Arch Public Health
1998, 56, 263-273

Prenatal care use, perinatal and infant mortality in Portugal An area-level analysis

by

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Abstract

This study describes differences in district utilization and content of prenatal care services in Portugal and its relation with perinatal and infant mortality. A sample of 1,582 deliveries in 41 public hospitals, grouped according to 19 districts of residence, was evaluated to obtain a quantitative characterization of care. Use of prenatal care was classified as no care, late care, and inadequate care and self-reported information on screening for hepatitis B surface antigen (HBsAg) was used as a surrogate for content of care. Linear regression and multiple regression analysis were performed to identify the contribution of prenatal care for the district variation in perinatal and infant mortality. Portuguese districts presented significant differences in prenatal care utilization. District perinatal mortality was related with the proportion of women without information on HBsAg screening ($\beta = 0.11$, p = 0.025) but not significantly correlated with quantitative indexes of care. After accounting for the significant effect of the proportion of women less than 19 years and with adverse obstetric history, the proportion of women with no care or without information on HBsAg screening were independent predictors of the district variation in

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infant (β = 0.33, p = 0.016; β= 0.10, p = 0.031, respectively) and neonatal mortality (β = 0.24, p = 0.048; β = 0.10, p = 0.013, respectively). Postneonatal mortality was associated with the proportion of women with no care (β = 0.14, p = 0.034) after adjusting for the proportion of less educated women. In Portugal, there are significant district disparities on the use and content of the freely available prenatal care services that show a relation with local rates of perinatal and infant mortality.

Key-words

Districts, ecological study, infant mortality, prenatal care, perinatal mortality, Portugal.

Introduction

Accumulating evidence links prenatal care to healthier mothers and newborns and it is generally accepted that some prenatal care is better than none, early prenatal care is better than late, and adequate prenatal care is better than inadequate (1).

Much of what is known about the role of prenatal care in the prevalence of low birth-weight and other adverse pregnancy outcomes that affect perinatal and infant mortality, is based on person-level analysis (2, 3). Maternal and infant health indexes are not uniformly distributed among human groups or geographical areas (4-7), and factors operating at an individual level do not necessarily provide information on the impact of measures reflecting general policies. The use of ecological analysis was thus suggested to evaluate the effectiveness of community intervention programs aimed to improve the quantity or the quality of prenatal care services (2) or, more generally, to assess the public health importance of group exposures and outcomes (8).

The objective of this study was to describe district utilization of prenatal care services in Portugal and to investigate the relation between district prenatal care use and perinatal and infant mortality.

Participants and methods

To obtain a quantitative characterization of prenatal care use in Portugal, a survey of women admitted for delivery was proposed in 1994 to the 50 major public hospitals providing obstetric care in the country.

Forty-one hospitals agreed to participate in the study and information was gathered for 1,582 women, interviewed by the obstetrician in charge, 24 to 48 hours after delivery, using a structured questionnaire. Though most hospitals recruited 40 women as initially proposed, few contributed with a smaller number due to local difficulties in maintaining the required consecutive sample. All women delivered during the study period were interviewed and the duration of enrolment varied according to the number of deliveries occurring in each hospital (5 to 20 days), during November/December.

In Portugal, most women are delivered at a hospital located in their district of residence. However, due to personal preference or referral criteria the hospital for delivery may belong to another district. As vital statistics are computed according to place of residence and prenatal care was received in the area of residence, women were grouped by district of residence. Nineteen geographical analysis units were used, representing all continental districts and Azores islands therefore considered as a district.

Data on district perinatal and infant (neonatal and postneonatal) mortality was obtained from published Portuguese vital statistics (9; table 1) and the rates calculated according to World Health Organization definitions. Rates for 1989 were chosen because it was the last year with information available at district level, and thereafter vital statistics were published according to seven administrative regions.

According to Kotelchuck's Adequacy of Prenatal Care Utilization Index (10), use of prenatal care was classified as inadequate, intermediate, adequate and adequate plus. This index combines the month of initiation of care and the percentage of recommended visits adjusted for the gestational age at initiation of care and for gestational age at delivery. The number of recommended visits proposed by the Portuguese health authorities was used to construct the index. Inadequate care corresponds to initiation of care after the fourth month of gestation or less than 50% recommended visits. Additionally, women were also classified as having no care (no visits during pregnancy) or late care (prenatal care beginning after the first trimester).

