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Researching hidden populations: approaches to and methodologies
for generating data on trafficking in persons

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PREFACE

Forum on Crime and Society is a United Nations sales publication issued by the United Nations Office on Drugs and Crime (UNODC), based in Vienna. It is published in the six official languages of the United Nations: Arabic, Chinese, English, French, Russian and Spanish.

Forum presents policy-oriented articles on crime prevention and criminal justice. It focuses on trends and practices in the field of criminal justice that are of special significance to the international community.

The present issue of *Forum* is devoted to research approaches to and methodologies for generating data on trafficking in persons. It is the ninth issue of *Forum* to be published and widely distributed to a varied readership. Past issues of *Forum* are available on the UNODC website (www.unodc.org/unodc/en/data-and-analysis/Forum-on-Crime-and-Society.html).

All contributions to this issue of *Forum* have been written by the authors in their personal capacity and should not be regarded as official views or positions of the institutions they represent.

UNODC wishes to thank Sonja Busch for her assistance in preparing the present issue of *Forum*.

Since 2010, when the General Assembly, in its resolution 64/293, adopted the United Nations Global Plan of Action to Combat Trafficking in Persons, UNODC has been assigned to collect relevant data and report on trafficking in persons, in particular on the patterns and flows of such trafficking, at the national, regional and global levels. Even though the importance of including statistics in an approach to tackling human trafficking is widely acknowledged in international legal and public documents, it is also recognized that there is still a scarcity of knowledge on the total scale of such trafficking. In preparing the global report on trafficking in persons, UNODC is faced with several challenges such as definitional ambiguity and the absence of primary data collection based on sound sampling and documentation procedures in the participating States.

Despite the internationally accepted legal definition of trafficking in persons established in the Protocol to Prevent, Suppress and Punish Trafficking in Persons, Especially Women and Children, supplementing the United Nations

Convention against Transnational Organized Crime,[a] in practice there are various interpretations of what constitutes such trafficking. The use of different interpretations, such as who are the victims of such trafficking, where can they be found and what are trafficking violations, makes it difficult to compare data at the international level. The different quality and documentation of procedures contribute to the difficulty of estimating the global scope of the problem, the biggest challenge being the hidden nature of such trafficking.

The long-term vision of UNODC is to know more about the hidden side of the phenomenon of trafficking in persons and to facilitate the development of more innovative research approaches in order to receive more sound data from States. For this reason, an expert workshop on research in trafficking in persons was organized in Vienna from 11 to 13 December 2013. Participants were researchers with experience conducting quantitative or qualitative studies in different areas, reaching hidden populations. The objectives of the meeting were to discuss the quantitative and qualitative aspects of new research methodologies and to develop concrete ideas and recommendations to be used by UNODC to improve its research on patterns and flows of human trafficking at the national, regional and global levels.

This issue of *Forum* is aimed at presenting the variety of research approaches and findings to a broader public and contributing to a discourse on how to obtain through research more sound data on the different aspects of trafficking in persons.

Concrete recommendations by the participating authors include:

- Using existing international and national surveys for analysis

- Taking advantage of existing data collection vehicles, especially in industrialized countries

- Encouraging the collection and analysis of data in microlevel settings and not relying on current estimates

- Carefully defining indicators of human trafficking with common

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[a] "'Trafficking in persons' shall mean the recruitment, transportation, transfer, harbouring or receipt of persons, by means of threat or use of force or other forms of coercion, of abduction, of fraud, of deception, of the abuse of power or of a position of vulnerability or of the giving or receiving of payments or benefits to achieve the consent of a person having control over another person, for the purpose of exploitation. Exploitation shall include, at a minimum, the exploitation of the prostitution of others or other forms of sexual exploitation, forced labour or services, slavery or practices similar to slavery, servitude or the removal of organs" (General Assembly resolution 55/25, annex II, article 3).

iv

characteristics to allow for the development of common counter-measures reflecting all international legal frameworks

- Establishing a global test databank to host various examples of trafficking instruments, together with their supporting documents and validation studies

The articles presented in this volume of *Forum* deal with challenges and solutions in collecting research data on trafficking in persons and presenting quantitative and qualitative aspects in reaching hidden populations and how to use them for research on such trafficking.

Editorial policy and guidelines for publication

The Editorial Board invites scholars and experts from around the world to contribute articles to *Forum* on criminological and socio-legal issues. Articles submitted for publication must be original, that is, they should not have been published elsewhere. The length of manuscripts to be considered for publication as articles should not exceed 6,000 words. Manuscripts should be submitted in electronic format and preferably also in hard copy and should be accompanied by the curriculum vitae of the author and an abstract.

All manuscripts, reviews and correspondence should be addressed to the Managing Editor of *Forum*, either by mail (Policy Analysis and Research Branch, United Nations Office on Drugs and Crime, P.O. Box 500, 1400 Vienna, Austria) or by e-mail (forum@unodc.org).

