SHORT THESIS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY (PHD)

Segregated Residential and COVID-19 pandemic effects on Healthcare Service utilization dynamics among vulnerable populations in Hungary

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I. Introduction

The history of need and demand for secured health and ill-free life status-seeking practices or healthcare utilization (HCU) had been observed in prehistoric or ancient times. However, the occurrence of endemic and epidemic diseases created an opportunity for the establishment of causation and innovations in public health and epidemiology for today's world. The concept of health care services (HCS) started from 2600 BC when Imhotep described, diagnosed and managed two hundred diseases. From time to time its concepts have been updated and modernized based on technologies, research and scientific findings. The sources of basic healthcare services at a time included societal beliefs and religious views about disease prevention and health promotion. Modern HCS includes delivering curative, preventive and palliative care at primary, secondary and tertiary healthcare institutions for patients. The following are basic concepts under the modern HCS (General practitioner (GP) visits, Specialist care, Hospital admission and prescription redemption).Its core principle was health for all. To date, its definition has been modified by World Health Organization (WHO) and United Nations Children's Fund (UNICEF) due to its whole spectrum of advantages and perspectives. Its core aims were to prevent diseases, promote health and prolong life for creating a healthy society. Thus, attaining the needs and demands of HCS has enormous values and benefits for every citizen.

Universal health coverage has been described as all people have access to quality health services when and where they need them, including well-trained health workers, safe treatment, access to medicines and vaccines. Across the globe, being living in a deprived settlement has been triggering residents to lower uptake of basic health care services (HCS)utilization. The factors are known by creating a gap and misuse of primary and secondary HCS. The vulnerability of those individuals increased than their counterparts.

According to a shred of evidence from previous studies, ethnicity/race has been a risk factor for poor HCU across the globe. The Roma population has been one of

these problems for a long time. Because of unresolved methodological problems of ethnicity-related health studies in the European legal environment, the determinants of this misuse have not been explored in detail. Consequently, there are no effective interventions for this behavioral risk factor, and the perceived misuse contributes to the development of a blaming attitude towards the Roma among health professionals, which becomes a distinct obstacle for targeted interventions. Unfortunately, primary medication adherence (prescription redemption) as a substantial indicator of appropriate healthcare use has not yet been investigated properly among the Roma.

The Roma constitute the largest European ethnic minority, and they account for 1.7% of the population. They originated from the northwestern Indian subcontinent and arrived in Europe between the 10th and the 12th century. Later, they were distributed throughout Europe but remained a marginalized social group with disadvantaged health status.

Unprecedently Corona Virus Disease-2019 (COVID-19) pandemic is a viral disease that originated in Wuhan, China in late 2019 and later covered the whole world declared as a pandemic on 11th May 2020. It is caused by a virus called Severe Acute Respiratory Syndrome coronavirus (SARS-CoV2). It has caused a deterioration in almost all aspects of life across the globe both at the individual and system level. Similarly in Hungary, the pandemic lockdown caused several health crises. Since the pandemic occurred, Hungary ranked 11th with excess mortality until the end of 2021. Besides, the extent, determinants and vulnerable social strata for HCU have not been explicitly studied yet except for limited findings on the immediate effects. Economy collapse, lack of job, furlough, unemployment, healthcare deterioration, excess mortality, lack of public trust in healthcare, low utilization of healthcare, political pressure among governments, and others could be mentioned.

According to the previous studies, Hungary has moderate HCU in terms of prescription redemption. Therefore, it is highly important to address further the determinants. Furthermore, the dynamics of other HCU following the COVID-19 pandemic it has not been well investigated except for a few preliminary findings of the immediate effects of the virus. It will provide the lenses through which the dissertation, as well as its methodological flows, new findings, conclusions, and recommendations, can be displayed. Mainly this dissertation focused on the impact of the segregated settlement on prescription redemption and COVID-19 pandemic on the dynamics of HCU, vulnerable social strata and sociodemographic, and clinical determinants in Hungary. Hence, it is very essential to ensure external validity and intervene the identified gaps according to the findings across Hungary.

II. Objectives

The objectives of this dissertation were

1. To assess the crude prescription redemption among Roma living in segregated settlements versus complementary areas.
2. To investigate the age-sex indirect standardized redemption ratio of Roma living in segregated settlements versus complementary areas.
3. To estimate the GP visit, specialist care, hospitalization rate and CRPNR pre-pandemic and during the COVID-19 pandemic
4. To investigate the effect of the pandemic on GP visit, specialist care, hospitalization rate and CRPNR controlled for established predictors and
5. To determine subgroups susceptible to the GP visit, specialist care, hospitalization rate and CRPNR elicited by the pandemic lockdown in Hungary.

