

# Infant and Child mortality in Switzerland in 19<sup>th</sup> and 20<sup>th</sup> Centuries\*

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## Sources: The problems of a Federal State

«Compiling a Swiss statistic is as difficult perform as an international one». These were the words of J. Bertillon<sup>1</sup>. Indeed, one had to wait the elaboration of the Federal Constitution in 1848 before it was decided, in 1850, to perform the first national census. Prior to the Constitution, the country was but a patchwork of republics all having their sovereign rule of law allowing them to enjoy both a politically autonomous and social development. In the dawn of the new Federal legislation, when the Confederation was still in its infancy and when the former independent states still felt possessive of their political administration, a statistical compilation of disparate sources was indeed a remarkable feat. It allowed for the first time an evaluation of the demographic situation of the country.

Information relative to the movement of population within the country started to be compiled only later in time. By 1867, all cantons in the confederation were compelled to harmonise their method of collecting data as well as its presentation to the Federal Bureau of Statistics (OFS). However, the gathering of the numbers was compiled by clergymen and was fraught with imprecisions casting doubts as to the relevancy. It was only in 1874, when the Federal Civil law was instituted, that the authorities had in possession a legal framework in which to evaluate the movement of populations. When the law became effective in 1876, it was required to create boroughs, where the count would begin, and have these procedures harmonised on a national level. Moreover, instead of having the communes publishing an annual synopsis of statistics, it became the responsibility of the Federal Bureau of Statistics to compile these data based on the individual birth, marriage and death certificates.

The information were then published annually under such headings as «Movement of Population during the Year...», which, until 1925, provided the number of deaths before the age of one (classified in months) and those who deceased between the age of one and four within each canton and borough of the country<sup>2</sup>. From 1926, the Federal Statistics ceased to provide the ventilation, for the cantons, of the number of deaths by age category and since 1931 the data does not contain any relevant information as to the number of deaths under the age of one in the various boroughs; only the cantonal readings have survived this depletion. From a federal vantage point, the death rate has been divided since 1867 as follows: less than a month, from 1 to 11 months, one year, 2 to 4 years, and 5 to 9 years. Those still-born were numbered in the different cantons since 1871.

To this annual publication, the OFS included, between 1895 and 1928, three volumes under the title «Marriage, birth and death». They are a recapitulation of the previously mentioned data from 1871 and 1890, from 1891 to 1900, and from 1901 to 1920. They also benefit from a detailed commentary on the evolution of the birth and death rates (and infant mortality) together with an

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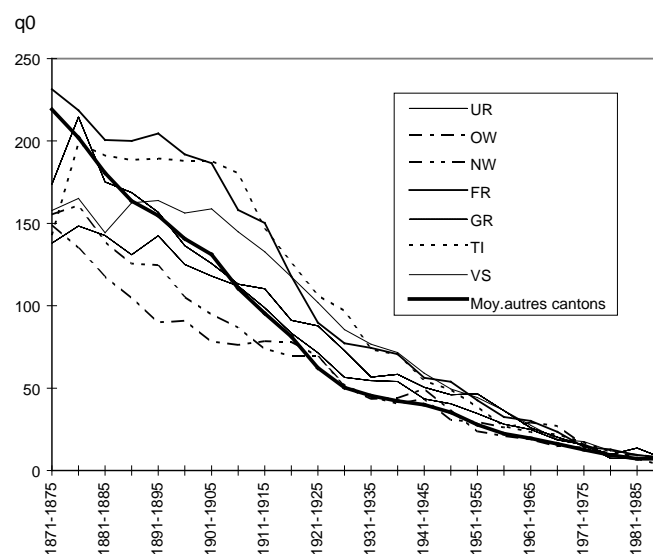
\* Translated by Balaji Ambigapathy.

<sup>1</sup> Mentioned by Dupâquier, Jacques and Michel, *Histoire de la démographie*, p. 272.

<sup>2</sup> Under the title «Movement de la population en Suisse pendant...», and then «Movement de la population en Suisse». From 1926 the publication does not provide anymore a ventilation of deaths by age groups over one year old. Moreover, from 1931 the data is only provided for the cantons and not for the districts.

analysis on the nuptiality. An important point to mention is they also consider characteristics on a cantonal level. From this two books have been published that assemble the principal statistics<sup>3</sup>. Many years after the introduction of this statistical ploy, it can not be said that the information provided is of a satisfactory nature. All the cantons having different definitions and, therefore, statistical entries with respect to infants who died right after birth and those still-born, hampers the readings. In Catholic areas, tradition called for a rapid baptising of the children in spite of the precarious situation of the child at birth. In these cantons, then, the proportion of still-birth deaths between 1871 and 1875 was, on average, 34.7 for a 1000 birth; the figure reached 51.1 in other cantons where the Catholics were in minority. In other mixed confessional areas, the rate hovered around 42.2 for a 1000 births. The correlation between mortality and the catholic confession stands at -0.69. These differences were to persist for a considerable length of time. Between 1921 and 1925, for instance, the averages were respectively of 22.6, 29.6 and 26.6 in the more tolerant cantons. Moreover, the aforementioned correlation remained significant at -0.61. Along with this there is a more serious note of caution that must be attributed to the data relative the death rate of children in several catholic boroughs even after the new Federal legislation on civil matters was promulgated. As figure 1 clearly shows, the canton of Obwald and Nidwald presented till 1915 abnormally low figures - the lowest in the country - followed from the 1920s, surprisingly, with a figures in the average for the country. In other Cantons (Valais, Ticino, Grison and Fribourg in a lesser extent) mortality stagnated up to 1901-1905 whilst elsewhere in the country it diminished. In the Canton of Uri and Ticino, it seems then apparent that the figures were under-estimated for the period running from 1871 to 1875.

Fig. 1: Comparative Evolution of Child Mortality in Cantons that present a probable under-representation of child deaths



It was therefore decided to *correct* the figures of these seven cantons by postulating that the slope of their straight line was identical to those cantons in which the registration of the data appeared satisfactory. The coefficient of correlation hence obtained are presented in table 1. The changes

<sup>3</sup> They are the *Statistique historique de la Suisse*, edited by Heiner Ritzmann-Blickenstorfer, under the supervision of Hansjörg Siegenthaler, Chronos Verlag, Zurich, 1996 and G. Calot (et alii), *Deux siècles d'histoire démographique suisse. Album graphique de la période 1860-2050* (with CD-ROM), ed by l'Office de la statistique et l'observatoire démographique européen, OFS, Bern, 1998.

brought by the new calculations may appear important, but we have only attempt to establish the trajectory of these cantons prior to improvements in the collection of data. Moreover, it must be noted that these cantons represent only 16% of the total population and, therefore, only marginally affected the under-estimation of the mortality rate.

Their quotients were calculated by pondering an average of the number of death during a given year and those of the previous year. The values that we obtained were 0.66 and 0.33 up to 1914, whilst for the years 1915 to 1959 the weighted values were 0.75 and .025. From 1960 we took the figures calculated by the OFS<sup>4</sup>.

Tab. 1: Observed infant mortality, coefficient of correction and corrected index of child mortality (CH=100)

	URI		OBWALD		NIDWALD		FRIBOURG		GRISONS		TTCINO		VALAIS	
	obs.	corr.	obs.	corr.	obs.	corr.	obs.	corr.	obs.	corr.	obs.	corr.	obs.	Corr.
1871/75	173.8	1.51	149.0	1.41	155.5	1.29	231.5	1.12	138	1.55	142.8	1.84	157.9	1.56
1876-80	214.5	1.40	135.3	1.44	160.8	1.16	218.6	1.12	148.4	1.55	198.6	1.25	165.2	1.4
1881/85	175.2	1.07	117.6	1.53	138.7	1.24	200.7	1.15	142.7	1.34	191.2	1.22	144.3	1.51
1886/90	168.8		105.0	1.58	125.6	1.25	200.1	1.08	131.0	1.29	188.6	1.16	162.5	1.25
1891/95	156.7		89.9	1.68	124.6	1.15	204.6		142.5	1.30	189.4	1.08	163.9	1.15
1896/00	136.5		90.8	1.50	105.2	1.22	191.8		125.0	1.09	188.0	1.01	156.2	1.11
1901/05	125.6		78.4	1.55	94.9	1.20	186.6		118.0	1.13	187.8		158.8	
1906/10	113.2		76.2	1.41	86.9	1.14	158.1		112.0	1.07	180.6		144.9	
1911/15	110.3		78.4	1.18	73.8	1.14	150.2		98.7		146.9		132.8	
1916/20	91.2		78.0		69.6		117.8		83.4		126.2		117.6	

	<i>Indices correspondants (CH = 100)</i>								Corr. CH
	URI	OW	NW	FR	GR	TI	VS		
1871/75	121	104	100	129	106	130	122		1.063
1876-80	121	103	98	129	121	131	122		1.041
1881/85		105	100	134	111	135	126		1.044
1886/90		103	98	135	105	137	126		1.031
1891/95		96	91		118	130	119		1.014
1896/00		94	88		94	131	120		1.009
1901/05		90	84		98		117		1.004
1906/10		92	85		103				1.002
1911/15		94	85						

### The trends of infant mortality before the establishment of the statistics

The research undertaken over the years has amply showed that the decline in infant mortality for most of the European countries that began at the end of the nineteenth century and which continued till the outbreak of the Great War, was preceded by a first decline that occurred as the eighteenth century was winding to a close<sup>5</sup>. More specifically around the 1790s several regions on continental Europe witnessed important declines in infant mortality. We see this in France and in Sweden, for instance, despite the dearth of information available; in Germany, where scholars were able to construct tables of mortality, the decline, albeit disparate, was simultaneous and parallel. This suggests that independent factors, uninfluenced by the socio-economic, cultural or the medical context, may have played an important part.

For Switzerland, the absence of national evaluations hampers, for the moment, the possibility of testing such a hypothesis; despite hints collected on a regional scale that strongly suggest that it may also be function of independent variable. In Geneva, for example, for the years 1770 to 1790 and again in the years 1800 through 1825, infant mortality declined by 26% and child mortality (for children between the age of 1 and 4) by 32%. In Jussy, a community in the Geneva country

<sup>4</sup> OFS, ODE, *Deux siècle d'histoire démographique*.

