RESEARCH ARTICLE

A survey of quality of life indicators in the Romanian Roma population following the 'Decade of Roma Inclusion' [version 1; peer review: 2 approved with reservations, 1 not approved]

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Abstract

Background: This study explores how the Roma in Romania, the EU's most concentrated population, are faring in terms of a number of quality of life indicators, including poverty levels, healthcare, education, water, sanitation, and hygiene.

Methods: 135 surveys were conducted across five geographically diverse Romanian communities. Household participants were selected through a comprehensive random walk method. Analyses were conducted on all data using Pandas for Python.

Results: These data indicate that the Roma in Romania face significant disparities in education, with Roma students less likely to progress beyond 8th grade. In addition, the Roma population remains significantly disadvantaged with regard to safe and secure housing, poverty, and healthcare status, particularly in connection to diarrheal disease. In contrast, however, both Roma and non-Roma in rural areas face difficulties regarding full-time employment, sanitation, and water, sanitation, and hygiene infrastructure.

Conclusions: These data demonstrate the challenges that remain to the Roma population in Romania, and also point to the myriad of ways in which all rural Romanians, regardless of ethnicity, are encountering hardship. This study highlights the areas in which improvements can be made to ensure the Roma, and indeed all Romanian citizens, have access to and confidence in sanitation services, clean water, and adequate healthcare treatment.

Keywords

Roma, Romania, rural populations, water quality, healthcare, development, global health, decade of Roma inclusion

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Introduction

In the years that followed independence from Soviet rule and the democratic election of 1990, the southeastern European country of Romania received significant aid from the International Monetary Fund (IMF), World Bank (WB), European Bank for Reconstruction and Development (EBRD), European Investment Bank (EIB), the US Agency for International Development (USAID), and other donors¹. This influx of investment enabled Romania to make great strides in multiple areas of development and meet a number of the goals set forth in the United Nations Millennium Development Goals (UN MDGs)². In particular, the issues of severe poverty and hunger have significantly improved for ethnic Romanians and affluent minorities, with severe poverty (as defined by the United Nations) decreasing from 10 per cent to 4.1 per cent as of 2006². In addition, maternal mortality has fallen by half to 17 deaths/100,000 births, infant mortality has decreased 25 per cent, and Romania has seen a significant decrease in adolescent pregnancy, concomitant with a significant increase in the use of modern contraceptives². Vaccination rates, particularly for measles, hover around 98 per cent, up from less than 70 per cent at the time of independence; HIV/AIDS cases have decreased and life expectancy for those living with HIV has increased dramatically; and there has been a significant decrease in domestic violence².

For the Roma, the second most numerous minority in the country (after Hungarians), however, such progress was not extended. Despite enjoying a reprieve from targeted discrimination during the Soviet era, Romanian independence brought on a renewal of oppressive policies and behaviours against the Roma. The Roma are Europe's most marginalised group³, a minority population numbering between 10–12 million individuals across the continent and the UK⁴. Emerging from slavery in the late 19th century, they have historically faced discrimination in employment, education, and access to healthcare⁵. Numerous studies indicate Roma have a significantly reduced lifespan compared to non-Roma and suffer greater rates of communicable and waterborne diseases^{6–8}. In multiple countries, they are less likely to have access to basic services, including a municipal water supply, waste water treatment, or trash disposal⁹, and they are routinely used as political scapegoats across the continent, from France to Moldova¹⁰. Romania boasts the largest concentration of Roma in the European Union (EU), at approximately 1.85 million individuals, representing 9.3 per cent of the overall population of 19.8 million, though official census numbers vary⁴.

The addition of eastern European countries (including Bulgaria, Romania, and Hungary) to the EU in the mid-2000s has renewed interest in the well-being of this population, as indicated by the EU's targeted attempt to improve the circumstances of the Roma through the recently concluded *Decade of Roma Inclusion* (DRI), a ten year long initiative by twelve European countries to improve the socio-economic status and social standing of the Roma minority across the continent¹¹. Numerous studies have explored the success of the DRI, both during its implementation and since its conclusion, and outcomes vary, depending on the sector and goal in question^{8,12–14}. This study has been prompted, in part, to explore how the EU's largest concentration of Roma are faring in terms of poverty levels, healthcare, education, and

water, sanitation, and hygiene (WASH), as well as to fill the gap in available literature that focuses solely on Romania. In particular, we examine the connection between physical WASH infrastructure relative to incidence of disease and overall health status.

Methods

Regional survey

Combining questions from a validated WASH survey previously used for multiple use service strategy research (MUS) in Burkina Faso (personal communication to *authors*) and the WHO core questions on drinking-water and sanitation¹⁵ with questions related to demographics, socio-economic status, and healthcare access and history, we conducted 135 surveys each consisting of 56 total questions across five geographically diverse communities throughout Romania. Communities were chosen at random from a list of those that had previously participated with *Agentia Impreuna* in education and anti-discrimination capacity-building programs for communities with prominent Roma populations. Household participants were selected through a comprehensive random walk method, with survey teams accompanied by both Roma and non-Roma community leaders. Any household with an individual over the age of 18 present and willing to participate, regardless of ethnicity, was included until the desired 30 surveys per community were achieved or there were no further willing participants. Interviews were conducted by trained volunteers who either spoke the national language (Romanian) or were accompanied by a certified translator. The team interviewed only one member of each household, who provided information about all members of the household.