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CONTENTS

ESTIMATING HUMAN TRAFFICKING WORLWIDE: A MULTI-MODE STRATEGY

By Jan van Dijk*

Abstract

In this article, the author presents the results of an in-depth analysis of the production of statistics by Eurostat on formally identified victims of trafficking in human beings in Europe. He concludes that the concept of an identified victim of trafficking in human beings has different meanings in different European Union member States and that the identification process is organized differently as well. On the basis of those regional results, he argues that statistics on the number of recorded victims of human trafficking cannot be used as a reliable measurement of the extent of trafficking in human beings in a country, neither in the European Union nor elsewhere. As follow-up to this critical assessment, the author argues in favour of a worldwide programme for the collection of survey-based estimates of human trafficking and, to that end, presents a methodological strategy combining various modes of data collection.

Keynotes: identification of victims of trafficking in human beings, Eurostat, cross-country differences, dark number studies, multi-mode strategies.

Introductory remarks

International legal instruments on human trafficking such as the Protocol to Prevent, Suppress and Punish Trafficking in Persons, Especially Women and Children, supplementing the United Nations Convention against Transnational Organized Crime [1], are explicitly victim-focused. Their ultimate aim is to reduce the number of persons, especially women and children, victimized by this type of crime. In addition, these instruments seek to improve the provision of services to identified victims. Considering these aims, the special interest in collecting international statistics on victims of human trafficking is obvious. Such statistics are important for monitoring the impact of the Trafficking in Persons Protocol, which, when properly implemented, should result in lower numbers of victims of human trafficking and a higher proportion of such victims being adequately served.

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The collection of international statistics on crime is challenging due to varying legal definitions, reporting patterns and recording practices. For this reason, official figures on police-recorded crime are increasingly seen as input statistics of criminal justice systems that cannot, and should not, be used to measure the level of crime or trends in crime ([2], [3]). In spite of this, statistics on the number of recorded victims of human trafficking continue to be collected by, among others, the United Nations Office on Drugs and Crime (UNODC) and Eurostat.

The present article contains the results of an in-depth analysis of the production of such statistics in Europe. Building on those results and a paper by Seo-Young Cho [4], the author argues that statistics on the number of recorded victims of human trafficking should be seen as an imperfect measurement of the performance of policies to counter such trafficking, or failure to implement such policies, rather than as a measurement of the phenomenon of human trafficking. In line with this assessment, the author argues in favour of introducing a worldwide programme to collect estimates of human trafficking that could supersede the tentative estimates of the International Labour Organization (ILO) [5] and, to that end, presents a methodological strategy for the collection of such data.

Counting identified victims

Official crime statistics from police forces or courts are case- or offender-directed and do not normally provide information on the number of victims of crime recorded by the authorities. In the case of human trafficking, this problem has to some extent been overcome by the introduction in many countries of mechanisms for the identification of victims of human trafficking. The author is not aware of mechanisms for the identification of any other type of crime. The increasing number of mechanisms for the identification of victims of human trafficking prompted UNODC to collect statistics on the number of officially identified victims for its global reports on trafficking in persons. It should be noted, however, that the Trafficking in Persons Protocol itself is silent on the identification of victims. After the adoption of the Protocol in 2000, the concept of identifying victims in the framework of a national referral mechanism was elaborated in a handbook of the Office for Democratic Institutions and Human Rights of the Organization for Security and Co-operation in Europe [6]. The concept has subsequently found its way into several regional legal instruments, prime examples of which are the Council of Europe Convention on Action against Trafficking in Human Beings, opened for signature at Warsaw on 16 May 2005, and directive 2011/36/EU

of the European Parliament and the Council of the European Union on preventing and combating trafficking in human beings and protecting its victims. Both of these European instruments oblige States parties or member States to establish appropriate mechanisms for the early identification of victims. The 2011 directive also instructs States to provide assistance and protection as soon as there are reasonable grounds to presume that someone is a victim of human trafficking (a so-called presumed victim). The latter obligation implies that in all European Union member States "appropriate mechanisms" must be in place for identifying victims of human trafficking, as well as mechanisms for identifying presumed victims.*

The existence of legal obligations to identify victims of human trafficking makes the European region a test case for the collection of comparable statistics on identified victims. In this region the legal and institutional conditions for the collection of such statistics seem relatively favourable. In 2010, Eurostat for the first time requested member States to use a questionnaire to report on, inter alia, numbers of identified and presumed victims. To what extent has this regional statistical exercise been successful? In a study commissioned by the European Commission, a team of scholars that included the author of this article made an in-depth assessment of the victim statistics collected by Eurostat [7]. It appears that the number of victims per 100,000 population shows extreme variation, ranging from lows of 0.1 in Hungary, Lithuania and Portugal to highs of 5.7 in Bulgaria, 6.0 in the Netherlands and 6.3 in Cyprus. Can these national figures be seen as a proxy of the extent of the phenomenon? Is human trafficking indeed most prevalent in Bulgaria, Cyprus and the Netherlands?

The first observation of the research team was that the guidance given by Eurostat to national respondent on the meaning of the concept of an identified or presumed victim was far from clear-cut. Even in the European context the concept has remained largely undefined. Fifteen European Union member States have reported on identified victims only. Ten member States have reported on both identified and presumed victims and two member States have reported on presumed victims only. In the Eurostat report, identified and assumed victims have been added up to yield the total for each country and for the European Union. That has led to further variation in the meaning of the victim statistics.