In Portugal, maternal screening for hepatitis B surface antigen (HBsAg) is by law, part of prenatal surveillance because immunization of newborns of positive mothers should be done within 24-48 h after birth. Thus, information on maternal HBsAg status is requested at admission, and if not available the infant will have immunization as for a new-born of a positive mother. Participants were asked if a test for HBsAg was per-

TABLE 1
Mortality rates according Portuguese districts

Districts	Infant Mortality per 1000	Neonatal Mortality per 1000	Postneonatal Mortality per 1000	Perinatal Mortality per 1000
Aveiro	11.0	6.6	4.4	12.2
Beja	5.3	2.9	2.4	8.7
Braga	15.1	10.7	4.4	17.0
Bragança	16.6	11.1	5.5	14.9
Castelo Branco	13.6	11.7	1.9	22.3
Coimbra	9.8	5.7	4.1	12.5
Évora	10.2	8.5	1.7	15.8
Faro	12.7	8.5	4.2	14.9
Guarda	18.4	11.7	6.7	19.2
Leiria	8.2	5.5	2.7	11.2
Lisboa	9.9	6.6	3.3	14.0
Portalegre	12.8	10.5	2.3	14.9
Porto	14.7	9.6	5.1	15.3
Santarém	9.2	6.2	3.0	12.9
Setubal	7.7	4.5	3.2	10.4
Viana do Castelo	14.3	9.3	5.0	15.6
Vila Real	14.6	9.2	5.4	16.2
Viseu	12.0	7.2	4.8	13.7
Açores	14.3	9.0	5.3	18.6
Total*	12.1	8.1	4.0	14.6

*The total mortality includes Madeira district not included in this study.

formed during the prenatal period, and the possible answers were yes, no or unaware of the procedure. As a surrogate for the local content of care we used the district proportion of women that presented themselves to admission without information on screening for HBsAg, either reflecting that the procedure was not performed or they were unaware of it. In both cases women need to be treated as potentially infectious.

For each district we calculated the proportion of women presenting characteristics that could confound the relation between prenatal care and mortality indexes: proportion of women younger than 19 years, older than 34 years, with low educational level (0 to 4 years of formal education), with high educational level (more than 12 years), single, smokers, primiparous, parous with 3 or more previous gestations, with an adverse obstetric history (one or more past events such as: preterm birth, abortion, fetal death, neonatal death, congenital abnormalities or infertility), with unplanned pregnancy, and with private obstetric prenatal care.

Pearson correlation coefficients between the independent variables were calculated to assess possible collinearity (11). In the presence of collinearity, one of the affected variables was eliminated from the model based on the importance of each of them to the hypothesized relation, the strength of its association with the dependent variable, and the accuracy of the data used to construct the variable.

Simple linear regression was used to assess the regional relation between perinatal or infant mortality rates and the proportion of women that presented the characteristics used as exposure measures of prenatal care. Multiple regression analysis was performed to adjust for the effect of confounders previously identified using a stepwise multiple regression procedure through forward addition and backward deletion of variables (12). In results section the partial regression coefficients (β) represent changes per 1,000 live births, except for perinatal mortality (per 1,000 fetal deaths + live births).

Results

In this sample, the median number of prenatal visits was 8 ranging from 0 to 30 visits. Overall, 2.7% of the women had no prenatal care and 18.0% began care after the first trimester; 15.3% had inadequate care, and 38.9% presented adequate and 13.7% adequate plus care.

There were significant differences in prenatal care utilization across Portuguese districts (table 2). Percentages of women with no care ranged from 0.0% to 13.6%, the proportion of late care ranged from 2.6% to 29.1%, and that of inadequate care from 8.1% to 27.0%.

There was a significant district correlation between the proportion of women with no prenatal care and the proportion of unplanned pregnancies ($r = 0.62$; $p = 0.004$), single women ($r = 0.44$; $p = 0.058$) and primiparous women ($r = 0.55$; $p = 0.015$). Late care was inversely related with the proportion of women seeking private obstetric care ($r = -0.59$; $p = 0.008$) and single women ($r = -0.43$; $p = 0.064$). The district proportion of women with inadequate care was directly related to the proportion of women younger than 19 years ($r = 0.58$; $p = 0.009$), primiparous ($r = 0.49$; $p = 0.034$) and with unplanned pregnancies ($r = 0.43$; $p = 0.066$). The district proportion of women not screened for HBsAg or unaware of the screening was related to the proportion of primiparous women ($r = 0.50$; $p = 0.031$) or those with past adverse obstetric history ($r = -0.42$; $p = 0.075$). For the other characteristics assessed only weak non significant associations were found.