Ethical statement

Surveys ([Supplementary material 1](#) and [Supplementary material 2](#)) and procedures were approved by the Virginia Tech Institutional Review Board (IRB) prior to study implementation (VT IRB #16-475), and all interviews and analysis were carried out according to IRB protocol.

IRB protocol and participant protections

Informed consent was obtained from all individual participants included in this study. A brief explanation of the survey questions and the intended use of the data was provided to each participant, and the individual's agreement to participate in the survey interview was considered consent, as indicated by the IRB protocol. Further, interviewers ensured each participant understood that he or she could refuse to answer any question and could withdraw their consent at any time. Survey participation was entirely anonymous, and no identifying information was obtained. In addition, the IRB stipulated that location data for the participating villages remain unavailable, due to the vulnerable population and minority status of some study participants. All demographic information was self-reported, and those who were considered part of the Roma sample self-identified as either Roma or Rudar (a sub-set of Roma people who do not speak Romani), in response to a question that explicitly asked for their ethnicity ([Dataset 1](#)).

Primary data analysis

All data analyses were conducted via Pandas with Python (version 2.7.11 & 0.18.0) notebook and the software package

Epipy^{16,17} (Dataset 2–Dataset 3). Descriptive statistics were broken down by community, ethnicity, gender, age, household size, education level, marital status, employment, literacy, and geographical description (urban *versus* rural). WASH parameters were defined using the UN descriptions as provided in the DRI progress report through 2013, as well as the addition of a ‘safe water score’, which included the option of a private, protected well water source in addition to tap water in the home¹¹. The overall WASH score for each participating household is an aggregate of the following UN parameters: indoor toilet (improved sanitation), indoor bathroom (improved sanitation II), piped water to tap (improved water source), and insecure housing (a 0–3 score reflecting the status of the floor, walls, and roof of a dwelling). The overall ‘WASH Safe’ score exchanged the improved water source parameter for the aforementioned safe water score. In addition, time to primary drinking water sources has been converted to a numerical scale, based on 15 minute intervals, up to one hour (0–4 scale). Distance to primary drinking water is indicated both by a percentage of those in each ethnic group who travel a kilometre or more and the average distance travelled by each group. Similar to the WASH score, the healthcare score is an aggregate of self-reported immunization, reported incidence of diarrheal event, access to primary care physician (PCP), and reported medical insurance status. Finally, the poverty score is an aggregate of available electricity in dwelling, available gas source in dwelling, and the UN indicator of severe poverty (surviving on 2USD/person/day or less). Univariate analyses compared the Roma sample to the non-Roma sample for each variable (using non-Roma as the reference population), as well as urban areas to rural ones (with urban areas as the reference population) for some parameters. Odds Ratios (ORs) with 95 per cent confidence intervals are reported, as are t-test results (95 per cent confidence interval) with accompanying p-value where appropriate.

Secondary data analysis and multivariate models

Multivariate linear regression analyses were conducted by using combinations of the four aggregate scores, as explained in primary analysis, and by including parameters that demonstrated significance in univariate modelling (Dataset 2–Dataset 3).

Results

Population demographics

Analyses of demographic data and breakdown by percentage indicate our sample population is, overall, predominantly Roma (72.6 per cent *vs.* 27.4 per cent non-Roma), split evenly by sex (50.4 per cent Female, 49.6 per cent Male), and average approximately 47 years of age (Table 1). Three of the five sample communities are rural (more than 25km from a city centre), one is suburban (between 10–25km from a city centre), and one is urban (less than 10km from a city centre). There is no significant difference between Roma and non-Roma in the sample population on the basis of marital status, age, or sex. However, our data indicate notable disparities in level of education (secondary school completion for Roma *vs.* high school completion for non-Roma), household size (5.3 individuals for Roma *vs.* 4.2 individuals for non-Roma), and literacy rate (61 per cent literate Roma *vs.* 97.4 per cent literate non-Roma) (Table 1). Little difference is noted in full-time employment rates between the groups (26.6 per cent Roma *vs.* 32.4 per cent non-Roma), though some difference is observable between rural and urban communities (Table 1).

WASH, healthcare, poverty parameters

Using parameters utilized by the DRI in the 2011 progress report, univariate analysis indicates little difference between Roma and non-Roma with regard to specific WASH variables. The non-Roma are slightly more likely to have an indoor toilet (21.6 per cent non-Roma *vs.* 17.3 per cent Roma) and bathroom (21.6 per cent non-Roma *vs.* 20.4 per cent Roma), but the Roma are more likely than non-Roma to have tap (indoor or outdoor) water (20.4 per cent Roma *vs.* 8.1 per cent non-Roma), whether piped in from a personal well or a municipal water source (Table 2). However, when considering all safe water options (including a protected well *without* a tap to the home or garden), non-Roma report greater accessibility (59.5 per cent non-Roma *vs.* 50 per cent Roma). In addition, Roma are significantly more at risk to inhabit insecure housing, regardless of geographical region, than non-Roma (27.6 per cent Roma *vs.* 5.4 per cent non-Roma) (Table 2). Interestingly, while the Roma population have greater access to tap water (indoor or outdoor), they are less likely to use it as their primary drinking water source, demonstrated by the increased time and distance Roma are likely to travel to secure safe drinking water (12.2km Roma *vs.* 10.8km non-Roma; Table 2). Of interest, however, is the increased time all individuals in suburban and urban areas must travel to secure drinking water compared to their rural counterparts (16–30 minutes (1.2 on 0–3 scale) urban *vs.* 0–15 minutes (1.0 on 0–3 scale) rural) (Table 3).