<sup>5</sup> See Perenoud A, Bourdelais P, «Le recule de la mortalité», pp. 68-71, as well as Vallin J., «Mortality in Europe», pp. 49-55.

side, the abatement was of the same magnitude<sup>6</sup>. In another instance, for the parish of Urseren (canton Uri), the decline was equivalent to 14% between the second half of the eighteenth century and the first quarter of the nineteenth. The ratios show here the figures going from 271‰ to 233‰<sup>7</sup>. And in Marbach, a community in the country side not far from Luzern, the decline was evaluated for the same period at 21.6%; the quotients, here, being 186‰ (1789-98) to 153‰ (1839-48) respectively<sup>8</sup>. Similar tendencies are also observed in Fleurier, a watchmaking district in the Jura; in Vallorbe, an industrial region in the canton of Vaud<sup>9</sup>; and in several other parishes around Glaris, where the quotients decline dramatically at the turn of the nineteenth century, albeit in variable intensities<sup>10</sup>. Nevertheless, these improvements should be attributed more to the overall economic situation than any structural revolutions. Thereby, they do not foretell of any future decline that took place. Indeed, in some cantons, the sparse data hint to a rise between the years 1840 and 1870. In Neuchâtel, it is acknowledged to have climbed from 175‰ to 208‰, in the canton of Vaud from 164‰ to 186‰, in Geneva from 112‰ to a staggering 183 ‰, and in Argau, in the years 1855 to 1870, the rise is calculated to have been from 215 ‰ to 244‰.

We may thus ask ourselves to what extent was Switzerland, which is said to have known a precocious industrialisation, subjected to a fresh increase in its rate of infant mortality as was the case in the other European countries between 1840 and 1880; a rise that historians generally attribute to the development of the proletariat and the precariousness of their sanitary conditions<sup>11</sup>. It is regrettable that the archives that have survived do not permit to answer this question.

In spite of the huge gaps we are confronted with, the statistical series at our disposal ranging from the mid nineteenth century clearly show a appeasement in the death rate from the years 1866-1870. Wherefrom we notice in the canton of Zurich, where in 1860 48% of the active population were employed in the secondary sector, as well in Thurgau, Appenzell AR, Argau, and Bern, a decline that has been continuous since 1865 (see Figure 2). If there is a correlation between industrialisation and mortality, the reading is complicated by the heterogeneous situation; not to mention that until 1870, the cantons that had similar industrial patterns found themselves at times among those who witnessed a decline and sometimes among those who went through a resumption in the rise of mortality. Various studies conducted on a local and communal scale have underlined, however, the key role the process of industrialisation played in the evolution of infant mortality. In Naefels (Glaris), for example, the rapid expansion of textile industry during the 1830s was accompanied by a rise in the quotient of infant mortality. This one went from a level of 300‰, that was observed during the first quarter of the nineteenth century, to a figure approaching 360‰ by the mid century<sup>12</sup>.

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<sup>6</sup> Perrenoud A., «La mortalité des enfants», p. 83.

<sup>7</sup> Zurfluh A., *Une population alpine*, pp. 501-502.

<sup>8</sup> See Burri A.R., *Die Bevölkerung Luzerns*, p. 139.

<sup>9</sup> See Hubler L., *La population de Vallorbe*, pp. 283-284.

<sup>10</sup> For Fleurier see Sorgesa-Miéville, *De la société traditionnelle*, p. 136-139; for the parishes of Glaris see Head A.L., «La mortalité à Glaris», pp. 44-45.

<sup>11</sup> We may further add that in the canton of Glaris the adoption, in 1872, of the labour legislation with respect women was then followed by an immediate fall in the level of infant mortality.

<sup>12</sup> Head A. L., «Frontière culturelles».

Fig. 2: *Infant mortality in selective Cantons 1841-1900*



Source: *Statistiques historiques...* pp. 236-242.

This evolution can be explained by the diffusion of the industrial labour in the community which is believed to have influenced mothers to abandon breast feeding to their siblings. A similar tendency can be attributed in Fleurier (Neuchâtel) where the spread of artificial breast feeding induced a rise in mortality due to exogenous factors. This index jumped from 80‰ to 97‰ (or an increase of 21.2%) between 1824 and 1855 and again between 1875 and 1884. The progress of obstetrics methods did compensate, nonetheless, this rise in that it allowed a gain on mortality due to endogenous factors, which declined for the same periods by 29.5% (the equivalent decline in the quotient being 105‰ to 74‰). The overall result is reflected by a decline in the infant mortality rate from 185 ‰ to 164‰ (or 11.3%)<sup>13</sup>.

### The trends of infant mortality since 1870

In the first years of the 1870s Switzerland was situated among the countries whose infant mortality rate was relatively high. It was in the neighbourhood of 214‰ and was close to those of Italy (221‰) and Holland (211‰). It was, nevertheless, superior to that of France (179‰), Belgium (151‰), the United Kingdom (153‰) and Sweden (133‰)<sup>14</sup>. But contrary to the other European nations - Sweden and Holland being exceptions to this development - the level of mortality in Switzerland was already declining in the three last decades of the century, allowing her to reach similar levels as those in France and Britain by 1900.

Since 1871 this decline has been continuous (see table 2). The level of 100‰ was definitely reached in 1912. Twenty years later we see the level arrive at 50‰. By 1964 a bench mark level of 20‰ was reached and by 1977 we touched the 10‰. In the past twenty years this ratio has diminished by half but as the following graphic illustrates if the declining trend went uninterrupted it did not follow a smooth curb over the 120 years of our observation.

<sup>13</sup> Sorgesa-Miéville B., *De la Société traditionnelle*, pp. 126-139. The dynamic presented is substantially modified at the end of the nineteenth century when infant mortality was entirely function of the fall in the mortality due to exogenous factors, induced by progress in child welfare practices.

<sup>14</sup> Chesnais J.-C., *La transition démographique*, p. 542, For more international comparisons see Gaselli G., Meslé F., and Vallin J., «Le triomphe de la médecine», p. 139.

Tab. 2: Quotients of mortality during the first year after birth\*

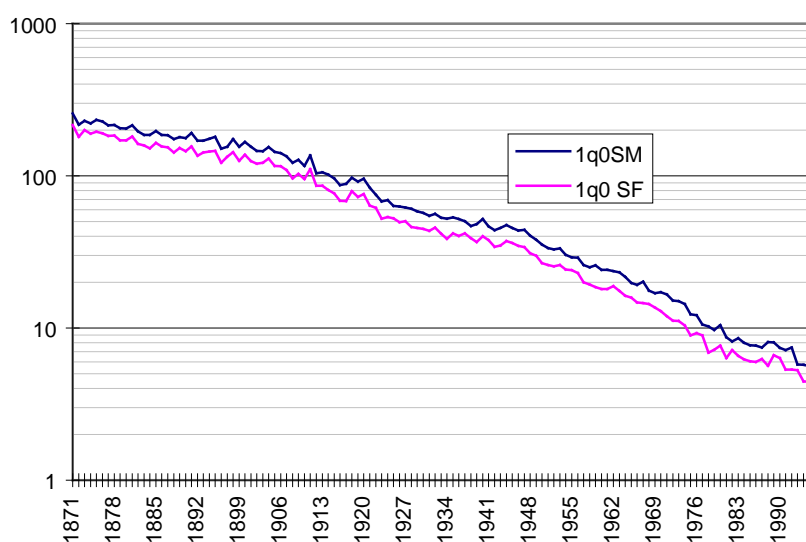
Period	Infant Mortality 1Q0 <sup>a</sup>			Components of mortality <sup>b</sup>		
	Boys	Girls	Total	Endogenous	Exogenous	Total <sup>b</sup>
1871/1875	231.7	195.9	214.2	41.0	157.2	198.2
1876/1880	213.7	179.9	197.3	50.5	137.6	188.1
1881/1885	195.8	163.6	181.1	45.8	125.5	171.3
1886/1890	180.5	150.0	165.6	44.2	114.9	159.1
1891/1895	177.3	145.0	161.5	40.5	114.9	155.4
1896/1900	160.5	132.4	146.8	36.4	106.3	142.7
1901/1905	149.1	122.7	136.1	35.4	98.9	134.3
1906/1910	128.3	103.8	116.3	33.8	81.3	115.1
1911/1915	108.8	88.1	98.7	30.5	68.6	99.0
1916/1920	92.0	72.9	82.7	33.3	51.6	82.9
1921/1925	71.9	56.8	64.5	27.3	37.6	64.9
1926/1930	60.2	47.3	53.9	22.7	31.4	54.0
1931/1935	53.9	42.3	48.2	23.7	24.6	48.3
1936/1940	49.9	39.6	44.9	23.0	21.9	45.0
1941/1945	45.8	36.1	41.0	22.6	17.8	40.4
1946/1950	40.3	31.2	35.9	21.4	14.7	36.1
1951/1955	31.8	25.1	28.6	18.3	10.2	28.5
1956/1960	26.0	19.8	23.0	15.5	7.4	22.9
1961/1965	23.5	16.8	20.0	14.0	5.9	19.9
1966/1970	18.2	14.0	16.1	11.3	4.9	16.2
1971/1975	14.6	10.7	12.7	7.8	5.0	12.7
1976/1980	10.6	8.0	9.3	5.8	3.9	9.6
1981/1985	8.2	6.5	7.4	4.1	3.4	7.4
1986/1990	7.7	6.2	7.0	3.5	3.5	7.0
1991/1996	6.4	5.0	5.7	3.0	3.3	6.3

\* Moyennes arithmétiques des taux annuels de la période considérée

a Source: until 1959 *Statistiques historiques*. (données rectifiées). Since 1960, OFS, ODE

b Source: *Statistiques historiques*. .

Fig. 3: Evolution of infant mortality in Switzerland, 1871-1996



In a first phase, from 1871 to 1904, the decline though obvious in appearance was in fact weak. If we assimilate this ebb of the mortality rate during this period to a **segment straight line**, we only arrive at a slope of 1.46% a year.

