J. Perinat. Med.
10 (1982) 105

Association of marital status and years of schooling with perinatal outcome: The influence of pre-natal care as an intermediate variable

Anibal Faundes, Ellen Hardy, Juan Diaz, José Pinotti

Department of Obstetrics and Gynecology, State University of Campinas, Brazil

1 Introduction

There is a large amount of evidence in the literature, showing a strong correlation between socio-economic variables and infant mortality and morbidity [3, 8]. The same kind of association has been found between social class and perinatal mortality and prematurity [2, 6, 10]. The precise aspects involved in low social class that give rise to higher pre-maturity and mortality rates are less clear in the literature. There are some indications that nutrition, maternal stature and work during pregnancy may explain part of that correlation. It is also argued that one important component of the association may be explained by differences in medical care during the pre-natal and post-natal periods [10]. Mothers' education, however, is one component of socio-economic level that seems to play a role of its own. Its effect over infant mortality persists after being controlled by other social variables and may be independent of the quality of health care [4]. The influence of marital status has not received the same attention maybe because pregnancy in the unmarried women was not that frequent in the past in developed countries, where most of the studies have been done. Even though its frequency is now higher because of the cultural changes with respect to sex life and the family, its social meaning is not the same as in the lower classes of Latin America.

The importance of improving the general socio-economic condition of a population in order to

Curriculum vitae

Dr. ANIBAL FAUNDES, M. D., Chilean, 50 years old, graduated from the Universidad de Chile, in Santiago, Chile in 1955. Physician specializing in Obstetrics and Gynecology with post-graduate training in Chile, in Uruguay with Professor R. CALDEYRO-BARCIA (1960-61) and USA at the Worcester Foundation for Experimental Biology (1963-64). He worked for almost 19 years at the Department of Obstetrics and Gynecology of the Hospital Barros Luco in Santiago, Chile where he organized a Center for Research in Reproduction, and introduced the precoded obstetrics form that was used in the recording of data used for this paper. He had a parallel career in the University where he reached the level of Full Professor and at the National Health Service where he became a member of the National Normative Committee for Women's Health. A member of the International Committee for Contraceptive Research since 1970, he was hired by the Population Council (New York) and assigned to the Dominican Republic in 1964. Since 1966 he is Visiting Professor of Obstetrics and Gynecology and Head of the Obstetrics Section at the Universidad Estadual de Campinas in Brazil.

reduce infant mortality is universally accepted. Any coherent program addressed to that purpose will include not only direct medical services, but also measures to satisfy other basic needs [9]. The discussion that remains is about the worthiness of initiating some elementary health activities in the absence of significant socio-economic improve-

ment or a more comprehensive program. The position in favor to do so is based on the historical reduction in mortality at a pace that cannot be explained by socio-economic progress [8].

In order to contribute to that discussion we have studied the association between mothers' education and perinatal mortality and between marital status and prematurity and the role of pre-natal care as an intermediate variable that may partially explain those associations.

2 Materials and methods

The population studied is made up of women who delivered their babies at the Department of Obstetrics and Gynecology of the BARROS LUCO-TRUDEAU Hospital in Santiago, Chile, during a period from late 1969 to mid 1971. Over 20,000 single births were recorded during that time, but fewer subjects are included in the tables because information for some variables was missing in different numbers of cases. This problem was usually caused by a patient being unable to answer a question, e. g. date of the last menstruation.

The BARROS LUCO-TRUDEAU Hospital was part of the National Health Service and was attended by patients who only had the social security enforced by law for all manual workers, or who had no health insurance at all and were unable to pay. The hospital's patients consisted mostly of blue collar workers and their families, as well as recent immigrants from the small towns and rural areas of the country. Consequently, the population was characterized by low income and low educational levels. This is why our highest category for education corresponds to "at least some secondary education" and why there is a relatively high proportion of unmarried women, an uncommon fact among the Chilean middle class.

With the purpose of registering the main variables influencing perinatal outcome in a prospective way, a single, pre-coded obstetric form was developed at the Department of Obstetrics and Gynecology in 1967. Three different versions of this form were consecutively tested and used. The third version, used between 1969-71, included for the first time years of schooling as a socio-economic indicator. The form was designed to

serve both clinical and research objectives, meaning that there was only one form, instead of one for clinical purposes and another for recording research data.