In addition to physical infrastructure, we analysed the differences between Roma and non-Roma with regard to key factors contributing to overall health status. Roma are more than twice as likely to report at least one household member suffering from moderate to severe diarrhoea (lasting more than 3 days) than non-Roma (58.1 per cent Roma *vs.* 40.5 per cent non-Roma; OR 2.04) (Table 2). In addition, while there is little difference in access to a primary care physician between the groups, Roma are approximately 1.5 times less likely to report having received an immunization of any kind (87.8 per cent Roma *vs.* 97.1 per cent non-Roma; OR 1.58) and fewer Roma possess medical insurance (81.6 per cent Roma *vs.* 89.1 per cent non-Roma; OR 1.86) than non-Roma (Table 2).

Finally, we used the UN definition of extreme poverty (2USD/person/day or less) in addition to two other variables as an overall indicator of impoverished conditions (Table 2). Roma report a slightly greater, though not significant, incidence of lacking working electricity in their homes or dwellings (13.2 per cent Roma *vs.* 2.7 per cent non-Roma), as well as lacking piped gas and/or the ability to purchase gas tanks (32.7 per cent Roma *vs.* 18.9 per cent non-Roma, $p=0.12$) (Table 2). Moreover, Roma report greater incidences of severe poverty (2USD/day/person or less) than non-Roma (55.1% per cent *vs.* 43.2 per cent) (Table 2), although overall, those in rural areas are significantly more susceptible to extreme poverty than those in suburban or urban communities (61.8 per cent rural *vs.* 32.6 per cent urban) (Table 3).

Multivariate analyses

Following univariate analysis, we used general multivariate linear regression analysis for four distinct models, combining categories that indicated a specific score (WASH, WASH Safe, poverty, healthcare) or approached a level of significance in the univariate analysis (Table 4). These analyses further demonstrate the significant ($\alpha = 0.05$) disparity between Roma and non-Roma.

Table 1. Study population demographics broken down by community. Romania, 2016. M=male, F=female, FT=full-time, UE=unemployed, DL=day labour.

	Population N (%)	Sex % M(F)	Age of Respondents (Mean in years)	House-hold Size N (Mean no. persons)	Education Level of Respondents (Mean Grade Completed)	Marital Status % Partnership (Single)	Employment Status % FT (UE or DL)	Literacy of Families Overall (%)	Geographical Location
Community 1									
Roma	28 (96.6)	28.5 (71.4)	49.3	4.7	Secondary School (8th grade)	71.4 (28.6)	10.7 (89.3)	56	--
Non-Roma	1 (3.4)	100 (0)	52	5	Some University / College	100 (0)	0 (100)	80	--
Overall	29	31 (69)	49.4	4.7	Secondary School (8th grade)	72.4 (27.6)	7.7 (89.7)	57.5	Rural
Community 2									
Roma	24 (80)	75 (25)	48.1	5.9	Secondary School (8th grade)	87.5 (12.5)	16.7 (83.3)	58.9	--
Non-Roma	6 (20)	50 (50)	50.1	4.8	Some University / College	83.3 (16.7)	66.7 (33.3)	100	--
Overall	30	70 (30)	45.8	5.7	Required School (10th grade)	86.7 (13.3)	26.7 (73.3)	66.7	Rural
Community 3									
Roma	18 (60)	44.4 (55.6)	42.6	5.3	Secondary School (8th grade)	94.4 (5.6)	27.8 (72.2)	58.3	--
Non-Roma	12 (40)	58.3 (41.7)	50.1	4.2	High School + Vocational School	91.7 (8.3)	25 (75)	100	--
Overall	30	50 (50)	45.6	4.9	Required School (10th grade)	93.3 (6.7)	26.7 (73.3)	74.4	Suburban

	Population N (%)	Sex % M(F)	Age of Respondents (Mean in years)	House-hold Size N (Mean no. persons)	Education Level of Respondents (Mean Grade Completed)	Marital Status % Partnership (Single)	Employment Status % FT (UE or DL)	Literacy of Families Overall (%)	Geographical Location
Community 4									
Roma	13 (43.3)	46.2 (53.8)	42.7	6.1	Secondary School (8th grade)	84.6 (15.4)	23.1 (76.9)	48	--
Non-Roma	17 (56.7)	29.4 (70.6)	60.4	2.9	Required School (10th grade)	58.8 (41.2)	23.5 (76.5)	95.1	--
Overall	30	36.7 (63.3)	52.7	4.3	Secondary School (8th grade)	70 (30)	23.3 (76.7)	69.2	Rural
Community 5									
Roma	15 (93.7)	66.7 (33.3)	35.4	4.7	High School (12th grade)	73.3 (26.7)	73.3 (26.7)	93.2	--
Non-Roma	1 (6.3)	100 (0)	40	4	Required School (10th grade)	100 (0)	100 (0)	100	--
Overall	16	68.8 (31.2)	35.7	4.7	High School (12th grade)	75 (25)	75 (25)	93.6	Urban
Overall									
Roma	98 (72.6)	51 (49)	44.8	5.3	Secondary School (8th grade)	75.5 (24.5)	26.6 (73.4)	61	--
Non-Roma	37 (27.4)	46 (54)	52.4	4.2	High School (12th grade)	75.6 (24.3)	32.4 (67.6)	97.4	--
Total	135	49.6 (50.4)	46.9	4.8	Required School (10th grade)	80 (20)	28.1 (71.9)	72.3	--

Table 2. Univariate analyses. Romania, 2016. Reference population for all variables is non-Roma. * indicates significance at 95% CI level. ** indicates significance at 90% CI level.