III. Methods

Datasource

Data were obtained from the respective higher Hungarian Government institutions' databases used for analysis in this study. A 2012 National Institute of Health Insurance Fund Management (NIHIFM) for prescription nonredemption in segregated Roma Colony (SRC) and complementary Areas (CAs), European Health Interview Survey (EHIS) wave 3 and 2021 International Social Survey Program (ISSP) of Hungary were used for the prepandemic and pandemic data analysis. The number of prescribed and dispensed drugs was used as a study unit. While under the COVID-19 effect on social inequalities on HCU, subjects or individuals were our study units.

Under the SRC, there were nearly 134,000 inhabitants in 758 colonies. Of these, 94% of colonies are occupied by the Roma population. This accounted for one-fifth to a quarter of the entire Roma population in Hungary. According to the earlier findings, the colonies have been living in underprivileged situations with different extents of health-related issues which can be measured by a merged score based on indicators of access to services and the presence of environmental vulnerabilities. The indicators include the environmental quality (poor sewerage system, waste disposal mechanism, lack of water gates), housing conditions (apartment/house/block of rooms/hut, etc), characterized by overcrowding and poor inhabitants compared to counterparts/neighbors in the colony. Nearly one-fifth to a quarter of the Hungarian Roma population exists in the segregated colony in Hungary.

Outcome measurement and Data analysis

The crude redemption rate (CRR) was calculated for national, SRC, and CA. Then, to compare the prescription redemption between SRC and CA, age-sex specific indirect standardization was applied to control the confounding effect of age and sex between two strata for each Anatomic Therapeutic Chemical (ATC) Classification. ATC was classified and controlled by WHO under Collaborating

Centre for Drug Statistics Methodology (WHOCC). The first level of the ATC code was used to show anatomical main groups and their letter [ATC_A to ATC_V]. The age-and-sex band was used to calculate the age-sex-specific redemption ratios between the strata. Indirectly standardized redemption ratio (SRR) is the ratio of *Redeemed* (drugs redeemed by patients among the prescribed amounts by the healthcare provider) per *Expected* (prescribed amounts by healthcare provider X Reference).

Then the relative redemption ratio (RR) was calculated as the ratio of indirect age-sex specific redemption ratio among SRC to CA. Similarly, the relative redemption difference (RRD) was computed as the difference between SRR_{SRC} and $SRR_{CA.}$ Attributable risk (the redemption attributed to the residential area) was calculated as the product of the RD and the expected amount of redemption among SRC.

All of the dependent variables [GP visit, specialist care, hospitalization and CRPNR] were dichotomous variables for subjects who had at least one episode of them before one year of the survey. If the patient had a history of GP visits, specialist care, hospital admission and CRPNR in a year was classified as 'yes'=1 and unless 'no'=0. Frequency, proportions, and figures were used to display the descriptive findings. In the analytic statistics, first, we conducted a bivariate analysis for identifying the associated variables besides the interaction effect of pandemic lockdown. Then multivariable logistic regression was run with the interaction effect of the pandemic, to identify independently associated with dependent variables [control the confounding effect of sociodemographic and clinical factors]. A 95% confidence interval (CI) was used to test the statistical significance. At the same time, the interaction of the effect of the pandemic on outcome variables among selected vulnerable social groups was assessed with a 95% CI to evaluate the statistical significance.

Ethical consent

The ethical consent for SRC and CA study used a secondary database and did not reveal any participant information (name, identity, or any further data kept anonymously). Therefore, according to the Hungarian regulations, no ethical approval was not required for such a study.

The EHIS wave 3 was endorsed by the European Statistical System Committee per Commission Implementing Regulation (EU) No. 255/2018. The ISSP data were used per the Ethical statement of ISSP https://issp.org/wp-content/uploads/2022/02/ethical_statement_issp.pdf the ethical requirements were approved according to the legal requirement of Hungary https://tarki.hu/sites/default/files/2018-05/adatbiztonsag_20180525.pdf

