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Cesarean section odds ratios

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Summary

Cesarean Section (CS) rates for primiparas, multiparas with and without previous CS were investigated in seven obstetrical settings. Despite the great diversity of global CS rates (5.3 to 17.4%), common CS odds ratios of 3.0 and 37 have been found for primiparas and multiparas with previous CS, respectively. Internal links between CS odds ratios have also been investigated for some anomalies associated with CS (fetal distress, non-vertex presentation, hypertension, dystocia, small for dates new born and prematurity), suggesting that perinatal services may be evaluated on CS aspects according to a single general interventionnist/conservative clinical attitude. Data from two additional obstetrical settings were used to verify the findings in terms of perinatal evaluation.

Cesarean section; Odds ratio; Evaluation

Introduction

The great diversity of CS rates associated with very low perinatal mortality makes the evaluation of perinatal services with respect to CS a difficult task. The negative correlation of CS rate and perinatal mortality suggested at first was not confirmed [1] and there is growing concern today for the high CS rate recorded in some countries [7,13], and more and more obstetricians are eager to analyse their CS rates in order to find ways of reducing them without altering the health of the neonate.

When an obstetrician wants to analyze the CS rate observed in his or her unit, he or she might want to know first whether the observed rate is higher (or lower) than that observed in other units. Then he or she may wonder whether there are some groups for which the CS rate is particularly high (or low). The aim of the present

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work is to propose a methodology to analyse the CS rates for specific indications, within a given unit, in order to identify pathologic conditions where the CS rate is different from what could have been expected, as well as to estimate the possible reduction in the overall rate of CS.

Population and methods

The proposed statistical tool to evaluate the level of CS in a given unit is the odds ratio (OR) [17] which is a measure of the 'risk' of CS in a given group compared to the 'risk' of CS in a reference group. It can be computed according to the following formula:

$$OR = \frac{f/(1-f)}{r/(1-r)}$$

where OR is the odds ratio; f the CS rate in the study group (e.g., women with hypertension); and r the CS rate in the reference group (women without hypertension).

OR is equal to 1 if f and r are the same, OR is greater than 1 if $f > r$. OR is a close approximation of the relative risk (RR) if the CS rates are low.

In this paper odds ratios have been computed using seven sets of data from three European countries covering a broad spectrum of obstetrical attitudes. The data cover a period of 11 years (1976 to 1987). The identification of the sets of data is given in Table I.

Table II shows the percentage of primiparous women and the overall CS rates that characterize the 7 obstetrical settings.

In the first part of this work, three groups were studied according to past obstetrical history: primiparas, multiparas with previous CS and multiparas without previous CS. The latter was taken as the reference group to estimate the CS odds ratio for primiparas and multiparas in the seven obstetrical settings. From these estimations, common odds ratios (COR) for primiparas and multiparas with previous CS have been derived. The method used was that of Mantel and Haenzsel [17].

TABLE I

Identification of the analysed data

	Period	Name of institution	Place	Ref.
B85	1985–86	Maternite Baudelocque *	Paris	present
E81	1981	National Survey	France	present
F87	1986–87	Hopital Foch, Suresnes	France	present
O83	1978–83	John Radcliffe Hospital	Oxford	[24]
D86	1986	Nat. Maternity Hospital	Dublin	[20]
N76	1976	N. Lanarkshire Maternity	Scotland	[15]
N78	1978	N. Lanarkshire Maternity	Scotland	[15]

* Only Jan–Aug 1985 and Jan–Oct 1986 data available.

TABLE II

Primiparity and Cesarean section rates

	Number of births	Primiparity (%)	Cesarean section (%)
B85	2917	54.4	17.4
E81	5442	40.9	10.9
F87	3783	49.5	8.6
O83	32735	43.6	10.0
D86	7065	35.8	5.3
N76	5575	41.0	6.8
N78	5377	38.9	11.4

A test described by Zelen [8,26] was performed to assess the homogeneity of the OR.

Reconstruction of the global CS rate was performed for each setting on the basis of the common odds ratios, the composition of the population and the CS rate for the group of multiparas with no previous CS: details are given in the appendix.

