The Impact of Social Determinants on Perinatal Outcome

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Abstract

The health of the pregnant woman has high impact over the health of her offspring. The social determinants of health are the circumstances in which people are born, grow, live, work and age. **Aim:** to evaluate the impact of few pre-pregnancy and social determinants on overall conceptual model of perinatal health. **Material and methods**: prospective cohort study evaluating preterm, SGA and LBW newborns in relation to social determinants in pregnant women at University Clinic for Gynecology and Obstetrics-Skopje**. Results**: the Relative Risk (RR) for delivering preterm baby (35-37 g.w. in unemployed mother is 2,96 with significant Confidence Interval, (1,86-4,71). If four more mothers are employed, there is a chance to get one preterm baby less, which means that this intervention could be beneficial for both. The Relative risk of delivering SGA baby in unemployed mothers is 1,98. The Relative risk to get preterm baby if BMI < 18 is 3,08 and is much higher than getting SGA baby (RR=1,85). The RR for delivering preterm baby and SGA baby at mothers with BMI >25 is 2,96 and 1,44 respectively. On the other hand, the RR for the both outcomes has no statistical significance independently whether the mother is living in rural or urban areas. **Discussion and Conclusion**: there is different impact of the social determinants on the perinatal outcome, and varying extent, depending on the country, social security, economic development. Many complementary actions should be undertaken by the Government, because the social determinants tackle every cell of the society.

Keywords: social determinant; newborn; perinatal; health; preterm baby; birth weight.

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1. Introduction

The importance of perinatal health lies in its strong influence on the short-term survival of the infant and on the other hand, setting important conditions for health in adulthood, shown in surveys published by Godfrey KM and Barker DJ, Wadhva, and Gluckman and his colleagues [1-3]. Thus, the health of the pregnant and delivering woman has an overall impact over the life course of her offspring. It is important to define the perinatal period, and its duration. In the literature there are few definitions, and all of them have fuzzy explanation. Hereby, some of them are presented.

The Perinatal Institute in UK as "Perinatal" describes the period surrounding birth, and traditionally includes the time from fetal viability from about 24 weeks of pregnancy up to either 7 or 28 days of life. Perinatal mortality covers perinatal deaths after 24 completed weeks of gestation and death before 7 completed days. According to the American Academy of Pediatrics [4], when comparisons based on gestational age are desired, the generally accepted breakdown is made in terms of the start and finish of this period, in general from 20 weeks and more up to 28 days after the birth. For the purpose of this paper, we have used the definition presented by the World Health Organization: The mostly explored definition is presented by the WHO, and it says that "the perinatal period commences at 22 completed weeks (154 days) of gestation and ends seven completed days after birth (www.who.int) [5]. It means, it is the period during the birth. This very influential period has an impact to the overall health, growth and development of the fetus and newly born child. Although the organogenesis has been completed, the perinatal period is not free of risk for the fetus and newborn, and is influenced by a myriad of risk and protective factors that affect women way before the pregnancy begins, during the pregnancy, birth and immediate short period after the birth, as [6] has presented in his paper. Thus, perinatal period is a subject of consideration in many of the Sustainable development goals, which deal with many areas of the social environment of the people, especially women and children. It is useful to mention the Report of the WHO in the World Health Statistics [7] which aimed to identify and collate evidence-informed policy options and recommendations for improving the social determinants of health and health inequities from international and intergovernmental organizations relevant to Member States of the WHO European Region. Social determinants of health (SDH) as defined by the WHO on the web site (www.who.int) are "economic and social conditions that influence the health of people and communities". The social determinants of health are the circumstances in which people are born, grow, live, work and age, which are shaped by the distribution of money, power and resources at global, national and local levels. It has been suggested that the social determinants of health are the fundamentalcauses for health disparities between and within countries. UNDP has linked social determinants with the maternal health as well [8].

Social determinants of health at this stage of life affect the child, the mother (especially during pregnancy, but also during early childhood) and the child's immediate family, with multiple interacting factors influencing early development and long-term outcomes. Spiegelman D. [9] has put efforts to calculate the risk of the impact of social determinants on the health during the early years, and has shown that there is a greatest potential to reduce the intergenerational transmission of poor health outcomes and health inequities.

