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Article *in* Substance Use & Misuse · November 2017

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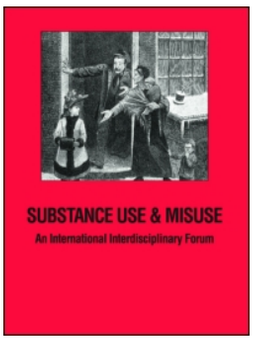

Substance Use & Misuse

ISSN: 1082-6084 (Print) 1532-2491 (Online) Journal homepage: http://www.tandfonline.com/loi/isum20

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To cite this article: Mehdi Noroozi, Ebrahim Rahimi, Hessam Ghisvand, Mostafa Qorbani, Hamid Sharifi, Alireza Noroozi, Ali Farhoudian, Brandon D.L. Marshall, Zahra Jorjoran Shoshtari, Salah eddin Karimi, Omid Rezaei & Bahram Armoon (2017): Decomposition of Economic Inequality in Needle and Syringe Programs Utilization to its Determinants among Men Who Inject Drugs in Tehran using Blinder–Oaxaca Decomposition Method, Substance Use & Misuse, DOI: 10.1080/10826084.2017.1400567

To link to this article: https://doi.org/10.1080/10826084.2017.1400567

Published online: 22 Nov 2017.

SUBSTANCE USE & MISUSE
2017, VOL. 0, NO. 0, 1–7
https://doi.org/10.1080/10826084.2017.1400567

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ORIGINAL ARTICLE

Decomposition of Economic Inequality in Needle and Syringe Programs Utilization to its Determinants among Men Who Inject Drugs in Tehran using Blinder–Oaxaca Decomposition Method

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ABSTRACT

Background: According to latest available data there are more of 300,000 people injects drug users (PWID) in Iran. *Objectives*: In this study, we used a Blinder–Oaxaca (BO) decomposition to explore the relative contributions of inequality in utilization of NSPs and to decompose it to its determinants in Teheran. *Methods*: We used data from a cross-sectional survey using snowball sampling to recruit 500 PWID from June to July 2016 in Tehran. Participants were reported injecting drug use in the past month, were able to speak and comprehend Farsi enough to respond to survey questions, and were able to provide informed consent to complete the interview. We used a BO method to decompose the role of economic inequality on utilization of needle and syringe programs. *Results*: A total 520 of clients participated in the study of which data was fully complete for 500. The selected predictor variables (age, education level, marital status, homelessness, HIV risk perception, and HIV knowledge) together explain 54% (8.5% out of 16%) of total inequality in utilization of needle and syringe programs and the remaining 46% constitute the unexplained residual. HIV risk perception status contributed about 38% (3.3% out of 8.5%) to the total health inequality, followed by HIV knowledge (26%) and education level were contributed 20% each, respectively. *Conclusion*: The results showed that contribution of economic inequalities in utilization of NSPs was primarily explained by the differential effects of HIV risk perception and HIV knowledge among PWID. Reducing HIV risk perception and increasing HIV knowledge might be essential to efforts to eliminate inequalities in access to NSPs among PWID.

KEYWORDS
Economic Inequality; needle and syringe programs; inject drugs; Tehran; Blinder–Oaxaca decomposition

Introduction

Injecting drug use (IDU) is responsible for a major proportion of burden of disease attributable to the blood-borne transmitted diseases including HIV and HCV in both developed and developing countries.(Aceijas & Rhodes, 2007; Alavian, Adibi, & Zali, 2005). Injection drug use is a major public health concern in Iran (Aceijas & Rhodes, 2007; Alavian et al., 2005; Noroozi et al., 2015; Zamani et al., 2007). According to latest available data there are more of 300,000 people injects drug users (PWID) in Iran. Among them, needle and syringe sharing and unprotected sexual behaviors are the most common risk factors of HIV transmission (Alipour, Haghdoost, Sajadi, & Zolala, 2010; Haghdoost et al., 2011; Nazari et al., 2016). HIV/AIDS epidemic is largely driven by injection drug use in Iran (Haghdoost et al., 2011). Approaches to HIV risk reduction among PWID include community-level interventions to change injecting norms, and needle syringe programs (NSPs) to provide sterile syringes and injection paraphernalia (Coates, Richter, & Caceres, 2008; Fung et al., 2007; Islam, Wodak, & Conigrave, 2008; Noroozi et al., 2015). In Iran, NSPs are