		Roma	Non-Roma	t-statistic	p-value	Odds Ratio	95% CI
WASH	Improved Sanitation (Indoor Toilet, % yes)	17.3	21.6	0.567	0.57	1.31	0.51, 3.37
	Improved Sanitation II (Indoor Bathroom, % yes)	20.4	21.6	0.154	0.878	1.08	0.43, 2.71
	Improved Water Source (Piped water to tap, % yes)	20.4	8.1	-1.701	0.091**	0.34	0.1, 1.24
	Insecure Housing (% yes)	27.6	5.4	2.858	0.005*	6.65	1.5, 29.6
	Time to Primary Drinking Water Source (Mean, 0–4 scale, 15min intervals)	1.12	1.0	0.769	0.443	1.12	0.37, 3.43
	Distance to Primary Drinking Water Source (% , 1km or more)	12.2	10.8	0.124	0.901	1.15	0.35, 3.82
	Safe Water Source (tap or well, % yes)	50	59.5	0.978	0.329	1.47	0.8, 1.91
Healthcare	Moderate/Severe Diarrhea in Last Year (% yes)	58.1	40.5	-1.84	0.07**	2.04	0.94, 4.4
	Reports Immunization of any kind (% yes)	87.8	97.1	0.678	0.499	1.58	0.42, 5.96
	Medically Insured (% yes)	81.6	89.1	1.057	0.292	1.86	0.58, 5.9
	Access to PCP (% yes)	98	97	-0.231	0.818	0.75	0.07, 8.53
Poverty	Electricity in Home or Dwelling (% no)	13.2	2.7	1.804	0.07**	5.51	0.69, 43.68
	Piped or Tank Gas in Home or Dwelling (% no)	32.7	18.9	1.57	0.12	2.47	0.82, 5.24
	Spends more than \$2/person/day (% no)	55.1	43.2	1.23	0.22	1.61	0.75, 3.45

Table 3. Geographical univariate analysis. Romania, 2016. Reference population for all variables is urban. * indicates significance at 95% CI level.

	Rural	Urban	t-statistic	p-value	Odds Ratio	95% CI
Time to Primary Drinking Water Source (Mean, 0–4 scale, 15min intervals)	1.0	1.2	1.306	0.194	0.53	0.19, 1.49
Spends more than \$2/person/day (% no)	61.8	32.6	3.323	0.001*	3.3	1.58, 7.08

Table 4. Multivariate analysis modelling. Romania, 2016. All models use non-Roma as reference. * indicates significance at 95% CI level. ** indicates significance at 90% CI level.

MOD1	Regression coefficient	p-value	95% Confidence Interval
Property Documents	0.0854	0.279	0.069, 0.240
Education Level	0.2613*	0.001	0.100, 0.422
Household Size	0.2362*	0.002	0.083, 0.389
Employment Status	0.0505	0.559	-0.119, 0.220
MOD2	Regression coefficient	p-value	95% Confidence Interval
Improved Water Source	-0.1914*	0.05	-0.383, -0.0000465
Moderate/Severe Diarrhea	0.1302**	0.08	-0.016, 0.276
Electricity in Dwelling	0.1802	0.139	-0.058, 0.419
Insecure Housing	0.2860*	0.001	0.111, 0.461
MOD3	Regression coefficient	p-value	95% Confidence Interval
WASH Score	-0.4104*	0.017	-0.747, -0.074
Healthcare Score	0.3407**	0.066	-0.022, 0.704
Poverty Score	0.3391*	0.013	0.070, 0.608
MOD4	Regression coefficient	p-value	95% Confidence Interval
WASH Safe Score	-0.250	0.203	-0.521, 0.111
Healthcare Score	0.3277**	0.083	-0.042, 0.698
Poverty Score	0.3305*	0.02	0.052, 0.609

A multivariate combination of demographic variables further highlights the difference in education level and household size between Roma and non-Roma. Roma households are significantly larger than non-Roma households, but whether this is a correlation with birth rate or the presence of multiple generations in a single dwelling is beyond the scope of this study. Furthermore, Roma individuals are far less likely to complete required education (10th grade) than non-Roma individuals (MOD1; Table 4). In our univariate analysis, we broke down the score categories to their individual components and identified significant factors to further explore. Multivariate analysis of these parameters points to insecure housing as having the strongest correlation with being Roma, followed by access to tap water (improved water source), and less significantly, the occurrence of moderate or severe diarrhoea (MOD2; Table 4).

