500-999	332.56	*578*		
1000-1499	78.95	*1435*		
1500-1999	13.95	*2544*		
2000-2499	10.76	*5517*		
2500 above	2.17	*51448*		
All	9.86	*61522*		

As already stated, the weight is a major factor in the infant mortality, especially in the early neonatal period. As we can see in the table above, the less the children weight at birth, the more prone they are to die during the first month of life. Out of a 1000 children born between 500 g and 999 g, 332 die before reaching their first month (and the majority of them before reaching 7 days of life). This proportion decreases as the weight increases as we can see on graph 4 below.

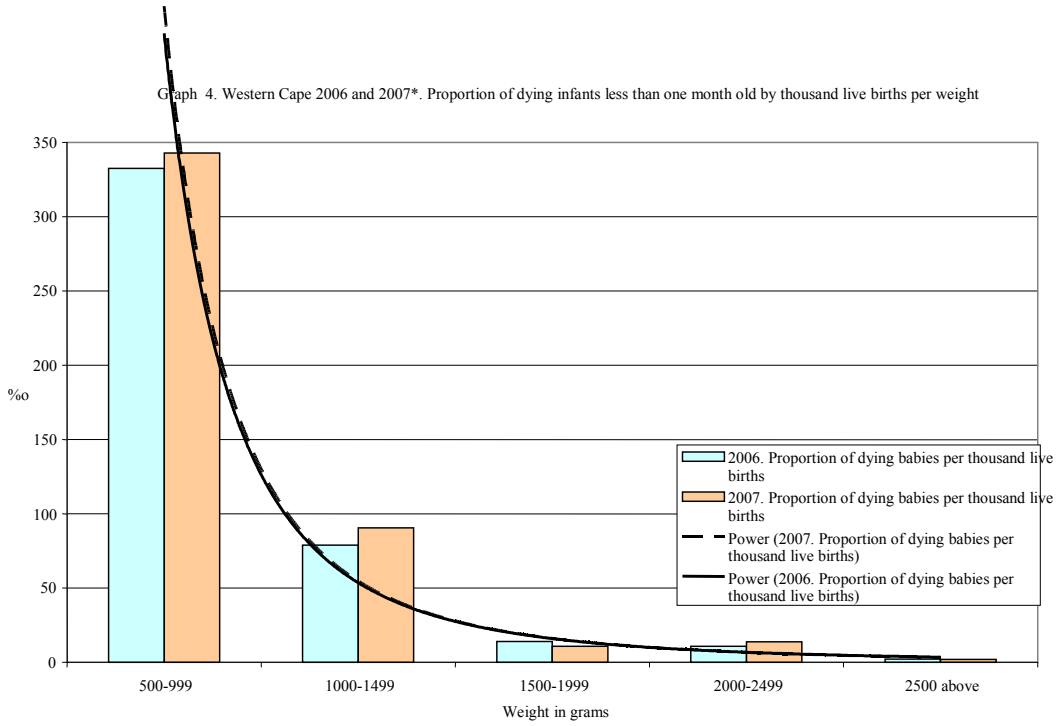
Table 14. Western Cape 2007*. Proportion of dying infants less than one month old by thousand live births per weight

Weight at birth in grams	Proportion of dying babies per thousand live births	*Number*
500-999	342.86	*490*
1000-1499	90.43	*763*
1500-1999	10.69	*3837*
2000-2499	13.74	*4949*
2500 above	2.01	*27878*
All	9.49	*37917*

In 2007, we can observe the same trend, but with a slight increase in the results for the lower weights. This can be attributed to an effective increase of the infant mortality, therefore the neonatal mortality, or to seasonal variation effects as 2007 comprises only data from January to June. The constant increase in the Western Cape since 1998 can let us think that this difference can be due to the continuation of the increase. But overall the rate is slightly lower than 2006.

On the following graph we can clearly observe the 2 phenomenon: the decrease of the mortality rate as the weight of the new born increases and a slight increase in 2007 of the lower weights.

Graph 4. Western Cape 2006 and 2007*. Proportion of dying infants less than one month old by thousand live births per weight



If we compare the neonatal mortality rate according to the sector of the institution of delivery, we can see that the public sector has a much higher rate of mortality in 2006 than the private sector, principally concentrated in the early neonatal period for the reasons we have explained earlier. But this trend reverses in 2007 with a higher mortality in the private sector. The small number of cases can explain this huge variation. But if we look at the gross number, the private sector had more infant deaths in the first 6 months of 2007 than in the whole year 2006.