In Switzerland, like elsewhere in Europe, the beginning of the twentieth century constituted watershed years. The first quarter saw a sudden acceleration in the decline, especially between 1904 and 1924 when the rate dropped by 43% (from 133.6‰ to 61.6‰) and the annual rate of decline measured at 3.38%; a fall that is a reflection of the progress made during the period, due much to the improvement in the rearing of children as well as in water and food hygiene<sup>15</sup>. From 1900 to 1913 Switzerland is the country, after the Netherlands, that enjoyed the highest decline in its infant mortality rate (37%), allowing her to be ranked on the eve of the First World War fifth among the European countries behind the Scandinavian countries and the Netherlands.

The third phase stretches between 1925 to 1947. These were difficult years because of the Great Depression and the on coming of the Second World War. Moreover, the backwardness of some of the cantons (Ticino, Valais, Fribourg) in the field of medical and sanitary conditions contributed in slowing the rate of decline on the national level (1.8% per year). The rate, nevertheless, remained one of the highest in Europe. Between 1919 and 1939 the decline could be measured at 48.2%, therefore superior to those of Belgium, Ireland, Spain and Italy (all between 15% to 25%) and analogous to those of France and Finland (approximately 48%). It was, on the other hand, inferior to the rate that Germany, Austria and the Netherlands enjoyed (all above 50%).

The economic spurt during the 1950s and 1960s and the improvement of medical care, notably because of antibiotics, was the launching pad of the fourth phase. This one was marked by a new acceleration in the decline. Between 1947 and 1981, the infant mortality rate fell by 80% (from 39.2‰ to 7.7‰), making this an annual decline of 4.5%<sup>16</sup>.

The 1980s were, however, less buoyant. From 1981 to 1983 the rate was stagnant. Twice, once in 1988 and again in 1989, it was superior to the three preceding years. But the mortality rate is currently so low that a dozen deaths in the cot are sufficient to considerably modify the rate. The last few years saw a notable progress in the decline. We have recently reached a level of 4.4‰ from a level of 6.9‰ in 1990.

Ever since we have been in possession of a complete statistical series, it was possible to see that Switzerland distinguishes herself by feeble amplitude in her annual variations. The various crisis of European dimensions were not as prominent in the country as compared to her neighbours. The epidemics of 1870-1871 caused a rise of 14% in the rate of mortality when compared to the following two years (respectively 35,000 and 30,800 casualties). The modified quotients overtook the level of 220‰ during the two years of crisis, when there followed in succession small pox, typhus, measles and scarlet fever. In the year 1911, when the sweltering summer heat was propitious in the spread an epidemic of diarrhoea, there were 1860 more deaths in August, September and October than in the same months of the previous year. The rate of mortality was up at 124‰ from 106‰. It was, here, the last crisis of such magnitude. The Spanish flu of 1918, which occurred during a brief spate in the rise of infant mortality, killed more active adults and old people than toddlers<sup>17</sup>.

If we distinguish within the infant mortality rate, the death among infants of a few months (the neonatal rate) and the deaths of children who were older than a month but younger than a year, we may discern a rhythm of evolution quite different. The quotients of endogenous and exogenous mortality were established from the death rate of age groups that were not *corrected* of the under estimated census. To distinguish the death rate of infants because of exogenous or endogenous factors, we have added a factor of 25% to the intervals of 1 to 11 months and

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<sup>15</sup> See Gubéran E., «Tendances de la mortalité».

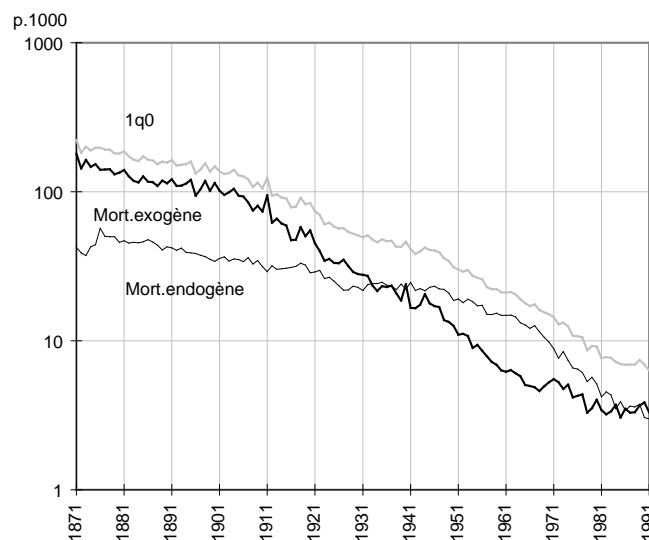
<sup>16</sup> It may be interesting to underline the similitude of the last three phases with those we observe in Belgium during the same years. See Vandenbroeke C., Van Poppel F. and Van der Woude A. M., «Le développement séculaire», pp. 261-262.

<sup>17</sup> Caselli G., Meslé F. and Vallin J., «Le triomphe de la médecine», p. 137.

subtracted the exogenous deaths, thereby obtained, from the total death rate to achieve a rate of endogenous deaths<sup>18</sup>.

We observe in figure 4 that the discordance between the mortality due to exogenous factors, which does have a rapid, regular and precocious decline, and the death rate caused by endogenous factors, whose evolution is slow and irregular, kept up to 1960. In the last quarter of the nineteenth century, the two slopes follow a parallel evolution. In 1904 they adopt different trends, whereby the decline of the exogenous mortality rate declines more rapidly at a constant rhythm till 1970. Hence, the phase of relative slow down of the pace of decline between 1925 and 1947 can be attributed entirely on the stagnation of the endogenous mortality rate. It is, therefore, difficult to put forth the argument of the economic cycle and that of the war, since we would have expected to see a rise in the overall death rate. This said, we note that from 1950 the endogenous mortality rate declines dramatically whilst the counterpart exogenous rate stagnates. The progress is primarily because of the advances in medical treatment of the premature babies. The transformation is overwhelming. In special institutions, like that found in Port Royal, Paris, one notes that before 1970, 80% of new born babies under 1200 grams died. After 1980, 80% of these babies survived in good conditions<sup>19</sup>.

Fig. 4: *The Components of Infant Mortality*



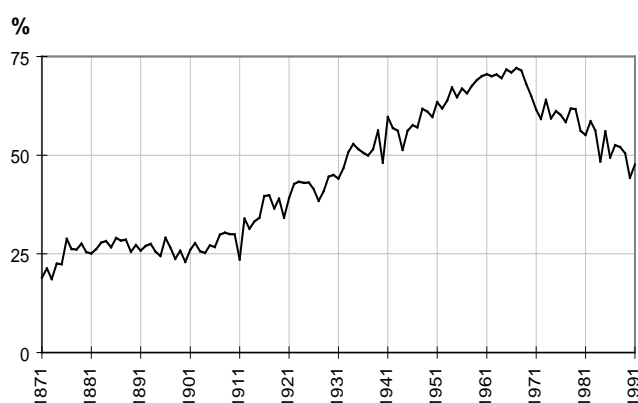
Source: *Statistiques historiques*, p. 252.

Finally, out of these developments, albeit divergent, we see an accentuated decline in the endogenous mortality rate. Up to 1904 it is by 25% but by 1933 it overtakes 50% to then arrive at 70% by 1960. The continual decline is pressed by a combination of a stagnation of the exogenous death rate and the continual decline of endogenous death rate. And by 1984 this reestablishes the balance between these two components of infant mortality.

<sup>18</sup> Pressat, R., *L'analyse démographique*, p. 136.

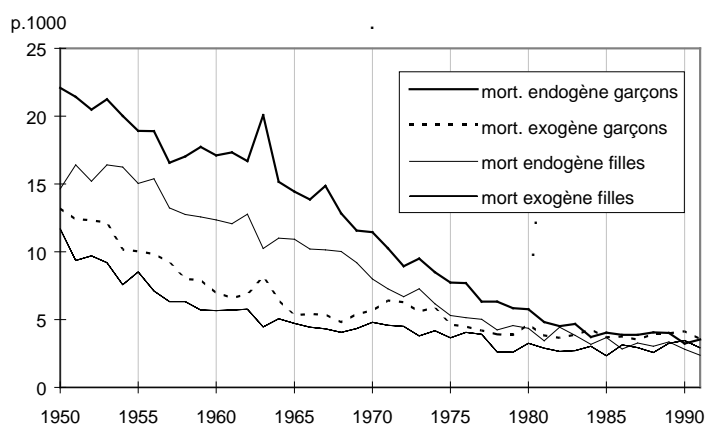
<sup>19</sup> Relier, J.-P., Les effets des évolutions technologiques et socio-culturelles sur la pratique de la médecine néonatale, in P.M. Brunetti, Perrenoud A. and Sprumont P. (ed. by), *Changement dans le processus de la reproduction humaine*, Fribourg, Editions Universitaire, 1994, pp. 61-68.

Fig. 5: Percentage of deaths due to endogenous causes



This begs the question of considering the two sexes separately. The highest rate of endogenous mortality was among the boys, and is a largely known phenomenon. But the question to examine is whether the decline of this rate contributed to the inequality of the overall rate. This was not the case before 1980. In the 1950s, the endogenous death rate of boys was of 32%. It was higher than that of girls (respectively 19.4‰ and 14.7‰). During the following two decades the excess mortality of boys reached 40% (between 1975 and 1979 it was respectively 6.81‰ and 4.86‰). The spread then is reduced in the following years: 22% in 1980/84, 25 in 1985/91. On the other hand, the exogenous excess mortality rate of male, which was of the same order (between 25 and 40%) did not decline over time.

Fig. 6: Components of infant mortality by sex, 1950-1991



As expected, the first year of life was characterised by an excess mortality of male which up to the twentieth century was of 20%. It then accelerates and by 1920 the difference was of 25% and reaches 35% in the 1970s. This evolution must be put in relation with the increasing weight of the endogenous mortality which, as we saw, represents from the 1930s the principal component of the infantile mortality rate.