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*The 2011 directive does not specify what identification mechanisms should be established, nor does the Council of Europe Convention. At this juncture, national referral mechanisms do not exist in all member States and existing national referral mechanisms show considerable variation. For a critical review, see *Prevent, Combat, Protect: Human Trafficking—Joint UN Commentary on the EU Directive—A Human Rights-Based Approach* (2011).

The fact that identification mechanisms are in place provides no assurance that the recorded numbers of victims are comparable. Just as statistics on police-recorded crimes are strongly dependent on the surveillance and investigative efforts of police forces, the numbers of persons identified as victims are strongly influenced by the efforts of police forces, border control agencies, labour inspectorates and non-governmental organizations (NGOs) to detect or reach out to victims. The reports of the monitoring body of the Convention on Action against Trafficking in Human Beings, the Group of Experts on Action against Trafficking in Human Beings (GRETA), reveal great variation in the funds and human resources available for victim assistance or action to counter such trafficking. To complicate matters further, the formal identification of victims, unlike statistics of police-recorded crimes, has been put into the hands of very different institutions. The reports note that, although the police are the principal source of information on identified or presumed victims in the European Union, this is not the general rule. Nine European Union member States obtained such information from NGOs and 10 obtained such information from a variety of other sources. The other sources showed wide variation: state-run social services in Denmark and Sweden, reception centres in Finland, victim services in Poland, prosecutors, social services and international organizations in Romania, a special agency acting as a clearing house for presumed victims in the Netherlands and Portugal, and local authorities, regional councils and social services in the United Kingdom of Great Britain and Northern Ireland.

The results of the study reveal a stunning variation in what the concepts of identified and presumed victims actually mean within the institutional context of a country. Some examples may suffice to convey the scope of variation. In Sweden, statistics can be retrieved from NGOs but the official statistics on victims are derived from irrevocable court convictions for human trafficking. Since many suspected cases of trafficking are never solved by the police and brought before a court, the Swedish statistics can be seen as the most minimalist victim statistics imaginable. In most other countries, stand-alone mechanisms for victim identification are in operation.

One of the most elaborate mechanisms is run in the United Kingdom. British statistics given to Eurostat refer to victims definitely identified through the national referral mechanism, either by the specialized unit within the police or by the border agency. Victims who have been provisionally identified by these agencies on a reasonable grounds basis but whose victim status is not confirmed later in the process are left out, although most of them have received assistance for months. If they had been included as presumed victims, the total number for the United Kingdom would have been almost twice as high.

In Belgium, the concept of an identified victim refers to third-country nationals who were granted a recovery period or residence permit by the immigration authorities upon the decision of the prosecutor and who have been received by any of the three dedicated reception centres in the country. These formally identified victims make up just a small part of all victims of trafficking because nationals of Belgium and other European Union member States are not included. For this reason, Belgium is one of the five countries where relatively few victims have been identified and where many more victims have received assistance according to the statistics provided.

Austria and Germany report on victims identified by the police, excluding victims who have received assistance from NGOs without formal identification by the police.*

In Ireland, a national referral mechanism is in operation, but since it is not functioning, the numbers of recorded victims refer to all victims who have been in contact with the specialized unit within the police.

The examples mentioned above yield statistics that exclude certain categories of victims and should be seen as deflated statistics. An example of possibly inflated statistics, or overcounting, is found in the Netherlands. The Netherlands has reported on the number of victims recorded by an NGO (CoMensha) operating (on behalf of the National Rapporteur on Trafficking in Human Beings and Sexual Violence against Children) as an observatory or clearing house for all relevant state institutions and NGOs encountering persons showing any signs of being possible victims of human trafficking. These victims are counted as presumed victims. This recording mechanism covers many more victims than those formally identified by the police or immigration authorities in the framework of the national identification mechanism for victims who are irregularly residing in the country (governed by immigration regulation B8/3Vc).

According to the evaluation report of GRETA, France has not yet established a formal identification mechanism for victims of human trafficking. The number of victims reported on by France seem to be taken from police administrations and to include victims of pimping or victims of smuggling of migrants.

The statistics previously provided by Spain to Eurostat are likewise based on police administrations and those statistics also seem to be lacking in specificity. They undercount by missing many victims of human trafficking and overcount by including victims of other types of offences.

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*In Germany, representatives of the NGO community resist exchanges of data on victims with state agencies to ensure the highest possible degree of confidentiality [8].

