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Events in pregnancy, delivery, and infancy and long-term effects on global quality of life: results from the Copenhagen Perinatal Birth Cohort 1959–61



Søren Ventegodt^{1A,B,C,D,E,F,G}, Trine Flensburg-Madsen^{1C,D,E,F},
Niels Jørgen Andersen^{2,D,E}, Joav Merrick^{3,D,E,F}

- ¹ The Quality of Life Research Center, Copenhagen, Denmark
- ² Norwegian School of Management and the Scandinavian Foundation for Holistic Medicine, Sandvika, Norway
- ³ National Institute of Child Health and Human Development, Office of the Medical Director, Division for Mental Retardation, Ministry of Social Affairs, Jerusalem, Zusman Child Development Center, Division of Pediatrics, Ben Gurion University, Beer-Sheva, Israel

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Summary

Background:	To study causal associations between factors occurring during pregnancy, birth, and infancy and global quality of life (QOL) in adulthood 31–33 years later.
Material/Methods:	Prospective study from the Copenhagen Perinatal Birth Cohort 1959–61. Two sets of questionnaires, one filled out by physicians during pregnancy, birth, and infancy and a validated, self-administered questionnaire on global quality of life (QOL) filled out by the person 31–33 years later (7,222 people).
Results:	Only a few of the factors examined showed association with later QOL. Regarding the mothers, associations were found between global QOL and mothers with congenital malformations (8.8%) or syphilis (8.5%), failing contraception (3.8%), and low social group (6.9%). Two main factors in pregnancy associated with reduced QOL for the child 31–33 years later: the mother's smoking habits (2.7%) and her medication, especially painkillers (15.3%) and different psychotropic drugs, with the association most prevalent early in pregnancy. Most of the associations found involved factors during the child's first year, including the mother's attitude towards her pregnancy (3.4%), unsuccessful abortions (2.2%), institutionalization (7.4%), meningitis (11.7%), and psychomotor development (14.2%).
Conclusions:	The results appear to disagree with previous reports that factors occurring during pregnancy, birth, and infancy are highly important for the later quality of life of the adult child. In accordance with other studies, this suggests that the aspects important for quality of life are influenced only to a minor degree by earlier conditions, but the major aspects are dependent on later attitudes towards life and philosophy of life.
key words:	birth cohort • prospective longitudinal study • QOL • SEQOL • maternal health • child health • development • global quality of life • Denmark

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Author's address: Professor Joav Merrick, MD, DMSc, P.O. Box 1260, IL-91012 Jerusalem, Israel, e-mail: jmerrick@internet-zahav.net

BACKGROUND

The concept of quality of life (QOL) has become an important topic in the health field, social welfare, and political debate [1–15]. Enhancing the quality of life is considered more and more to be an objective in the treatment and prevention of illness, together with providing psychosocial support. In recent years the concept of quality of life and living “a good life” has been the subject of a number of philosophical, psychological, and psychometric studies [5–38]. During the past 14 years, the Quality of Life Research Center has investigated more than 11,000 Danes and revealed a series of strong associations between QOL and different factors in our lives [19–25]. Our results are built on the validated SEQOL questionnaire (Self evaluation of Quality of Life) [26–34]. Among other findings, it is becoming increasingly apparent that illness is closely related to the individual perception of a good life, which is the reason that an exploration of indicators related to quality of life appears to be of broad importance for the prevention and treatment of disease.

A lot of attention has been paid to the role that early life events have on adult life, examining its effect on personality traits or biologic embedding [35,36]. Studies have shown that the mother’s attitude towards her child is associated with the child’s behavior five years later [37], and a series of indicators regarding the mother have been shown to be associated with the child’s health-related quality of life at 13 years [38]. The data on which this study is built, the Copenhagen Perinatal Birth Cohort 1959–61 [39], have also been the subject of a number of other prospective studies examining the effects that pregnancy, birth, and the first year of life have on later life [40–57]. The hypothesis of this study was that a causal connection exists between factors occurring during early life and the quality of life of the adult child 31–33 years later, which to our knowledge has not been examined in any other studies.

MATERIAL AND METHODS

Subjects

The connections between quality of life and the various early life factors which are presented in this study are based on two sets of responses. The first set was taken from a questionnaire filled out by the physician during the mothers’ pregnancy and the second set the children’s own answers to the SEQOL questionnaire (Self evaluation of Quality of Life Questionnaire) [26,58] in adulthood 31–33 years later.