Finally, we analysed our four score categories, using two different approaches. We first analysed the WASH score, as defined by the DRI, together with the healthcare and poverty scores (MOD3; Table 4). Healthcare and poverty equally significantly correlate with being Roma. The WASH score, however, is negatively correlated to the Roma, indicating that Roma individuals actually have

an advantage over non-Roma individuals. To further investigate this question, we ran an additional analysis with healthcare and poverty, but substituting our WASH Safe score (MOD4; Table 4). The significant difference observed in healthcare and poverty remains, but when protected well water is included alongside tap water in the definition of improved or safe water sources, the disparity associated with WASH is eliminated.

Dataset 1. Coded survey data

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Romania, 2016. Excel file of compiled responses to survey questions. Coded and de-identified. Numerical code corresponds to responses as indicated on the study surveys (Supplementary material 1 and Supplementary material 2).

Dataset 2. Python Notebook data analysis and statistics

<http://dx.doi.org/10.5256/f1000research.12546.d177234>

Romania, 2016. Python Notebook analysis of survey data.

Dataset 3. Python Notebook data analysis and statistics

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Romania, 2016. Python Notebook analysis of survey data, exported as a PDF file.

Discussion

A number of studies have examined the various factors *the Decade of Roma Inclusion* sought to address in Roma communities across the EU, both during the implementation of the project and since its conclusion in 2015^{5,11,13,18,19}. Unfortunately, while some improvements did occur, a number of studies indicate the DRI did not achieve its stated goals in the areas of education, housing, employment, and health status of Roma in participating countries^{20,21}. Our study supports these conclusions, particularly with regard to education, healthcare, and poverty. However, disparities that other studies have highlighted in multiple countries with regard to employment and sanitation do not necessarily occur in Romania^{19,22–24}. Rather, both the Roma and non-Roma in rural Romania face similar challenges regarding access to full-time employment and water, which are exacerbated by a lack of municipal sanitation services in over 800 Romanian communities²⁵. The lack of significant difference between Roma and non-Roma in our sample in relation to indoor toilets and bathrooms does not indicate that either ethnic group has an advantage, but rather all those who reside in rural communities face a disadvantage, regardless of ethnicity. Notably, our findings indicate that, in some instances, the Roma appear to have a slight advantage over non-Roma (Table 4). Using the DRI definition of piped water to an indoor or outdoor tap, our analyses indicate Romanian and other non-Roma individuals lag behind the Roma in ‘improved water sources’. However, when one accounts for the prevalence of private, protected wells (WASH Safe score), the disparity is minimized and no longer significant (Table 4). We postulate this distinction is indicative of how our survey collected this type of data, and future iterations will refine how we classify ‘safe’ and ‘improved’ water sources.

Of additional interest is the key indicator that those in suburban and urban areas, Roma and non-Roma alike, take longer to reach their chosen primary drinking water sources than do their rural counterparts. However, this statistic is potentially ambiguous. The urban community included in this study reported overwhelmingly that it had recently been subject to a contamination of the municipal water supply with coliform bacteria and, thus, the majority of residents therein reported the need to purchase water rather than use the taps available in their homes. It was not possible to collect data regarding the behaviour of these residents prior to the contamination event. Furthermore, the suburban community included here recently experienced the loss of a bridge, connecting the far side of the river to the village centre on the other side. Those individuals stranded on the far side of the bridge (predominantly Roma) reported numerous problems with their wells, requiring them to travel 5km or more to the nearest crossing to reach a shop or market until the bridge is restored. Therefore, this statistic is potentially a reflection of the walking or driving time that would otherwise be unnecessary.

Despite the evidence presented that Roma and non-Roma alike are subjected to ineffective sanitation and hygiene services throughout the country, one should note that the Roma population still reports a greater incidence of diarrheal disease *and* a reduced rate of immunization than the non-Roma population. There are potentially a number of reasons for this. Unlike in other countries^{5,24}, the Romanian Roma report fairly equivalent rates of medical insurance and access to primary care, but the type of treatment received when care is sought was beyond the scope of this study and may be a contributing factor. Indeed, Roma individuals have elsewhere reported poor health related to both their unhygienic circumstances and the care they receive^{19,26,27}. In addition, as has already been noted, both literacy rates and overall levels of education are significantly decreased in the Romanian Roma population. This is in contrast to education rates in Roma populations of other countries, as the educational component of the DRI has been lauded as the most successful portion of the initiative, albeit only for primary school attendance^{20,21}. Rates of disease and healthcare status overall are inversely associated with education²⁸, which may offer another possible explanation for the disparity in diarrheal disease rates. It is important to consider, however anecdotally, the Roma do report some knowledge of personal water treatment and safety (data not shown), through the use of salt or lime in personal wells and a commitment to boiling water before drinking or cooking if possible. However, the lack of infrastructure and services works against these individual and imperfect efforts. Furthermore, for those Roma who do have access to tap water (municipal or otherwise), many of them report using an alternative primary water source. While these same individuals indicate that they believe their tap water to be safe (data not shown), their daily activities are in direct contrast to this assertion.

Overall, while these data demonstrate the ongoing challenges following the *Decade of Roma Inclusion* as applied to the Roma population in Romania, this study also points to the myriad of ways in which all Romanians, regardless of ethnicity, are encountering challenges. It highlights the areas in which improvements can be made to ensure all Romanian citizens have access to and confidence in basic sanitation services, clean water, and adequate healthcare treatment.