The examples above show that the numbers of victims identified are not only dependent on the efforts of the key institutions involved in identification but that on top of this, the concept of an identified or presumed victim is interpreted by the European Union member States in such diverging ways as to seriously compromise the comparability of the resulting statistics on persons so defined. The scope and outreach of the national mechanisms of identification vary widely, ranging from identification through a final conviction of the trafficker by a criminal court in Sweden to the identification of any person showing signs of being a possible victim according to police officers, NGOs or labour inspectors in the Netherlands. The ranking of individual countries in terms of numbers of identified or presumed victims does not, therefore, reflect the relative size of or trends in the phenomenon of human trafficking. The author fully agrees with the caveat included in the Eurostat report that "more reported cases do not necessarily mean an increase in the actual number of victims" ([9], p. 30).[*]

If the statistics on identified victims collected by Eurostat cannot be reliably used as a comparative measurement of human trafficking, what does this imply for the statistics on victims collected by UNODC? Given the absence of any formal obligation of States parties to the Trafficking in Persons Protocol to establish and maintain identification mechanisms—and the absence of a definition of the concept of identification in the UNODC questionnaire, it can safely be concluded that the concept of identified victims will be even more heterogeneous among the Member States of the United Nations than among the member States of the European Union. On the basis of the European test case, the author concludes that statistics of identified victims of human trafficking cannot and should not be used as a comparative measurement of the phenomenon of human trafficking.

Counting identified victims for what?

A critical assessment of the validity of statistics on victims begs the question "For what purposes are such statistics collected?" Using econometric analysis, one of the experts participating in the above-mentioned study tested whether

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[*] In her presentation at the expert meeting of the project on tools for the validation and utilization of European Union statistics on human trafficking (TRAFSTAT), held in Amsterdam in September 2013, the National Rapporteur on Trafficking in Human Beings and Sexual Violence against Children in the Netherlands, Corinne Dettmeijer-Vermeulen, made the point that victim identification is strongly driven by awareness among relevant officials. She presented data showing that the surge in presumed or identified victims in the Netherlands between 2008 and 2012 was mainly driven by greater awareness among the border police, resulting in many more reports to CoMensha of suspected cases of trafficking [10].

the number of identified or presumed victims can be used as a proxy indicator for the policy efforts of countries to address human trafficking [4]. Her results confirmed that the higher the quantifiable input to address human trafficking, such as available police officers, the higher the number of identified or presumed victims. She suggested including such statistics in indices of policies to counter human trafficking, such as those developed by Van Dijk and Klerx-Van Mierlo [11], rather than in indices of the extent of human trafficking. This finding can be illustrated by the comparatively high number of victims in the Netherlands. According to the GRETA report on the Netherlands, the country complies better with international standards and invests more in detection and prosecution, education and victim protection than almost all other countries evaluated so far. In conclusion, the high number of identified victims of human trafficking in the Netherlands reflects the quality of the policies to counter such trafficking rather than the extent of the phenomenon.

Just as statistics on the number of identified victims are often erroneously used as an indication of the extent of the phenomenon in a country, statistics showing the gender, age, nationality or type of exploitation of the victims are all too frequently used as an indication of the nature of human trafficking in a country rather than as an indication of the priorities within the national policies to counter such trafficking. Extreme values for factors such as the age of victims may reveal special patterns in a country but they should primarily be used to raise questions about the focus of national policies. For example, there is a relatively low proportion of registered minors in Austria, Cyprus, the Czech Republic, Denmark, Finland, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia; is trafficking in minors very rare in those countries or is it simply overlooked by the authorities? In the author's opinion, such deviant values primarily beg the question of whether the identification of victims who are minors is receiving sufficient attention. Another example is the relatively low proportion of male victims in Germany and Hungary; the low value may suggest that national policies focus more on sexual exploitation and less on labour exploitation. In Finland, the relatively low number of identified victims of sexual exploitation may be an indication that policies are focused solely on labour exploitation. The proportion of nationals among identified victims shows similar divergence: in the destination countries Germany and the Netherlands, the proportion of identified or presumed victims who were nationals of Germany and the Netherlands were 20 and 30 per cent, respectively; this finding is in line with the general conclusion in a 2012 UNODC report that one in every four victims between 2007 and 2010 was a national of the country where he or she was exploited ([13], p. 50). However, most other destination countries in the European Union show a much lower proportion. The latter finding begs the question of whether those countries'

identification and detection systems are sufficiently geared towards victims of trafficking in those countries.

Deviant values in these and other statistics on victims deserve further scrutiny because they may be the result of existing policies or be peculiarities or deficiencies of the national policies regarding certain forms of human trafficking. Only after such examination can such values be interpreted as reflecting special patterns in human trafficking in a country.

Beyond counting identified victims

For lack of research-based knowledge on the true volume of victims of human trafficking in the world, the latest ILO estimate of 20.9 million victims of forced labour per year is the best available estimate, and the most widely quoted one [5]. Estimates have also been made by ILO for regions, including Europe. Using the European Union estimate, FairWork, an NGO in the Netherlands, has calculated an estimate of the real number of trafficking victims in the Netherlands. The ILO estimates are produced in two stages. The first stage consists of a sophisticated extrapolation of the number of recorded victims of labour exploitation in public reports using the capture-recapture formula. The second stage consists of extrapolating those estimates of recorded victims to estimate the real number of victims on the basis of surveys on exploitative experiences of returned migrants in four countries in the Caucasus. In the final analysis, the global, regional and national estimates are based on the multiplication of the estimated numbers of recorded victims by a factor derived from survey research on labour exploitation conducted in a handful of small countries in one subregion. It should therefore be best regarded as a sophisticated "guesstimate" rather than as a reliable measure.