The Copenhagen Perinatal Birth Cohort 1959–61 began with the examination of 9,006 mothers and their 8,820 surviving children (from a total of 9,125 children) born at the University Hospital in Copenhagen (Rigshospitalet) during the 1959–1961 period. With the help of the Central Person Register (CPR) we succeeded in tracing 7,222 of the original children from the cohort. To ensure that the people drawn from the register were actually the same persons as the original cohort, names and dates of birth were checked as were the names and dates of birth of their mothers. When we repeatedly compare these data we find a match between the persons of around 98–99%, and therefore estimate that the accurateness of the match of “the responses 1959–61” against “the responses 1993” was better than 98%.

Procedure

The SEQOL questionnaire measures the global quality of life in a self-administered questionnaire with items rated on a five-point Likert scale. The questionnaire consists of 317 items based on an “integrative” theory of the quality of life. The integrative QOL theory was created to organize a number of theories on the quality of life into a spectrum that spans the extremes of subjective and objective quality of life. These measures are shown below (sample questions from the questionnaire included):

Subjective measures:

1. Immediate, self-experienced well-being (“How are you feeling?”);
2. Life satisfaction (“How satisfying is your life?”);
3. Happiness (“How happy are you at present?”).

Existential measures:

4. Fulfillment of needs (e.g. “How well are your social needs fulfilled?”);
5. Experience of life’s temporal domains (e.g. “How do you feel when you are at home?”);
6. Experience of life’s spatial domains (“How satisfied are you with [each of five domains: self, partner, family, friends, community]?”);
7. Expression of life’s potentials (some 30 questions on the extent to which they are fulfilled);

Objective measure:

8. Objective factors (some 80 questions on income, status, work, etc.).

Replies to each of the questions that constitute these measures are weighted and scored to yield computable numbers between a minimum of 0 and a maximum of 100 [26–34,58]. These numbers are then taken as representing the quality of life of the respondent expressed in terms of the eight different ways the quality of life has been measured by the questionnaire. Suitably weighted and scored, the replies to the first part of the questionnaire constitute variables from whose co-variation the quality of life can be calculated.

Measuring quality of life has been the subject of many disagreements. In our research, the global QOL, in the broadest and most all-inclusive sense, was the primary outcome measure (dependent variable). The integrative QOL theory made us include 113 items in the SEQOL questionnaire for the calculation of the global QOL [26,59]; the rest were control questions and questions giving more information about health status, sexuality, philosophy of life, life style, self-perception, and social circumstances. The principle of SEQOL is a hierarchy of factors adding up to an abstract total QOL.

Statistical analysis

In this study we had to deal with an essential problem: when the statistical connection between the 113 life factors and the global QOL was measured, we often had a contribution to the statistical co-variation from the construction of the global QOL measure. This problem turned out to be of little significance, as even the most strongly “constructed” connections did not account for more than 1/15 of the

Table 1. Mother's situation.

Quality of life and...	QOL difference% *)
... mother's illness (syphilis) before pregnancy	8.5
... mother's congenital malformations	8.8
... social group	6.9
... failing contraception	3.8
... mother's situation: overview	3.8
... marital status at conception (married versus divorced)	3.0
... venereal diseases	2.4
... mother's abortion attempts	2.2
... mother is overweight	2.1
... habituation (living alone with the mother)	2–4%

The connection between global QOL and the mother's situation during pregnancy. Only statistically ($p < 0.05$) and clinically significant factors listed. Difference in global QOL was measured according to the Integrated QOL theory [30] measured with the validated SEQOL questionnaire [26].

* Difference in percentage between the worst and the best off (single events), or calculated with the method of weight modified linear regression (impact of all events) [34].

total connection. Still this gives an error of up to 7% in co-variation. As the large connections in our study showed a co-variation of 20% global QOL or more, the above-mentioned error introduced by the construction of the global all-including QOL measure is generally neglectable. It is important to notice that the way our QOL measure was constructed seems to minimize many of the measuring problems normally found in such investigations [27–34]. It is also important to remember that we almost always will find a high statistical correlation when $N = 5-10,000$ between QOL and the many factors constituting the global QOL or the factors related to them. However, we are not looking at the size of the statistical significance of the correlation, but at the size of the statistical co-variation (QOL difference in %) showing the clinical significance [34].

