COMPARISON OF BIRTHWEIGHT PATTERNS IN RURAL MUNICIPALITIES WITH AND WITHOUT A ROMA COMMUNITY: A CROSS-SECTIONAL ANALYSIS IN SLOVAKIA 2009–2013

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SUMMARY

Objectives: The health of the Roma population is relatively poor and indicators on municipal level are needed to inform authorities to improve it. The aim of this study was to compare the rate of low birthweights (LBW) and mean birthweight (BW) in municipalities with minor Roma population (MMR) and municipalities with large Roma population (MLR) in Slovakia.

Methods: A population-wide, ecological level, cross-sectional study was conducted using data from 2009–2013. Data on proportions of newborns with LBW, on mean birthweight of newborns and on mean ages of mothers at birth were obtained from the National Health Information Centre of Slovakia. Rates of LBW and mean BW were compared between the MMR and MLR groups. Mean age of mothers and rates of unemployment were considered possible confounders.

Results: The mean BW was by 183 g higher in the MMR group compared to MLR; the rates of LBW were 4.2% and 8.9%, respectively. Increasing proportions of Roma were significantly associated with increasing rates of LBW and decreasing mean BW, one percent increase in the proportion of Roma was associated with an increase in LBW rate of 0.15% and a decrease in mean LBW of −4.9 grams.

Conclusions: Our findings could be used as a proxy for the purposes of policy making, replacing individual level studies with more resource-demanding design.

Key words: low birth weight, birth weight, Roma, reproductive health, public health, epidemiology

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INTRODUCTION

Due to substantially higher risk of death observed in children weighing less than 2,500 grams (1), the World Health Organization defined this weight as a cut-off to define low birthweight (LBW) (2). While most LBW newborns have normal outcomes, overall they have higher rates of suboptimal growth, illnesses, or neurodegenerative outcomes that can be apparent even in adulthood (3). Newborns with LBW are a heterogeneous group that includes newborns that are born pre-term, growth-restricted, or the combination of both. In general, LBW due to preterm birth has been associated with risk of death, morbidity and disability, and LBW due to restricted foetal growth has been associated with poor growth in later childhood and with higher likelihood of diseases such as type 2 diabetes, hypertension or cardiovascular diseases (2), although the causality of such relationships has been challenged (4). LBW as a relatively easily available measure (especially in high income countries) has been widely used as an indicator of both individual and population health (2, 4).

The Roma are diverse ethnic population group that is to a large extent concentrated in Central Europe and the Balkan countries — their estimated population in Slovakia is about 380,000 (5). Previous studies reported that their health status is substantially worse when compared to the general population (6–8). Although these disparities may be caused by a variety of factors such as poor hygiene (9), limited access to health care (10, 11), indoor environment or life style-related factors (12), a number of investigations suggest that socioeconomic factors are the main drivers (13–15).

Studies comparing LBW between the Roma and general populations have usually been designed as comparative between individuals sampled from the two populations, and are in general reporting lower average birthweights (6, 15, 16) and higher rates of LBW newborns (16, 17) in the Roma population. Targeted policies on different levels have been recommended as a key tool to any improvements (13–15). Formulation and implementation of such policies could be to an extent based on evidence from research conducted on the level of individuals. However, of key importance is to provide evidence on the level of administrative units such as municipalities or regions, as socioeconomic policies are best and most effectively targeted to such units rather than individuals (18). Therefore, our investigation, rather than focus-

ing on Roma individuals or the ethnic group as such, took the approach of outlining the situation on the level of municipalities. Our intention was to provide evidence on which targeted local level policies could be based. The aim of this study was to compare the rates of low birthweight, and to compare the mean birthweight in municipalities with and without major Roma population in Slovakia during the period from 2009 to 2013.

MATERIALS AND METHODS

Study Design and Setting

A population-wide cross-sectional study was conducted using aggregated data for the years 2009–2013. Proportions of LBW newborns of all livebirths and mean birthweights were compared in the population of Slovakia between municipalities with and without Roma minority. Proportion of Roma out of the total population of the municipality was considered the primary predictor of LBW. Mean age of mothers at the date of birth and proportion of registered unemployed people in the respective municipality were considered as possible confounders.

Participants and Variables

Proportions of newborns with low birthweight out of the total number of births, mean birthweight of newborns, and mean age of mothers at birth were obtained for the purposes of the study for each municipality in Slovakia between 2009 and 2013 (for each year separately). For this study, data were aggregated for all years and considered one dataset, rather than analyzed for each year separately.