The true number of victims is certainly many times higher than the number of identified victims, but there is as yet no basis for determining how much higher. The sole method for estimating the true volume of various forms of human trafficking in the world would entail conducting large-scale surveys among risk groups about their personal experiences during the past one or two years in a sample of member States. Standardized surveys on victims of types of common crime have been carried out worldwide [2]. A pilot study for a survey on experiences with trafficking or exploitation could be modelled after these earlier dark number studies regarding other types of complex criminality and after the pioneering ILO surveys on labour exploitation mentioned above. Pilot studies on the extent of criminal exploitation among migrant workers have also been carried out in the United States of America

with funding from the Department of Justice [12]. In the Netherlands, the Ministry of Labour and Social Affairs has commissioned a similar pilot study among migrant workers. Innovative studies have also been conducted with the aim of estimating the prevalence of exploitative practices in the sex industry in countries such as Cambodia, the Netherlands and the United Kingdom [14].

Estimating the number of victims of human trafficking worldwide: a proposal

Conducting dark number studies to determine the true number of trafficking victims in the world would require funds and human resources that are unlikely to be made available in the near future. As an alternative, the author has devised a research strategy that would allow the international community to arrive at tentative but credible estimates without requiring unrealistically large financial resources. This strategy seeks to combine results from various sources in a selection of countries representative of the main regions of the world (Africa, Asia, Europe, North America, South America and Oceania). Three test countries would be selected from each of the regions, preferably countries with large populations.

As the first step of this strategy, a research team would need to collect from existing sources in each of the 18 test countries estimates of the stock of workers in illegal non-sex labour markets and of the stock of sex workers. In most countries such estimates can be retrieved from existing publications. In some countries this may require the commissioning of ad hoc studies.

As a second step, surveys on criminal exploitation, modelled after the ILO surveys in the Caucasus and the study conducted by Zhang [12] in the United States, would be carried out in each of the 18 countries. Separate studies would need to be conducted on the exploitation of vulnerable groups such as illegal migrant workers who are not sex workers and on the exploitation of sex workers. Although some of these studies may need to be commissioned by the research team, it is to be expected that, over the years, the results of such studies in an increasing number of countries would become available. The availability of such results could be a criterion in the selection of the test countries.

The second step of the strategy would yield estimates of the proportion of sex workers and other illegal workers who are exploited in each of the test countries. As a third step in the strategy, the exploitation proportions would be

applied to the stocks of illegal workers and sex workers estimated in the first step. This would yield estimates of the total number of persons exploited in non-sex labour markets and the sex industry in each test country. Using existing knowledge on the average duration of exploitation per person (e.g. four months in the sex industry and perhaps six month in the other sectors), estimates can subsequently be made of the total number of persons exploited during a period of one year.

In the fourth step of the strategy, the estimated number of exploited persons per year per country in each of the two categories would be compared with the number of identified victims according to the UNODC *Global Report on Trafficking in Persons*. In this way, the ratio of the estimated real number of victims to the number of officially identified victims in each country could be calculated. By averaging these ratios, and possibly weighting the national ratios according to population size, the ratio could be calculated for each of the regions and for the world total. Each regional ratio could also be tentatively used to estimate the real number of victims in other individual countries in the region, extrapolating from the known number of identified victims.

A numerical example

To illustrate the proposed multi-mode model, an example of how the strategy would work out if one of the test countries were the Netherlands is provided below. According to available research findings, there are 30,000 illegal migrants working in the country and 20,000 sex workers. According to a study in Amsterdam, 20 per cent of the sex workers can be categorized as being victims of criminal exploitation (human trafficking) [14]. There is less known about the proportion of illegal migrants exploited by their employers. Using the results of the study conducted by Zhang in the United States [12], the proportion of exploited persons is tentatively put at 30 per cent. On the basis of this, it can be assumed that there are 4,000 victims of trafficking for the purpose of sexual exploitation and 9,000 (30 per cent of 30,000) victims of trafficking for labour exploitation.

Assuming that victims of sexual exploitation are on average exploited for four months, this results in an estimate of 12,000 victims of trafficking for sexual exploitation per year. Assuming that the average duration of exploitation is six months, this results in an estimate of 18,000 victims per year.

According to the number of identified victims of sexual exploitation in the Netherlands in recent years (about 1,000 per year), the ratio between the

estimated real number and the official number in the country is 12:1. Looking at the low number of formally identified victims of labour exploitation (about 300 per year), this gives a ratio of roughly 30:1. Since the number of officially identified victims of sexual exploitation in Europe is 15,000, the real number can be estimated at 180,000 when the ratio of the Netherlands (30:1) is applied. The number of identified victims of labour exploitation is much lower—about 1,500. Applying the ratio of the Netherlands would result in an estimate of the true number of victims: 45,000. In the proposed strategy, the ratio to be applied is not the ratio in a single country but the average ratio of three selected countries in the region.