Table 15. Western Cape 2006. Proportion of infant deaths by medical sector per 1000 live births of each sector

Period	Sector		
	Private	Public	All
Early neonatal	5.03	9.34	9.23
Late neonatal	0.00	0.66	0.64
Neonatal	5.03	10.00	9.86
Number	*3379*	*60182*	*63561*

** The small number of cases over six months only might be at the origin of this high rate

Table 16. Western Cape 2007*. Proportion of infant deaths by medical sector per 1000 live births of each sector

Period	Sector		
	Private**	Public	All
Early neonatal	9.95	7.61	7.22
Late neonatal	109.45	1.85	2.27
Neonatal	119.40	9.46	9.49
Number	*201*	*39940*	*40141*

Now, regarding the type of institution, we can see that the National Hospital has the highest mortality rates amongst all institutions. Unsurprisingly, we can see that the smaller the institution is, the less the neonatal mortality is. It seems therefore that smaller structures provide better care. Obviously to understand why we see such difference, we should be able to cross-check this data with information regarding the mother, and all its socioeconomic and demographic details. This unfortunately is not accessible.

Table 17. Western Cape 2006. Proportion of infant deaths by medical institutions per 1000 live births of each institution

Period	Type of medical institution				
	District hospital	National hospital	Regional hospital	Specialized Hospital	All institutions
Early neonatal	7.21	18.37	5.77	9.35	9.23
Late neonatal	0.25	2.21	0.19	0.58	0.64
Neonatal	7.46	20.58	5.96	9.93	9.86
Number	*19976*	*11758*	*21485*	*8558*	*61777*

Table 18. Western Cape 2007*. Proportion of infant deaths by medical institutions per 1000 live births of each institution

Period	Type of medical institution				
	District hospital	National hospital	Regional hospital	Specialized Hospital	All institutions
Early neonatal	6.75	17.17	7.85	8.05	7.22
Late neonatal	2.88	6.10	1.35	3.80	2.27
Neonatal	9.63	23.27	9.20	11.85	9.49
Number	*9036*	*6231*	*11086*	*4472*	*31135*

If we look at the proportion of deliveries by place, we can see that the majority of the deliveries occur in a regional hospital, which have the lowest mortality rates. But still 20% of the deliveries take place in a National hospital where the probability to die for a neonate is more, between 20‰ in 2006 and 23‰ in the first 6 months of 2007.

Table 19. Western Cape 2006. Distribution of deliveries, by place of delivery, per 100 deliveries

District hospital	National hospital	Regional hospital	Specialized Hospital	All institutions
32.34	19.03	34.78	13.85	100.00

Table 20. Western Cape 2007*. Distribution of deliveries, by place of delivery, per 100 deliveries

District hospital	National hospital	Regional hospital	Specialized Hospital	All institutions
29.02	21.01	35.61	14.36	100.00

The latest data available on the medical reasons of death is outdated as they are from year 1995 and 1996 and at the national level. But even if this data is more than 10 years old, it seems important to look at it as it helps to understand the physiological reasons for deaths.

The following tables are for year 1995 and 1996 combined, in order to increase the population under study by making the assumption that the causes of mortality were stable from 1995 to 1996.

When we consider the distribution of infant deaths throughout the year we can see that the Western Cape has a normal distribution since the deaths are concentrated in the first month of life. These early neonatal and late neonatal deaths are certainly the hardest to control as they are mainly influenced by biological factors (weight for instance as we could demonstrate earlier) or up-stream variables during the pregnancy. After this period, the child mortality, accounting here still for 65% of the deaths, shows different factors of mortality and a certain number of deaths is no more due to endogenous causes but exogenous ones, which could be avoidable.

Table 21. Western cape 1995 1996. Distribution of 100 infant deaths per duration

	< 1 day	1-6 days	7-27 days	28-364 days	Year
Male	15.25	20.70	8.59	55.46	100.00
Female	15.18	17.83	8.75	58.25	100.00
Both sexes	15.22	19.36	8.67	56.76	100.00

If we now consider the reasons, we can see that the distribution is normally concentrated around medical causes as perinatal problems or congenital anomalies for deaths occurring during the first day or the first month. For the deaths of the rest of the year these conditions are negligible. After one month of life the critical variables are, normally, infectious diseases and intestinal infectious diseases. But at each period we can see that more than 40% of the deaths are qualified as "other causes", therefore were not recognized by medical workers as the usual medical conditions.
If, once again it is hard to act on endogenous causes, we can see that a certain number of deaths could be avoided, especially amongst the 25% of deaths occurring after the first month due to infectious diseases. If we add the other causes, then we can considered that almost 50% of the deaths of these 2 generations belong to causes that could be acted on, and therefore could have saved the life of newborn.