All Slovakian municipalities were included in the analyses and were categorized into two groups based on the size of the population of Roma and the presence or absence of a segregated Roma village as part of the municipalities: municipalities with large Roma population (MLR) and municipalities with minor Roma population (MMR). The main factor for this grouping was the size of the Roma population in the respective municipality, as outlined in the Atlas of Roma Communities in Slovakia (ARCS) (19). This Atlas is an official government report outlining the distribution of Roma in Slovakia, the size of the respective Roma communities at municipal level, and their living conditions. The ARCS is based on a population-wide survey which included every municipality where a population of at least 30 Roma was assumed. In these municipalities a detailed survey and a census were conducted that fed data into the atlas. All municipalities that were included in the ARCS were considered to have a relatively large Roma community and were categorized as MLR. During the analyses, the relative number of Roma to the total population of the municipality (percent of Roma of the total population) was taken into account for the role of increasing proportion of Roma in the community. The municipalities that were not included in the ARCS survey were considered to have only a minor and well-integrated Roma population of less than 30 people and were categorized as MMR. Low birthweight was determined using the WHO standard (2): weight at birth less than 2,500 grams was considered low birthweight, newborns weighing 2,500 or more grams were considered normal.

Data Sources and Bias

Data on proportions of newborns with LBW, on mean birthweights of newborns and on mean ages of mothers at birth on municipality level were provided by the National Health Information Centre (NHIC) of Slovakia. Due to restrictions of data and privacy protection legislation, no data on individual level were made available for the study. All provided data were in an aggregated format (by municipality and year) and were extracted from the reports on newborns and reports on mothers that are routinely submitted to the NHIC by the respective health care providers.

It is known that the birthweights of newborns from multiple pregnancies (e.g. twins, triplets etc.) can be physiologically lower compared to single pregnancy newborns (2). In order to remediate the influence of this bias, only newborns from single born pregnancies were analyzed.

Proportions of LBW newborns could be disproportionately high in municipalities with low number of annual births (e.g. 50% proportion of LBW if one out of two births would be LBW newborn). The absolute number of births per municipality and year was not provided due to data protection, and thus to remediate this bias all municipalities with populations below 100 were excluded (in such municipalities low numbers of annual births could be assumed).

In addition, all municipalities with city status (total of 140) were excluded from the analyses in order to eliminate possible bias introduced by presumably better access to health care and other services in cities compared to rural municipalities.

After applying all the above restrictions, 2,515 out of the total of 2,927 municipalities officially registered in Slovakia were included in the analysis. Of these, 930 (37%) were included in the ARCS and detailed information on the Roma population were available.

Statistical Methods

The main line of analysis in this study is the analysis of influence of the presence and size of the Roma population in municipalities on the patterns of birthweight of newborns. For the purposes of such comparison, birthweight was analyzed in two forms: rate of low birthweight per municipality (e.g. percent of newborns with birthweight $<2,500$ g); and mean birthweight of all livebirths per municipality. Data on both indicators were provided for each year between 2009 and 2013 separately; for the purposes of all analyses mean values of each were calculated for the five-year period and these were used.

In the first step, rates of LBW and mean birthweights were compared between MLR and MMR municipalities. Secondly, ordinary least square regression models were fit using mean birthweight and rate of LBW as response variables and using the proportion of Roma in the municipality, mean age of mothers at birth in the municipality, and proportion of unemployed in the municipality as predictors.

All predictors were fit as univariate models and subsequently in combination as multivariable models (to control for confounding effects). All models were fit using two scenarios: only including municipalities with Roma populations (to evaluate the effects of the size and intensity of covariates on outcomes without the control population); and including all municipalities (to increase contrast and include control municipalities where the population

of Roma was assumed to be marginal and well-integrated). All analyses were performed using the R statistical software. For all analyses, routinely collected, secondary data were used, and no ethics committee approval was needed.

RESULTS

In total, 2,515 municipalities were included in the study, of which 930 (37%) were MLR. The median of proportions of Roma of the total population in the MLR group was 18.4% (IQR: 9.5–35.6%), the large span of IQR indicating that the distribution of Roma among the municipalities were relatively heterogeneous.

Table 1 shows the basic comparison of studied outcomes in the two compared groups and overall. These findings suggest the situation is worse in the MLR group: these municipalities have significantly higher (more than double) rate of LBW newborns and significantly lower mean birthweight (by about 200 grams), compared to the MMR group. The mean age of mothers was lower by 2 years in the MLR group and the rate of unemployment was higher by more than 5%, compared to the MMR group.