In this context, there are plenty of papers investigating the influence of the socioeconomic, (pre-pregnancy)

factors on the perinatal outcome of the both, mother and her baby. All authors, particularly Aliyu MH and his colleagues [10] and Butta ZA at al [11] have advocated for the conceptual integration of multiple social determinants within a life course perspective for a better understanding of perinatal health outcomes, as well as for identifying potential ways to improve perinatal health.

A woman's social circumstances play a serious role in determining the health of her baby, and they include factors such as income and education level, social supports, physical environment and working conditions. Numerous studies, including the most extensive published by Kadir A. and his colleagues [12] have attempted to elucidate pregnant women with low level education and few social supports could have poorer birth outcomes than pregnant women with higher incomes, education levels and powerful social supports. Women with higher education are more likely to doing healthful behaviors, such as seeking early prenatal care, attending prenatal education and exclusively breastfeeding for at least six months. As well, the rates of preterm labor, small for gestational age, stillbirth, infant mortality, smoking, exposure to second-hand smoke and alcohol consumption during pregnancy all decrease once the level of mother's education increases, as was shown even in 1996 by Nordstrom ML and his colleagues [13]. The other previous study has reported that correction of Socioeconomic indicators alone were not associated with reduction in fetal growth or preterm delivery in lower or middle class women and psychological job demand was alone the weakest predictor for small gestational for age of infant. Education also enhances women's self-efficacy and has been associated with other predictors of safe maternity, such as use of contraception programs for birth control, better marital status relationships, and economic independence that all of these illustrating, confirming the close link between biological and social explanations, shown in surveys published by Antonovsky A and his colleagues, Cantaruty A at al, Dunn HG., and Joffre M. [14-17]. Lower social class consistently has been related to higher infant mortality rate and lower birth weight in a number of region and nations. Racial disparitiesin obstetrical outcomes are the main problem in developing countries that it has been manifested with consistent two fold increase in the infant mortality rate between minorities and dominant population.

Another group of studies led by Nair [18] has focused on inadequate access to medical care, in particular inadequate prenatal care. Epidemiological analyzes of preterm birth often consider multiple factors by "controlling out" social indicators as epidemiological confounders, but the assessment of the contributing role of each social determinant within the web of causation is frequently overlooked. In the real-world, health determinants act synergistically and in a cumulative way throughout the life span to produce the social gradient in adverse health outcomes. As was proposed by Butta ZA and his colleagues [19], there is a clear need for studies that incorporate multiple social determinants while assessing the interrelationships among determinants matched with the perinatal outcome.

Aside from these issues, several behaviors have been associated with preterm birth and low birth weight including: tobacco use, alcohol consumption (especially in early pregnancy), illicit drug use, maternal nutrition (being underweight before pregnancy, obesity), lack of physical activity, sexual activity, and douching before pregnancy, as presented clearly by Richard E and his colleagues [20]. Other determinants associated with maternal behaviors that have been associated to preterm birth include late or no prenatal care attendance and interconceptual spacing less than 6–months between giving birth and the beginning of the next pregnancy.

PTB and LBW represent significant public health problems for which a definite solution is still unavailable, and they have persisted over the years worldwide, which have been found to be strongly linked to social and economic disadvantage, thesis supported strongly by Wallace ME and his colleagues [21]. The literature still lacks an empirically tested models of perinatal health and morbidity that integrates the synergistic configuration of multiple determinants of perinatal health. An initial exploration of the interrelationships among multiple health determinants and key perinatal morbidity indicators (i.e. birth weight and gestational age) could serve as the pivotal point for further theoretical development and refinement in this area.

1.1. Rationale for the study

Based on what mentioned above, it is obvious that understanding the social determinants of health priorities is the first and most important step toward addressing and to some degree, solving them. Understanding and identifying the determinants of health can help us to know the entry points for action, and also characterizing them as necessary to achieve explicit health goals, including sustainable development goals. Nowadays, unfortunately, social determinants of fetal growth and pregnancy adverse outcome have been ignored in developing countries.

2. Aims of the study

Considering all of these, this paper was conducted to assess SES indicators and other social determinants of health and pregnancy outcome due to maternal characteristics and investigate the role of each determinant in pregnancy outcome, considering as outcomes premature birth (preterm birth, particularly of 35-37 gestational week), low birth weight (LBW, <2500 grams of BW), term and near-term babies, and small for gestational age (SGA) term and near term babies.