Discussion

The core of international statistics on trafficking in human beings consists of the numbers of identified and/or presumed victims. Of all statistics on trafficking in human beings, these are cited the most often. They are in most cases presented as measurements or proxy measurements of the size of the phenomenon. Commentators on these numbers often observe that they must be seen as reflecting just the tip of the iceberg. On the basis of the statistics on identified victims, the public is informed that human trafficking is a very prevalent humanitarian problem that is still on the increase and therefore needs to be tackled by the Government as soon as possible. The use of soft data to estimate the number of identified victims for propagandistic purposes has been criticized on methodological grounds [15-18]. Analysis of the Eurostat statistics on victims [9] confirms that such statistics cannot and should not be used as a measurement of the phenomenon [7]. The proper use of such statistics would entail using them as a proxy indicator of the performance of government agencies in their fight against human trafficking, with a higher number of identified victims indicating better performance. Having said that, it should be acknowledged that the use of victim statistics for the purposes of awareness-raising and lobbying is fully legitimate. For this reason, more knowledge about the true number of victims of human trafficking is urgently needed, both for monitoring purposes and for responsible awareness-raising.

Pilot studies of the exposure to exploitative practices of risk populations such as illegal migrant workers or sex workers have yielded encouraging results. In theory, it seems feasible to embark on an initiative to conduct standardized dark number studies of victims of human trafficking, similar to the International Crime Victims Survey coordinated by the United Nations Crime and Justice Research Institute between 1996 and 2005. In the current situation, it may prove difficult to ensure sufficient funding for such global research. As an

alternative, the author has proposed a strategy that uses a combination of official statistics of identified victims and the results of dark number studies in selected countries as the bases for regional estimates of the true number of victims of trafficking for the purposes of sexual exploitation and labour exploitation.

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EXTREMELY WANTED: HUMAN TRAFFICKING STATISTICS — WHAT TO DO WITH THE HODGEPODGE OF NUMBERS?*

By Ieke de Vries** and Corinne Dettmeijer-Vermeulen***

Abstract

The total scale of human trafficking is still unknown. The existing estimates are frequently based on false or unfounded assumptions, insufficient and unreliable data and inadequate use of methodologies. Yet statistics on the scale of the problem are often used in political debates on, for instance, what policy on prostitution would be the most effective for combating sexual exploitation. Consequently, improper comparisons are made of the total scale of human trafficking in various countries. The authors of this article suggest a new perspective on the use of statistics on human trafficking in smaller settings. On the basis of research by the National Rapporteur on Trafficking in Human Beings and Sexual Violence against Children in the Netherlands, the authors discuss three ways in which statistics are of the utmost importance in the fight against human trafficking: in informing policy (evidence-based policy), in exposing bottlenecks on the basis of which suggestions can be made to introduce more efficient policies and as a starting point for further research providing answers to questions such as why certain aspects still seem to be underexposed in the fight against human trafficking.

Keywords: National Rapporteur on Trafficking in Human Beings and Sexual Violence against Children, human trafficking statistics, evidence-based policy, Netherlands.

Introduction

In March 2014, *12 Years a Slave* won the Academy Award for Best Film. The film is set in the United States of America of the nineteenth century, during a period when many people were sold as slaves, physically

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*This article is an updated version of four reports of the National Rapporteur on Trafficking in Human Beings and Sexual Violence against Children in the Netherlands [1-4].

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exploited, tortured and abused. It is widely acknowledged that slavery-like practices are not just part of the past: about 21 million people world-wide live in slavery today, according to the director of the film, Steve McQueen. His figure is based on the estimate of 20.9 million victims* made by the International Labour Organization (ILO) ([5], [6]). More recently, the Walk Free Foundation estimated that there are nearly 29.8 million victims** worldwide [7]. Such estimates are often reproduced without examining how researchers arrived at their estimates ([8], pp. 1344-1345; [9], pp. 86-90). The above-mentioned estimates have been given significant media attention. In news releases, it is often suggested that although exact figures are not available, it is likely that the number of victims of human trafficking is higher rather than lower than the estimated number of such victims (see, for example, Sharifi [10]). In numerous academic works, the estimates of the total scale of human trafficking are often considered to be on the conservative side (see, for example, Shoaps ([11], p. 934)). In a study on the total number of "victims of slavery and human trafficking" in 37 countries in Europe, Datta and Bales mention that "the size of the dark figure for slavery/trafficking crime for most European countries is so large that it suggests a crisis of public policy and law enforcement" ([12], p. 829). In reality, the total number of trafficked persons, as well as offenders (who are generally disregarded in estimates), is unknown.

In this article, the authors first explore briefly the complexity of calculating the total scale of trafficking in human beings. In various academic works published in recent years, efforts have been made to estimate the total scale of trafficking in human beings at the national and international levels (see, for example, International Labour Organization [5], International Labour Office [6], Walk Free Foundation [7], Bottenberg and others [13] and FairWork [14]). At the present time, however, there is no

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*With the exception of human trafficking for the purpose of organ removal, forced marriage and forced adoption, this estimate encompasses the types of exploitation specified in article 3 of the Protocol to Prevent, Suppress and Punish Trafficking in Persons, Especially Women and Children, supplementing the United Nations Convention against Transnational Organized Crime ([1], p. 18; [5], p. 20). ILO applied a capture-recapture methodology to estimate the number of registered victims. On the basis of four national surveys, ILO thereafter calculated which portion of the total population of victims of human trafficking was registered, which was 3.6 per cent. This percentage was used to calculate the unregistered portion of the population, leading to the ILO estimate of 20.9 million victims (standard error: 1.4 million (6.7 per cent)). The range of this estimate is between 19.5 million and 22.3 million victims. The reliability interval is 68 per cent, which means there is still a 32 per cent chance that the estimate does not fall within that range [5]. The National Rapporteur critically assessed, inter alia, the ILO estimate with the purpose of providing suggestions for further improvements ([1], pp. 17-31).