Limitations and future directions

The primary limitation to this study is the sample size of 135 individuals. Time and funding constraints, as well as limited personnel, inhibited our ability to interact with more than 30 households per community and restricted the study to five communities. Future efforts will expand the population included in similar studies by increasing the number of communities engaged, and will seek to enroll equal numbers of Roma and non-Roma. Additionally, subsequent studies can use these and other data to generate detailed models that explore specific initiatives that could be implemented to address discrepancies in equality and access, and progress the literature around Roma health disparities beyond analysis and into intervention testing.

Data availability

Dataset 1: Coded survey data. Romania, 2016. Excel file of compiled responses to survey questions. Coded and de-identified. Numerical code corresponds to responses as indicated on the study surveys ([Supplementary material 1](#) and [Supplementary material 2](#)).

DOI, [10.5256/f1000research.12546.d177233](#)²⁹

Dataset 2: Python Notebook data analysis and statistics. Romania, 2016. Python Notebook analysis of survey data.

DOI, [10.5256/f1000research.12546.d177234](#)³⁰

Dataset 3: Python Notebook data analysis and statistics. Romania, 2016. Python Notebook analysis of survey data, exported as a PDF file.

DOI, [10.5256/f1000research.12546.d177235](#)³¹

Competing interests

No competing interests were disclosed.

Grant information

This work has been partially supported by the National Institutes of Health and National Institute of General Medical Sciences - Models of Infectious Disease Agent Study Grant 5U01GM070694-13, the Defense Threat Reduction Agency - Comprehensive National Incident Management System Contract HDTRA1-11-D-0016-0001, and the Virginia-Maryland College of Veterinary Medicine.

The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Acknowledgments

We would like to thank Dr. Ralph P. Hall for his assistance developing the surveying instrument, and all the staff members at *Agentia Impreuna* for helping to make this project possible. We thank our external collaborators and members of the Network Dynamics and Simulation Science Laboratory (NDSSL) for their suggestions and comments. In addition, we are grateful to the numerous friends and family who contributed financially to support our time in the field, with particular thanks to George K. Agardi, Sr. and Dr. Susan Evans.

Supplementary material

Supplementary material 1: Quality of Life Survey, English. Romania 2016. Survey questions provided in English.

[Click here to access the data.](#)

Supplementary material 2: Quality of Life Survey, Romanian. Romania, 2016. Survey questions provided in Romanian.

[Click here to access the data.](#)

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Version 1

Reviewer Report 02 January 2018

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Pilar Carrasco-Garrido

Medical Microbiology and Immunology and Nursing Department, King Juan Carlos University, Madrid, Spain

This is a relevant manuscript from a public health standpoint because one of the main contributions of the present work is to determine quality of life indicators in the Romanian Roma, but methodologically it has significant shortcomings:

- The comparison between the population of Burkina Faso and the population of Romania is not adequate. They are very different populations. This aspect is a methodological problem.
- Discussion of the results is limited. Some aspects are not adequately discussed.
- There is no information about the survey's non-response rate.
- Few references and some of them unrelated to the purpose of the study. It does not seem correct to incorporate a press article as a reference.

Sorry but, I do not recommend the indexing of the article.

Is the work clearly and accurately presented and does it cite the current literature?

Partly

Is the study design appropriate and is the work technically sound?

No

Are sufficient details of methods and analysis provided to allow replication by others?

No

If applicable, is the statistical analysis and its interpretation appropriate?

I cannot comment. A qualified statistician is required.

Are all the source data underlying the results available to ensure full reproducibility?

Partly

Are the conclusions drawn adequately supported by the results?

Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Public health

I confirm that I have read this submission and believe that I have an appropriate level of expertise to state that I do not consider it to be of an acceptable scientific standard, for reasons outlined above.

Reviewer Report 12 December 2017

<https://doi.org/10.5256/f1000research.13585.r26652>

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Martin McKee

European Centre on Health of Societies in Transition, London School of Hygiene and Tropical Medicine, London, UK

The introduction is well written and provides a good overview of the situation facing the Roma population. There are a few more recent references that could be included, such as an evaluation of the Decade of Roma inclusion in Hungary but, in general, the authors have found most of the relevant information.

The fundamental challenge facing anyone doing research among the Roma population in this region is how to develop a sampling frame. There are numerous methodological problems, in particular varying degrees of assimilation (see, for example, work by K Kosa). Previous studies, such as that by the UNDP or in Hungary, have used Roma communities, identifiable by their socio economic and physical characteristics, while recognising that this is imperfect. However, this paper would benefit from a more detailed description of the communities from which the samples were drawn, in particular, how they relate to Romania as a whole. Given that, in many parts of Romania, Roma live in distinct settlements, separate from the Romanian population, even within individual villages, could the authors comment on any implications that their sampling strategy had for generalisability?

Given the high levels of distrust that many Roma, justifiably, have, some studies have sought to ensure involvement of Roma fieldworkers, or at least, involvement of community leaders. Can the authors comment on what measures they took in this regard?

The greatest problem in this paper is the very small sample size. Overall, less than 100 Roma

respondents were included and only 37 non-Roma. Given the numerous problems involved in sampling in a study such as this, this is really far too few from which to draw any meaningful conclusion. This is noted in the limitations but I'm not really convinced that a study of this size can be regarded as much more than a pilot. I would suggest that it is described in this way, with many more caveats than there are at present.

