For the classroom

New evidence for the Theory of the Stork

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Summary

Data from Berlin (Germany) show a significant correlation between the increase in the stork population around the city and the increase in deliveries outside city hospitals (out-of-hospital deliveries). However, there is no correlation between deliveries in hospital buildings (clinical deliveries) and the stork population. The decline in the number of pairs of storks in the German state of Lower Saxony between 1970 and 1985 correlated with the decrease of deliveries in that area. The nearly constant number of deliveries from 1985 to 1995 was associated with an unchanged stork population (no statistical significance). However, the relevance of the stork for the birth rate in that part of Germany remains unclear, because the number of out-of-hospital deliveries in this area is not well documented. A lack of statistical information on out-of-hospital deliveries in general is a severe handicap for further proof for the Theory of the Stork.

The intended value (disclaimer): This article is not intended to disprove the value of serious epidemiological investigations. It is an example of how studies based on popular belief and unsubstantiated theory, seconded by low quality references and supported by coincidental statistical association could lead to apparent scientific endorsement. Insofar it is a humorous case study for education in perinatal epidemiology.

Introduction

Background

Two different theories exist concerning the origin of children: the Theory of Sexual Reproduction (ThoSR) and the Theory of the Stork (ThoS).

For many people the stork has been and still is the 'bringer of new life' or the 'baby-carrier'. During pregnancy people say, 'the stork has been visiting'. Old German scientists therefore named the stork odebero (in dutch ooievaar), which means 'bringing luck'.

Nowadays, many people believe in the theory of reproduction, simply because they have been taught this theory in school, although it is a scientific theory, not a truth (Leisti T, personal communication via leisti@cc.helsinki.fi, 2001). A number of the world's leading scientists are still in favour of ThoS. Some recent scientific work (1997–2001) has shown new evidence for ThoS.

Status of ThoS

A search conducted on the internet revealed that more than 20 internet domains are communicating about aspects of ThoS (Table 1). This is evidently important for the future of the ThoS's relevance.

According to work of Prof Erkki Aalto[1] from the University of Helsinki the evidence supporting ThoS is based on six facts:

(i) storks exist
(ii) unexplained features of fetal development
(iii) a newborn is new-born
(iv) sexual intercourse without delivery
(v) positive correlation of birth rate to stork population
(vi) scientific studies.

Aalto's work focussed not only on aspects in the field of gynaecology and obstetrics:

Aspect no. (i): It is a scientifically established fact that the stork exists, which is confirmed by ornithologists.

Table 1. Internet domains covering aspects of ThoS

http://www.californiastork.com
http://www.internetstork.com
http://www.modernstork.com
http://www.newarrivalstorks.com
http://www.smartstork.com
http://www.storkadopt.com
http://www.stork-arrivals.com
http://www.storkavenue.com
http://www.storkhelper.com
http://www.storklanding.com
http://www.storknet.com
http://www.storknews.com
http://www.stork-online.com
http://www.storksdelivered.com
http://www.storksearch.com
http://www.storksneworleans.com
http://www.storks-store.com
http://www.storkstop.com
http://www.thestork.com
http://www.thestorkdelivers.com
http://www.welcomebabystorks.com

Aspect no. (ii): The alleged human fetal development contains several features that the theory of sexual reproduction is unable to explain.

Aspect no. (iii): The theory of sexual reproduction implies that a child is approximately nine months old at birth, which is an absurd claim because all parents know that a newborn child is new-born.

Aspect no. (iv): According to the theory of sexual reproduction, children are a result of sexual intercourse. There are however, well-documented cases where sexual intercourse has not led to the birth of a child. To the contrary, in the fundamental Christian work The Bible a case of delivery without sexual intercourse is documented ('This is how the birth of Jesus Christ came about: His mother Mary was pledged to be married to Joseph, but before they came together, she was found to be with child through the Holy Spirit.').[2] Therefore, this aspect should be amended to read: 'No scientifically proven absolute cause-effect relationship exists between intercourse and delivery'.

Aspect no. (v): A study by Sies[3] had shown a positive correlation between the birth rate and the number of storks in the 60s and 80s years of the twentieth century in Germany.