The most important difference with the usual clinical forms was that all the information to be used for research was registered in fixed spaces, that corresponded to columns in a punch card. Numerical variables such as weight and height were recorded directly and all other variables were pre-coded.

The clinical records were completed during the time the patient was hospitalized, as each different stage of delivery and puerperium took place. The patient's history and the result of the physical examination, were recorded at admission. A summary of labor and delivery, as well as some information on the newborn was filled out immediately after delivery. At the time of discharge the final data on the patient and the baby were registered and the clinical records were then edited by a physician.

As the hospital had between 30-40 deliveries a day, it was necessary to hire one person who was exclusively in charge of punching and verifying the data from the obstetric forms. The data were stored on computer tapes until the opportunity for analysis arose.

For the purpose of this paper, we consider marital status, years of schooling and pre-natal care as independent variables, and the proportion of pre-term deliveries and perinatal mortality as dependent variables. Marital status discriminates between women who are single, married, in common law union, separated or widowed. The last two alternatives were not taken into account for the analysis because of the relatively small number of cases in each one. Common law union was defined as a stable relationship of a couple living together but not legally married.

Years of schooling was defined as the last grade completed. The total number of completed grades were recorded with no intention of differentiating between the women who had attended regular high school and those who went to technical school. Three categories were considered for the analysis. The first group included illiterate women as well as those who had not completed more than

two grades, as previous experience had shown that the latter were also practically illiterate. The second group included women who had completed 3 to 8 grades that is, those with not more than elementary education, and the third group included women who had completed 9 or more grades that is, those with at least some high school education.

Pre-natal care was divided into good, poor and no pre-natal care. The definition of good pre-natal care (PNC) used at the BARROS LUCO-TRUDEAU Hospital was less demanding than the usual WHO definition: initiation of care before 5th month of pregnancy; at least 5 visits and the recording of at least body weight and blood pressure during every visit. Those with some PNC, but who did not fulfill these conditions were classified as "poor PNC". For the purpose of this study we grouped the women who did not have PNC and those with "poor PNC" together.

To define pre-term deliveries, we used the criteria of weeks of amenorrhea considering as pre-term all deliveries occurring before completing 38 weeks. All cases in which information on weeks of amenorrhea was ignored were eliminated as well as those with less than 30 weeks or with a newborn weighing less than 1000 gr. The usual definition of perinatal mortality was used, that is, the addition of late fetal mortality plus infant death during the first week after birth.

3 Data analysis

The first step was to edit the data by using a computer program that checked for inconsistencies and illegal codes, the final analysis being initiated only after this stage was completed. The initial analysis consisted in studying the association of marital status and years of schooling with the proportion of pre-term deliveries and perinatal mortality. Only cases that had information for all the relevant variables were included. When the analysis was done controlling PNC, the cases without this information were not considered.

Statistical significance was tested by X^2 in Tabs. I through VI and by COCHRAN's method in all the others [1].

4 Results

The highest proportion of pre-term deliveries was found in the group made up of single women, followed by those in common law union, with the lowest proportion found among married women. The difference was significant with a $p < 0.001$ as shown in Tab. I.

Tab. I. Proportion of pre-term deliveries according to marital status.

Marital status	Pre-term deliveries		Term deliveries	Total births
	N ^o	%		
Single	552	26.0	1,573	2,125
Common law	264	24.0	838	1,102
Married	2,410	21.3	8,924	11,334
Total	3,226	22.2	11,335	14,561

$$X^2 = 25.29 \quad p < 0.001$$

The analysis of years of schooling and perinatal mortality showed a negative association, with the highest rate in the group of women with less education, and the lowest rate of perinatal mortality in the group of mothers with the highest education (Tab. II).

Tab. II. Perinatal mortality according to years of schooling (total group).

Years of schooling	Perinatal mortality		Live births	Total births
	N ^o	Rate/1000 live-births		
Up to 2 years	106	47.2	2,245	2,297
3-8 years	535	37.0	14,459	14,721
9 or more	71	29.5	2,409	2,443
Total	712	37.3	19,113	19,461

$$X^2 = 9.92 \quad p < 0.01$$

When the association between those sociological variables and PNC was studied, a clear cut difference between the two groups of PNC was found. Only 35% of the single women and 37% of those in common law unions had good PNC compared to 57% of the women who were married (Tab. III).