IV. Results

i. The prescription redemption in SRC and CA

In 2012, a total of 947,008 prescriptions were written by healthcare providers for patients in the study area. Among these 674,670 were dispensed by patients. This makes the crude prevalence of prescription redemption 71.24% (95% CI, 71.15-71.34%). Comparatively, in SRC 46,107 prescriptions written and dispensed amount was 33,720 making 73.13% (95% CI, 72.79-73.60%) while in CA 900,901 prescriptions written and dispensed amount was 640,950 making 71.15%, (95% CI, 71.06-71.25%) by patients. The amount prescription per person for specific age and sex, majority of prescriptions went for 65 years and above followed by 45 to 64 years in SRC and vice versa for CA . More prescriptions were written for females in both settlements (61.9% in SRC vs 61.58% in CA). There were significant differences seen in the age-specific dispense rate between the settlements. In SRC , both females and males dispensed relatively higher than counterparts in CA s. On the other hand, significant differences were seen in the redemption rate for different ATC classes. Alimentary tract and metabolism (77.6 vs 74.96%), cardiovascular (74.92 vs 67.15%), musculoskeletal (76.53 vs 73.96%), and various types (81.83 vs 75.23%) of prescriptions were highly redeemed among SRC than CA patients. Conversely, anti-infectives for systemic use (57.60 vs 74.67%) and sensory organ system (62.57 vs 71.47%) prescriptions were less redeemed among SRC than CA .

ii. Indirect age-sex specific redemption ratio

The relative risk of redemptions, alimentary tract and metabolism RR=1.035 [95% CI 1.006-1.062], cardiovascular RR=1.115 [95% CI, 1.097-1.135], musculoskeletal RR=1.037 [95% CI, 1.003-1.067] and various types RR=1.088 [95% CI, 1.006-1.139] of prescriptions were highly redeemed among SRC than CA. Conversely, anti-infectives for systemic use RR=0.771

[95% CI, 0.766-0.816] and sensory organ system RR=0.875 [95% CI, 0.791-0.987] prescriptions were less likely redeemed among SRC than CA. The risk of redemption among SRC was higher than CA after adjusting differences for age and sex. The segregated colony attributability accounted for about 2.8% among Hungarian Roma living in SRC compared to CAs with a corresponding 95% CI, RR=1.028[1.018-1.038].

iii. Social inequality, Healthcare Use and COVID-19 effect in Hungary

There were significant reductions in all of the outcome variables except for CRPNR between the two periods. There were 4251 and 561 episodes of GP visits, corresponding to a prevalence of 79.2% (95% CI 78.1-80.3) and 56% (95% CI 52.9-59.1), 3426 and 378 episodes of specialist care, corresponding to a prevalence of 64.4% (95% CI 63.1%-65.7%) and 38.0% (95% CI 35.0%-41.0%), and 728 and 68 episodes of hospital admission, corresponding to a prevalence of 13.5% (95% CI 12.6%-14.4%) and 6.8% (95% CI 5.2%-8.4%), and 245 and 36 episodes of CRPNR, corresponding to a prevalence of 5.6% (95% CI 4.9%-6.3%) and 5.2% (95% CI 3.5%-6.9%) in the pre-pandemic and pandemic periods, respectively. The GP visits, specialist care and hospital admission were accompanied by a significant reduction between two periods for studied predictors.

Sociodemographic and clinical factors associated with HCS utilization

Aging, being female and having a chronic disease were highly related to GP visits, specialist access and hospitalization rate. However, age and sex did not show the same pattern for CRPNR except for chronic diseases. Particularly COPD, IHD and diabetes patients had more frequent episodes of CRPNR. Furthermore, for each predictor and the studied characteristics association varied by age, sex, residence and chronic illness status.

Determinants of healthcare utilization and subgroup-specific role of COVID-19 pandemic

After controlling for the potential confounders and social strata, with time to the pandemic the remarkable exhaustive reductions were observed for the probability of specialist care and hospital admission during the pandemic period. But the decline in GP visit frequency was less strong and proved to be borderline significant in the multivariable model. Also, the CRPNR did not show a significant change during the pandemic period.

The association between the studied outcome variables and age, sex, residential place, and prevalence of chronic disease described by bivariate analyses have been confirmed by multivariable analysis with varying degrees of association. The remarkable social stratum for HCU was Roma for CRPNR. The CRPNR was more frequent among Roma (aOR=2.018, 95% CI: 1.061-3.838). But the association was insignificant with GP visits, specialist care, and hospital admission for this ethnicity. However, marital status did not show a significant relationship with the three studied outcomes (GP visit, hospital admission and CRPNR). But it showed significant association with the specialist care, which was less likely among single (aOR=0.753, 95%CI: 0.636-0.891) and widowed (aOR=0.740, 95%CI: 0.597-0.918) compared to the married group. The role of achieving a higher education level as a determinant of more frequent use of GP and specialist care after controlling the sociodemographic and clinical status of survey participants. Conversely, the subgroup had fewer odds of hospital admission and CRPNR was confirmed by the final model.