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well established having been developed and implemented since 2002 (Mirahmadizadeh, Majdzadeh, Mohammad, & Forouzanfar, 2009; Nazari et al., 2016). Based on WHO reports, NSPs been found to be play an important role among public health strategies for reducing unsafe injection and particularly needle/syringe sharing and HIV transmission among PWID (Kyle et al., 2015; Nazari et al., 2016). A Study conducted in sub-Saharan African (SSA) countries showed that HIV infection is concentrated among poor in urban area (Hajizadeh, Sia, Heymann, & Nandi, 2014). Several studies have indicated inequity in access to NSP among high risk groups (Sia et al., 2016). Although reports of disparity in the frequency of access to NSP are available, we found no report on the role of economic inequality in access to NSP. It is important to clarify whether economic inequalities in needle and syringe programs utilization are explained by demographic or socioeconomic status differences. This knowledge is important for establishment and developing more effective HIV prevention programs. Moreover, the determinants of socioeconomic inequalities in access to and utilization of NSPs have not been empirically investigated. This study attempts to address these gaps by estimating socio-economic inequalities in NSP utilization among PWID. To our knowledge, this is the first study to measure the role of socioeconomic gradient in NSPs utilization. In this study, we used a Blinder–Oaxaca (BO) decomposition to explore the relative contributions of inequality in utilization of NSPs and to decompose it to its determinants in Tehran.

Methods

We used data from a cross-sectional survey using snowball sampling to recruit 500 PWID from June to July 2016 in Tehran. The methods are outlined elsewhere(Sharifi et al., 2017), but briefly, participants included in the study were those who were aged over 18 years, had reported injecting drug use in the past month, were able to speak and comprehend Farsi enough to respond to survey questions, and were able to provide informed consent to complete the interview. The study protocol and all the procedures were reviewed and approved by the Research Ethics Committee of the University of Social Welfare and Rehabilitation Sciences. The questionnaire included socio-demographic information (i.e., participant age at the time of survey, sex, marital status, occupational status, educational attainment, monthly income), substance use history (i.e., age of first injecting drug use, age of first drug use), contextual factors (i.e., use of syringe exchange program), and syringe and injection equipment sharing behaviors (i.e., receptive syringe sharing, distributive syringe sharing). All behavioral questions referred to the 3-months prior to completing the interview. Outcome of interest was utilization of needle and syringe programs services defined as self-reported use of any kind of NSP during last 3 months. Needle and syringe programs utilization was ascertained by the yes/no question. Economic status was measured by a composite index created by principal component analysis (PCA) using participants' income data. The sample was grouped to two categories according to their economic status. Economic status categorization was done first on home assets, as described by O'Donnell, Van Doorslaer, Wagstaff, and Lindelow (2008a,b). Then, we constructed the assets index variable based on the weighting of the first component and divided it in to tertiles. To assess inequalities, the first group was considered as the high-economic group and the third as the low-economic group. Firstly, socioeconomic differentials in utilization of needle and syringe programs were assessed by cross-tabulations. Also, the socioeconomic differentials in needle and syringe programs utilization are tested for statistical significance by Chi-square. Then, we used a BO method to decompose the role of economic inequality on utilization of needle and syringe programs. Because of Oaxaca–Blinder (OB) decomposition method has not been widely used in HIV and healthy research, this section explains the concept of the OB decomposition, followed by the empirical analytical methods used to address this study. The decomposition method was introduced first by Blinder (1973) and Oaxaca (1973) to examine racial/gender discrimination in the labor market. The core idea is to explain the distribution of the outcome variable in question by a set of variables that vary systematically with socioeconomic status. The BO decomposition technique is especially useful for identifying and quantifying the separate contributions of group differences in measurable characteristics, such as education, experience, marital status, and geographical location, to racial and gender gaps in outcome (Fairlie, 2005). The aim of the BO decomposition is to explain how much of the difference in mean outcomes across two groups is due to group differences in the levels of explanatory variables, and how much is due to differences in the magnitude of regression coefficients (Fairlie, 2005). in contrast to the standard regression method that just, accounts for the differential distribution of characteristics between two group (high and low), the BO method additionally reflects the effects of group differences in unobserved variables (Bauer & Sinning, 2008; Fairlie, 2005). The original method using counterfactual regression approach separates the mean difference between "advantaged" and "disadvantaged" groups into two components; (1) the first