Tab. III. Pre-natal care according to marital status.

Marital status	Good PNC		Poor/ no PNC	Total births
	N ⁰	%		
Single	665	35.1	1,213	1,868
Common law	354	36.7	611	965
Married	5,581	57.0	4,209	9,790
Total	6,590	55.2	6,033	12,623

$$X^2 = 403.5 \quad p < 0.001$$

Forty percent of the women with little or no education had good pre-natal care in comparison to 48% of those with 3 to 8 years of schooling and 53% of women in the higher education group (Tab. IV).

Tab. IV. Pre-natal care according to years of schooling.

Years of schooling	Good PNC		Poor/ no PNC	Total births
	N ⁰	%		
Up to 2 years	788	39.9	1,188	1,976
3-8 years	6,033	47.9	6,561	12,594
9 or more	1,090	52.8	974	2,064
Total	7,911	47.6	8,723	16,634

$$X^2 = 70.18 \quad p < 0.001$$

On the other hand, pre-natal care also shows a strong correlation with the proportion of pre-term deliveries and with perinatal mortality (Tabs. V and VI). In view of these crossed correlations a new analysis of the relation between the independent variables and perinatal outcome was made, each one being controlled by the others, using COCHRAN's method.

Tab. V. Pre-term deliveries according to pre-natal care.

Pre-natal care	Pre-term deliveries		Term deliveries	Total births
	N ⁰	%		
Poor/no PNC	1,594	26.4	4,439	6,033
Good PNC	1,137	17.3	5,453	6,590
Total	2,731	21.6	9,892	12,623

$$X^2 = 156.1 \quad p < 0.001$$

Tab. VI. Perinatal mortality according to pre-natal care.

Pre-natal care	Perinatal mortality		Live births	Total births
	N ⁰	Rate/ 1000 livebirths		
Poor/no PNC	359	42.0	8,552	8,723
Good PNC	192	24.6	7,809	7,911
Total	551	33.7	16,361	16,634

$$X^2 = 36.93 \quad p < 0.001$$

Tab. VII shows that there is a highly significant difference in the proportion of pre-term deliveries found in the women with good PNC compared with those with poor or no PNC, that the difference was observed in the three groups of marital status, and that the association between PNC and proportion of pre-term deliveries is significant. The proportion of pre-term deliveries remains significantly higher in single women with poor or no PNC compared to married women in the same PNC group, but the difference for marital status was no longer significant among women with good PNC. The standardized difference for the whole

Tab. VII. Proportion of pre-term deliveries according to marital status in women with good or poor/no pre-natal care.

Marital status	Good PNC		Poor/no PNC		X ²	p
	No.	Proportion pre-term	No.	Proportion pre-term		
Single	655	.195	1,213	.289	18.75	.001
Common law	354	.175	611	.262	9.57	.005
Married	5,581	.170	4,209	.258	112.15	.001

$$X^2 \text{ total} = 141.02 \quad X^2 \text{ association} = 140.92 \quad x^2 \text{ homogeneity} = 0.10 \quad \text{COCHRAN's method}$$

group did not show a significant association between marital status and pre-term deliveries, and the effect was not homogeneous in the two groups of PNC (Tab. VIII).

When the women in common law unions were compared with married mothers in the same way, no difference in the proportion of pre-term deliveries was found (Tab. IX). As differences between the single and common law unions were even smaller, and there were fewer cases, the statistical analysis of that group was dispersed with.

Tab. X analyses the association between PNC and perinatal mortality, controlled by the women's

education. Perinatal mortality was significantly lower for good PNC among the newborn of women with elementary education, but the differences were not significant in the group with up to two years of schooling, nor in the group with at least some secondary education. However, the standardized difference for the whole group showed a significant association between PNC and perinatal mortality.

The difference in perinatal mortality between the women with up to 2 years of schooling and the group with at least some high school education, remained significant for those who had poor or no

Tab. VIII. Proportion of pre-term deliveries according to pre-natal care in single and married mothers.

Pre-natal care	Single		Married		X ²	p
	No.	Proportion pre-term	No.	Proportion pre-term		
Poor/no PNC	1,213	.289	4,209	.258	4.68	.05
Good PNC	655	.195	5,581	.170	2.58	N. S.