For validation, SEQOL was sent to 2,460 persons 18-88 years old randomly selected from the Danish Central Person Register (CPR) together with the Nottingham Health profile (NHP), and the Sickness Impact Factor (SIP). The test-retest reliability correlation was > 0.8 , Cronbach's alpha was 0.75, and correlation (r) to NHP was 0.49 and to SIP 0.27 ($P < 0.05$). Adjustment for health status made the correlation to SIP stronger among the sick ($r = 0.41$). For SEQOL, 111 respondents were needed to detect 3% difference in QOL. SEQOL are thus valid as it showed a high level of reliability, sensitivity, and consistency.

All analyses were carried out using the statistics program SAS and with correlation and modified regression [34], which takes into account that there are relatively few respondents in certain groups. In this way all procedures were standard apart from a few rather insignificant modifications.

RESULTS

The data collected are both subjective (self-evaluated QOL and self-evaluated health) and objective. The results from

the start of the cohort were divided into three parts: 1) the mother's situation during pregnancy, 2) pregnancy and birth and 3) the child's first year. The results listed in the tables and mentioned in the text below are chosen among many other findings from the prevailing study. For further details we refer to the original work of tables [60].

Mother's situation during pregnancy (see Table 1)

The results showed no or very small correlations between common conditions of the mother during pregnancy and the quality of life of the child 31–33 years later. No significant associations were found between global QOL and the mother's age, height, and blood type, and only a small significant association was found in relation to the mother's weight, where those who were born of mothers who were overweight had a slightly lower quality of life (2.1% less than average). The QOL of the adult child showed an enormous resilience to the health of the mother at the time she gave birth (the mother's health was measured merely in objective terms according to the judgment of the physician). Illnesses before and during pregnancy and medical treatment of the mother showed almost no correlation with QOL. Exceptions were children born to mothers with congenital malformations (8.8%), syphilis (8.5%), or other venereal diseases (2.4%) before pregnancy. If the mother had experienced complications in former pregnancies and births or pre-natal complications, no correlation with quality of life of the child 31–33 years later was found.

Marital status was only weakly connected to QOL of the adult child (3% higher quality of life for those whose mother was married), even though it is known that children of unmarried or divorced mothers are significantly below the average as regards quality of life [61,62]. Being adopted showed no significant association with the later quality of life nor did the course and number of the mother's former births. Failing contraception was associated with a quality of life

Table 2. Pregnancy and birth.

Quality of life and...	QOL difference% *)
... mother's medication during pregnancy (painkillers in first month)	15.3
... manner of delivery: expression (assistance during the birth)	3.8
... mother with a mental illness during pregnancy (psychopharmacological medicine late in pregnancy)	3.4
... Valgus position, one foot (versus nothing or both)	3.2
... mother smoking during pregnancy (more than 10 cigarettes a day)	2.7

The connection between global QOL and factors occurring during pregnancy and birth. Only statistically ($p < 0.05$; NS: Not significant) and clinically significant factors listed. Difference in global QOL was measured according to the Integrated QOL theory [30] with the validated SEQOL questionnaire [26]. * Difference in percentage between the worst and the best off (single events), or calculated with the method of weight modified linear regression (impact of all events) [34].

3.8% below average. No significant associations were found between QOL and whether or not the mother worked at the time of the one-year examination nor the amount of time she worked. The mother's social group, corresponding to Svaslastoga's system, showed a small correlation with QOL, as we found a difference of 6.9% between the highest and the lowest group. No significant associations were found according to the educational level of the main provider.

Pregnancy and birth (see Table 2)

Being born prematurely (before the 37th week of pregnancy) or being post-mature showed no connections with later quality of life. No associations were found between medical treatment received by the mother during pregnancy or viral infections, which are often feared to cause possible harm to the fetus. However, the smoking habits of the mother were associated with later quality of life: children of mothers who smoked more than 10 cigarettes a day during the last trimester of pregnancy had a significantly lower quality of life as adults than children of mothers who were non-smokers (2.7% lower). In addition, the mother's medication during pregnancy showed an association with later quality of life, as painkillers, especially early in pregnancy, were connected with a lower quality of life of the child as an adult (15.3% lower in the group where the mother took painkillers on at least 5 different occasions during the first month of pregnancy). Furthermore, the use of psychopharmacological drugs showed significant associations with quality of life, the connection being smaller when the drugs were taken in the later stages of pregnancy. Weight gain or edema in the mother during pregnancy showed no connection with quality of life in the child 31–33 years later. Neither did the condition of the placenta or the thickness of the subcutaneous fat layer of the newborn child. Apparently, children are resilient to many of the complications occurring during pregnancy.