The decline of child mortality (between 1 and 4 years old) follows a similar trend as that of the infant mortality but with more regularity and at a faster pace. Already, in the last quarter of the nineteenth century, the level was 40%. For infant mortality it is of 26%. This result may be explained in part by the vaccination campaign and particularly the re-vaccination campaign that

took place after the epidemic of small-pox in 1870-71<sup>20</sup>. But if the number of death fell considerably, first to hundreds between 1876 and 1885 then to double figures at the beginning of the twentieth century they represent only 5% of the deceased children between the ages of 1 and 4. Furthermore, with a constant regularity up the Second World War the quotients decline by 30% every 10 years (see table 3). From 1901/05 to 1921/25, infant and child mortality evolve together (a decline of 53% and 54% respectively). From 1926-1930 to 1946-1950 child mortality had the upper hand (53% against 33%) but since the 1950s the trend has converged towards a faster decline of infant mortality: 1951/1975, 56% and 54%; 1976/1996, 39% and 36%. Currently, child mortality is at 1.2‰. The deaths today are regarded largely due to accidents.

Tab. 3: *Quotients of Mortality during childhood and probability of survival to the fifth birthday (in per thousand)*

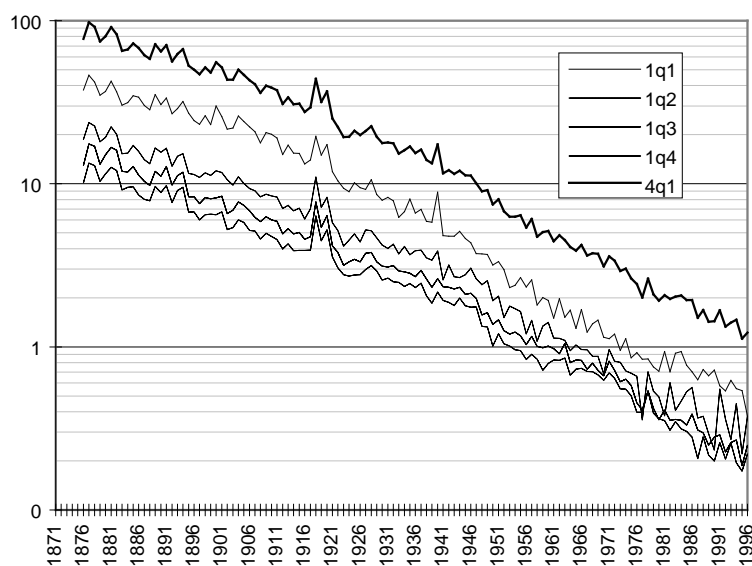
Period	Child Mortality					Boys	Girls	Boys	Girls
	1Q1	1Q2	1Q3	1Q4	4Q1	4Q1	4Q1	S <sub>5</sub>	S <sub>5</sub>
1876/1880	39.5	20.5	15.1	11.7	84.2	84.8	83.5	723	755
1881/1885	35.1	18.1	13.9	10.6	75.5	75.6	75.5	752	781
1886/1890	31.7	15.1	10.9	8.6	64.7	65.3	64.1	772	801
1891/1895	29.7	14.2	10.8	8.5	61.8	63.5	60.1	776	809
1896/1900	25.4	11.4	8.1	6.4	50.4	51.3	49.6	799	827
1901/1905	23.9	10.6	7.4	5.8	47.0	47.4	46.6	812	838
1906/1910	20.3	8.7	6.2	4.9	39.7	40.6	38.8	837	862
1910/1915	16.4	7.3	5.2	4.1	32.7	33.9	31.6	862	884
1916/1920	15.8	7.9	5.8	4.8	33.8	34.0	33.7	877	896
1921/1925	10.2	4.9	3.6	3.0	21.4	22.6	20.2	907	924
1926/1930	9.2	4.7	3.5	2.9	20.1	21.0	19.2	920	935
1931/1935	7.4	4.0	3.0	2.5	16.8	17.8	15.7	929	943
1936/1940	6.8	3.7	2.6	2.2	15.3	16.7	13.8	934	947
1941/1945	4.8	2.8	2.3	1.9	11.7	12.5	10.9	943	954
1946/1950	3.7	2.5	1.7	1.4	9.4	10.2	8.6	950	960
1951/1955	2.7	1.7	1.3	1.0	6.8	7.5	6.0	961	969
1956/1960	2.1	1.3	1.0	0.8	5.3	6.1	4.4	968	976
1961/1965	1.6	1.1	0.9	0.8	4.3	5.0	3.7	973	979
1966/1970	1.4	0.9	0.7	0.7	3.7	4.2	3.2	978	983
1971/1975	1.0	0.8	0.7	0.6	3.1	3.6	2.6	982	987
1976/1980	0.8	0.5	0.4	0.4	2.2	2.5	2.0	987	990
1981/1985	0.9	0.5	0.4	0.3	2.0	2.3	1.7	989	992
1986/1990	0.7	0.4	0.3	0.2	1.6	1.8	1.4	990	992
1991/1996	0.5	0.4	0.2	0.2	1.4	1.5	1.3	992	994

Source: OFS, ODE.

The decomposition of child mortality rate by age groups clearly indicates the importance of risk of the second year of life. Up to 1930, the risk was twice as important than during the third year. This ratio then declined till the 1950s to stabilise itself at 1.5-1.6. This denotes a rapid regression for the age groups of a higher order. If we take 100 as a base for the years 1876/80, the quotient at one year reaches 51 on the index for the years 1906-1910 and 43, 41 and 42 for the other age groups. In 1926/30, the ratio is more balanced (23, 23, 23, 25 on the index) and then the trend reverses, with the regression diminishing for the higher age groups. In 1941/45 the respective levels reached were 12,14,15 and 16; in 1961/65, 4,5,6 and 7. Here a balance is reached in the 1980s. In other words, between 1926/30 and 1966/67 the respective quotients of mortality declined by 85%, 82%, 78% and 76%.

<sup>20</sup> The explanation can only be partial since the rate of vaccination was rather high in Switzerland. In the canton of Zurich, the rate of vaccination for 1000 children, born alive, reached 78 % in the 1860s whilst it was only 36 % in the 1880s and 14 % between 1895 and 1899.

Fig. 7: Evolution of quotients of mortality during childhood

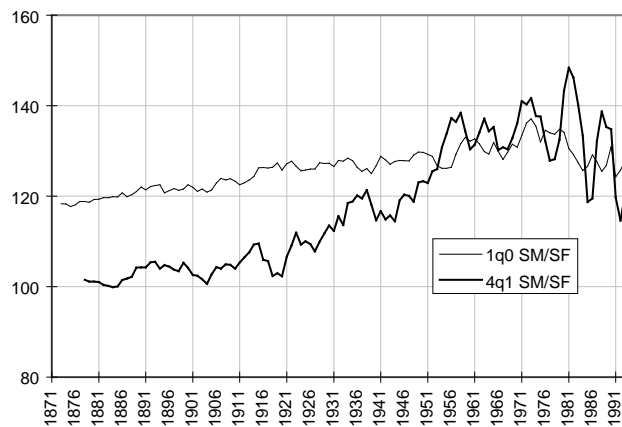


Source: OFS, ODE

As we can see, the child mortality rate is, as a whole, subjected more to strong accidental variations than infant mortality. The epidemic of the Spanish flu in 1918 caused the death of 817 children between the ages of one and four of a total of 2,197 victims. This brought the quotient in 1917 from 29.3‰ to 43‰. Since the mid 1920s these variations have disappeared and if there was a peak in 1940 it almost exclusively touched one year old babies. We have already underlined, regarding the differences of sexes, the weight of the endogenous factor in the male excess mortality of the first age and of its growing importance. An essential characteristic of the evolution of child mortality during last century was the growing level of excess mortality. We see from figure 8 that this one is almost non existent up to the beginning of the century. Then, it slowly emerges to take on a clear rhythm from the 1920s, just after the Spanish flu, which provoked an abnormal death rate among young girls. At the end of the Second World War, the mortality rate of boys is 20% above that of girls. From the 1960s this difference is accentuated to 35%. Then from 1975 the fluctuations become very important because of a low number of observations. But the abnormal mortality rate among the boys does decline as is the case with the infant mortality. We have attempted to explain the emergence of an abnormal rate of male mortality after the Second World War by a fall in the deaths caused by measles. This followed better nutrition enhancing their immune system, particularly among young girls<sup>21</sup>. But if the number of deaths caused by measles did indeed decline (on average by 80 between 1886/1890 and 1906/1910 and 10 in the 1930s) there was always more deaths among young girls than boys.

<sup>21</sup> Menthonnex J., Wanner P., (réd), *Tables de mortalité longitudinales*, p. 26. For deaths caused by small pox see *Statistiques historique*, p. 315.

Fig. 8: The sex ratio of child quotients for new-born infant and for those between the ages of 1-4, 1876-1996 (5 year moving averages)



Source: according to OFS, ODE.

The development prior to the period mentioned is still unknown to us though we may say that the difference concerned in particular the children in their third year (and to a lesser extent those in their fourth and fifth year). This in spite of the fact that the second year did not seem to play a major role in the difference between the two sexes.

### Heterogeneity and regional disparities

The data at our available at a cantonal level since the 1870s allows us to establish conclusions of regional evolutions of mortality among children. We shall limit our study to the infant mortality without losing perspective of the heterogeneous situation in some of the cantons, whether ecological or economical; these, indeed, hide important differences. We will neither ignore the disparate variation of rhythm which have a tendency of disappearing when considering national averages alone. In the canton of Vaud, for instance, at the end of the nineteenth century the infant mortality rate of the most favoured districts was inferior by approximately one third to those living in less developed districts (133-134‰ in the districts of Nyon, Rolle and Aigle and 205 in the districts of Avenches and Payerne). In the boroughs of Valais, in the 1900s, the rate varied from 109‰ (Entremont) to 190‰ (Loèche). The infant mortality declined considerably in all the districts but did harmonize. From 1896/1906 to 1926/1930 the mortality rates in cantons fell by 45% with intensities varying in the districts from 19% to 62%<sup>22</sup>. These heterogenities did not facilitate our search to find an explanation to the development.