X² total = 7.26 (p < .05) X² association = 1.19 (N. S.) x² homogeneity = 6.07 (p < .05) COCHRAN's method

Tab. IX. Proportion of pre-term deliveries according to pre-natal care in married mothers and women living in common-law unions.

Pre-natal care	Common law		Married		X ²	p
	No.	Proportion pre-term	No.	Proportion pre-term		
Poor/no PNC	611	.262	4,209	.258	0.05	N. S.
Good PNC	354	.175	5,581	.170	0.06	N. S.

X² total = 0.11 (N. S.) X² association = 0.00 (N. S.) X² homogeneity = 0.11 (N. S.) COCHRAN's method

Tab. X. Proportion of perinatal deaths according to years of schooling in women with good or poor/no pre-natal care.

Years of schooling	Poor/no PNC		Good PNC		X ²	p
	No.	Rate/1000 live-births	No.	Rate/1000 live-births		
Up to 2 years	1,118	.046	788	.033	2.04	N. S.
3-8 years	6,561	.043	6,033	.024	38.29	.001
9 or more	974	.025	1,090	.019	0.86	N. S.

X² total = 41.19 (p < .001) X² association = 38.95 (p < 0.001) X² homogeneity = 2.24 (N. S.) COCHRAN's method

PNC, but was not significant for the women with good PNC. The standardized difference for the whole group was significant (Tab. XI).

The comparison of the women with 3 to 8 years of schooling with those with higher education also showed significant differences in perinatal mortality among those with poor or no PNC. However, the difference were not significant when PNC was good. Once again, the standardized difference showed statistical significance (Tab. XII).

Finally, no significant difference in perinatal mortality was found when women with up to two years of schooling were compared with those with 3 to 8 years of schooling, when the association was controlled by PNC (Tab. XIII).

5 Comments

The evidence that sociological variables such as marital status and education are important predictors of perinatal outcome is not new. The fact that being single and having a low education level represents a higher risk for the baby, has been well documented and it is not surprising that this has also been demonstrated by our data.

Our intention however, was to test the hypothesis that an appropriate PNC somehow changes the poor prognosis attached to illiteracy and to pregnancy in the absence of a responsible partner. Moreover, we intentionally defined good PNC at a level much easier to achieve in developing coun-

Tab. XI. Proportion of perinatal deaths according to pre-natal care in women with 2 years or less and with 9 or more years of schooling.

Pre-natal care	Up to 2 years		9 or more		X^2	p
	N_1	P_1	N_2	P_2		
Poor/no PNC	1,188	.046	974	0.025	6.61	.025
Good PNC	788	.033	1,090	0.019	3.67	N. S.

X^2 total = 10.28 ($p < 0.1$) X^2 association = 10.27 ($p < .01$) X^2 homogeneity = 0.01 (N. S.)
COCHRAN's method

Tab. XII. Proportion of perinatal deaths according to pre-natal care in women with 3–8 years and with 9 or more years of schooling.

Pre-natal care	3–8 years		9 or more		X^2	p
	N_1	P_1	N_2	P_2		
Poor/no PNC	6,561	0.043	974	0.025	7.16	.01
Good PNC	6,033	0.024	1,090	0.019	1.03	N. S.

X^2 total = 8.19 ($p < .025$) X^2 association = 7.42 ($p < .025$) X^2 homogeneity = 0.77 (N. S.)
COCHRAN's method

Tab. XIII. Proportion of perinatal deaths according to pre-natal care in women with 2 years or less and 3 to 8 years of schooling.

Pre-natal care	Up to 2 years		3–8 years		X^2	p
	N_1	P_1	N_2	P_2		
Poor/no PNC	1,188	.046	6,561	0.043	.22	N. S.
Good PNC	788	.033	6,033	0.024	2.31	N. S.

X^2 total = 2.53 (N. S.) X^2 association = 1.47 (N. S.) X^2 homogeneity = 1.06 (N. S.) COCHRAN's method

tries, than the usual minimal standard proposed by international organizations. Instead of the usual requirement of 8 to 12 visits, starting before the third month of pregnancy, with physicians' participation at least in the first and in several of the last visits, we established only 5 visits, starting before the fifth month and did not require the presence of a physician.