3. Material and methods

This study represents a part of a large, multicenter study conducted as prospective cohort study throughout the country, assessing the impact of a set of social determinants on the overall perinatal health, including the structure of neonatal morbidity and mortality. Particularly, the study explored the extent to which alternative conceptual models of the social determinants of health are capable of explaining birth outcomes, based on gestational age and birth weight in term and near term newborns in an ethnically diverse sample of pregnant women who are attending public tertiary maternity hospital, University Clinic for Gynecology and Obstetrics in Skopje during 2017.

Two tools for data collection were used in this study:

(1) the Social Determinants Questionnaire based on the sociodemographic and obstetric independent variables,

(2) a Childbirth Abstraction Tool, based on the prenatal and postnatal records of the participants, was used for assessing information on the past obstetric history, gestational age, birth weight, Apgar scores.

In order to evaluate the synergistic effects of the social position and intermediary social determinants on some perinatal outcomes, a prospective semi quantitative study was conducted using self-administered questionnaires with pregnant women during her stay in the maternity hospital. Versions of these instruments were available in two mainly spoken languages in the country, and additionally English, for foreign women. All instruments described were pilot tested with selected volunteers before conducting the study.

Social determinants explored were employment status, Body Mass Index (BMI) and place of living. The strand of research focused on obstetrical risk factors analyzes the role of maternal age and number of antenatal visits. Pre-pregnancy underweight and overweight represented by the Body Mass Index (BMI) have been implicated in increased risks of adverse pregnancy outcomes.

3.1. Population surveyed

Pregnant women, with singleton pregnancy, without pre-existing medical conditions who were admitted to the University Clinic for Gynecology and Obstetrics during the second half of 2017, who provided voluntary consent to participate in the study. For that purpose a recruitment sheet was designed with the following inclusion and exclusion criteria:

Inclusion criteria: upon enrollment, the patient had to be at least 34 gestational age pregnant, first pregnancy, pregnant with singleton (no twins or multiple), had to understand and sign the Institutional approved consent, had a well-estimated date of confinement from last menstrual period or ultrasound, and being able to communicate with the interviewer.

Exclusion criteria: patients who opted for elective pregnancy termination or delivery, medically indicated preterm delivery, women with chronic medical illness requiring long-term or intermittent drug therapy or frequent hospitalizations. Women with congenital uterine anomaly (malformation of the uterus), women with in-place cervical cerclage during the entire pregnancy and pairs mother/baby where the fetus showed evidence of congenital and/or chromosomal anomalies in the current pregnancy.

3.2. Pregnancy outcome

Two primary outcome variables were considered in this study: gestational age (in weeks of gestation), estimated using Dubowitz assessment scale (revision of Dubowitz L in 2005) [22], because this score has shown higher accuracy in the review presented by [23] and birth weight measured on digital scale (in grams). Apgar score was considered only in control group of healthy term and near term newborns, in order to exclude all confounding factors. Matching these two primary outcomes, the investigated group consisted of three subgroups (pregnancy outcomes):

- Preterm birth -the delivery before 37th gestational week, but ≥35 gestational week (35-37 weeks of gestation);
- SGA (Small for Gestational Age) - mean birth weight below the 10th percentile of weight for a given gestational age according to the National standard weight for age;

As control group were considered 300 participants, (pairs mother/baby) successively completed deliveries and criteria for eligibility met, where the baby had weight appropriate for the age (AGA babies), born between 38-41 gestational week, Apgar score in the first minute was >4 and Apgar score in the fifth minute was >7.

The statistical analysis comprised of descriptive methods and Relative Risk calculated for estimation of the risk to get adverse outcome in relation to predetermined social determinant (Preterm baby-PTB and Small for gestational Age-SGA baby). The statistical software used was MEDCALC.

Recruitment procedures comprised of strict rules acquired by the health professional staff during the training held before the survey started.

These combined (socioeconomic and obstetric) variables were investigated in the Questionnaire and health record: maternal employment status (employed/unemployed), BMI (<18; 18-24,9; >25), and place of living (urban/rural).