one is explained by differences in level of observable characteristics (Endowments effect or Explained part) and (2) the second one that could not be explained by such differences, is due to deferential effects of characteristics across the comparison groups (coefficients effect) along with effects of other characteristics not included in the model (constant). The coefficients effect is attributed to discrimination in some context (Jann, 2008). Since the techniques were originally applied to linear model, an nonlinear extension of the model was developed by some investigators (Bauer & Sinning, 2008; Fairlie, 2005; Sinning, Hahn, & Bauer, 2008; Yun, 2004). For example, poor children may be less healthy not only because they have less access to piped water but also because their parents are less knowledgeable about how to obtain the maximum health benefits from piped water. The decomposition technique considered in the next chapter does not permit such a distinction between the contributions of differences in the magnitudes and the effects of determinants. In its favor, however, it does allow us to decompose inequalities in health or health care across the full distribution of say, income, rather than simply between the poor and the better-off (O'Donnell et al., 2008a, b). In this study, the technique provides an objective means of disentangling the effects of true impact of economic differences versus other justified differences.

$$\bar{Y}^U - \bar{Y}^L = \left[\sum_{i=1}^{N^L} \frac{F\left(X_i^L \beta^H\right)}{N^L} - \sum_{i=1}^{N^H} \frac{F\left(X_i^H \beta^H\right)}{N^H}\right] + \left[\sum_{i=1}^{N^L} \frac{F\left(X_i^L \beta^L\right)}{N^L} - \sum_{i=1}^{N^L} \frac{F\left(X_i^L \beta^H\right)}{N^L}\right] \quad (1)$$

In equation (1), N refers to the sample size for high and low economic. In equation (1), the first term in brackets shows the part of the needle and syringe programs utilization gap that attributable to differences in the distribution of characteristics (the explained component or characteristics effects endowments) and the second term also represents the portion of the syringe programs utilization gap that due to differences in the effects of these characteristics on needle and syringe programs utilization (the unexplained component or coefficient effect. This involved decomposing the observed high-low economic gaps in the prevalence of needle and syringe programs utilization into two components: composition and response effects. Composition effects represent the contribution to economic inequalities in needle and syringe programs utilization due to economic differences in the distributions of observable HIV risk factors between high and low (i.e., socio-demographic characteristics). Response effects reflect the contribution to economic inequalities in needle and syringe programs utilization due to economic differences in the effects of measured factors, as well as unmeasured factors not included in the model. The analyses were done in STATA Software (v11) using last version of Oaxaca-available package that supported the nonlinear decomposition for binary dependent variables proposed by Yun (2004).

Results

A total 520 of clients participated in the study of which data was fully complete for 500. The mean age was 35 years (SD = 13.4). The majority of respondents had less than 6 years of education (73%). The proportion of unemployed persons was 78%. The proportion of never-been-married was 40%. The majority of the participants were homeless (61%). In Table 1, we compared the characteristics of injection drug users by Economic level. Injection drug users with low Economic level were more likely had low HIV risk Perception (66.4% vs. 64.8%, $p = 0.02$), to be have a lower HIV knowledge (13.5% vs. 10.6%, $p = 0.01$), and had low Needle and syringe programs utilization (11.5% vs. 25.5%, $p = 0.03$), Table 2 presents coefficient (odds ratio) estimates across economic groups in multivariable logistic regression models. dependent variable was self-reported of Needle and syringe programs utilization. For instance, the estimated coefficient of having a "HIV knowledge" was high among low economic (OR = 1.57 in Table 2), in terms of increasing the likelihood of the Needle and syringe programs utilization, compared to that among high economic (OR = 1.37), which led to an increase of the low–high disparity by 4.5 pp (i.e., the largest "share" of 39.1%.

Table 1. Observed characteristics across low/high Economic level, Tehran, 2016 N = 500.