Under the pandemic interaction model, a multivariable model proved that uneven distribution of pandemic effect by social status. The decline in hospital admission attributed to the pandemic was evenly distributed for all of the social strata [education, ethnicity and marital] subgroups. The pandemic effect was appeared to be significantly lower among mid-level educated for GP (iORhigh school/primary=0.434, 95%CI: 0.243-0.776) and specialist care (iORhigh

school/primary=0.598, 95%CI: 0.364-0.985, iORtertiary/primary=0.331, 95%CI: 0.179-0.611). Also, this subgroup had a less likelihood of CRPNR than primary education level subjects (iORhigh school/primary=0.236, 95%CI: 0.075-0.743). Regarding the marital stratum, the pandemic significantly provoked the likelihood of both GP visits (iOR=2.284, 95% CI: 1.043-4.998) and specialist care (iOR=1.915, 95% CI: 1.157-3.168) wth among widowed compared to married subgroup. The specific pandemic effect on HCU among the Roma was not confirmed in the multivariable approach. Thus, the pandemic has no sole effect on the ethnicity in terms of Roma and non-Roma counterparts.

V. Practical Implications

Firstly, the excess prescription redemption among SRCs was a new finding that changed long-standing stereotypes about Roma ethnicity and healthcare use in terms of prescription redemption. This suggests that if the culturally adapted interventions are targeted, Roma can better utilize other pillars of HCS. Thus, our study revealed that keeping their preference or analyzing the situation on the ground would better promote their uptakes.

Secondly, the COVID-19 pandemic spectacularly caused a negative magnitude on the HCU among different social strata in Hungary. Except for a hospital admission rate, other HCUs were unevenly affected across social strata during the pandemic lockdown. Most of the declined HCSs during the pandemic lockdown were emanated from the preexisting (before the pandemic) social inequality and inequity among the substrata. For this reason, the declines could be considered as adequate reactions from the subjects. During the pandemic, less uptake of the GP and specialist care among the highly educated subgroup suggested that severe medical conditions are less prevalent among this stratum as the pandemic restrictions allow only those patients with serious medical scenarios. This assumption has also been supported by our descriptive findings that this subgroup had a lower frequency of hospital admission during both periods compared to others. While increased GP and advanced care uptake among the widowed subgroup indicated their severe health status in both periods. On the contrary, the pandemic caused inequality and negatively influenced the CRPNR among less-educated patients. This is a profound COVID-19 pandemic social gap that declined HCU among the education category. This could be mitigated by the state to enable affordability of prescriptions among the stratum in the next epidemic waves.

On the other hand, Roma vs non-Roma subgroup had a higher magnitude of hospital admission in both periods [19.2 vs 13.3% and 9.2 vs 6.6 % pre-pandemic and pandemic], respectively. That meant they had poor or severe medical

conditions during the pandemic. It is also important to note that the Roma had a higher CRPNR than the non-Roma population regardless of the pandemic [with a slight increase in the frequency during the pandemic and the problem was almost quadruple among Roma in both periods]. Based on another finding from Hungary, a higher COVID-19 related mortality among the densely populated Roma residences during the lockdown could be due to less redemption. This signals that the affordability of drugs and medical supplies is a matter for Roma and it needs prompt attention to overcome the identified problem among the Roma.

VI. Conclusion and recommendations

This dissertation uncovered that the prescription redemption was better in SRCs than CAs after adjusting for age and sex. The chronic illness medications were highly prescribed and significantly redeemed among SRCs than CAs. There was about 3% excess redemption among SRC than CAs.

Next, the COVID-19 pandemic dramatically reduced access to GP visits, specialist care and the hospital admission rate but did not affect CRPNR in Hungary. The changes were unevenly distributed across the social strata. The reductions confessed the better compliance with the pandemic lockdown regulations among the social strata except for inadequate reactions in a few strata for some specific outcomes. The GP and specialist care were had an adequate reaction among the widowed subgroups that were related to the services, attributable to the pandemic lockdown. Whereas specialist care had an adequate reaction for all sociodemographic influenced by the pandemic. Also, a higher academic status was associated with less utilization of specialist services due to the pandemic lockdown. Thus, these reduced uptakes of these services due to the priority given for the severe medical conditions during the lockdown. But the pandemic lockdown effect on CRPNR among the less education category suggests that integrated support targeting these social strata has high importance in mitigating the harmful consequence of lockdown. Widowed patients proved to

be protective to the pandemic lockdown in the respect of GP and specialist care. Although the increased uptake of these services was inspiring, the reasons for these protective factors need further and deep investigations. Wholly, this investigation demonstrated that integrated support for patients with the most susceptible groups has to be focused on during the pandemic-related restrictions or lockdown. In general, asset-based approaches (ABA) can better empower the uptake of HCU that could result in reducing the inequalities and social exclusion among vulnerable societal sections in Hungary. This remarkable approach to health has extraordinary importance when the susceptible population becomes part of the solution generation.