Linear regression models were fit to evaluate the association between mean birthweight and proportion of LBW newborns as exploratory variables and percent of Roma population in the municipality, percent of unemployment and mean age of mothers as predictors. Figure 1 shows the results separately for municipalities in the MLR group. Statistically significant associations

Table 1. *Comparison of studied birth outcomes, mean age of mothers and rate of unemployment in municipalities with large and minor Roma population*

Variable	MMR Mean (95% CI)	MLR Mean (95% CI)	Total Mean (95% CI)	p-value
Mean birthweight of newborns	3,350 (3,342–3,358)	3,167 (3,157–3,177)	3,282 (3,275–3,290)	< 0.001
Proportion of LBW newborns	4.16 (3.92–4.41)	8.94 (8.52–9.35)	5.92 (5.69–6.16)	0.003
Age of mothers	28.6 (28.5–28.7)	26.6 (26.5–26.7)	27.7 (27.6–27.8)	< 0.001
Rate of unemployment	7.29 (7.13–7.46)	12.95 (12.49–13.39)	9.19 (9.42–9.65)	< 0.001

LBW – low birth weight, MLR – municipalities with large Roma population, MMR – municipalities with minor Roma population, CI – confidence interval

Table 2. *Characteristics of univariate and multivariable models of associations between LBW rate and mean birth weights, and proportions of Roma, rates of unemployment and mean age of mothers*

	Predictor	Response variable					
		Rate of LBW			Mean BW		
		Beta	p-value	R^2	Beta	p-value	R^2
All municipalities	**Univariate models**						
	Proportion of Roma	0.16	< 0.001	0.22	−5.9	< 0.001	0.31
	Mean age of mothers	−0.86	< 0.001	0.09	35.6	< 0.001	0.18
	Rate of unemployment	0.41	< 0.001	0.14	−15.5	< 0.001	0.22
	Multivariable models						
	Proportion of Roma	0.15	< 0.001	0.23	−4.9	< 0.001	0.34
	Mean age of mothers	−0.12	0.053		10.8	< 0.001	
	Rate of unemployment	0.03	0.265		−1.8	0.049	
Only municipalities with Roma (MLR)	Predictor	Response variable					
		Rate of LBW			Mean BW		
		Beta	p-value	R^2	Beta	p-value	R^2
	Univariate models						
	Proportion of Roma	0.13	< 0.001	0.19	−4.5	< 0.001	0.36
	Mean age of mothers	−1.2	< 0.001	0.13	40.2	< 0.001	0.25
	Rate of unemployment	0.33	< 0.001	0.13	−11.8	< 0.001	0.26
	Multivariable models						
	Proportion of Roma	0.11	< 0.001	0.21	−3.5	< 0.001	0.4
	Mean age of mothers	−0.4	< 0.01		−1.2	< 0.001	
	Rate of unemployment	0.013	0.756		−1.2	0.197	