**The range of this estimate is between 28.3 million and 31.3 million victims [7].

systematic methodology for estimating the scale of human trafficking in its entirety (see also Sarrica ([15], p. 4)). The lack of accuracy in estimating the total scale poses problems in creating effective and coherent policies to counter human trafficking ([1], pp. 17-32; [2], p. 21; [5]; [8]; [16-24]). Nonetheless, available figures on the total scale of human trafficking are often used in support of, for instance, a particular policy on prostitution. The authors show how debates on the most efficient prostitution policy for tackling human trafficking underpin the request for statistics on the total scale of human trafficking. In those debates, improper comparisons are often made of the total scale of human trafficking in various countries. As long as reliable estimates on the total scale of trafficking in human beings are absent, the authors advocate microlevel quantitative research that allows for the necessary interpretation in concrete settings (see also Weitzer ([23], pp. 15-16)), as quantitative data have proved to be valuable in efforts to tackle human trafficking. The authors also examine the usefulness of statistics on human trafficking: in informing policy, in exposing bottlenecks in efforts to counter human trafficking and as a guide for further research. The authors conclude that, in the absence of reliable estimates, the available statistics on the nature of human trafficking at the national and local levels are more relevant for guiding measures to counter human trafficking.

Scale statistics

For the purpose of this article, figures on the total scale of human trafficking are referred to as scale statistics. A basic formula to retrieve scale statistics on human trafficking is as follows:

> "The scale of human trafficking is equal to the scale of registered—known—human trafficking minus the false positives (human trafficking that is registered as such but is not in reality human trafficking) plus the dark figure (of unregistered/unknown human trafficking), which includes the false negatives (human trafficking that is known but is not recognized or registered as such)" ([1], p. 18).

A formula for the total scale of trafficking in human beings is shown in the figure below.

Formula for the total scale of trafficking in human beings

Total scale of human trafficking
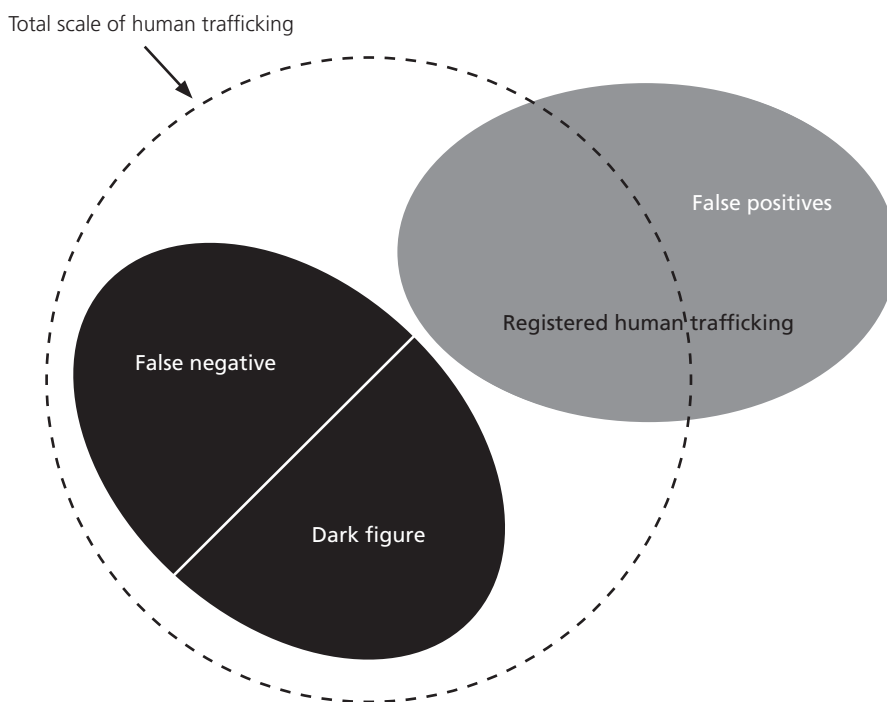
Note: The figure does not indicate actual scale ratios.
Dark figure: human trafficking that is unknown
False negatives: human trafficking that is known to the relevant authorities but is not registered
False positives: victims or perpetrators who have been registered but in the end may not be
victims or perpetrators of the delinquency for what they have been registered
Registered human trafficking: visible human trafficking that is registered by authorities