Whether the birth was induced with medication, whether it took less than 12 hours or more than 72 hours, whether the labor was weak, whether there was mechanical hindrance, and whether the mother was medicated or anesthetized all appeared to be irrelevant for the quality of life of the child as an adult. The child seemed to be very robust at this time of life. No associations were found between quality of life

and complications during birth, such as ruptured uterus, contracted pelvis in the mother, complications with the umbilical cord, pregnancy toxemia, affected cardiac sound, meconium stained (discolored) amniotic fluid signifying a fetal distress (lack of oxygen) during the birth, or whether the child was the first or second born twin (or triplet). The method of delivery also showed no connection with the quality of life in the adult. Only when the birth was aided by expression (outward pressure applied on the child through the mother's stomach), an association was found with the quality of life (3.8% below the average). The fetal posture was not correlated with the quality of life of the child as an adult, although asymmetrical valgus position of the feet was (3.2% below the average).

The child's first year (see Table 3)

The results showed that the mother's attitude towards her pregnancy leaves a lasting impression on the child. Unwanted children, as adults, have a quality of life which is 3.4% below that of children that were wanted. Children born after failed abortions also showed a significant correlation (2.2%), as did institutionalization during the first year (7.4%). The psychosocial factors seemed to dominate the biological factors. For instance, lack of oxygen during birth did not result in a reduced quality of life nor did premature or post-mature birth. No significant associations were found between quality of life and the weight of the newborn or the blood type, and only small associations were found regarding sex and the length of the child (which can possibly be explained because of smoking). Children who contracted meningitis in the first year of life had a quality of life that was 11.7% below the average, which can be explained by the fact that neonatal meningitis at that point in time often causes severe brain damage. Other illnesses hardly showed any conclusive effect. Even serious accidents, which were relatively common, as for instance falls from great heights and cranial fractures, did not show conclusive results in this study; nor did medical treatment received by the child.

Only small associations were found between the quality of life of the adult and the neurological maturity and muscular development of the newborn or one-year-old child. The speed of neuro-motor development did not seem to have any influence on the quality of life of the adult nor did leg-

Table 3. Child's first year.

Quality of life and...	QOL difference(% *)
... the child's ability to sit at the one-year examination (sit badly and bent forward versus sit naturally)	21.0
... age when the child walks with support (before the 7th month versus does not walk when one year old)	14.2
... hanging day one – no moving	13.4
... signs of brain damage in the child (tense fontanelles versus none known)	12.9
... malformations in the child (central nervous system)	12.3
... disease in the child's first year (meningitis)	11.7
... accidents (other than cranium trauma, poisoning) burns) versus no accident in the child's first year	8.9
... infection in the first year (lymphatic node in armpit versus none)	7.9
... institutionalised during the first year of the (nine to ten months versus not institutionalised)	7.4
... social status (Svalastoga's system) at the child's one-year examination	6.9
... first year of life, overview	5.9
... abnormal findings in the child at the one-year examination (locomotive apparatus, central nervous tem, respiratory system)	5.6
... does not stand at one year despite support	5.1
... age when child stands with support (7–8 months versus 12 months)	4.3
... traces of neglect at one year (child's skin very dirty)	4.2
... age when child walks without support (cannot at one year versus can walk by 12 th month)	3.9
... does not walk despite support at one-year examination	3.8
... child's length at birth (45–47 cm versus 50–51 cm)	3.5
... mother's attitude towards the present pregnancy (the child wanted versus unwanted)	3.4
... start of life: overview (3 domains)	3.3
... the nose blocked up at the one-year examination	3.3
... child placed in residential care after birth (versus taken home with mother)	3.1
... breast fed versus formula from first day	2.9
... marital status of mother at one-year examination (married versus unmarried)	2.8
... head circumference, first day (30–32 cm versus 34–36 cm)	2.8
... start of life, overview (best/worst in 3 areas)	2.7
... age when child stands without support (not by one year versus stands before 12 th month)	2.4
... born after failed abortion	2.2
... hospitalisation in child's first year (1–2 months versus never)	2.2
... child's height at one year (81–85 cm versus less)	2.2
... gender of the child (male versus female)	2.1
... strong physiological screaming, first day	1.8
... child's weight at one year (more than 12 kg versus less)	1.6

Table 3. Cont. Child's first year.