Table 22. South Africa 1995-1996, Distribution of infant deaths per reason of death by duration

Causes	< 1 day	1-6 days	7-27 days	28-364 days	Year
Infectious and parasitic diseases	0.36	0.63	3.07	14.08	8.38
Intestinal infectious diseases	0.00	0.23	2.52	11.77	6.89
Whooping cough	0.00	0.00	0.00	0.02	0.01
Nutritional deficiencies	0.00	0.00	0.36	2.21	1.28
Diseases of the nervous system	0.00	0.08	0.33	0.99	0.60
Meningitis	0.00	0.06	0.29	0.82	0.50
Diseases of the respiratory system	0.00	0.01	0.31	7.96	4.51
Pneumonia	0.00	0.00	0.00	6.73	3.79
Influenza	0.00	0.00	0.00	0.08	0.04
Congenital anomalies	3.50	2.62	3.38	1.71	2.31
Congenital anomalies of heart and circulatory system	0.44	0.79	1.21	0.67	0.71
Certain conditions originating in the perinatal period	39.64	38.08	34.01	1.93	17.61
Birth trauma	0.50	1.42	0.50	0.05	0.42
Hypoxia and birth asphyxia	11.37	13.23	7.48	0.31	5.15
Signs symptoms and ill-defined conditions	0.01	0.50	1.52	8.23	4.87
Other causes	44.19	42.34	45.01	42.45	42.93
All causes	100.00	100.00	100.00	100.00	100.00

Profile of dying children: who dies in the Province?

In order to control and act on infant and child mortality, one need to have a clear picture of the profile of the population of children who are the most at risk of dying before the age of 1 if we consider infant mortality and before the age of 5 if we focus on child mortality.
Once again, due to the lack of comprehensive data, we cannot really create an exhaustive profile. We can only try to enhance some characteristics that were highlighted using different scientific approaches and data sources.

However, this list can aid us acting on specific points to help reduce child mortality.
Because any up-to-date, correct and comprehensive analyses cannot be done, we cannot gauge the effect of one variable on the other and see the correlation between them even if sometimes obvious correlations can be made.

The point is here at least to list some evidence, from different sources and from different points in time. We would like to remind you that the only South African Demographic and Health Survey available, is the one from 1996, and that it could be one of the most useful tools if it was not so outdated.

Residential variables

- Children born in an informal urban area have more chances to die than children (all population groups have the same probability then) from a formal urban area
- Children born in a rural area have more chances to die than children born in a formal or mixed urban area. But they have better probabilities to survive than children born in an informal urban area

Education variables

- Children whose mother has a no education have more chances to die than the ones who have a mother who completed her matric for instance.

Socioeconomic variables

- Children from poorer households have more chances to die than children from richer households.
- Children from households without proper water and sanitation systems have greater chances to die than children with appropriate access to water and sanitation systems.

Motherhood variables

- Children born from young or old mothers have a higher chance to die than children of mothers aged 20 to 34 years old.
- Children whose the mother has smaller birth intervals (less than 2 years), have a higher probability to die than children whose mother has greater births intervals
- Children of rank one and rank 4 or more have a higher probability to die than children of parity 2 and 3.
- Children of multiple pregnancies have higher chances to die than a single born

Maternal care variables

- Children whose the mother received no antenatal care have more chances to die than children where the mother went for antenatal visits.
- Children whose mother delivered in inadequate and unhygienic conditions have a higher probability to die than the children whose mother delivered in a medical structure of good quality.
- Children of smaller sizes have a greater probability to die (especially during the first month) than bigger children (over 2000 g.).
- Children who are born prematurely have a higher chance to die than children born at the normal gestation period.
- Children whose mother had to face complications during maternity (puerperal accidents and infections due to poor hygiene and sanitation during delivery, hemorrhagic delivery, arterial hypertension and convulsions) have a higher chance to die than children whose mother was in good health and had good delivery conditions.
- Children whose mother was suffering from malnutrition or who was mistreated have a higher chance to die than children whose mother was treated correctly.
- Children who are not breastfed have more chances to die than the children who were breastfed (HIV/AIDS effect not taken into account here).
- Children whose mother is HIV positive have a higher probability to die than children of HIV negative mothers.