In the second part of this work, the following anomalies have been considered because they are associated [7,14] with the decision to perform a CS:
- Fetal distress
- Non-vertex presentation
- Hypertension
- Dystocia (fetopelvic disproportion or failure to progress)
- Small for dates
- Prematurity (< 34 weeks)

The CS odds ratios corresponding to each anomaly were estimated amongst the data from France, and a COR was derived for each anomaly. These CORs were used to discuss the CS rates of an independent set of data: the births of the Centre Hospitalier de La Grave, Toulouse, France of 1986 and 1987 (Grandjean H. and Baron M., personal communication, 1988).

All odds ratio calculations have been performed with specially developed programs run on an MS-DOS personal computer.

Results

CS odds ratio by parity

The odds ratio of CS for primiparas and for multiparas with previous CS appeared similar regardless of the overall CS rate. For primiparas, the odds ratios ranged from 2.7 to 4.2, while for multiparas with previous CS, it ranged from 26 to 55 (Table III and Fig. 1).

The Zelen test applied to the OR for Primiparas ($Z = 11.2$) allows us to keep the hypothesis of homogeneity of the odds ratios. This finding suggests that, regardless of the overall CS rate, the odds of CS are three times higher for a primipara than for a multipara with no previous CS.

The Zelen test for multiparas with previous CS ($Z = 302$) reflects a lack of homogeneity. However, the validity of the common odds ratio can be shown by

TABLE III

CS odds ratio for primiparas and multiparas with previous CS

	Primiparas		Multiparas with previous CS	
	odds ratio	95% interval	odds ratio	95% interval
B85	2.7	2.1–3.6	44	33–59
E81	3.1	2.5–3.8	55	44–70
F87	4.2	3.0–5.8	51	38–68
083	2.8	2.6–3.1	36	33–39
D86	3.5	2.8–4.6	32	25–40
N76	2.8	2.2–3.6	37	29–48
N78	3.4	2.8–4.1	26	20–32
COR	3.0	2.8–3.2	37	34–39

COR = common odds ratio.

performing a reconstruction of the global CS rate. Using the common odds ratios, the overall CS rate can be deduced from the rate for multiparas without previous CS and the composition of the population. The results of the reconstructions are shown in Table IV and in Fig. 2 and the details of the procedure are presented in the appendix.

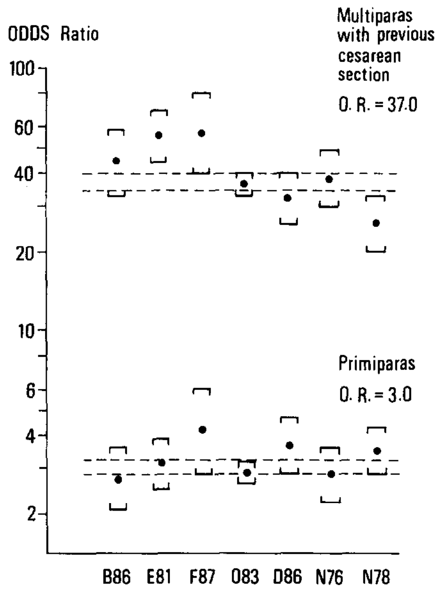

Fig. 1. CS odds ratios of primiparas and multiparas with previous CS with respect to multiparas with no previous CS. Odds ratios are shown for seven obstetrical settings: B85, Maternite Baudelocque Paris; E81, French National Survey; F87, Hopital Foch Suresnes France; 083, John Radcliffe Hospital Oxford; D86, National Maternity Hospital Dublin; N76, North Lanarkshire Maternity Scotland; N78, North Lanarkshire Maternity Scotland.

TABLE IV

Observed and reconstructed CS odds ratio

	Observed CS rate (%)	Reconstructed CS rate (%)
B85	17.4	17.4
E81	10.9	10.1
F87	8.6	6.7
O83	10.0	10.3
D86	5.3	5.1
N76	6.8	7.0
N78	11.4	11.2

The agreement between these figures indicates that, to explain a high (or low) CS rate in a given unit, the general policy of the unit seems to be more important than the rate of CS observed in specific parity groups, since the overall rate is very well predicted by the rate observed amongst multiparas without previous CS.