Characteristics	Economic: Low ($n = 328$) *N* (%)	Economic: High ($n = 142$) *N* (%)	*p*-Value
Age (Mean + SD)	33.95 ± 8.91	33.8 ± 8.98	0.8
Education			
>High school	203 (61.9)	95 (66.9)	0.3
<High school	125 (38.1)	47 (33.1)	
Living Status			
Homeless	192 (58.5)	85 (59.9)	0.7
Stable housing	136 (41.5)	57 (40.1)	
HIV risk Perception			
high	108 (33.6)	50 (35.2)	0.02
Low	313 (66.4)	92 (64.8)	
HIV knowledge			
high	281 (86.5)	127 (89.4)	0.01
Low	44 (13.5)	15 (10.6)	
Needle and Syringe Programs Utilization			
yes	106 (11.5)	121 (25.5)	0.03
no	214 (88.5)	59 (74.5)	

Table 2. Coefficients (Odds Ratio (OR)) estimates across economic groups (Low/High) in multivariable logistic regression models (dependent variable = self-reported of Needle and syringe programs utilization.

	Low economic groups			High economic groups		
		95% CI			95% CI	
	Coefficient	LL	HL	Coefficient	LL	HL
Age (year)	1.24	1.00	1.54	1.14	0.72	1.80
Education: (>High school = 0, <High school = 1)	1.14	0.97	1.34	1.04	0.69	1.59
Living Status: (Homeless = 0, Stable housing = 1)	1.57	1.32	1.85	2.91	1.88	4.50
HIV risk Perception: (Low = 0, High = 1)	1.40	1.18	1.66	1.46	0.74	2.87
HIV knowledge: (Low = 0, High = 1)	1.52	1.26	1.84	1.37	0.81	2.29

Table 3. Contribution of socio-demographic factors to role of economic inequalities in utilization of needle and syringe programs; decomposition analysis.

	Utilization of needle and syringe programs during past 3 months				
		95% CI			
	Coefficient	LL	UL	*p*-Value	Contribution%
Prevalence in low economic group	11.5	8.6	−13.5	0.02	
Prevalence in high economic group	25.5	21.2	28.5		
Differences	−16	−15.3	18.3	0.01	100.0
Endowments effect (Explained part):	−11.5	−12.4	−6.6	0.01	71.8
Age	−2.1	−2.7	2.9	0.3	18.2
Education level	−2.7	−3.2	1.8	0.02	23.4
HIV risk perception	−2.2	−4.2	−2.8	0.03	18.4
HIV/AIDS knowledge	−4.5	−3.9	−1.4	0.003	39.1
Coefficients effect (Unexplained part):	−4.5	−9.6	−5.3	0.2	28.2
Age	−2.7	−7.4	5.3	0.2	60.2
Education level	1.2	−5.2	4.9	0.1	−26.6
HIV risk perception	−2.7	−7.2	3.28	0.02	82.2
HIV/AIDS knowledge	0.8	−2.8	4.8	0.3	−24.4
Constant	−1.1	0.55	3.2	0.7	24.4

Decomposing economic inequalities in needle and syringe programs utilization

In terms of Utilization needle and syringe programs, the difference between high- and low-economic groups was −16%. The gap between the low and high economic groups was decomposed into components. The results of decomposition analyses indicate that selected sociodemographic factors together explained a major part of inequalities in use of needle and syringe programs in PWID. The selected predictor variables (age, education level, marital status, HIV risk perception, and HIV knowledge) together explain 72% (11.5% out of 16%) of total inequality in utilization of needle and syringe programs and the remaining 28% constitute the unexplained residual.

The estimates of contributions from specific factors show that HIV knowledge made the largest contribution to total inequalities in using needle and syringe programs among PWIDs. HIV/AIDS knowledge status contributed about 28.1% (4.5% out of 16%) to the total health inequality, followed by HIV of perception (13.7%) and education, respectively (Table 3). This implies that economic inequalities in utilization of needle and syringe programs would be decreased if low and high economic groups had similar levels of HIV risk perception and HIV knowledge and socio-demographic characteristics. The remaining gap (i.e., −4.5%) due to difference in the effects of the variables studied, as well as other factors that were not included in this study (unexplained component or coefficient effects). This may be attributed to factors that correlate with economic status but were not included. In this part only HIV knowledge was found to significantly contribute to the gap between the two economic groups.