Minor points:

I'm not sure that it is appropriate to use the words of Soviet rule for the countries of south-eastern Europe. Arguably, Romania was one of the most independent of the Soviet bloc states.

Is the work clearly and accurately presented and does it cite the current literature?

Partly

Is the study design appropriate and is the work technically sound?

No

Are sufficient details of methods and analysis provided to allow replication by others?

Partly

If applicable, is the statistical analysis and its interpretation appropriate?

Partly

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Public Health – and have written extensively on Roma health

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 06 November 2017

<https://doi.org/10.5256/f1000research.13585.r26651>

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Ciprian Marius Ceobanu

Faculty of Psychology and Education Sciences, Department of Psychology, Alexandru Ioan Cuza University, Iași, Romania

The main issue is related to the size of the sample and its geographical distribution. It is hard to generalize over the entire Roma minority the conclusions of the study even if the statistical approach is appropriate.

The geographical distribution of the Roma population is pretty different over the Romanian national territory. The lack of indication of the geographical area of the subjects of the sample is a flaw. Another issue regards the random walk method for sampling which, in our opinion, is not representative for the entire Roma population. Maybe a multilevel sampling would be more appropriate than a simple random walk.

Despite the fact that the conclusions of the study are correct, these are pretty well known to all levels; also these are commonplaces that were specified in the documents of Decade of Roma Inclusion as directions for future action. There are a lot of significant reports that draw the same conclusions (see The World Bank documents for instance¹). From this point of view, there is no original approach to the Roma problem in Romania.

The conclusion following the Decade of Roma Inclusion is that despite the efforts that there were made, there still remain lots of issues regarding the integration of the Roma population. Also, solving great structural problems of Romania will certainly improve the Roma population situation.

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Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Partly

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

I cannot comment. A qualified statistician is required.

Are all the source data underlying the results available to ensure full reproducibility?

Partly

Are the conclusions drawn adequately supported by the results?

Partly

Competing Interests: No competing interests were disclosed.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Comments on this article

Version 1

Author Response 04 Mar 2018

Rebecca Powell Doherty, Virginia Tech, Blacksburg, USA

Please find below a detailed, point-by-point response to each query raised by the three published reviewers. We thank the reviewers for their time and effort. The changes to the manuscript, based on the below, can be seen in the revised document, version two.

Reviewer #1: Approve with Revisions

1. The main issue is related to the size of the sample and its geographical distribution. It is hard to generalize over the entire Roma minority the conclusions of the study even if the statistical approach is appropriate.

We agree with the reviewer that the size of the sample is relatively small. To address this issue, we have reframed the work as another reviewer recommended, as proof of concept. The data described here is utilized in a computer simulation designed to identify areas at high risk of certain health factors. In preliminary analysis, the simulation holds up when compared to on-the-ground knowledge and experience, as well as other published evidence. With regard to the geographical distribution, we purposely chose to visit Roma villages and settlements that were different from one another in an attempt to reduce the bias that inevitably occurs with this type of research, as it is logistically impossible for our small team to reach the entire Roma minority in Romania.

2. The geographical distribution of the Roma population is pretty different over the Romanian national territory. The lack of indication of the geographical area of the subjects of the sample is a flaw. Another issue regards the random walk method for sampling which, in our opinion, is not representative for the entire Roma population. Maybe a multilevel sampling would be more appropriate than a simple random walk.

As indicated above, our geographical distribution was actually varied. Of the five communities we visited, they ranged from extremely urban and close to the capitol to rural and in the far north of the country. We chose these villages and settlements specifically for their geographical diversity and, in particular, because they aligned with the non-Roma majority in their areas very differently. Some were extremely well-integrated and others entirely separate. We do not share the geographical area of the subjects as this level of anonymity was a requirement of our ethical approval to conduct the study, as the IRB considered the population to be 'vulnerable'.

With regard to the random walk method, we respectfully disagree that this was not appropriate for sampling. Varying the time of day that we walked through these areas, and ensuring we went into shops as well as knocked on gates and doors allowed us to reach greatest number of people throughout a given area without the intimidation of a formal gathering, as well as ensuring the anonymity of our participants.

Our manuscript has been updated to reflect, where possible, some of these details.

3. Despite the fact that the conclusions of the study are correct, these are pretty well known to all levels; also these are commonplaces that were specified in the documents of Decade of Roma Inclusion as directions for future action. There are a lot of significant reports that draw the same conclusions (see The World Bank documents for instance¹). From this point of view, there is no original approach to the Roma problem in Romania.

We respectfully disagree. Our approach has indeed taken elements from other studies, although the reports that the reviewer references are not properly peer-reviewed, and it is important that independent research verifies the information put forth by such entities as The World Bank and even the World Health Organization. Importantly, however, we believe our study to be significant in that our survey brings together questions of demographics, public health, and education, along with added insights into the level of trust (or lack thereof) that the Roma minority has in its government and fellow citizens. Further to this, there are few studies that focus exclusively on Romania, and we disagree with the notion that it is appropriate to compare Roma in Hungary, for example, with the Roma population in Romania, and indeed, our findings demonstrate clear differences in the Romanian Roma from what is reported elsewhere in the literature.