CS odds ratio by specific condition

The CS odds ratios for the main anomalies have been calculated with respect to the group that does not present the anomaly (the complement). This estimation was done for three data sets from France (B86, E81 and F87) and is shown in Table V.

For such conditions as hypertension and small-for-dates, the observed odds ratios do not vary significantly, whereas for dystocia, fetal distress, non-vertex presentation and prematurity they vary considerably, which means that there are great variations of policies.

To give an application of the results obtained, data from another unit were used (data that were not used to estimate the common odds ratios). The Center Hospitalier de la Grave has an overall CS rate of 14.1%, while the rates for

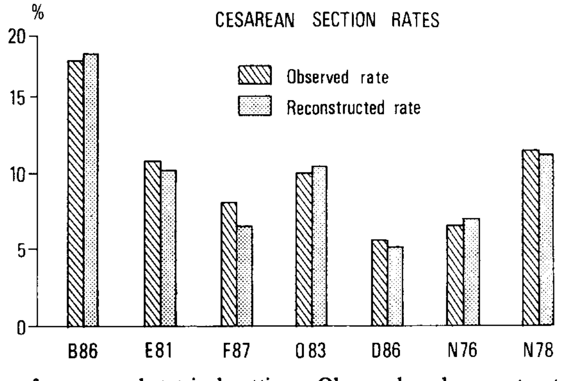

Fig. 2. Overall CS rate for seven obstetrical settings. Observed and reconstructed rate show a good agreement. B85, Maternite Baudelocque Paris; E81, French National Survey; F87, Hopital Foch Suresnes France; O83, John Radcliffe Hospital Oxford; D86, National Maternity Hospital Dublin; N76, North Lanarkshire Maternity Scotland; N78 North Lanarkshire Maternity Scotland.

TABLE V

CS common odds ratios for anomalies associated with CS

	Common odds ratio	Range of observed OR	Zelen	Probability non-homogeneity
Fetal distress	3.5	2.9– 5.9	47.1	< 0.001
Non-vertex pres.	8.2	6.1–10.5	24.0	< 0.001
Hypertension	1.9	1.6– 2.2	7.5	NS
Dystocia	6.3	3.6–34.7	491.5 *	< 0.001
Small for dates	1.7	1.3– 2.1	4.8	NS
Prematurity (< 34)	1.3	1.0– 3.4	9.6	< 0.05

* This variable was not available for E81. NS, non-homogeneity is non significant, i.e., uniform odds ratio.

primiparas, multiparas with no previous CS and multiparas with previous CS are 14.5%, 5.7% and 77.9%, respectively. The CS rates in case of fetal distress, non-vertex presentation, hypertension and dystocia are 44.8%, 63.2%, 31.1% and 50.5%, respectively. Table VI presents the observed odds ratios as well as 95% confidence intervals around the expected values (see appendix for details of evaluation).

The Hospital 'de la Grave' of Toulouse exhibits an odds ratio for primiparas that matches well the common odds ratio. On the other hand, for multiparas with previous CS, the odds were different and the observed ratio was not included in the 95% interval around the expected figure.

Fetal distress, non-vertex presentation and hypertension presented odds ratios that are not included in the confidence intervals calculated taking into account the size of the data from Toulouse. Dystocia as an anomaly associated with CS has an odds ratio of 6.5 for Toulouse, a figure which matches the expected value of 6.3 (the common odds ratio).

TABLE VI

CS odds ratios (observed and expected) for the 1986–1987 data from Toulouse, France

	CS		Odds ratio	Common O. ratio	95% interval
	yes	no			
Multiparas with no previous CS	176	2920	–	–	– –
Primiparas	387	2273	2.8 [a]	3.0	2.5– 3.6
Multiparas with previous CS	304	86	58.6 [a]	37	30 –45
Fetal distress	152	187	5.8 [b]	3.5	2.8– 4.4
Non-vertex pres.	194	113	13.1 [b]	8.2	6.7–10.1
Hypertension	55	122	2.9 [b]	1.9	1.3– 2.7
Dystocia	50	49	6.5 [b]	6.3	4.4– 9.0

[a] With respect to multiparas with no previous CS.

[b] With respect to absence of the anomaly.