Table 4 was established from annual quotients that were amended for observation purposes. The most remarkable feature is the presence of disparities. Between the averages of the three cantons that presented the highest and the lowest level of mortality in 1871/1880, the spread is still 61% (275.1‰ and 170‰). In 1891/1990 it is of 60% (9.23‰ and 5.77‰). This amplitude between the extremes together with the coefficient of variations increases for the period between 1910 and 1940 and again in the 1950s, when we see an important fall of mortality or the presence of instability in this same rate. More recently the variations stabilised, without leading towards a convergence of infant mortality in all the cantons.

<sup>22</sup> Chambovey D., *Le déclin de la fécondité*, p. 158.

Tab. 4: Evolution of Child Mortality in Cantons (corrected values)(1)

	1871/ 1880	1881/ 1890	1891/ 1900	1901/ 1910	1911/ 1920	1921/ 1930	1931/ 1940	1941/ 1950	1951/ 1960	1961/ 1970	1971/ 1980	1981/ 1990
Zurich	206.3	159.9	144.5	113.2	76.5	45.3	33.9	30.0	20.4	15.7	10.1	7.2
Bern	165.5	149.2	141.1	110.3	76.5	50.2	40.8	34.3	24.3	15.6	10.0	6.8
Luzern	178.8	144.0	120.9	103.9	89.5	63.8	52.3	44.3	27.4	19.2	11.5	6.4
Uri	239.8	172.0	146.6	119.4	100.7	80.2	57.5	48.2	41.4	23.1	12.4	10.4
Schwyz	210.8	172.6	150.5	131.2	95.7	62.3	46.9	43.7	28.0	21.3	11.2	7.7
Obwald	202.6	173.1	143.7	114.4	85.3	60.3	43.7	43.1	22.4	16.7	11.3	5.0
Nidwald	193.8	163.9	136.1	106.3	76.7	60.5	42.7	37.1	27.8	28.1	12.9	8.6
Glaris	189.5	151.5	125.5	104.1	77.7	54.3	35.3	31.3	22.0	16.6	10.7	7.2
Zug	225.2	158.6	130.2	108.2	85.2	55.1	38.3	41.7	29.7	16.8	10.9	6.7
Fribourg	252.0	223.4	198.2	172.4	134.0	83.5	72.5	55.1	37.6	26.8	13.6	8.7
Solothurn	200.6	171.6	160.0	121.4	90.1	59.8	41.1	35.7	24.4	17.5	11.5	8.3
Basel-City	211.7	176.8	148.1	117.1	67.8	48.9	40.2	33.2	21.4	17.2	10.0	8.3
Basel-Country.	234.6	193.2	156.7	120.9	86.1	48.3	42.0	29.0	18.7	14.6	8.7	7.1
Shaffhausen	206.1	158.1	141.6	114.8	88.0	50.3	41.8	36.3	23.0	19.1	11.6	7.3
Appenzell AR	260.4	213.2	158.3	126.1	96.4	56.5	41.5	36.2	26.7	17.3	9.4	7.7
Appenzell IR	301.3	255.7	218.6	173.1	141.2	93.3	75.6	54.2	36.1	20.5	15.8	7.0
St-Gall	241.6	195.0	152.5	138.6	101.9	64.1	47.7	38.9	24.5	17.3	11.7	6.9
Grisons	206.9	177.2	148.5	119.0	91.1	64.1	54.3	42.0	31.4	21.7	11.6	7.3
Argau	200.2	153.0	128.3	111.1	81.5	50.6	37.3	32.9	23.0	15.6	9.8	5.9
Thurgau	212.6	160.0	136.3	119.8	89.7	54.5	40.8	37.3	22.6	18.2	10.7	6.6
Ticino	263.7	225.9	197.2	184.2	136.5	101.7	72.0	51.7	32.8	22.7	14.2	7.1
Vaud	178.1	161.3	155.6	128.7	85.8	52.3	45.6	39.0	28.3	19.6	11.2	7.4
Valais	239.1	211.7	180.9	151.8	125.2	93.8	74.1	54.3	40.4	23.2	14.8	8.6
Neuchâtel	198.8	175.7	156.6	126.3	84.7	53.3	42.5	38.9	25.6	18.7	13.2	6.9
Genève	168.8	149.5	133.1	105.7	75.8	51.6	46.0	41.0	26.4	20.2	10.8	7.7

(1) Average over ten years calculated as an Arithmetic Average of the Annual Rate for the Considered Period.

Indeed, as table 5 illustrates, the rate of decline varies in function of the canton and the period observed, engaging a process of differentiation that modifies the chart of mortality. Up to 1900, cantons which had at first a high mortality rate were the ones which enjoyed a rapid decline, with the exception of Luzern and Glaris. The coefficient of correlation calculated for the 18 cantons reaches 0.488. It is significant. For the following period, 1901-1930, everything changed. First we find no correlation (-0.134) between the level of mortality and the pace of decline. But there is a significant correlation ( $r=0.76$ ) with regard to confessions. Nine of the ten cantons that were in majority Protestant occupied the head of the league with percentages ranging from 54% to 60% (on average 56%). Six of the ten cantons, having more than 80% of Catholics follow far behind and those more tolerant intercede in between. In the Catholic cantons the decline ranges from 33% to 52%.

Between the 1930s up to the 1950s there seems to be a pause in the decline of mortality which allows regions, where the level is still high to catch up with the other regions. It is the case of Fribourg, Ticino, Valais, Appenzell IR. We find, as a result, a correlation of 0.65 between the intensity of the decline and the level of mortality. This development continued for the period 1951-1970. The cantons that had the most to do were the ones that achieved the important results. The correlation here was 0.73.

Beyond these variations, which reflect a disparity between cantons and the process of decline, it is important to note the perennial element within the geography of infant mortality. Some cantons found themselves systematically in the group that presented the lowest decline in mortality, whilst others always occupied the last position on the table. Thereby Bern, for instance, is 10 times out of 12 in the first quarter, Glaris 9 times, Aargau 8 times and Zurich 7 times. On the other hand, Fribourg was always in the last quartile, Appenzell IR finds herself 10 times, and

Ticino and Valais are both 11 times in the last quartile. These changes affected and modified the rank of cantons which occupied the middle of the league.

*Tab. 5: Variation of Infant Mortality in the Swiss Cantons. Calculated as a Percentage of the Decline Between the Given Periods*

		1871/1900	1901/1930	1931/1950	1951/1970
Zurich	P	29.9	60.0	11.5	50.2
Bern	P	14.8	54.5	15.7	58.9
Luzern	C	32.4	38.6	15.4	58.2
Uri	C	38.9	32.8	16.1	70.0
Schwyz	C	28.6	52.5	6.9	59.9
Obwald	C	29.1	47.3	14.2	49.4
Nidwald	C	29.7	43.1	13.0	53.8
Glaris	P	33.8	47.8	11.4	51.3
Zug	C	42.2	49.1	-0.09	63.3
Fribourg	C	21.3	51.5	24.0	63.8
Solothurn	M	20.2	50.7	13.2	53.0
Basel-City	P	30.1	58.3	17.3	53.0
Basel-Country.	P	33.2	60.1	30.9	53.6
Shaffhausen	P	31.3	56.1	13.2	49.6
Appenzell AR	P	39.2	55.2	12.9	64.9
Appenzell IR	C	27.4	46.1	28.3	56.2
St-Gall	C	36.9	53.8	18.4	52.3
Grisons	M	28.2	46.2	22.7	62.9
Argau	M	36.0	54.4	11.9	57.6
Thurgau	P	35.9	54.5	8.5	52.6
Ticino	C	25.2	44.8	28.2	56.6
Vaud	P	12.6	59.3	14.6	60.4
Valais	C	24.4	38.2	26.7	63.4
Neuchâtel	P	21.2	57.8	8.5	48.6
Genève	M	21.2	51.2	10.9	58.9

C = cantons with more than 80% of Catholic people in 1900

P = Protestant cantons, less than 35% of Catholic people in 1900

M = Mixed cantons

It allows us to explain how over time the positive correlation was able to maintain itself (see table 6). The map of infantile mortality between 1971 and 1980 is still significantly correlated with what it was one hundred years ago, with a coefficient at 0.50. When we compare this to the beginning of the century, the coefficient of correlation reached 0.72 and for the years 1921 through to 1931, 0.85. This means that the geographical dispersion of abnormal infantile mortality was astonishingly stable and was only meagrely affected by the demographic as well the socio-economic transformations of the last century.

This is not the case for all the cantons. Geneva, for instance up to the 1920s was always ranked among the first six, but then receded to hover between the twelfth and the eighteenth place for the years 1930 to 1970. Similarly, Luzern quit her first place to tumble to the eleventh place between 1911 and 1920. This all means that the prior rates of decline must be taken with caution. The two half cantons of Basel followed the opposite trajectory, climbing from the third quartile, a position they held up to 1920, to the first quartile; and for Basel-Country it was a position in the first rank from 1940 to 1980. Since then the geography of infant mortality has drastically changed. The coefficient of correlation which was 0.69 for the years 1961 to 1981 fell to 0.26 during the remainder of the 1980s.

These first conclusions must be taken with moderate enthusiasm. An more detailed analysis shows major changes in the geography of infant mortality in Switzerland. The regions located in high planes which, up to the mid nineteenth century, seemed to enjoy a lower rate of infant

deaths than those villages of the lower planes, become by the early 1900s victims as well of high infant mortality<sup>23</sup>.

The general consensus today is that in the past mortality amongst infants and children were more important in mountainous regions than the hillside ones, as well as in the flat planes and in the valleys<sup>24</sup>. An advantage often explained by the better quality of water and food as well as a low exposure to infectious diseases, due mostly to a colder climate. Naturally, the economic, social and cultural variables also played an important part.