... illness in the child's first year (lungs, bronchi/trachea)	1.5
... day care in child's first year (did not take place versus took place)	0.3
... natural reflexes at one year (versus other things)	0.3

The connection between global QOL and the child's first year. Only statistically ($p < 0.05$; NS: Not significant) and clinically significant factors listed. Difference in global QOL was measured according to the Integrated QOL theory [30] with the validated SEQOL questionnaire [26].

* Difference in percentage between the worst and the best off (single events), or calculated with the method of weight modified linear regression (impact of all events) [34].

endary symptoms of brain damage such as the "frog position" and the notorious "brain cry". Biological factors such as "spontaneous activity during the first and the fifth day", sucking reflex, gripping reflex, plantar reflex, crawling reflex, and walking reflex proved to be quite unimportant as predictors for the quality of life of the adult.

Neither blood transfusion due to rhesus type, genetic malformations, anemia, heart dissonance, edema, blood spots under the skin (petechia), jaundice, or "the nurse having a really bad impression of the child on the fifth day" showed any correlation with the quality of life as a grown-up person. However, some factors were connected with global QOL to a small extent: congenital malformations in the central nervous system, small head circumference on the first day after birth, milk formula instead of mother's milk on the fifth day after birth, and long stays in hospital during the first year of life. Problems with lungs, bronchi, or trachea also had an effect on the quality of life of the adult.

Regarding the psychomotor development of the child, the most significant association was found in relation to walking with support (14.2% difference in the overall quality of life of the adult between the best (fastest) and the worst (slowest) group). In contrast, how quickly the child can hold the head, smile, grab hold of things, sit, or crawl showed no associations with the later quality of life. To stand with and without support (5.1%/2.4%) and to walk without support (3.9%) showed small significant associations. We found a small but clear association between QOL and the ability to stand and walk at the age of one year (4–5% lower quality of life if the child cannot stand or walk). We found a small positive connections between normal reflexes at the age of one year and QOL.

Generally, we found no connection with QOL of the adult and the nutrition of the child. For instance, vitamins during the first year of life or iron treatment did not have a clear effect on QOL. We found no connection between QOL and the age when the child started to eat foods such as meat, eggs, and vegetable-mash or stopped using the bottle. Being very heavy and tall at one-year of age, an expression of inactivity during the first year of life [39], was correlated with a slightly lower QOL for the adult.

DISCUSSION

The results obtained in this study repudiate to a certain degree the common notion and the hypothesis of this research, namely that the global QOL of the adult is determined by factors occurring during pregnancy, birth, and

infancy. Only very few factors among the 1,000 that we explored showed significant correlation with the global QOL of the adult children 31–33 years later.

The only indicators regarding the mother's situation during pregnancy that showed clear connections with a reduced quality of life were mothers with syphilis, congenital malformations, failing contraception, and low social group. Since syphilis is a venereal disease which is statistically linked to sexual activity with different partners, it is likely that these women represents a special group, so that it may not be syphilis itself which leads to a reduced QOL, but rather some underlying psychosocial factors that the child acquire through social inheritance. The association between a lower QOL and failing contraception can be explained by a connection between an unwanted child and the limited resources of the mother in the midst of physical, financial, and social stress, which can also explain the association between QOL and low social group. This is in accordance with another prospective study showing that children born to mothers in the lowest socio-economic group were more likely to be impaired with regard to their mental/emotional health later in childhood [61]. However, we found no significant associations regarding the educational level of the main provider. Assuming that parents with a higher education generally have highly educated children [62,63], this was in agreement with other studies showing that highly educated people do not have a higher quality of life than the lower educated [64].

Two main factors in pregnancy seemed to be associated with reduced quality of life for the child 31–33 years later: the mother's smoking habits and her medication, especially painkillers and psychopharmacological drugs. From the point of view of prevention it is interesting to note that in both cases the mother was in a position to control these factors. She could do without cigarettes during pregnancy and, to a certain extent, she could do without painkillers and psychopharmacological drugs.

Considering all the things which can and do go wrong during the various stages of labor and birth, and considering that we did not find a connection between these factors and QOL in later life, it seems that the child is remarkably resilient to external influences during delivery and birth with regard to the later QOL. If we compare the potential dangers the child faces during pregnancy, delivery, and birth, the research implies that it is not birth which is the real threat. Apparently it is the pregnancy and, especially, factors such as smoking and the use of medication that can compromise the quality of life of the child as an adult. It is

likely that in many cases it is not the medication which is responsible for the later deterioration in QOL. Instead, the association can be described in terms of problems which necessitated the use of the medication, for example a low existential and emotional pain threshold as an indicator of a low quality of life [61,62], which can be “inherited” in the form of non-constructive attitudes to life.