Aspect no. (vi): A number of scientific reports have been published. Kelly[4] in her study 'Give the stork some orange juice' reported that giving the stork folic acid will help in getting healthy children. She recommended that women between the ages of 19 and 45 take a folic acid supplement every day to reduce the incidence of neural tube defects in newborns. A study completed at the University of Toronto (Canada) analysing a local programme in Quebec called 'Subsidizing the stork' suggests that thousands of Quebec children owe their existence to a government cheque.[5] More evidence is shown by Steele,[6] who reported about stork bites which occur in 30–40% of all newborns. Di Bitelli and Janson[7] reported in the American Journal of Primatology on their study 'When will the stork arrive? Patterns of birth seasonality in neotropical primates', and the results show birth seasonality for most New World monkeys. They explained: 'The pattern of births is consistent with the weaning hypothesis. However, . . . this pattern is also consistent with an alternative strategy.' Food availability for insectivores could be the most important cause of seasonality, according to their studies.

Methods and results

Background

More than a decade after publication of Sies' important epidemiological work[3] we sought for new and more detailed data to confirm Aalto's statement on the correlation of birth rate and the stork population.

There are regular counts of the white stork Ciconia-ciconia breeding population in many areas in Europe, although only very few data are published in international journals.[8,9] Following the scientific work at the Federal Office for Nature Conservation and the Lower Saxony's Country Office for Ecology, Wendt[10] was able to make available detailed data on the development of the stork population from 1971 to 2000 in Germany.

In contrast, the sketchiness of human birth rate documentation in Germany in general, and regarding out-of-hospital deliveries in particular, is amazing. This has been the subject of a recent report (Rott and Verleger, Interventionen im Bereich klinischer und außerklinischer Geburtshilfe – ein Vergleich, presented at the Expertenworkshop Technisierung der normalen Geburt – Interventionen im Kreissaal. Universität Osnabrück, 16–17 November 2001, unpublished). Because of lack of such data, statistical studies were not possible for most parts of Germany. We had to restrict ourselves to the northern state of Lower Saxony and the area around Berlin. Moreover, the impact of the stork population on clinical and out-of-

hospital deliveries could only be analysed in Berlin. Surveys on the birth rates in Lower Saxony and Berlin have been published recently by the competent authorities.[11,12]

The Lower Saxony case

The birth rate is regularily published by the Lower Saxony's State Office for Statistics. New data are available.[11] Data on clinical and out-of-hospital deliveries were found in the Lower Saxony's Perinatal and Neonatal Survey for 1999 only.[13] However, this survey is open to bias because co-operation was restricted to a number of hospitals thus not including all clinical deliveries in this state. It does not cover all out-of-hospital deliveries. Data from that study and the official numbers published suggest that 6214 out of 79 436 deliveries in Lower Saxony (7.8%) do not occur inside the hospitals that took part in this review, thus leaving a grey area.

According to the figures, the total birth rate in Lower Saxony declined from 1971 to about 1985.[11] Data are shown in Fig. 1. Thereafter, following a steady increase, the number of deliveries reached more or less a plateau in 1995. In parallel, the numbers of stork pairs declined from 1971 to 1985, increased from 1985 to 1993, and reached a plateau afterwards. Although these developments are very suggestive, there is no significant statistical correlation between the rates. We had to assume that other factors are involved, not covered by ThoS today. However, missing data hampered further research.

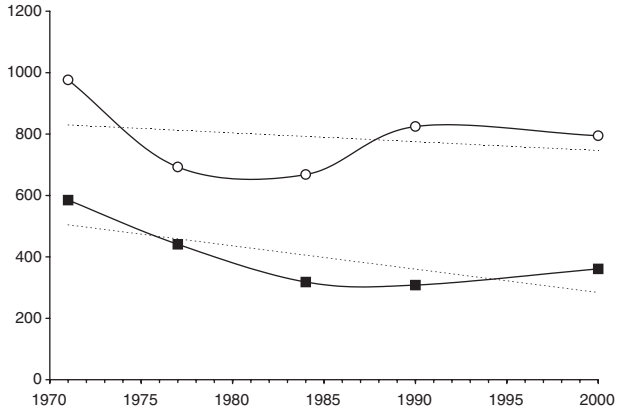

Figure 1. Storks and the birth rate in Lower Saxony, Germany (1971–2000). Open circles show yearly birthrates in hundreds in Lower Saxony. Full squares show numbers pairs of storks in Lower Saxony. Dotted lines represent linear regression trend ($y = mx + b$).