Tab. 6: *Variability of Infant Mortality between Cantons in intervals of ten years*

	Average	St.dev.	Var. Coeff.	Higher Mortal. (a)	Canton	Lower Mortal. (b)	Canton	Ratio a/b	Coefficient of correlation			
1871/80	215.6	32.33	0.150	301.3	AI	165.5	BE	1.82	with 1871/1880			
1881/90	177.8	28.48	0.160	255.7	AI	144.0	LU	1.78	0.91			
1891/00	152.4	23.79	0.156	218.6	AI	120.9	LU	1.81	0.78			
1901/10	125.7	22.22	0.177	184.2	TI	103.9	LU	1.77	with 1901/1910			
1911/20	93.6	19.94	0.213	141.2	AI	67.8	BS	2.08	0.80 0.93			
1921/30	62.3	15.67	0.251	101.7	TI	45.3	ZH	2.24	with 1921/30			
1931/40	48.3	12.51	0.259	75.6	AI	33.9	ZH	2.23	0.69 0.83 0.84 0.94			
1941/50	40.4	7.57	0.188	55.1	FR	29.0	BL	1.9	0.54 0.73 0.90			
1951/60	27.4	6.14	0.224	41.4	UR	18.7	BL	2.21	0.50 0.59 0.83			
1961/70	19.3	3.45	0.178	28.1	NW	14.6	BL	1.92	0.23 0.44 0.62			
1971/80	11.6	1.72	0.148	15.8	AI	8.7	BL	1.82	0.50 0.72 0.85			
1981/90	7.4	1.06	0.144	10.4	UR	5.0	OW	2.08	0.20 0.16 0.31			

By the end of the nineteenth century, these alpine regions lost their comparative advantage. This is what cantonal sources suggest. This slow rate of decline was indeed real as it can be seen in the three categories of alpine regions. These categories were built following a criteria of where the important inhabitation was situated; however mountainous the canton. Hence in the most alpine of regions the mortality rate was 30% behind those living on the planes; in the more moderate cantons it was between 10 and 20% whilst in the low ground cantons the proportion was less than 10%<sup>25</sup>. The differential increases during the decade of the 1920s when the gap between industrial areas and the alpine as well as the rural areas was accentuated. This did arouse some worry among the cantonal and federal authorities who were anxious to avoid important regional disparities. As we can see from table 7, the excess infant mortality in alpine cantons can not be attributed to their overwhelming Catholic orientation, since the differential is as important as those Catholic areas located on the planes.

The analysis should be, therefore, led at a more subtle level than the cantonal perspective, in order to determine the turning point. Francine van de Walle calculated, with the census data and at a district level, the correlation between altitude (defined as the percentage of the population in a given district living at more than a 1000 meters) and infant mortality. In 1870, this coefficient was clearly negative ( $r = -0.434$ ). In 1888 it still remained negative ( $r = -0.343$ ) but in 1910 the figure become positive ( $r = 0.101$ )<sup>26</sup>. At the turn of the century, the alpine regions detached themselves from the industrial transformations taking place elsewhere and isolated themselves from the entire process of «modernisation».

<sup>23</sup> van der Walle F., *One Hundred Year*, p. 414. One can note that contrary to Switzerland, Austria had a significant under mortality rate in the alpine villages up to the first half of the twentieth century. For more details see Münz J., R., «Infant mortality in Austria», pp. 76-85.

<sup>24</sup> Viazzo P.P., «Les modèles».

<sup>25</sup> These criteria were used by Hagmann H.-H., and Menthonnex J., «Element de démographie alpine».

<sup>26</sup> van de Walle F., *One Hundred Year*, table 4.7

Tab. 7: Ratio of Infant Mortality in Alpine Cantons Compared with those of the plains and the mixed inhabitations

	Alpine Cantons	Mixed Cantons	Plain Cantons	Cantons with catholic majority	
	(a)	(b)	(c)	Alps	Plain
1871/1880	227.1	224.3	202.1	231.2	201.6
1881/1890	187.9	193.8	162.4	191.5	158.1
1891/1900	156.5	169.1	141.4	162.7	137.1
1901/1910	127.3	146.4	115.0	132.7	111.1
1911/1920	98.9	106.7	83.3	104.1	88.2
1921/1930	69.5	70.6	52.8	75.1	59.6
1931/1940	52.4	55.1	41.8	56.8	43.9
1941/1950	43.3	43.8	36.4	46.8	40.6
1951/1960	30.7	28.9	24.1	32.7	27.2
1961/1970	20.9	20.2	17.6	22.1	17.9
1971/1980	12.2	12.5	10.6	13.1	11.3
1981/1990	7.7	7.3	7.2	7.9	7.1

(a) Uri, Schwyz, Obwald, Nidwald, Glaris, Appenzell AR, Appenzell IR, Grisons, Valais

(b) Bern, Fribourg, St-Gall, Neuchâtel, Ticino

(c) Zurich, Luzern, Zug, Solothurn, Basel-City, Basel-Country, Shaffhausen, Argau, Thurgau, Vaud, Genève.

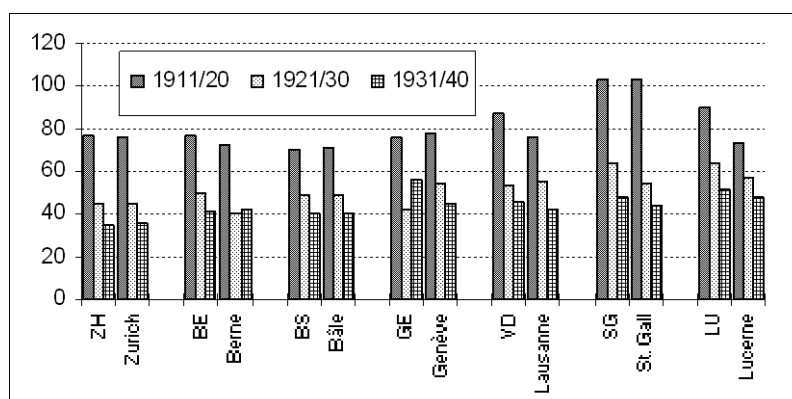
The correlation is notably different if we consider child mortality. Indeed, in the communities of Glaris located in altitude (Elm, Matt) the death rate of these toddlers was lower than in the other districts of the canton (Mollis, Ennenda and Glaris). If we consider other regions the results are not necessarily similar though. In the alpine community of Aquila, situated in Ticino, the child mortality is superior to what we observe in the heights around Arzo and Meride, which are two villages located south of the canton. Furthermore, in Speicher (Appenzell AR) in spite of a high rate of infant mortality, those in the age between one and four was moderate. This suggests that it is necessary to evaluate with more precision the multiple cause of mortality during the first year of life.

Another swing happened in the geography of infant mortality in Switzerland and occurs at the end of the nineteenth and the beginning of the twentieth century: the disparity between rural and urban districts. From the little information we have for the first half of the nineteenth century we denote a well established view, that of an excess mortality rate among the infants of rural areas. As the century came to a close, however, this difference diminished. Nevertheless, there was still between 1891 and 1910, a significant disproportion between the industrial towns and the averages calculated for the respective canton. Hence, the infant mortality in St-Gall is 13.6% above that of the cantonal average. Slightly inferior differences are found for the towns of La Chaux-de-Fonds (located in Neuchâtel), Bienne (in Bern) and Zurich (which is situated in the canton bearing the same name). In the urban centres where the density of industrial activity was less, the disparities are less apparent and even at times favourable to the major agglomerates. This was the case in Bern, Lausanne, Geneva, and Luzern, where the infant mortality rate was inferior to the average of their respective cantons. This indicates, therefore, that it was not the urban context but rather the industrial nature of the environment that may help to explain the important excess mortality in some cities. We can also see that the high levels of infant mortality were to be found in St-Gall (164.1‰) and La Chaux-de-Fonds (155‰); both being at that time centres for textile and watch-making.

On the eve of the First World War, the swing towards a lower rate of mortality in towns compared to rural areas was almost complete. If we disregard the examples of St-Gall and Zurich, the urban centres had totally compensated the negative effects induced by the industrial development, mostly by a policy of health securing measure, such as improved sanitation, the

provision of a central water supply and a sewage system. Between 1911 and 1940 the advantage of the major cities gave them a difference in infant mortality rate ranging from 10 to 13%. There are exceptions. In Zurich there is a slight excess of infant mortality (59.2‰ in the city and 57.4‰ for the canton) while in La Chaux-de-Fonds the advantage of the urban centre is only of 2.8%.

Fig. 9: Infant mortality in selected cantons and towns in Switzerland



Source: OFS, *Annuaire statistique de la Suisse*, Berne, 1941.

### Elements for an Explanation

The data presented up to now tried to show the complexities in the geographical distribution as well as the evolution over the past century of child mortality. The geographical distribution was the result of multiple factors and variables as diverse as ecology, economy as well as socio-cultural reasons. The complexity of this distribution had already been underlined by previous studies conducted by the Federal Bureau of Statistics during the 1920s - notably through statistics of infant mortality rates in various districts of the country. As the following table shows, between 1902 and 1910 and again between 1911 and 1920, the Catholic boroughs had a rate of infant mortality superior to that of the Protestant districts and this despite the state of economic development. Furthermore, it seems that it was the districts where the economic development had not blossomed completely that the level of infant mortality was the lowest; independent of the confession. This could explain the persistent excess mortality of infants in the industrial regions but also the rural ones that were sidelined by the industrial transformation.

The excess mortality in Catholic regions is not a recent development. The example of the two communities adjacent to Glaris, similar in their activities, family structure, social practices and probably in their eating habits of children bears testimony to this. The excess mortality in catholic parishes here varies between 20 to 40% (see table 8).

Tab. 8: Infant Mortality According to Categories of Districts

	Industrials and Protestants	Industrials and Catholics	Mixed and Protestants	Mixed and Catholics	Agricult. and Protestants	Agricult. and Catholics	Total Switzerland
1901-10	104.3	129.7	95.8	122.2	107.8	126.5	111.8
1911-20	71.7	93.6	68.3	93.3	91.1	116.2	81.4

Source: OFS, *Mariages, naissances et décès en Suisse de 1901 à 1920*, Berne, 1928, pp. 181\*-182\*.