TABLE VII

Reduction of global CS rate obtained with expected values of CS odds ratio, data from Toulouse

	Odds ratio	Expected O. ratio	Expected CSs [a]	Avoided CSs	Resulting CS rate
Multiparas with previous CS	58.6 [b]	37	269	35	13.5%
Fetal distress	5.8 [c]	3.5	112	40	13.5%
Non-vertex pres.	13.1 [c]	8.2	159	35	13.5%
Hypertension	2.9 [c]	1.9	41	14	13.9%
Sum of all avoided CSs				89	12.6%

Primiparity and dystocia are not shown since no reduction is expected.

[a] Real figures are given in Table VI.

[b] With respect to multiparas with no previous CS.

[c] With respect to absence of the anomaly.

The data from the Toulouse Hospital show that several odds ratios are higher than the 'common odds ratio'. Therefore, a reduction of CS might be obtained by reducing the CS rate specifically amongst the groups that show higher odds ratios.

Table VII presents the CS rate reductions that could be obtained for the Toulouse Hospital if the odds ratio of a group was made to coincide with the expected value, which can be considered a reasonable objective.

If the Hospital of Toulouse were to match the expected CS odds ratio for non-vertex presentation, 35 CSs would be avoided in that group, leaving 159 CSs. This reduction would modify the global CS figure from the observed 14.1% to 13.5%. It can be seen that the other anomalies have comparable influences on the overall CS rate. Summing all reductions, a theoretical situation since more than one anomaly can be associated to a single decision to perform a CS, the overall rate would be 12.6%. This figure allows one to set a lower limit to realistic goals in an eventual CS rate reduction program.

Discussion

Very dissimilar CS rates have been reported throughout the world. Differences of obstetrical attitudes towards selected groups of patients have been presented as possible causes [19,21,23]. The results of the present work suggest that differences in CS rate between units could largely be explained by the general attitude of the unit. This seems to be true despite the great variability of attitude according to specific indications, as reflected by the wide range of observed odds ratios.

This result is drawn from the fact that the overall CS rate, in a given unit, can be accurately predicted by the rate among multiparous women. This conclusion is reinforced by the observation that the modification of the CS odds ratio for a given indication has little impact on the overall rate.

These results appear because it was decided to use odds ratios to compare CS rates. Considering the characteristics of the odds ratio [16,17] it seems to be a better index than differences in rate or relative risk which are two very commonly used indices. In order to highlight the use of these measures, we consider three perinatal units to be evaluated with respect to CS rate. The CS rates for vertex presentation are as follows: Unit A: 5%; Unit B: 10%; Unit C: 20%.

Unit A has a CS rate of 30% for non-vertex presentation. Units B and C are to be compared to Unit A. If we use differences in rate, the situation in Unit B and Unit C would be considered equivalent to Unit A if CS rates for non-vertex presentation were 35% and 45%, respectively. It seems difficult to accept a difference in rate from 5% to 30% (Unit A) as equivalent to a difference from 20% to 45% (Unit C): a relative difference must be considered, such as the relative risk.

In Unit A, the observed relative risk of CS for non-vertex with respect to vertex presentation is 6, therefore the CS rate amongst non-vertex in Unit B will be considered equivalent if it reaches 60%, whereas in Unit C it is impossible to observe a relative risk of 6, since the vertex figure is already greater than a CS every 6 cases. The relative risk therefore fails as a way of comparing high rates and risks.

Let us consider the odds ratio. The non-vertex CS odds ratio with respect to vertex presentation is 8.1 in Unit A. Units B and C would be considered equivalent to Unit A if their observed rates were, respectively, 47.5% and 67.1%. The odds ratio can therefore be used whatever the level of CS is, and it takes it into account. For instance an increase from 10% to 40% features the same odds ratio as an increase from 80% to 96%. Besides theoretical consideration, the odds ratio seems to be a good index, since it fits very well with the concepts of the CS rates presented here. The use of the odds ratio can lead to new interpretations of the data.