The Berlin case

According to Berlin officials, there are no stork nests in Berlin. Brandenburg is the countryside around the city harbouring a large stork population. It can be assumed that Brandenburg's stork population will have an impact on deliveries in Berlin.

Statistical data by Meinlschmidt of the city of Berlin health administration on Berlin's birth rates have recently been published.[12] Birth rates were severely influenced by the unification of Germany in 1989/1990. A full match of the numbers from former Berlin-East and Berlin-West seems not to be possible because of presumably biased publication of data under the former GDR government officials and a difference in technical categorisation aspects used for the statistics. Nearly all deliveries in the former capital of eastern Germany took place in hospitals. Therefore, we had to restrict our evaluations on the birth rates in Berlin after the unification.

Data are shown in Fig. 2. There has been a decline of the total birth rate from 1990 to 1993/94. After a slight increase until about 1997, a nearly constant rate has been reached. Numbers of out-of-hospital deliveries increased from 1991 to 1999. In parallel, the stork population in Brandenburg has increased during that period, which shows a significant statistical correlation (linear regression $R^2 = 0.49$). However, there is no such significant correlation between deliveries in hospital buildings (so called clinical deliveries) and the stork population (linear regression $R^2 = 0.12$).

Discussion

Criticism on ThoS is often *inter alia* based on the argument that data cannot show a clear and significant relationship between the number of deliveries and the number of storks, notwithstanding that Sies could clearly demonstrate such a correlation for a limited period and area.[3] It is a well-known fact that storks are never seen in hospitals, but scientists have disregarded this simple truth in their studies. Medical interventions may be able to replace the stork. They are particularily necessary in hospitals where storks do not come. Our study clearly shows that ThoS has to be restricted to out-of-hospital deliveries.

Aalto's fifth aspect of ThoS therefore has to be amended to read: 'there is a correlation between

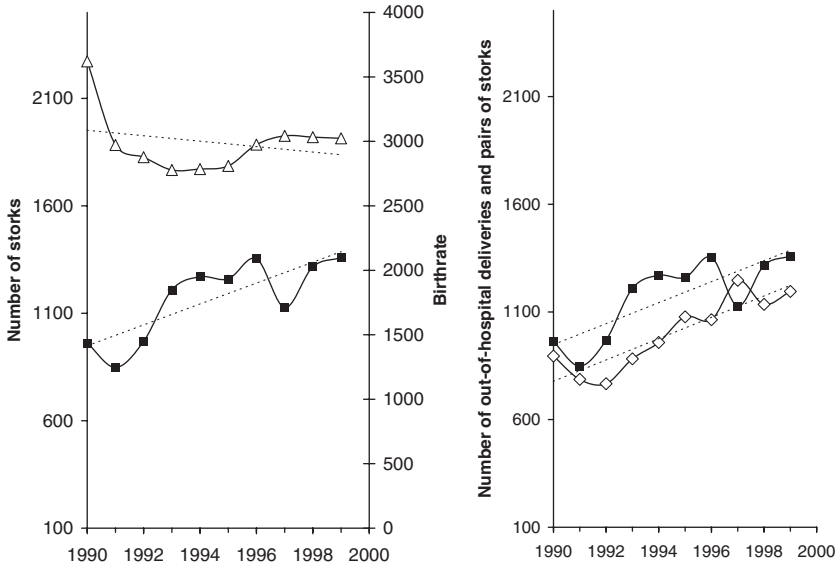

Figure 2. Storks in Brandenburg and the birthrates in Berlin, Germany (1990–99). Open triangles show number of clinical deliveries per year in Berlin. Open diamonds show number of out-of-hospital deliveries per year in Berlin. Number of pairs of storks are shown as full squares. Dotted lines represent linear regression trend (y = mx + b). For the convenience of the readers, two figures are presented. Left graph shows clinical deliveries against pairs of storks using two scalings, right graph shows numbers of out-of-hospital deliveries and pairs of storks both on the same scale. In both figures, data are from the years 1990–2000.