Together with the testimonies of contemporary chroniclers in the eighteenth century, who blame the thoughtless attitudes of mothers during the epidemics of measles and smallpox<sup>27</sup>, the practise of precocious serfdom, quite frequent in eastern Switzerland, may explain the excess mortality in these regions. Several oral accounts between the end of the eighteenth century and the early 1900s underscore the habit mothers had of feeding their new born child with boiled wheat<sup>28</sup>. A study conducted in the canton of St-Gall in 1875 shows that in certain districts of the town where less than 40% of the mothers gave breast feeding, the infant mortality rate reached 252‰ but in those neighbourhoods where mothers adopted the traditional feeding method, the mortality rate of the new born represented 188‰<sup>29</sup>. In the 1880s, 24% of the infant mortality was due to gastroenteritis<sup>30</sup>. In 1938 a medical study showed that «gastroenteritis of new born», which was identified as the principal cause of cot deaths, could be linked to the artificial breast feeding<sup>31</sup>. Nevertheless, neither this factor nor the backwardness in economic development can provide sufficient to explain the excess mortality of infants in Catholic regions since, as table 9 illustrates, it maintained itself with astonishing regularity and persistence. We may object that this measure does not take into account the fact that still born babies were considered, in Catholic regions, as effectively born; despite having never breath an gasp of air. We had to, consequently, constitute ratios between Catholic and Protestant cantons by including those still born. The differences are then considerably reduced and up to the early 1900s are of little significance.

*Tab. 9: Infant Mortality in 10 Cantons Predominately Catholic Compared with the 10 Containing more Protestants and Those of Mixed Religious Inhabitation*

	Catholic Cantons		Protestant Cantons		Mixed Cantons		Ratio Cath./Protest.
	Average	Coefficient of variation	Average	Coefficient of variation	Average	Coefficient of variation	
1871/1880	230.7	15.8	206.4	13.1	203.6	12.7	1.12
1881/1890	190.1	19.1	169.9	11.9	169.2	11.0	1.12
1891/1900	162.3	20.7	146.4	7.3	144.5	9.3	1.11
1901/1910	136.5	22.8	118.1	6.6	119.2	10.5	1.16
1911/1920	107.0	23.0	82.9	9.9	88.1	11.3	1.29
1921/1930	75.5	22.6	51.4	6.6	58.0	11.3	1.47
1931/1940	57.6	25.6	40.4	8.5	45.3	14.4	1.42
1941/1950	47.4	13.2	34.6	10.4	38.1	9.9	1.37
1951/1960	32.4	19.5	23.3	12.7	25.9	12.5	1.39
1961/1970	21.8	17.3	17.3	9.6	18.5	13.3	1.27
1971/1980	12.9	13.2	10.6	11.8	11.1	7.3	1.22
1981/1990	7.6	20.0	7.3	6.7	7.2	12.7	1.05

Cantons with Catholic majority: Nidwald, Obwald, Valais, Ticino, Schwyz, Uri, Appenzell IR, Zug, Luzern, Fribourg.

Cantons with Catholic minority: Appenzell AR, Vaud, Bern, Shaffhausen, Zurich, Basel-Country, Glaris, Neuchâtel.

Mixed cantons: Solothurn, St-Gall, Genève, Grisons, Aargau.

<sup>27</sup> See the accounts mentioned by Schürmann M., *Bevölkerung, Wirtschaft*, p. 101. Several doctors at the end of the eighteenth century, notably Tissot and Lavande, underlined importance of nutrition for the survival of children of all ages.

<sup>28</sup> Schürmann M., *Bevölkerung, Wirtschaft*, p. 101. Analogous descriptions are found in other regions. In Valais, for instance, a midwife's observations, as the nineteenth century drew to a close, were many children were dying enteritis because they were given \*\*\***untreated**\*\*\* milk from the cow's udder (taken from Chambovay D., *Le déclin*, p. 159). The shortcomings of artificial breast feeding were already noted at the end of the century of Enlightenment. In 1778, doctor Venel showed raised misgivings as to nutrition value of feeding boiled meat whilst doctor de la Harp in 1837 insisted upon the necessity of sterilising milk.

<sup>29</sup> *Statistique de la Suisse*, 1887, livraison 66, p. ix, quoted in van de Walle., *One Hundred Years*, p. 49.

<sup>30</sup> *Statistique de la Suisse*, 1903, livraison 137, 3<sup>rd</sup> part, 2<sup>nd</sup> section, p. 31.

<sup>31</sup> Imboden-Kaiser, «Die Stillverhältnisse in der Schweiz», in *Schweizerische Medizinische Wirtschaft*, 22 (1938), pp. 47-51.

After that the phenomenon is indeed a sticking observation. Cantons where Catholics were in considerable number had an infant mortality rate 20% superior to those where they were a minority and this situation persisted up to the 1980s. Indeed, this was despite of the uniformity of habits, the increasing blend of both confessions in the country notably by the progression of Catholics in bastions traditionally populated by Protestants. Furthermore, as we had expected the differential increases within the period where there was a rapid decline of mortality in these Protestant areas.

The coefficients of correlation between infant mortality and the percentage of Catholics, established during the previous census, was always positive though feeble during the nineteenth century and non significant between 1891 and 1900. It became positive during the second decade of the 1900s and remained so until 1980. The analysis conducted under the pen of Francine van de Walle, again at a regional level, underscores this view to the extent that the correlation is indistinguishable in 1870 and 1888. This may imply the poor condition of the data.

*Tab. 10: Coefficient of Correlation Between Infant Mortality and Percentage of Catholics in the Different Cantons*

1871/ 1880	1881/ 1890	1891/ 1900	1901/ 1910	1911/ 1920	1921 1930	1931 1940	1941/ 1950	1951/ 1960	1961/ 1970	1971/ 1980	1981/ 1990
0.328	0.309	0.292	0.366	0.532	0.707	0.616	0.773	0.648	0.606	0.667	0.192

We can multiply the factors that may be susceptible to explain the differences: eating habits, education, hygienic practices, measures taken to protect the infant and the mother and labour legislation. With respect to industrial development van de Walle’s study shows that there was a strong correlation, during the nineteenth century, with all factors related to economic prosperity, but that from 1910 this relation is reversed and becomes in disfavour to the Protestant cantons heavily industrialized. This may be true but how does one explain that these differences persisted?

To have a better understanding of the underling current of explanations of the geographical distribution of infant mortality, we have decided to perform an analysis by principal components. To do this we have chosen two years, the first one prior to the demographic transition (around 1880) and the other after the transition is believed to have come to an end, in the 1930s. Unfortunately, the low number of variables at our disposal that may have allowed us to illustrate the relation with infant mortality, prevent us from providing a thorough explanation. However, the calculations we conducted provide interesting results and is why we decide to present them here. The variables we chose for our analysis - taken at a cantonal level - other than quotients of infant mortality were the following: the index of Coale relative to the legitimate fertility (Ig), to the illegitimate fertility (Ih) and to nuptiality (Im), the percentage of French speaking individuals in the population (franç) and those of German extraction (allem) as well as the Protestant (protest) and Catholics (cathol). The index also includes the percentage of women exerting a professional activity (fact) and in the secondary sector (factsec), the ratio of men active in agriculture (hactagr), in the secondary sector (hactsec), the level of urban development (txurb) and finally the number of inhabitants per doctor available (habmed)

In table 11 we have summarized the matrix of saturation for to the first two factors and relative the two periods of observation. Let us review the result for the year 1880. The two principal components illustrate 60.5% of the variance: this is a relative high proportion which implies an important relationship between the original parameters.

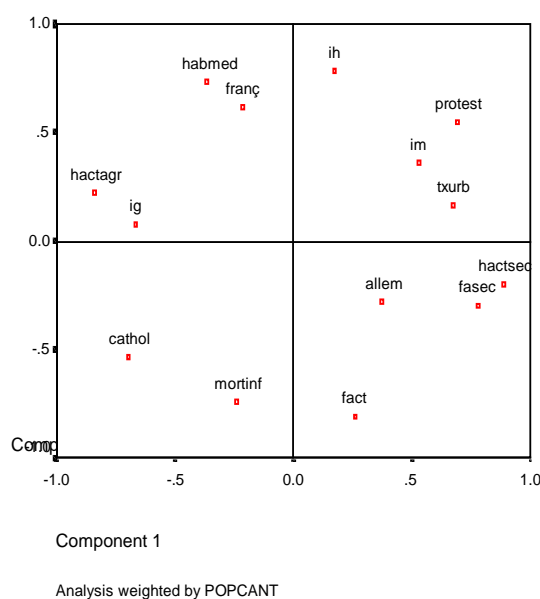
Tab. 11: Matrix of Saturation on the First two Components

	1880		1930	
	1	2	1	2
MORTINF	-0.24	-0.74	0.80	-0.36
IG	-0.67	-0.07	0.93	0.34
IH	0.17	0.79	0.00	-0.25
IM	0.53	0.36	-0.48	0.22
ALLEM	0.37	-0.28	-0.25	0.82
FRANÇ	-0.22	0.62	0.13	-0.69
PROTEST	0.69	0.54	-0.79	-0.03
CATHOL	-0.70	-0.54	0.79	0.03
FACT	0.26	-0.81	-0.59	-0.29
FASEC	0.78	-0.3	-0.34	0.74
HACTAGR	-0.84	0.22	0.90	0.10
HACTSEC	0.89	-0.20	-0.80	0.42
TXURB	0.67	0.16	-0.73	-0.38
HABMED	-0.37	0.74	0.57	0.68

Source: OFS, *Recensements de la population*, diverses années; Ibid., *Mouvement de la population*, diverses années.

The circle of correlation calls for a double reading: a socio-economic one defined by the first component and a socio-cultural one defined by the second component (see figure 10). The first component explains approximately one third (33.8%) of the variance. It also indicates a clear opposition between the cantons that had a high ratio of employment in the secondary sector and those whose structures were essentially agricultural.