For instance, let us compare the data of the French National Surveys of 1972 with those of 1981 [2]. The CS rate for multiparas with previous CS was 63.4% in 1972 and 72.6% in 1981. It is difficult to say whether there has been a change in this population. The CS odds ratios for this group were found to be 68 in 1972 and 55 in 1981, both figures are higher than the odds ratio of 37 deduced from the seven settings. The clinical attitude for this group was therefore more interventionist in 1972 than in 1981 for that particular group.

The situation today is probably even closer to the odds ratio of 37, since multiparas with previous CS are given more chances to deliver vaginally, as confirmed by a growing concern to allow trials of labor following previous abdominal delivery [7,11].

The CS rate for primiparas was 7.2% in 1972 and 12.7% in 1981. The first reaction is that there has been an increase in the CS rate for that particular group. In fact, the CS odds ratio for primiparas was 3 in 1972 and 3.1 in 1981 which confirms the fact that there has been no change in the relative attitude towards primiparas with respect to multiparas without previous CS: in other words the odds of CS for a primipara are three times as high as those for a multipara with no previous CS. What has changed from 1972 to 1981 is the general attitude, since CS rates for multiparas climbed from 2.5% to 4.5%.

As a consequence, it seems that comparison of CS rate between two units (or the same unit at two different times) should be based on a three step procedure. The first step is the comparison of actual rates to determine which unit is more 'interventionnist'. This evaluation must be carried out controlling for major changes in population (confounding factors) such as parity and previous CS. The second step is the computation and comparison of odds ratios. The third step is the estimation of the impact on the overall CS rate of modification of odds ratios. An expert system for the evaluation of perinatal services based on these guidelines has been developed and described elsewhere [13].

Besides the methodology, this paper also provides some results. From the analysis of the data presented here, it seems that significant reduction in CS is more likely to happen by changing overall policy in a given unit than by changing indication for CS for specific conditions. This statement is in agreement with at least two observations [4,10]. The first concerns a maternity unit in Scotland, where the CS rate increased from 7% to 16% from 1977 to 1980, at which time it was decided to implement an audit and the rate of sections began to fall during the audit. Similar results have been obtained in a maternity unit in Paris where epidemiological investigations accompanied by critical scrutiny and assessment of clinical decision for every CS were followed by a decrease in CS rate.

A more complete analysis of the Paris data has shown that the fall in CS rate has been obtained mainly through a decrease in CS performed before labor and a decrease in diagnosis of dystocia (due to failure to progress) mainly by a more careful discussion of the diagnostic criteria.

Such means of reducing the incidence of CS are acceptable if the reduction has been obtained by decreasing the cases where CS were unduly performed previously. As a matter of fact decrease in CS cannot be considered as an objective if it is accompanied by any detrimental effect on the neonate. This means that any policy aiming at modifying the rate of CS by 'critical scrutiny' of clinical decision should include the same critical scrutiny of neonatal state to be sure that good neonatal results are achieved even if the rate of intervention is decreasing.

Another approach could be to try to implement new policies of management of labor. Such policies should aim at preventing conditions which constitute the main indication for CS. If one looks at the reviews of the literature [7,22], four indications are responsible for most of the CSs: repeat CS, breech presentation, fetal distress and dystocia.

Some of the repeated CSs could certainly be avoided by waiting more often for the spontaneous onset of labor; however, even if we accept that hypothesis that vaginal delivery is possible in half the cases, the impact of such a reduction will not be very important. It therefore seems easier to envisage a decrease in the rate of primary CS as the best way of reducing the rate of repeat CS.

Prevention of breech presentation seems to be theoretically possible by external version; however, practical application seems to be difficult. For fetal distress, the main problem lies in the validity of the diagnosis with a too high proportion of false positive. Even if many improvements have already been accomplished, no clear prospect of new devices seems to exist to improve the diagnostic value of present day technology. But again, the best approach is probably one that is preventive.

In this respect the most promising area appears to be that of dystocia. In order to identify policies which might prevent dystocia, it might be useful to look at some of the data from European countries [5]. Two places have particularly low CS rates: Dublin and the Netherlands. Both places differ from the rest of Europe with respect to the policy of management of labor. Home deliveries, as practised in the Netherlands, can certainly not be easily applied elsewhere, whereas 'active management' as applied in Dublin might be [12].