TABLE 2

Prenatal care in a sample of Portuguese women measured as district proportion of no care, late care, inadequate care and women without information on HBsAg screening

	No prenatal care	Late prenatal care*	Inadequate care (10)**	No information on HBsAg screening
Districts (N)	n (%)	n (%)	n (%)	n (%)
Aveiro (108)	1 (0,9)	14 (13.3)	10 (9.7)	13 (12.0)
Beja (45)	0 (0.0)	8 (17.8)	7 (16.7)	4 (8.9)
Braga (152)	4 (2.6)	21 (14.5)	16 (11.1)	20 (13.2)
Bragança (22)	3 (13.6)	2 (11.8)	4 (25.0)	12 (54.5)
Castelo Branco (91)	3 (3.3)	25 (29.1)	15 (17.4)	33 (36.3)
Coimbra (72)	0 (0.0)	19 (27.5)	9 (13.2)	15 (20.8)
Évora (35)	0 (0.0)	2 (6.3)	3 (12.5)	5 (14.3)
Faro (40)	3 (7.5)	6 (16.7)	10 (27.0)	7 (17.5)
Guarda (43)	5 (11.6)	10 (26.3)	9 (20.9)	13 (30.2)
Leiria (71)	1 (1.4)	14 (20.6)	7 (15.9)	5 (7.0)
Lisboa (156)	3 (1.9)	28 (18.5)	27 (18.4)	25 (16.0)
Portalegre (43)	3 (7.0)	1 (2.6)	9 (22.0)	15 (34.9)
Porto (186)	3 (1.6)	20 (11.2)	17 (9.7)	17 (9.1)
Santarém (115)	2 (1.7)	15 (13.4)	12 (12.1)	14 (12.2)
Setubal (117)	7 (6.0)	17 (16,2)	21 (20.8)	18 (15.4)
Viana do Castelo (39)	0 (0.0)	10 (26.3)	5 (13.5)	8 (20.5)
Vila Real (44)	0 (0.0)	7 (16.3)	3 (8.1)	7 (15.9)
Viseu (82)	2 (2.4)	22 (27.8)	14 (18.4)	19 (23.2)
Açores (121)	2 (1.7)	29 (25.7)	20 (18.7)	28 (23.1)
Total (1,582)	42 (2.7)	270 (18.0)	218 (15.3)	278 (17.6)
p***	< 0.001	< 0.001	< 0.001	< 0.001

* n = 1,499. Women with no prenatal care and 41 with missing information on month of first visit were excluded.

** n = 1,427, due to missing information on month of first visit, total number of visits or gestational age.

*** p-value for the comparison of proportions across districts for each type of indicated care.

Infant mortality was significantly correlated with the proportion of pregnant women with no prenatal care (r = 0.50; p = 0.028) and the proportion of women not screened for HBsAg (r = 0.56; p = 0.012). Neonatal mortality was also significantly correlated with the proportion of pregnant women with no prenatal care (r = 0.47; p = 0.040) and the proportion of women not screened for HBsAg (r = 0.62; p = 0.004).

In a multiple regression model, accounting for the significant effect of the regional proportion of women aged less than 19 years and those with adverse obstetric history, the proportion of pregnant women with no prenatal care remained an independent predictor of regional infant (β coefficient = 0.33) and neonatal (β coefficient = 0.24) mortality. The pro-

portion of women with unknown HBsAg screening status was also an independent predictor of infant (β coefficient = 0.10) and neonatal mortality (β coefficient = 0.10), after adjusting for the same variables (Table 3).

District postneonatal mortality variation was significantly explained by the local proportion of women with no prenatal care (β coefficient = 0.14; Table 3) adjusted for the proportion of less educated women (0-4 years of formal education).

No correlation was found between infant mortality, or its components, and the other evaluated indicators of quantitative prenatal care use. The only significant predictor of regional variation regarding perinatal mortality was the proportion of women without screening for HBsAg ($r = 0.47$; $p = 0.041$). The association remained significant even after adjustment for the proportion of smokers, less educated women and with a diagnosed pregnancy complication (β coefficient = 0.11; table 3).

Discussion

This study showed significant district differences in the use and content of care, that significantly correlates with the district rates of perinatal and infant mortality. Some points related to the methodology of the

TABLE 3
Association of proportion of no care and no information on HBsAg screening with district mortality rates using multiple linear regression

	β coefficient	p	Adjusted R^2 (p of the model)
Infant mortality			
no care (%)*	0.33	0.016	0.68 (0.0001)
no information on HBsAg screening (%)*	0.10	0.031	0.65 (0.0003)
Neonatal mortality			
no care (%)*	0.24	0.048	0.55 (0.002)
no information on HBsAg screening (%)*	0.10	0.013	0.62 (0.0005)
Postneonatal mortality			
no care (%)**	0.14	0.034	0.46 (0.003)
Perinatal mortality			
no information on HBsAg screening (%)***	0.11	0.025	0.59 (0.002)

* Adjusted for the proportion of women less than 19 years old and with adverse obstetric history.

** Adjusted for the proportion of women with low educational level.

*** Adjusted for the proportion of women with low educational level, smokers and with a diagnosed pregnancy complication.

investigation and the Portuguese prenatal care context deserve special attention.