Fig. 10: Circle of Correlation in regard to the two principal axis in 1880

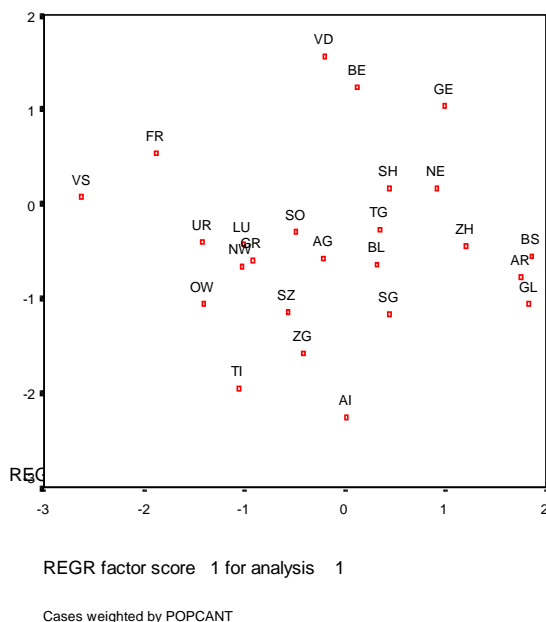


Source: OFS, *Recensements de la population*, several years; Ibid., *Mouvement de la population*, several years.

This allowed us to denominate the first of the axis as the economic character of the cantons. The weak correlation of infant mortality to this first axis begs us to keep a stock of caution when trying to associate a link with the other variables. It seems, however, that infant mortality was positively associated to the Catholic cantons whilst the Protestant republics had a negative correlation. The second component that explains the 26.9% of the variance reveals a close association between infant mortality and the proportion of active women in the labour market. This result, also revealed in other contexts,<sup>32</sup> confirms the negative impact of working women, which was underlined by several contemporaries of the nineteenth century with respect to the industrial pockets of the country<sup>33</sup>. On the other hand, the axis indicates a negative correlation between infant mortality and the linguistic provenance as well the illegitimate fertility. In other words, it was the French speaking cantons, primarily of Protestant faith (Vaud, Neuchâtel and Geneva) that appeared to benefit from the low level of infant mortality. In what would seem at first an astonishing link, infant mortality is negatively associated with the number of inhabitants per doctor. This result can be explained probably by the unfavourable relationship that existed within French speaking cantons but seems to have been absent in the German cultured cantons. Furthermore, the infant mortality in those years was still function of the spread of infectious diseases to which doctors were powerless.

The complexity of this panorama appears then clearly illustrated in figure 11 which in fact represents the projections of the cantons on two factorial axis. As we can see, the first axis opposes the cantons that witnessed an agricultural development (located on the left of the first axis) to the cantons of a more industrial nature (located on the right of the first axis).

Fig. 11: Representation of Cantons on the two principal axis, 1880



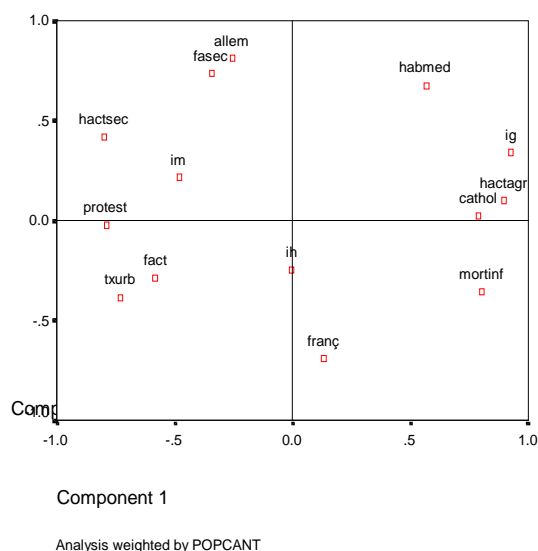
Source: OFS, *Recensements de la population*, several years; Ibid., *Mouvement de la population*, several years.

<sup>32</sup> See in particular the case of Belgium analysed by Masuy-Stroobant, *Les déterminants*, pp. 172-179.

<sup>33</sup> See in particular the comments added to the federal statistics in the final years of the nineteenth century.

The second axis, however, reflects the cultural differences that were essentially linguistic. Indeed, exceptions granted, the French speaking cantons are situated on the positive level of the diagram whilst the more Germanic regions are located on the negative side of the figure. We deduce from this that the German speaking cantons, having a high proportion of active women in the labour force, were the ones who faced a high level of infant mortality (particularly Appenzell IR, and St-Gall). Nevertheless, several of the cantons who are Germanic and were then in majority Protestant, managed to distance themselves from this relationship, helped as they were by substantial improvements in their socio-medical environment. Other cantons of these Germanic regions but who, on the other hand, leaned more towards Catholicism faced continually harsh economic conditions due to their lagging industrial take-off. This, naturally, increased the incidence on the infant mortality rate. In stark opposition, the cantons of a rural nature and who declared themselves to be Protestant, benefited a more favourable outcome in their mortality rate as the examples of Vaud and Bern plainly indicate. In 1930, the situation was slightly altered (see figure 12).

Fig. 12: Circle of correlation on the two principal axis for 1930



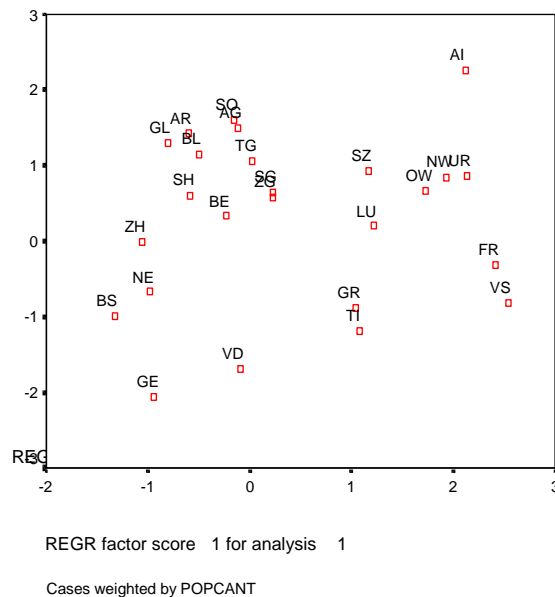
Source: OFS, *Recensements de la population*, several years; Ibid., *Mouvement de la population*, several years.

The first two components still explain roughly 60% of the total variance. The first, which denotes 41.6%, is negatively correlated with the proportion of active men who laboured in the secondary sector as well as the highly urban districts. The axis is, however, positively correlated with the ratio of men working the land as well as the level of legitimate fertility, infant mortality and the Catholic faith. The second axis is positively linked with the proportion of active women in the secondary and with German linguistics. It is negatively correlated, however, with the French speaking cantons. Finally, the cantons with a high infant mortality rate may be associated with the cantons of Catholic confession who had not yet achieved their fertility transition nor undergone any industrial transformation.

The projection of the cantons on both the axis illustrates a first association of cantons from central Switzerland to those of Valais and Fribourg, characterised by their Catholicism, their low industrial growth, and levels of infant mortality and legitimate fertility superior to the national average (see figure 13). To this group we oppose a second association of cantons mostly urban,

of Protestant dominance and with an important presence of their labour force in the secondary sector. In 1930, then, the mostly catholic rural cantons suffered the most of infant mortality. This was because of an inadequate sanitary infrastructure and a standard of life quite inferior to what other citizens were enjoying in the industrial plateau of Swiss Germany.

Fig. 13: Representation of Cantons on the two principal axis, 1930



Source: OFS, *Recensements de la population*, several years; Ibid., *Mouvement de la population*, several years.

## Conclusion

Up to the early 1800s the study of infant mortality in Switzerland faces numerous obstacles inherent to the multi-federal systems of government. The least we may say is that the data relative to infant mortality has to be taken with caution in many of the Catholic cantons. Statisticians today are conscious of the poor quality of data at their disposal but consider that the census conducted since the introduction of the civil law, in 1876, are dependable and complete. Their conclusion is probably erroneous since many of the numbers available up to 1910 are deficient. The data presented in this study have, therefore, been adjusted so as to rectify underestimation in mortality, we thought important, that were previously taken for granted in some cantons.

Beyond a parallel evolution that seems to fit the European model, the variety in the levels of infant and child mortalities, which we observe in our case study, reflects the cultural, confessional, and language diversities that still today shape the country. To this we may also add the multiplicity of socio-economic situations as well as a noted ecological difference.

Let us, hence, summarize the main findings of our research:

The decline in infant mortality was precocious and had a rapid rate of decline starting in the 1870s; allowing it to reach 45% in the preceding years of the Great War. This allowed Switzerland to occupy the fifth rank with Holland and the Scandinavian countries.

- Up to 1960 the rapid and steady decline was related to exogenous factors after which infant mortality due to endogenous elements declined whilst exogenous mortality stagnated.

- The death rate of new born between the ages of one and four follow a differentiated path. The trend is the same as in France or in Belgium : a very precocious decline that was more ample and became more significant for higher age groups.
- Excess mortality amongst the male population was an important phenomenon. Though almost non existent in the 1900s it slowly emerged to become more important for the remaining years of the nineteenth century and reached 40% in the 1970s. For infants less than a year old the rate reached a staggering figure of 35%. Only since the 1980s have we seen it receding.
- Infant mortality witnessed important geographical variations even though the amplitude between the most extreme cases varied little from one tendency to another (between 1.8 to 2.2).
- If the rate of decline varies between cantons and over time, there is still a permanent element within the geography of infant mortality in Switzerland.
- Since the end of the nineteenth century, mountainous regions lost the comparative advantage they had over the planes. Indeed, during the inter-war years the alpine regions see a rise in their mortality rate, that we trace to the disparity of their economic development.
- The religious confession played an important role in the differentiation. The excess mortality rate in Catholic regions may be explained by multiple factors, that we exposed in our analysis of principal components. The striking finding was that the differences we found lasted to very recently. In the 1980s the Catholic cantons had on average a infant mortality rate of 22% superior to those cantons where the Catholics were in minority.

We touch here the limit of our study. An explanation in the difference of mortality rates among Christians of different faith requires a more detailed study on the causes of the deaths. Unfortunately, the data on this are not abundant and have to be manipulated with care. They are, however, available and their analysis may provide a key to a better understanding of certain disparities, which is also to be researched in the social practices rather than in inequalities of economic development. It is therefore necessary to call for an oral history as well an anthropological study of our habits and our beliefs. Witnesses are present. It may be worthwhile to record their experience.

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