4. The conclusion following the Decade of Roma Inclusion is that despite the efforts that there were made, there still remain lots of issues regarding the integration of the Roma population. Also, solving great structural problems of Romania will certainly improve the Roma population situation.

We agree this is the case, and as mentioned above, these data will be used to pilot a simulation that allows us to pinpoint areas of high risk for structural problems, educational deficits, and numerous other public service categories to ensure the appropriate type of aid is delivered to the right place. This has implications for the Roma population within Romania of course, but also for those living elsewhere, and if other data sets are available, other minorities as well.

Reviewer #2: Approve with Revisions

1. The introduction is well written and provides a good overview of the situation facing the Roma population. There are a few more recent references that could be included, such as an evaluation of the Decade of Roma inclusion in Hungary but, in general, the authors have found most of the relevant information.

No specific response required.

2. The fundamental challenge facing anyone doing research among the Roma population in this region is how to develop a sampling frame. There are numerous methodological problems, in

particular varying degrees of assimilation (see, for example, work by K Kosa). Previous studies, such as that by the UNDP or in Hungary, have used Roma communities, identifiable by their socio economic and physical characteristics, while recognising that this is imperfect. However, this paper would benefit from a more detailed description of the communities from which the samples were drawn, in particular, how they relate to Romania as a whole. Given that, in many parts of Romania, Roma live in distinct settlements, separate from the Romanian population, even within individual villages, could the authors comment on any implications that their sampling strategy had for generalisability?

We thank the reviewer for this thoughtful commentary, and we agree there are numerous problems with the available methodology, regardless of which is chosen. Our sample choice closely resembles that of what was used in Hungary, targeting specific Roma communities. We appreciate this is indeed imperfect, but we chose communities that our NGO partner had connections to and allowed us to identify community leaders (see response to next question) with whom we could work. These villages and settlements were purposefully geographically diverse, ranging from extremely urban and central to the capitol to rural and in the far north of the country with a large Hungarian population. Appreciating that our sample size, due to resources and logistics, is extremely small, we felt the geographic diversity to be a significant factor in our ability to generalise our findings to the whole of the Roma minority in Romania. We absolutely maintain, and indeed is part of the reason for this study, that our findings are specific to Romania and that there are too many variables to extrapolate to Roma living in other countries.

Our manuscript has been modified to include, where possible, some of this detail.

3. Given the high levels of distrust that many Roma, justifiably, have, some studies have sought to ensure involvement of Roma fieldworkers, or at least, involvement of community leaders. Can the authors comment on what measures they took in this regard?

As indicated in our methods section, all of our work was conducted in collaboration with a Roma-centric NGO based in Bucharest. The NGO assisted us in identifying appropriately diverse communities that may be receptive to speaking with us. In addition, as our NGO partner had extensive knowledge of the communities and a presence in them, we were able to identify community leaders who accompanied us as we moved through the areas. Importantly, the community representatives we worked with were both Roma and non-Roma. Despite this, we do note that it was more difficult to connect with individuals who did not identify as Roma, which is the reason for the small sample size in our data set.

4. The greatest problem in this paper is the very small sample size. Overall, less than 100 Roma respondents were included and only 37 non-Roma. Given the numerous problems involved in sampling in a study such as this, this is really far too few from which to draw any meaningful conclusion. This is noted in the limitations but I'm not really convinced that a study of this size can be regarded as much more than a pilot. I would suggest that it is described in this way, with many more caveats than there are at present.

We thank the reviewer for this suggestion, and we absolutely agree the sample size is quite small. As noted, this is due to a number of resource and logistic constraints, but we have modified our paper to reflect this study be considered as a pilot or proof-of-concept study.

5. I'm not sure that it is appropriate to use the words of Soviet rule for the countries of south-eastern Europe. Arguably, Romania was one of the most independent of the Soviet bloc states.

We thank the reviewer for this insight and agree there is complexity in the discussion of how different countries functioned under communist leadership. We have, therefore, removed the reference to Soviet rule from the manuscript.

Reviewer #3: Not Approved

This is a relevant manuscript from a public health standpoint because one of the main contributions of the present work is to determine quality of life indicators in the Romanian Roma, but methodologically it has significant shortcomings:

1. The comparison between the population of Burkina Faso and the population of Romania is not adequate. They are very different populations. This aspect is a methodological problem.

We apologise that our paper was written in such a way as to confuse this reviewer. There is no comparison between Romania and Burkina Faso in our work. Our paper has been edited to ensure further clarity.

2. Discussion of the results is limited. Some aspects are not adequately discussed.

As the reviewer did not specifically indicate the ways in which our results are inadequately addressed, we are unable to make direct changes. However, we do feel our discussion of results is appropriately limited to the data we have and in keeping with the limitation of our sample size, as we mention in our limitations section.

3. There is no information about the survey's non-response rate.

As we were a small team and logistics was complicated, this is not data that we collected. We do note, however, that our surveys were conducted as interviews and as such there was not a 'non-response' rate, but rather individuals who simply did not want to talk to us and were not therefore included in our study.

4. Few references and some of them unrelated to the purpose of the study. It does not seem correct to incorporate a press article as a reference.

We respectfully disagree and feel that all of our references are appropriate and pertain to our work.

Competing Interests: I am the primary author of the study.

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