Active management has two components: one is 'more clinical' and includes 'early rupture of membranes' and use of oxytocin on a large scale, the other is 'more physiological' with the permanent presence of a nurse. Both components might have an impact on the rate of dystocia, as for instance in the trials reported by Marshall et al. [10]. Taking this result into account, two controlled trials have been designed to evaluate the two components. These trials are part of an EC-concerted action and are about to start in different EC countries [3,9].

Conclusion

This work provides a new methodological tool to evaluate the CS rate in different settings. The constancy of the CS odds ratios for particular sub-populations, whatever the global CS rate, has to be validated on further data bases from different perinatal settings in order to test the hypothesis presented here.

Appendix

Reconstruction of CS rates

The composition of the population of mothers is known in terms of percentage of primiparas, multiparas with previous CS and multiparas with no previous CS:

R_WOUT, percentage of multiparas with no previous CS.

R_WITH, percentage of multiparas with previous CS.

R_PRIM, percentage of primiparas.

The expected rate of CS amongst primiparas (E_C_PRIM) can be calculated from the rate of CS amongst multiparas with no previous CS and the expected CS odds ratio with respect to multiparas with no previous CS; let:

R_C_WOUT, rate of CS amongst multiparas with no previous CS.

E_C_PRIM, expected rate of CS amongst primiparas.

OR_PRIM, expected CS odds ratio for primiparas.

then, algebraic transformations of the definition of the odds ratio lead to the following expression in terms of the CS rates:

$$\mathrm{E\_C\_PRIM} = \frac{(\mathrm{OR\_PRIM} \times \mathrm{R\_C\_WOUT})}{(100 - \mathrm{R\_C\_WOUT}) + (\mathrm{OR\_PRIM} \times \mathrm{R\_C\_WOUT})}$$

Similarly E_C_WITH (expected CS rate amongst multiparas with previous CS) can be derived from the expected odds ratio and the baseline CS rate (CS rate for multiparas with no previous CS):

$$\mathrm{E\_C\_WITH} = \frac{(\mathrm{OR\_WITH} \times \mathrm{R\_C\_WOUT})}{(100 - \mathrm{R\_C\_WOUT}) + (\mathrm{OR\_WITH} \times \mathrm{R\_C\_WOUT})}$$

A global CS rate can be estimated, reconstructing the whole from the parts:

$$R\_C = (R\_PRIM \times E\_C\_PRIM) + (R\_WITH \times E\_C\_WITH) + (R\_WOUT \times R\_C\_WOUT)$$

Confidence interval around an expected odds ratio

A confidence interval at the 95% level for the CS odds ratio around the expected odds ratio is estimated with the expected numbers of CS and vaginal deliveries amongst primiparas. The size effect is thus taken into account in much the same way as the confidence interval of the estimation of a mean.

To investigate the compliance of observed data to an expected odds ratio, a 2×2 table is set up as follows:

	Cesarean Yes	Section No	
Exposed	a expected	b expected	n1
Non - Exposed	c	d	n2

Expected figures for exposed mothers (a and b) are deduced from the expected odds ratio (OR), the observed values for non-exposed cases (c and d) and the observed total number of exposed (nl):

$$\text{a expected} = \frac{OR \times nl \times c}{n2 + c(OR - 1)}$$

$$\text{b expected} = nl - \text{a expected}$$

The expected a figure is useful in terms of evaluation in that it highlights the difference between the expected number of CSs amongst the exposed mothers and the number of CSs actually observed. The odds ratio of this table is obviously equal to the expected odds ratio (OR). The 95% confidence interval is calculated then to evaluate the spread of odds ratio values that can be expected with the total volume of cases studied and in the hypothesis that the odds ratio is equal to the expected odds ratio.

The observed odds ratio can be compared to this 95% confidence interval considering the observed odds ratio a particular sample odds ratio. The fit of the observed odds ratio to the expected odds ratio is therefore evaluated taking into account the size effect of the observed situation.