Discussion

The determinants of economic inequalities in needle and syringe programs utilization are poorly understood. Socio-demographic factors can contribute to differences in needle and syringe programs utilization among low and high-economic groups (Sia et al., 2016). Using multiple logistic regression models, previous studies from this database in Iran showed that background variables, such as demographic, Education level, HIV risk perception were important in explaining the relationship between economic status and access needle and syringe programs. Also result of odds ratio in regression models showed contribution each of variable is vary in access needle and syringe programs (Rezaie et al., 2016, 2017). Other

previous studies which have also found strong statistical association between HIV /AIDS knowledge and access to needle and syringe programs (Noroozi et al., 2017). A study in sub-Saharan Africa found that PWIDs who reporting some higher level of education were more likely access needle and syringe programs than those higher level of education (Sia, Onadja, Nandi, Foro, & Brewer, 2013). In this study, we estimated the absolute difference in needle and syringe programs utilization comparing low to high economic status of PWID in Tehran and identified sources of economic inequalities. In this study, we found that PWID who had low economic status are less likely to use needle and syringe programs than PWID who had high economic status and educational level was a significant contributor to inequalities of needle and syringe programs utilization among PWIDs. This indicates the important role of economic status in needle and syringe programs utilization. These findings are in line with studies that have identified lower socioeconomic status are associated with lower access to needle and syringe programs in PWID (Li et al., 2014; Nazari et al., 2016; Noroozi et al., 2015; Song et al., 2011). Many studies using regression models showed the role of socioeconomic status and access to NSP (Lee et al., 2005; Li et al., 2014; MacPhail, Pettifor, Moyo, & Rees, 2009). The results of this study showed that HIV/AIDS knowledge was a major contributor to economic inequalities in needle and syringe programs utilization. Overall, these factors explained 26.6% (4.5 out of 16%) of the economic inequalities among PWIDs in Tehran. This is consistent with a previous research (Rhodes, Singer, Bourgois, Friedman, & Strathdee, 2005; Zhang et al., 2013). Nazari et al. (2016) showed that there are positive association between HIV knowledge and use of needle and syringe programs and higher HIV knowledge level can strengthen use of NSPs among PWID. This finding suggests striving to promoting HIV knowledge in lower economic groups might be effective in buffering effects of economic inequality. So, HIV prevention programs should strongly focus on promoting HIV knowledge among their clients. Policy makers should pay more attention to implementing and expanding education programs on HIV in drop in centers (DIC) among PWIDs. Also, based on result of our study, contribution of economic inequalities in needle and syringe programs utilization can partially explained by HIV risk perception. This is consistent with a previous research (Rhodes et al., 2005; Zhang et al., 2013). Our findings showed that education level can explained inequalities in use of needle and syringe programs. This is in accordance with a recent study by Noroozi et al. that demonstrated that higher education level was positively associated with access to needle and syringe programs (Noroozi et al., 2015). Our findings indicated that the contribution or effect of all individual-societal factors on the access to healthcare services were approximately similar considering the odd ratios in two social classes. Therefore, it is essential for the policy makers to consider these factors as well as the programs focusing on the knowledge promotion about HIV in both strata. Nevertheless, it is recommended to include some related educational programs to increase the knowledge about HIV in Harm Reduction Centers. There were several limitations to this study. The first major limitation of this study was the cross sectional design. This design did not enable us to directly investigate the causal relationships. Therefore, a longitudinal study is required to provide a more detailed description. Furthermore, our data were based on participants self-report and therefore this may be subject to recall and social desirability bias (Latkin & Vlahov, 1998). Third, the sample was not a random sample and was recruited using snowball sampling techniques, which may have biased the sample because of the size of participants' social networks and homophile in recruitment patterns. Caution is thereby necessary in generalizing the results to all PWIDs living in Iran.

Conclusion

The results showed that contribution of economic inequalities in utilization of NSPs was primarily explained by the differential effects of HIV risk perception and HIV knowledge among PWID. Reducing HIV risk perception and increasing HIV knowledge might be essential to efforts to eliminate inequalities in access to NSPs among PWID.

Acknowledgments

We gratefully thank all staff in the drop-in centers (DICs) in Tehran who contributed in recruiting and data collection interviews. We thank participants for their time and interest in the study.

Authors' contributions

Study concept and design: BA and MN. Analysis and interpretation of data: H Shand AND drafting the manuscript: AF, HGh and BM. Critical revision of the manuscript: ZJSh, SK, ER.

Conflict of interests

All other authors have no conflicts of interest to be declared.

Funding source

This study, funded by Substance Abuse Prevention and Treatment Office (SAPTO) of Mental Health, Social Health and

Addiction Department (MeHSHAD) of Ministry of Health and Medical Education, Islamic Republic of Iran.

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