Only a few of the factors examined during the first year have a significant association with the later quality of life. Among the factors that have the strongest associations with QOL were the mother’s attitude towards her pregnancy, unsuccessful abortions, institutionalization, and early cessation of suckling. These are all factors that tell us about either a negative attitude towards the child or separation between the mother and child during the first year of life. Meningitis and psychomotor development also seemed to have a great impact on the later quality of life. It is complex to explain how the fact of having meningitis to such a high degree was associated with the later QOL, especially when so many other complications were included. The strong association with psychomotor development can possibly be explained with regard to the parent’s attention for the child, since it is assumed that psychomotor development is to a high extent reliant on the parent’s assistance. Psychomotor development can to a high degree be explained in terms of the level of brain stimulation and, thus, brain development; which is fundamental to the child’s school performance and achievements later in life. Cognitive ability is perceived to be central to the individual’s capacities and abilities to utilize the opportunities obtainable in life, and this ability is part of the global QOL, and therefore the connection seems evocative.

In other studies we have shown that the factors important here and now for global QOL and for a good health derive from good relations with the close as well as the distant world and from one’s overall view of life [16–22,61–63]. What one possesses in objective terms – money, status or work – does not seem to be important for one’s global QOL and of little importance to self-assessed health. These results indicate that what is really important is not what you have, but how you see, evaluate, and experience what you have. The person’s level of consciousness and responsible attitude towards life and others has shown to be far more important for the global quality of life and health than social status and material wealth. With regard to these findings it is not so strange that we do not find any strong connections between the numerous objective factors during pregnancy, birth, and infancy and quality of life of the adult child. The results seem to indicate that our lives as adults are determined by what we ourselves choose to do with our lives as young people and as adults, and only to a marginal degree by factors related to our background. This suggests that we as adults have great freedom to achieve a good life despite our background, despite our outcome due to the “natural lottery”. The reflections are in agreement with the life mission theory, explaining how happiness and QOL come from living your purpose of life in the present and succeeding in taking responsibility for your life here and now by expressing the talents in your life [64–70].

An important limitation of the research is the quality of data collected during pregnancy, birth, and infancy, since this is possibly sensitive to the opinion of the physician

(data during pregnancy were collected by one obstetrician, while birth and infancy data were collected by a few pediatricians). However, because of the very objective form of the data, an approximate uniformity is, to a certain extent, guaranteed. On the other hand, a very important limitation of the data collected exists because of their very objective nature. It would have been valuable to have some subjective life evaluations from the mothers, whether they were satisfied with life, whether they thrived in their relationships and in their work, whether they had some really good friends, and whether they were happy persons in general. This would have revealed more about how the mother’s perceptions of her life had an influence on the quality of life of the adult child.

CONCLUSIONS

Our results showed only small associations between the mother’s situation during pregnancy and the quality of life of the adult child 31–33 years later. Overall it was only mothers with congenital malformations or syphilis, failing contraception, and low social group which showed clear connections with a reduced quality of life in the child as an adult.

Only two main factors in pregnancy seem to be associated with a reduced quality of life for the child 31–33 years later: the mother’s smoking habits and her medication, especially painkillers and psychopharmacological drugs. Considering how labor and birth can be stressful and how few connections existed between these factors and later quality of life, it seems that the child is remarkably resilient to external influences during birth.

During the child’s first year, the mother’s attitude towards her pregnancy, unsuccessful abortions, and institutionalization leave a permanent trace on the child. Meningitis during the first year of life was also associated with a lower quality of life, as were problems with lungs, bronchi, and trachea. The largest associations were found regarding psychomotor development, especially the factor “walking with support”.

We conclude from this study that, despite examining 1,000 diverse early life factors, we have not found those which determine the quality of life of the adult. The results suggest that the quality of life of the adult is probably not determined by early childhood events, contrary to the beliefs held by many psychologists, therapists, and psychoanalysts. Other factors seem to play a greater role in determining the quality of life, which seems to be in accordance with, among others, the life mission theory [65–70]. It opens one up to the belief in the power of now [71] and for the power of the individual to form and create his own life. It is thus in support of the great spiritual traditions of personal growth [72–81].

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