In Portugal, approximately 95% of the deliveries occur in public hospitals (13). The hospitals that agreed to participate in this survey are responsible for more than 75% of those deliveries. They represent a homogeneous sample of the urban and rural areas of the country, either covering a whole area or serving both as local and referral hospitals. Also, the study sample distribution on mothers age, parity, marital status, gestational age at time of delivery and district of residence was not different from the published Portuguese demographic data concerning births for the same year (13).

During the last decades, Portuguese infant mortality presented a remarkable decrease from 77.5/1,000 in 1960 to 12.1/1,000 in 1989, but regional disparities still persist (table 1). The ecological analysis performed supports the hypothesis that differences in the content and utilization of prenatal care contribute to part of the district variation in mortality indexes. However, the number of districts limited the possibilities for multivariated analysis and influenced the stability of the associations. Additionally to the well known limitations of ecological data for inferring causality (14), the small sample sizes for some districts may affect the precision of the prevalence estimates of prenatal care utilization.

Earlier studies in other populations, both observational and preventive interventions, presented controversial relation between the utilization of prenatal care and rates of low birth weight, preterm birth or infant mortality, with some showing important reductions and others showing no benefit at all (3, 15-18). A critical step in the evaluation of such results is the type of index used for assessing care. As observed in this study, the different indicators do not correlate well, what probably shows that they measure or express different determinants. It remains unclear what factors associated with prenatal care influence the observed outcomes, and if the results can be attributed to the amount and content of care or to uncontrolled risk factors that might also affect the search for and the delivery of care.

Infant and perinatal mortality are the end result of a very broad and complex web of events, and though it is obvious that adequacy of prenatal care is not the solely explanation, our finding of an association between rates of infant or perinatal mortality and geographical asymmetries in prenatal care use seems plausible and favors the hypothesis that improvements in the regional quantity, quality or access to prenatal care might improve infant outcomes.

The relatively high proportion of women with no care and late care, in the absence of obvious financial restrictions, reveals the reality of barriers to care, and are not confounded by gestational age once its median value was 39 weeks compared to 40 weeks for women that began care earlier. These barriers need to be identified and removed in order to increase the efficiency of the health care system offered to pregnant women. Portugal is a country where pregnant women are entitled to free prenatal care. However, there has been no formal evaluation of the costs and the benefits of maternal and infant health programs, namely regarding its effects on the trends of low birth weight and mortality rates. Moreover, on a national basis no information is available concerning neither high risk women for missing prenatal care nor the measures to outreach them. Compared to other European countries ethnic differences do not account for variability in prenatal care take up because the Portuguese population is rather homogenous and in the present sample less than 0.5% women were not of Caucasian Portuguese ancestry.

At an individual level, different variables are associated with prenatal care use and have also been identified as predictors of preterm, low birth weight, and perinatal or infant mortality (1, 3, 18-21). However, the importance of the person-level relation does not necessarily reflect the impact of health factors or lifestyle modifications in the population. At a district level this investigation found that both prenatal care and mortality rates were significantly dependent on mother's age, education, marital status, gravidity, adverse obstetric history, pregnancy complications and pregnancy planning. These findings highlight the need to identify the independent role of prenatal care if investments on and the evaluation of community based programs to promote infant health are envisaged.

Perinatal mortality is traditionally regarded as a marker of the quality of care provided during pregnancy, delivery and the early puerperal phase. In this study no area-level correlation was found between quantitative indicators of prenatal care and perinatal mortality. This could be an unexpected finding particularly regarding the significant correlation obtained between no prenatal care and infant mortality. However, the proportion of women not informed about the antenatal screening procedure for HBsAg, the surrogate indicator used to approach information on the quality of care, was significantly associated with district perinatal mortality. This was also true for the other mortality rates and regardless of considering all women or excluding those without any visit (data not shown). As women were specifically asked if they knew that a screening test for HBsAg took place during prenatal visits, and hepatitis B is a sensitive

topic in Portugal nowadays concerning both woman and child health, the answer to this question was expected to give some indirect information about the extent to which the women were informed and receiving the recommended components of prenatal care. One may expect that using knowledge to measure content of care could be seriously confounded by education. However, the proportion of women answering no or ignoring the procedure was similar across education strata and was even highest for those more educated (> 12 years) but with quantitative inadequate care (data not shown). Our findings point to the fact that when the quantity of care is reasonably enough, the quality or the content of care get a predominant role if local health indexes need to be monitored.

This analysis of the first national survey on prenatal care performed in the country showed that part of the district variation on infant and perinatal mortality is probably explained by differences in the local content and utilization of prenatal care.

Acknowledgements

The skilful assistance of Ms Maria Luisa Abreu is gratefully acknowledged. Thanks are due to all the doctors in the participating hospitals for providing data on their patients.

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