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References

1 Bergsjø P, Schmidt E, Pusch D. Differences in the reported frequencies of some obstetrical interventions in Europe, Br J Obstet Gynaecol 1983;90:628–632.
2 Breart G. Evolution of Cesarean section in France. in Clinch J. and Matthews T, Perinatal Medicine, proceedings of the IX European congress of perinatal medicine, Dublin, Ireland, Lancaster: MTP Press Limited, 1981:151–153.
3 Breart G, Buekens P (eds.). Evaluation of perinatal care, methodology and research proposals, Paris: Copedith, 1987.
4 Breart G, Poisson Salomon AS, Cabrol D, Maillard F, Chavigny C, Llado J. Evolution de la fréquence des césariennes. In Blanc B, Thoulon JM eds. Medecine perinatale, 15eme journées nationales, Nice 1985, Paris: Librairie Arnette, 1985.
5 Chalmers I. Trends and variations in the use of Caesarean delivery. In Clinch J, Matthews T, eds. Perinatal medicine. Lancaster: MTP Press, 1985.
6 Collins R, Langman M. Treatment with histamine H2 antagonists in acute upper gastrointestinal hemorrhage, N Engl Med 1985;313:660–666.
7 Grandjean H. Determinants of Caesarean section. In Kaminski M. et al eds. Perinatal care delivery systems, Oxford: Oxford University Press, 1986.
8 Jenicek M. Meta-analyse en medicine, evaluation et synthese de l'information clinique et epidemiologique. Paris: Edisem, Quebec et Maloine, 1987.
9 Kaminski M, Breart G, Buekens P, Huisjes HJ, McIlwaine G, Selbmann HK (eds.). Perinatal care delivery systems: description and evaluation in EC countries. Oxford: Oxford University Press, 1986.
10 Klaus M, Kennell JH, Robertson SS, Sosa R. Effects of social support during parturition on maternal and infant morbidity. Br Med J 1986;293;585–587.
11 Notzon FC, Placek PJ, Taffel SM. Comparisons of national cesarean section rates. N Eng J Med 1987;316:386–389.
12 O'Driscoll K, Meagher D. Active management of labour, London: Balliere Tindall, 1986.
13 Placek PJ, Taffel SM, Moien M. 1986 C-section rise; VBACs inch upward. Am J Publ Health 1988;78.
14 Poisson-Salomon AS, Breart G, Maillard F, Rabarison Y, Chavigny C, Sureau C, Rumeau-Rouquette C. Can the number of Cesarean sections be reduced without risk? An analysis of rates and indications in a university clinic. Eur J Obstet Gynecol Reprod Biol 1986;22:297–307.
15 Rosenberg K, Hepburn M, McIlwaine G. An audit of Caesarean section in a maternity district. Br J Obstet Gynaecol 1982;89:787–792.
16 Rothman KJ. Modern Epidemiology. Boston: Little, Brown and Company, 1986.
17 Rumeau-Rouquette C, Breart G, Padieu R. Méthodes en épidémiologie. Paris: Flammarion, 1985.
18 Shiono PH, McNellis D, Rhoads GG. Reasons for the rising Cesarean delivery rates: 1978–1984. Obstet Gynecol 1987;69:696–700.
19 Simini F, Berardi JC, Breart G. An expert system for the evaluation of perinatal services: Cesarean section aspects. Comp Biomed Res, in press.
20 Stronge JM. National Maternity Hospital Dublin, Clinical Report, Dublin, 1986.
21 Taffel SM, Placek PJ, Liss T. Trends in the United States Cesarean section rate and reasons for the 1980–1985 rise, Am J Publ Health 1987,77:955–959.
22 Thierry M, Derom R. Review of evaluative studies on Caesarean section. In Kaminski M. et al, eds. Perinatal care delivery systems, description and evaluation in EC countries. Oxford: Oxford University Press, 1986.
23 Williams RL, Chen PM. Controlling the rise in Cesarean section rates by the dissemination of information from vital records, Am J Publ Health 1988,73:863–867.

24 Yudkin PL, Redman CWG. Caesarean section dissected, 1978–1983. Br J Obstet Gynaecol 1986;93:135–144.
25 Yusuf S, Peto R, Lewis J, Collins R, Sleight P. Beta blockade during and after myocardial infarction: an overview of the randomized trials. Prog Cardiovasc Dis 1985;27:335–371.
26 Zelen M, The analysis of several 2×2 contingency tables. Biometrika 1971;58:129–137.