LBW – low birth weight, BW – birth weight

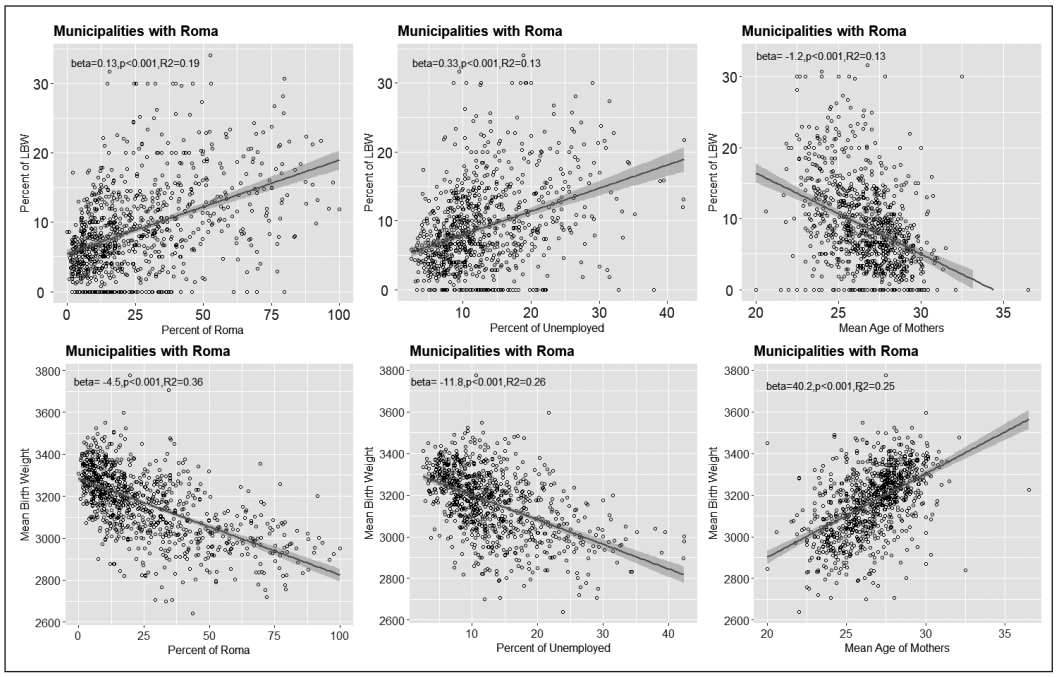

Fig. 1. *Associations between proportion of Roma, rate of unemployed and mean age of mothers, and rate of low birth weight newborns and mean birthweight in municipalities with large Roma population.*

LBW – low birth weight

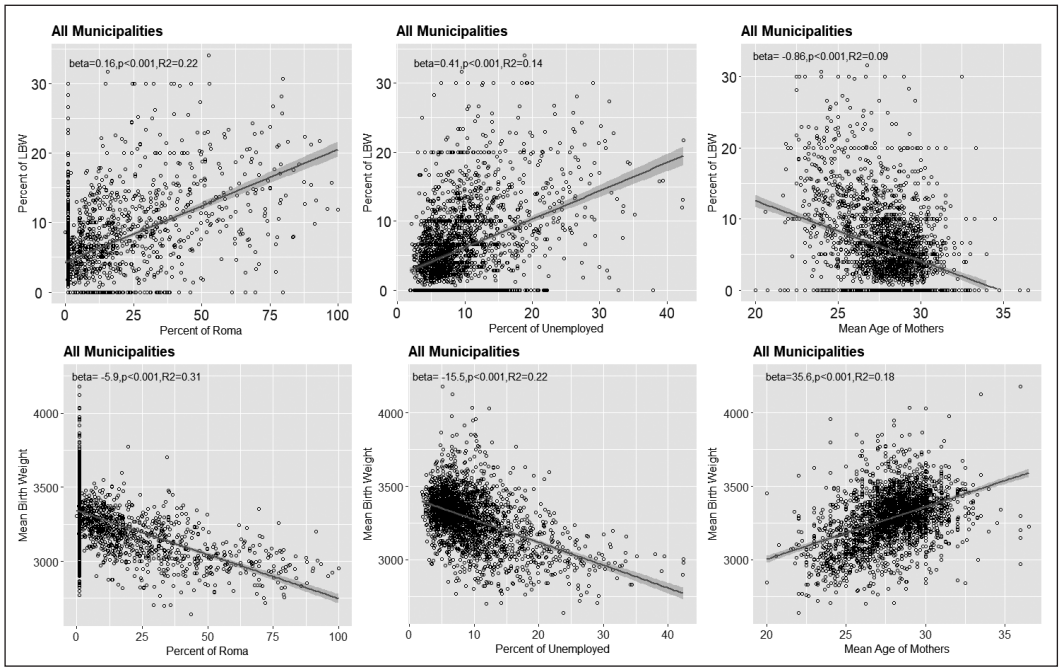

Fig. 2. *Associations between proportion of Roma, rate of unemployed and mean age of mothers, and rate of low birth weight newborns and mean birthweight in all municipalities.*

LBW – low birth weight

were observed in all models indicating that all three predictors are significantly associated with the studied outcomes. Figure 2 shows the same models fit using data from all municipalities (MLR and MMR at the same time). Again, all associations were significant. In general, addition of MMR municipalities in the models increased the contrast and thus in all these models the coefficients are larger (as compared to the models only including MLR countries).

In the same manner (e.g. separate for MLR and then all municipalities combined) multivariable models were constructed where all predictors considered in univariate analyses were included in the models at once. Table 2 shows both, the characteristics of the univariate models and the multivariable models. Analyzing only data for the MLR group and for all municipalities combined, the proportion of Roma displayed a significant effect on both outcomes even after adjustment for mean age of mothers and

rate of unemployment. Thus, proportion of Roma appears to be a strong predictor of both, rate of LBW and mean birth weight.