Even though the definition of good PNC is not as demanding as that of the World Health Organization, a significantly better perinatal outcome was observed in the group with good PNC. The perinatal death rate was approximately half in this group and the proportion of pre-term deliveries was one third of the one observed in the group with poor or no PNC. That association remained significant after being controlled by the mothers' marital status and education.

Even more important is the fact that when the association between marital status and the proportion of pre-term deliveries was tested controlled by PNC, the influence of the social factor practically disappeared in the group of women with good PNC, remaining significant among the mothers who did not attend the pre-natal clinic or who did not have adequate care.

Similarly, perinatal mortality continued to be significantly higher for the groups of mothers with less than high school education, as compared with those with at least one year of high school, but only when they did not have PNC or it was inadequate. In the groups with good PNC, the difference between the women with less than high school education and those with one or more years of high school was never significant.

Our interpretation of the data is that the influence of a stable union and better education over perinatal outcome cannot be denied, but that a good pre-natal makes that difference insignificant, com-

pensating for the other factors that explain the different perinatal outcome in the groups without PNC.

The choice of the proportion of pre-term deliveries as one of our dependent variables was not by chance. We had previously found an association between years of schooling and 'child survival', defining the last as the number of children presently living divided by the number of deliveries for a given woman [5]. We also know that infant mortality relates very strongly with pre-term births. As we did not have any way to study infant mortality from our data, we decided to select the proportion of pre-term deliveries as at least a weak indicator of bad prognosis for the first year of life. To us, there are some practical conclusions derived from our results. No one could think of diminishing the importance of improved education and stable families on perinatal and infant health. Without forgetting this, and as better social levels are achieved, we still have a factor that will improve the chances of single and uneducated women having a live and healthy baby, that is to carry out more efforts to bring them to the pre-natal care clinics by establishing primary health stations closer to where they live in large cities and rural areas. We also believe to have shown that neither high technology nor costly specialists are needed to reduce perinatal risk, when the level of perinatal mortality is as high as is usually the case in developing countries. The simple equipment to measure body weight and blood pressure, and a trained midwife, are sufficient to produce a very great impact. It is only after the levels of perinatal mortality of the rich countries have been reached that the use of more sophisticated equipment may have some public health impact on perinatal indicators.

Summary

The association between mother's education and perinatal mortality, and between marital status and proportion of preterm deliveries was analyzed using data from 20,000 women and newborns delivered at the Hospital BARROS LUCO-TRUDEAU in Santiago, Chile.

A highly significant correlation was found, but after being controlled by pre-natal care, that association dis-

appeared for those mothers with good pre-natal care, remaining only as a part of the association for women who did not attend the pre-natal clinics or did not follow minimal standards of care.

The definition used for "good pre-natal care" was much less demanding than WHO recommendation. We required a minimum of only 5 visits, starting before the 5th month

of the pregnancy and with blood pressure and body weight registered at each visit. Pre-natal assistance was provided mostly by registered midwives, with occasional consultation by physicians.

The efficiency of a low cost health activity, such as pre-natal care, in improving infant health is held in contrast with the inefficiency of high cost technology when applied to developing countries' health problems.

Keywords: Marital status, perinatal mortality, pre-natal care, schooling.

Zusammenfassung

Zusammenhang zwischen Familienstand und Schulbildung der Mutter und perinatalen Komplikationen; Einfluß der Schwangerenvorsorge als entscheidende Variable

Uns interessierte der Zusammenhang zwischen mütterlicher Schulbildung und perinataler Mortalität sowie zwischen dem Familienstand der Mutter und dem Anteil an vorzeitigen Entbindungen. Wir analysierten die Daten von 20000 Frauen und ihren Neugeborenen, die im Hospital BARROS LUCO-TRUDEAU in Santiago, Chile entbunden wurden.

Die Korrelation schien zunächst hochsignifikant. Nachdem aber ein weiterer Parameter, die Schwangerenvorsorge, mit einbezogen wurde, ließ sich der beschriebene Zusammenhang nicht mehr nachweisen, sondern galt dann nur noch für die Frauen, die keine Schwangerenvorsorge-

einrichtung aufgesucht haben und im allgemeinen keine Vorsorge betrieben haben.