3.3. Limitations of the study

Although it was mentioned that this is a part of a large multicenter national study of great number of social determinants and more adverse perinatal outcomes, some of the imitations of this study were:

- small sample size, which gives ground for wide range of values and decreases the power of the statistical results;
- inclusion of few social determinants, which limits the real picture of the impact of social determinants and possibility to analyze them in the full context;
- the employment status of the mothers is not correlated with their level of education, which can distort the clear picture;
- the risk of the preterm baby can not get high statistical significance, due to the fact that the space between the births is not analyzed, and other issue is that were not included more immature newborns and those who have died in the perinatal period, and therefore it will be dificult to propose strategy for reducing the morbidity related to social determinants, considering that the group of newborns of <1500 grams birth weight are more prone to the impact of the social determinants;
- the ethnicity is not considered in this study, but considering that this is a sensitive issue, this determinant was analyzed in the larger study linked to other social determinants.

4. Results

During the surveyed period, following the eligibility criteria and recruitment process, 67 near term premature babies were born (35-37 gestational week), and newborns, and 243 Small for Gestational Age (SGA) babies.

The distribution of the patients related to all determinants and perinatal outcome in the surveyed groups were as follows in Table 1, Perinatal outcomes related to the social determinants.

Table 1: Perinatal outcomes related to the social determinants

		Control group, term AGA babies N=300	Preterm babies 35-37 g.w. N=67	SGA newborns N=243
Maternal employment status	Unemployed	105	45	158
	Employed	195	22	85
Place of living	Rural	112	28	92
	Urban	188	39	151
Body Mass Index	18,5-24,9	168	17	88
	<18,5	33	13	58
	>25	99	37	97

As the most relevant statistical parameter we identified Relative Risk (RR) for bad outcome, calculating the risk to get adverse perinatal outcome giving the certain social determinant. Statistical analysis for each perinatal outcome is performed and presented below, in Table 2. The Results have shown that the RR for delivering preterm baby (35-37 g.w.) in unemployed mother is 2,96 and there is significant Confidence Interval, (1,86-4,71), because both limits are over 1,0. If four more mothers are employed, there is a chance to get one more term baby instead of preterm, which means that this intervention could be beneficial for both. The Relative risk of delivering SGA baby in unemployed mothers is 1,98 and although not very high, it is significant because again the both limits of 95% CI are above 1,0. The Relative risk to get preterm baby if BMI < 18 is 3,08 and is much higher than getting SGA baby (RR=1,85). The RR for delivering preterm baby and SGA baby at mothers with BMI >25 is 2,96 and 1,44 respectively. On the other hand, the RR for the both outcomes has no statistical significance independently whether the mother is living in rural or urban areas.

Table 2: Statistical analysis for social and biological determinants in preterm (near term newborns in 35-37 week of gestation) and SGA babies

Exposition to risk (social determinant)	Comparison	Statistical parameter	Outcome: preterm newborn (35-37 g.w.)	Outcome: SGA baby
Unemployment	Employment	RR	2,96	1,98
		95% CI	1,86-4,71	1,62-2,42
		NNT	4	5
Rural place of living	Urban place of living	RR	1,16	1,01
		95% CI	0,75-1,80	0,84-1,23
		NNT	35	180
BMI < 18	BMI = 18-24,9	RR	3,08	1,85
		95% CI	1,61-5,87	1,47-2,33
		NNT	5	3
BMI ≥ 25	BMI = 18-24,9	RR	2,96	1,44
		95% CI	1,74-5,03	1,15-1,80
		NNT	6	7

BMI = Body Mass Index   95% CI = 95% Confidence Interval (lower limit-upper limit)