DISCUSSION

We conducted an ecological level cross sectional study in rural municipalities in Slovakia in order to analyze the association between the size of the Roma population and two birth outcomes: rate of LBW newborns and mean birth weight. We found that even after adjusting for potential confounders such as age of the mother and rate of unemployment (as a proxy of overall social and economic status), increasing proportion of Roma out of the total population in rural municipalities was significantly associated with increasing rates of LBW newborns and decreasing mean birth weight of newborns. A one percent increase in the proportion of Roma in the municipality was associated with an increase in LBW rate of 0.15% and with a decrease in mean LBW of –4.9 grams.

To our knowledge, this is the first study that relates LBW to the proportion of Roma population on the level of municipalities, and thus our findings are not directly comparable with previously published work. However, our findings are in line with studies reporting on birth outcomes in the Roma population versus the majority population on individual level. A study from the Czech Republic comparing 76 Roma women with 156 mothers from the majority population reported shorter pregnancy duration (by about 1 week), lower birth weight and shorter length of the newborns among Roma (15). Another study reported a median birthweight of 2,800 g in the Roma population, compared to 3,350 g in the majority population, when comparing 157 Roma mother-infant pairs with 1,335 non-Roma pairs (6). A study from Hungary, comparing 1,643 Roma newborns and 3,989 newborns from the majority population showed a birthweight of Roma being lower on average by 288.7 grams (16). Similarly, another study from the Czech Republic which compared 8,938 non-Roma and 1,388 Roma newborns reported the birth weight in the Roma group to be on average lower by 373 grams compared to the non-Roma (17). Also, substantially higher rates of LBW were observed when comparing a sample of newborns from Roma and non-Roma populations: 14.1% vs. 3.6% (17). Our study confirms these findings on the ecological level, showing the birth weight in municipalities with major Roma population to be on average lower by 183 grams, compared to municipalities without major Roma population and the rates of LBW being 8.9% vs. 4.2%.

The comparability of our findings with the results of individual level studies points towards the robustness of our method to indicate the differences in birth outcomes related to Roma ethnicity on the level of municipalities. Thus, using routinely collected data in a similar way could possible drive the development of policies targeted to improve reproductive health and overall health in the municipalities with large Roma population. Targeting regions, municipalities or other administrative units has been proposed to be more suitable to implement such policies than individual level action (18).

This study in general provides grounds for the discussion of possible unfair health inequalities in reproductive health between the Roma and majority populations in Slovakian municipalities. Although such consideration is beyond the scope of this study, we provide a good example of how routinely collected data can be used to outline such inequalities, which in turn may lead to better understanding of policy areas that need to be targeted in order to improve health of the Roma population in general and to start closing the health inequality gap between the Roma and majority populations.

Despite population wide coverage and compulsory reporting enforced by legislation, a number of factors could limit the provided data and subsequently our findings. First, data from municipalities where there was only one new birth in a year were not provided, as in such cases identification of persons would be possible. Second, data on births outside an official health care provider (e.g. at home) were not included. Due to these two factors, some cases were excluded from the analyses; however, even though it is not possible to estimate the exact number of excluded cases (the number of births at home is not officially recorded by NHIC, and the number of exclusions on grounds of low number of births was not provided), we do not assume that the overall findings of this paper would be influenced as a consequence in any major way. Third, the fact that we have analyzed only those municipalities for which we have had data on the size of the Roma population, could pose a bias. This could be present, if there was a systematically different association between the analyzed entities (e.g. in case the association between LBW and mean BW on one side, and the analyzed predictors and confounders on the other side would have a systematically different pattern, the observed effect could change, most likely to the null). However, we did not have the opportunity to test these presumptions, due to lack of data. In general, there may be bias imposed by possible inaccuracies of the data in the ARCS, but we were not able to identify or remediate them in any way. The birthweight could also be influenced by the sex of the newborn (somewhat higher BW in boys) and by the gestational age at birth. We are aware of these possible influences, but we were not able to analyze them in our study, as we did not have data to do so. All the above limitations must be kept in mind, when using and interpreting our findings.

CONCLUSIONS

The size of the Roma population in rural municipalities in Slovakia appears to be strongly associated with lower birthweight and higher rates of LBW on the ecological level of comparison. As our findings confirm those of individual level studies, our study design could be used as a proxy for the purposes of policy making, replacing individual level studies with more resource-demanding design.

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Conflict of Interests

None declared

Compliance with Ethical Standards

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national

research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. For this type of study, formal consent is not required.

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