Population groups variables.

- Black and Colored children have greater chances to die than White children. But if we compare the population groups for equal socioeconomic variables (example, same place of residence), then Black and Colored (mixed descent) children have the same chances to die than their White counterparts. Hence, the differential mortality does not reside in the population group itself but in the socioeconomic status of the different population groups.
- Boys have naturally higher chances to die than girls.

What can be done to reduce infant mortality in particular and child mortality in general?

- **Strengthen policies to expand and enhances primary health care services**.

- **Health cares services should be targeting all groups that are disadvantaged** geographically and socioeconomically (especially as these groups are the most fertile).

- Develop and strengthen **family planning policies** and offer **universal and easy access to these services** (direct effect on teenage pregnancies and birth control and unwanted pregnancies for instance).
-
- Promotion and awareness campaigns on healthy lifestyles, and the effects of repeated pregnancies.

- Greater emphasis needs to be placed on sector-wide interventions and partnerships to link health with initiatives in **reducing poverty and improving living standards of the entire population.**

- Efforts should be done on the social environment of females in general and mothers in particular by promoting health development programmes to improve the status of women. This would help to reduce the maternal, infant and child mortality.

Efforts to improve the health care system (ex. universal access to 24-hour, good quality essential and emergency obstetric services).

- Efforts on breastfeeding campaigns and programmes.

Ensure adequate nutrition of pregnant and breastfeeding women.

- Efforts to improve basic sanitary conditions, especially in informal settlements where the mortality levels are higher than anywhere else.

Efforts to control infectious diseases.

Efforts to universal access to antiretroviral treatment for pregnant women and mothers and children suffering from VIH/AIDS.

Systematic data on health and mortality have to be gathered in order to improve health policies.

- Research should be carried out to understand and examine the relationship between socioeconomic changes, HIV/AIDS, child mortality and health risks in particular.

Conclusion

The Western Cape is still in a good position compared to the rest of the country and the rest of the continent regarding the level of its infant mortality.
Though, one should not ignore that the infant and under-five mortality in the Western Cape is before all due to an artefact in the population's distribution.
Indeed, the Western Cape has the biggest white population who in turn has the smallest infant and infant-juvenile probability to die. The level of infant and child mortality in the Western Cape is first of all the result of a weighed average of unequal probabilities of different population groups which are represented in different proportions in the Province.

Even if the Western Cape has one of the lowest infant mortalities in the country, it is still far from the 2015 millennium goal set-up by the United Nations of 20%o for the under-five mortality.

In order to improve the situation of infants and children in the Province, and therefore to reduce infant and child mortality, it seems obvious that the very first step is to

accelerate the efforts made to improve the socioeconomic and health status of a great part of the population who is today still disadvantaged.

The pandemic of HIV/AIDS also needs to be taken into account to understand and gauge the effect of this sickness on child mortality and especially to evaluate to which extend it is responsible of the increase in infant and infant-juvenile mortality of the last few years.

But today, it is quasi impossible to gauge and understand perfectly the role and action of different and essential variables on the infant and child mortality as no data is available.
The phenomena will not be correctly evaluated until the researcher has access to correct and comprehensive dataset.
None of the datasets available today are satisfactory. All of them use different methodology and gather different variables which satisfy each service alone.
We do need an integrated study to understand the causes, the level, the trends and the effects of the phenomena.
The first priority is to ensure that civil registration is universal and adequate. The second priority is the need for a family survey, based on historic tables of events. The survey would need to be articulated around socioeconomic characteristics, but the one essential table would be a "birth history table", which all interviewed women of 15 years old and over would have to complete. Such a table would gather information on every pregnancy, as the date, the outcome, the place of potential delivery, and the survival of each child, in other to give all the information to calculate the correct indicators to monitor the phenomena.
- In order not to underestimate the infant and child mortality which could happen when interviewing the alive mothers (if the children of the mothers who are dead have a differential probability to die as it is the case, by interviewing the alive mothers we could not capture the level of mortality of children whose mother is dead) a specific table would gather the demographic events during the last 12 months, for instance, and therefore capture the level of maternal, infant and child mortality during that period, which would enable us to estimate previous and future levels.-

The Western Cape is in urgent need of knowledge on infant and child mortality in the Province. Such knowledge would only come from appropriate statistics… Such statistics could only come from a comprehensive survey.

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