RR = Relative Risk   NNT= Numbers Needed to Treat

5. Discussion

The social position is determined by social stratifies such as socio-economic conditions, maternal education, occupation and employment, marital status, number of prenatal visits, adverse maternal behavior. Indicators of social and economic position, such as educational attainment, household income, and occupational status, have all been independently associated with increased risk of adverse pregnancy outcomes, including preterm delivery. Few studies consider the effect of maternal employment on pregnancy outcomes in the United States. A study by Savitz and colleagues even in 1999 [24] has explored the association of maternal occupation in relation to adverse pregnancy outcomes, including preterm birth, and the authors found that the textile workers had 1.5 greater odds of preterm delivery (OR=2.0), while clerks, teachers and librarians had reduced risks. The proportions of term SGA for the weight and the SGA for weight and length were 9.7 and 4.1% respectively. After adjustment for potential confounders, the risk of term SGA birth among less educated, unemployed, unmarried, smoking and underweight women was higher compared with women from the reference groups. Some of these results are in accordance with our findings. The employment status of the mother has shown higher impact on the risk of preterm delivery than for SGA baby. Unfortunately, Strategy for improving the employment rate is a long running pathway, and depends on many other interlinked activities within the Government at all. Therefore it is very difficult to improve such a determinant. In extensive study by [25] was shown data that maternal overweight and obesity have decreased the risk of SGA. In our study, maternal obesity has increased the Relative Risk more than twice for delivering either preterm (35-37 g.w.) or SGA baby. This social determinant is directly linked to the overall life style, which suggests that strategy for improving life style should be in place. Unfortunately, obesity (high BMI) is a social determinant which has high impact on the overall health, and future risk for non-communicable diseases. Also, this result indirectly implies to the inappropriate or insufficient antenatal control of the pregnant women, which could lead to many other adverse events during the pregnancy. Tennant got similar results to our study in terms of BMI and perinatal outcome [26]. In the study of Jennifer Lynn Leason [27], of five participants who struggled with financial stress and worry about money, three indicated they have experienced stress around not having enough food to eat and worry that their children were not receiving adequate nutrition. We have not completed yet the correlation of ethnicity with the perinatal outcome to compare it with literature data, but it seems that this determinant has an influence on pregnancy outcome {28-29]. A large body of evidence links education with health, even when other factors like income are taken into account [30]. Maternal marital status was evaluated, but not presented as it showed very few mothers were single parent having a child, and it didn't influence the overall results, although it was shown to be influential, as for example, PTB was increased among unmarried (OR 1.22, 95%CI 1.14-1.31) and single (OR 1.54, 95%CI 1.39-1.72) mothers, and SGA birth was increased among unmarried (OR 1.45, 95%CI 1.32-1.61), and single (OR 1.70, 95%CI 1.47-1.97) mothers. Meta-analyses of adjusted odds estimates confirmed these findings at marginally lower odds. Maternal unmarried status is associated with an increased risk of LBW, PTB and SGA births [31].

6. Conclusions

The results showed different impact of the social and biological determinants on the perinatal outcome. Compared to other studies, there is also difference in the extent of impact, depending on the country, social

security, economic development, etc. The level of influence is varying, but some actions have to be undertaken in order to improve the pregnancy outcome. Therefore, it is wise to extend the study by all means, bigger sample size in order to get higher statistical significance, include more social determinants which strengthens the study, and conduct it in different settings, nationwide. This is the best mode of getting strong evidence about the impact of the social determinants on the perinatal health, thus enabling the key stakeholders to focus activities towards improving health promotion, education of the women in reproductive age, implementing activities to improve employment rate, antenatal monitoring of the pregnancies, enhance education level of the women and health education about healthy nutrition and keeping good BMI. All these actions should be undertaken under the umbrella Health for all policy, and by effort put by the whole Government, because the social determinants tackle every cell of the society.

7. Recommendations

Excess risks in each of patients' groups and the differences between these groups require further investigation, but strategies targeting suboptimal birth weight and modifiable risk factors for congenital anomalies would be merited. It is recommended extension of the research on larger sample size as an imperative, in order to get higher statistical significance. Inclusion of more social determinants, and application of multiple regression method to work up majority of confounding factors would be also recommended. Segregation of the population on ethnical basis, aiming to identify potential racial and ethnical differences. It would be useful to use the same methods for smaller premature babies and died newborns, and thus correlate different adverse perinatal outcomes with diverse social determinants. It also recommended to investigate thoroughly the marital status as one of influential social determinants, and to find modes how to get exact data about the income and social state of the family as a whole.

The findings in this branch of study suggest that further research is needed into the causes of preterm birth with the aim of developing strategies for the prevention and management of preterm birth and the causes of iatrogenic preterm delivery in these mothers and their infants.

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