Bei der Beurteilung der Schwangerenvorsorge blieben wir hinter der WHO-Empfehlung zurück; für uns genügte eine mindestens 5malige Teilnahme, wovon das erste Aufsuchen vor dem 5. Schwangerschaftsmonat geschehen sollte. Bei jedem Besuch sollten Blutdruck und Körpergewicht kontrolliert werden. Die Beratung erfolgte durch ausgebildete Hebammen, gelegentlich wurden Ärzte konsultiert. Es zeigt sich, daß eine kostengünstige Gesundheitsmaßnahme wie die Schwangerenvorsorge sehr effizient sein kann, um die kindliche Mortalität und Morbidität zu senken, während eine kostenintensive Technologie, auf die Gesundheitsprobleme der Entwicklungsländer angewandt, ineffizient ist.

Schlüsselwörter: Familienstand, perinatale Mortalität, Schwangerenvorsorge, Schulbildung.

Résumé

Relation du statut marital et du degré de scolarisation avec le devenir périnatal: L'influence des soins pré-nataux en tant que variable intermédiaire

Les relations entre l'éducation maternelle et la mortalité périnatale, et entre le statut marital et la proportion d'accouchements prématurés, ont été analysées à partir des données fournies par l'étude de 20000 femmes et de leurs nouveaux nés, ayant accouchées à l'Hôpital BARROS LUCO-TRUDEAU de Santiago du Chili.

Une corrélation hautement significative a été trouvée, mais après étude de la surveillance prénatale, cette corrélation disparaît chez les mères qui ont eu des soins prénataux satisfaisants et elle ne persiste que partiellement pour les femmes qui n'ont pas subi de surveillance clinique

ou qui n'ont pas bénéficié d'un suivi minimum. Les critères utilisés pour déterminer les soins pré-nataux satisfaisants sont de loin inférieurs à ceux recommandés. Les auteurs exigent un minimum de seulement 5 visites, débutées avant le 5ème mois de grossesse, avec prise de la P.A. et contrôle du poids lors de chaque consultation. La surveillance prénatale est assurée essentiellement par des sages-femmes diplômées, avec consultation occasionnelle auprès des médecins.

L'efficacité d'une action de santé de faible coût, telle que la surveillance pré-natale, sur la santé infantile, contraste fortement avec l'inefficacité de la technologie de haut coût mise en oeuvre pour les problèmes de santé des pays développés.

Mots-clés: Etat marital, mortalité périnatale, surveillance pré-natale, scolarisation.

Bibliography

- [1] ARRIAGA, E., K. DAVIS: The pattern of mortality change in Latin America. *Demography* 6 (1969) 223
- [2] BAIRD, D.: The influence of social and economic factors on stillbirths and neonatal deaths. *J. Obstet. Gynaec. Brit. Emp.* 52 (1945) 339
- [3] BEHM, H., D. A. PRIMANTE: Mortalidad en los primeros años de vida en la American Latina. *Notas de Población.* 6 (1978) 23
- [4] CALDWELL, J. C.: Education as a factor in mortality decline. An examination of Nigerian data. *Population Studies.* 33 (1979) 395
- [5] FAUNDES, A., E. HARDY, G. HENRIQUEZ: Escolaridad y conducta reproductiva. *Cuadernos Medico-Sociales.* 12 (1971) 18
- [6] FEDERICK, J., A. B. M. ANDERSON: Factors associated with spontaneous pre-term birth. *Brit. J. Obstet. Gynaec.* 83 (1976) 342.

- [7] FLEISS, J. L.: Statistical methods for rates and proportions. John Wiley & Sons, New York 1973
- [8] KINCALD, J. C.: Social pathology of foetal and infant loss. Brit. Med. J. 1 (1965) 1057
- [9] NORBERG, O., P. PHILLIPS, G. STERKY: Action for Children. Towards an optimum child care package in Africa. The Dag Hammarskjöld Foundation. Uppsala 1975
- [10] THOMSON, A. M.: Prematurity: Socio-economic and nutritional factors. Modern Problems in Pediatrics 8 (1963) 197

Received February 20, 1981. Revised June 23, 1981.
Accepted September 3, 1981.

Dr. Anibal Faundes
Caixa Postal 1452,
13100 Campins, S. P.,
Brazil