VII. New findings

The impact of the segregated colony on prescription redemption

The core finding of this dissertation under the general and specific objectives came with eight important new elements.

i. Roma pediatrics has a higher prescription of anti-infectives (ATC_J) than CAs

The majorly of anti-infective (ATC-J) medications were highly prescribed (64.9%) for pediatrics groups within Roma than non-Roma (38.55%) inhabitants. This shows still communicable diseases or susceptibility to acquiring ill-health situations were prevalent among the Roma community. However, the redemption of this group was significantly lower (57.6% vs 74.68%) than the complimentary area.

ii. The cumulative impact of the colony on prescription redemption was seen in excess among Roma living in SRCs

Alimentary tract and metabolism, cardiovascular, musculoskeletal, anti-infective, and sensory organs ATC classes with excess redemption of 3.7%, 11.5%, -22.9%, and -12.5%, respectively.

Overall, 2.8% of excess redemption was seen among SRC than CA that was attributed to the settlement. This might be related to the previous study that the Swiss Hungarian Cooperation Program (SHCP) has been effective in improving the redemption of ATC_A and ATC_C prescriptions by 19.9% and 42.6% (250).

The COVID-19 pandemic lockdown and dynamics of HCS utilization in Hungary

iii. There were massive changes in basic HCS utilization due to the pandemic

Except for CRPNR, the remaining basic HCS were significantly reduced due to the pandemic lockdown in Hungary. The uptake of GP, Specialist service and hospital admission were reduced by 22.2%, 26.4% and 6.7%, respectively.

However, the CRPNR did not result in significant change despite there was a 0.4% decrease due to the pandemic lockdown. These changes suggest prepandemic social inequalities and inequities resulted in the difference during the pandemic lockdown except for a few strata and outcomes.

iv. Gender role showed the dominance of females HCU in Hungary

Regardless of the pandemic lockdown, females were found to be more frequent users of all of the studied HCS including the segregated settlements than males.

v. The uptake of HCS for chronic illnesses was moderately reduced during the pandemic period

Almost all kinds of chronic patients had lower utilization of basic HCS during the pandemic lockdown. Thus, it is very crucial to trace chronic patients to reduce the severity, further complications and mortality during the pandemic lockdown period.

vi. Roma had significantly a higher CRPNR than the non-Roma population

Although Roma had better redemption in SRC in the previous study (265), in both periods they had a higher likelihood of CRPNR than non-Roma people. It suggested that the pandemic was not the sole cause for the increased CRPNR among the Roma. Thus, Roma needs special attention on achieving the prescribed drugs and medical supplies from financial barriers perspectives regardless of the pandemic.

The Pandemic Interaction effect /modifying HCS utilization among the social strata

vii. The pandemic lockdown significantly modified the effect of education level on GP visits, specialist care and CRPNR

Subjects with a higher academic level showed a significant decline in the use of GP during the pandemic lockdown. Conversely, the less educated subjects faced a significant increase in CRPNR during the pandemic lockdown. While this is a

unique social stratum in that the pandemic caused a remarkable inequality in utilizing HCS from CRPNR perspectives in Hungary.

viii. The pandemic lockdown significantly modified the GP and specialist care among marital categories.

Being widowed had a significant role in the GP visits attributed to the pandemic lockdown restrictions. Even though there was a decline in specialist care during the pandemic lockdown, such a reduction was significantly lower than in other marital subgroups. This suggested that the responses seemed to be adequate as this marital stratum had serious health issues, needs and demands.

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X. Publication List

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List of publications related to the dissertation

1. **Bekele, B. B.**, Alhaffar, M. H. D. B. A., Wasnik, R. N., Sándor, J.: The Effect of the COVID-19 Pandemic on the Social Inequalities of Health Care Use in Hungary: a Nationally Representative Cross-Sectional Study.
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List of other publications

3. **Bekele, B. B.**, Manzar, D., Alqahtani, M., Pandi-Perumal, S. R.: Diabetes mellitus, metabolic syndrome, and physical activity among Ethiopians: a systematic review.
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Total IF of journals (all publications): 23,657
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