the stork population and out-of-hospital deliveries in an area'. The strong relation between stork numbers and deliveries outside hospitals underline the importance of activities in the USA for selling 'Stork Helper Birth Kits', delivery kits which will prepare women in the event of an unexpected delivery.[14]

The number of storks has decreased in Germany from the 1950s to the 1980s. This reduction has been explained with the introduction of, for example, electrical wires, traffic, noise and chemical pollution. In spite of the still existing physical hazards, the number of storks has increased in the last two decades in Germany. This is an indication that the reduction of emission of organic chemicals and use of pesticides by farmers may have helped to increase the stork population. In their provocative book Ehrlich and coworkers[15] look at the interaction between population and food supply and propose reforming the agricultural system. Supporting the stork population by organic farming may have a positive influence on the low birth rate in most European countries, at least on deliveries outside hospitals.

The ThoS should be further substantiated by rigorous scientific methods. The only assumption involved is that children are delivered by storks. It is to be deplored that biased philosphical opposition is still preventing scientific research and denies financial support. It is, however, a positive sign for the future of the stork and very welcome that within the worldwide economical globalisation via the internet, lobbying for the ThoS is on the increase.

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References

1 Aalto E. Ovulation versus cretinism. http://www.xs4all.nl [accessed 12 April 2002].
2 *The Bible.* Matthew 1:17–19. New international version, 2000.
3 Sies H. A new parameter for sex education. *Nature* 1988; **332**:495.
4 Kelly SH. Give the stork some orange juice. http://www.HealthAtoZ.com [accessed 29 August 2001].
5 Lefebvre P. Study on 'Subsidizing the Stork'; economics professor from University of Toronto reports on study. *Globe and Mail* January 27, 2001.
6 Steele R. What is a 'stork's bite'? http://www.parentsplace.com/babies [accessed 29 August 2001].
7 Di Bitelli MS, Janson CH. When will the stork arrive? Patterns of birth seasonality in neotropical primates. *American Journal of Primatology* 2000; **50**:109–130.
8 Rejman B, Folk C. Results of the fourth international white stork census in the Czech Republic. *Folia Zoologica* 1991; **40**:179–186.
9 Schifter H, Schifter T. The development of the breeding population of the white stork Ciconia-Ciconia L. in Austria from 1975 to 1984. *Egretta* 1990; **33**:1–10.
10 Niedersächsisches Landesamt für Ökologie NLOE. *Bestandsentwicklung des Weißstorchs in Niedersachsen. Anzahl*

der Brutpaare 1971–1998. http://jupiter.nloe.de/scripts/db4web_c.exe [accessed 22 November 2001].
11 Niedersächsisches Landesamt für Statistik NLS. *Natürliche Bevölkerungsentwicklung in Niedersachsen, Hannover.* Tabelle Z1001693. http:www1.nls.niedersachsen.de/Statistik [accessed 19 February 2002].
12 Meinlschmidt G. *Bericht über die geburtshilflich-gynäkologische Statistik 1999 in Berlin (Entbindungen/Geborene/Fehlbildungen).* Berlin: Senatsverwaltung für Arbeit, Soziales und Frauen, 2001.
13 Zentrum für Qualitätsmanagement im Gesundheitswesen ZQ. *Niedersächsische und Bremer Perinatal- und Neonatalerhebung. Npextra 1999.* Hannover: Ärztekammer Niedersachsen, 2001.
14 Stork Helper. Stork helper birth kits, a business dedicated to mom's and baby's safety. http://www.storkhelper.com [accessed 29 August 2001].
15 Ehrlich PR, Ehrlich AH, Daily GC. *The Stork and the Plow*. New Haven, CT: Yale University Press, 1997.