Simply said, to calculate the total scale of human trafficking, accurate data on both the visible part and the invisible part of human trafficking are required. Nonetheless, the application of the formula is apparently challenging. The difficulty in reaching reliable scale statistics is mainly caused by the challenges researchers face in attempts to measure this phenomenon. There are two main challenges in the application of the formula. First, when researching human trafficking, it is necessary to deal with hard-to-reach populations, for which the scale and boundaries are unknown and for whom a reliable sampling frame does not exist ([22], p. 2; [25], p. 18). This factor is not unique to data on human trafficking—it appears in data on many other forms of organized crime, resulting in the crime being underreported ([19], [26-28]). Like most other offenders, traffickers aim to keep their criminal activities hidden from investigative agencies. Yet not every crime is equally hidden. In cases involving trafficking in human beings, the victims are not readily inclined to

report their perpetrators and therefore tend to be less well documented (i.e. they have a larger dark figure), whereas in cases involving other forms of crime, the victims may be more willing to inform the police. Trafficked persons may be afraid to report their situation to the police, they may deny their victimhood or they may not consider themselves as victims ([1], pp. 17-18; [12], p. 823; [25]).

Second, what part of human trafficking is visible (known and registered) depends to a great extent on independent factors that have no direct link with the actual scale of human trafficking. For instance, despite the internationally accepted legal definition of trafficking in persons established in the Protocol to Prevent, Suppress and Punish Trafficking in Persons, Especially Women and Children, supplementing the United Nations Convention against Transnational Organized Crime [29], in practice there are different interpretations of what constitutes such trafficking ([1], p. 93; [2], pp. 241-244; [22], p. 7; [23], p. 7; [30], pp. 180-184; [31]). By way of illustration, in some countries moral attitudes may imply that prostitution is, by definition, regarded as human trafficking. Consequently, the data that are collected might be based on a wider interpretation of human trafficking than the one adopted in countries such as the Netherlands, where prostitution is not criminalized ([1], pp. 93-94). In general, the availability, nature and scope of data on human trafficking depend on the underlying legal instruments that criminalize (and define) such trafficking. As such, an absence of specific legislation causes that no standardized information will be available ([32], pp. 32-33; [33]). Other factors, such as the priorities set by authorities in tackling human trafficking, the capacity that is made available, public attention for human trafficking, changes in legislation, the research methods and research facilities used to report on the crime and financial resources affect both the availability of quantitative data and what kind of data can be collected in a country ([1], pp. 12, 39 and 61; [2], pp. 241-244; [32], p. 37); see, in the context of other types of crime, Aebi and others [34], Aebi [35], Bennett and Lynch [36], Farrington, Langan and Tonry [37], Howard and Smith [38] and Soares [39]).

The issue of false positives deserves special attention. Very few researchers refer to false positives when determining the visible part of human trafficking (for an example of researchers who do mention false positives, see Zhang and others ([24], p. 81)). Nonetheless, the mapping of false positives is extremely challenging because of different and continuously changing interpretations of the concepts of "victims" and "perpetrators". Thus, the framing of human trafficking in a specific period provides the basis of what is known about such trafficking. Hence, changing attitudes about and interpretations of the concept of human trafficking most likely result in "living statistics", referring to

statistics that change over time and retrospectively (see, in the context of statistics on murder, Bovenkerk and Hogewind ([26], p. 3)). As a matter of fact, what person A considers to be cases of human trafficking may be to person B cases of, for instance, domestic violence and considered as false positives. This dilemma may be even more apparent when it comes to counting victims of human trafficking, since "victimhood" is a highly sensitive and politicized concept. Indeed, the label "victim of trafficking" is occasionally used for other matters, such as defending moral ideologies and political agendas that are not necessarily related to fighting human trafficking [40-46].

The total scale of human trafficking can only be estimated. Given the challenges that are inherent to human trafficking (including the challenges that have been mentioned above), standard methods of estimation cannot be used. It is difficult to estimate the total number of trafficked persons. The existing estimates are frequently based on false or unfounded assumptions or are inaccurate because of insufficient and unreliable data and inadequate use of methodologies ([1], pp. 17-32; [2], p. 21; [8]; [16]; [18-24]). By extension, instruments that attempt to rank countries on the prevalence of human trafficking (see, for example, Walk Free Foundation [7]) give a distorted picture of the actual extent and nature of human trafficking. As for the Global Slavery Index, which ranks 162 countries on the prevalence of "slavery" (defined most broadly as human trafficking, forced labour and slavery), most of the criticism refers to the use of a "medley of unstandardized and thus noncomparable sources" ([23], p. 14).

The request for scale statistics from debates on prostitution policy

The request for scale statistics across countries is reinforced by current political debates about what would be the most efficient policy for countering human trafficking. One frequently asked question in these debates is whether the legalization of prostitution generates more human trafficking. Often in these debates, improper comparisons are made of the total scale of human trafficking in various countries [3]. Several scholars tackling this difficult question found evidence that certain prostitution policies have an impact on the prevalence of human trafficking [47-50].

In the light of the above, Cho, Dreher and Neumayer [47] concluded in their research on the extent to which legalized prostitution increases human trafficking that there is more cross-border human trafficking to countries where

prostitution has been legalized. This is also what Jakobsson and Kotsadam concluded in their article [49]. In order to reach their conclusion, the authors of both articles conducted cross-sectional research.[*] However, cross-sectional research provides no indication of the impact of changes in legislation on prostitution in a particular period. Therefore, the authors carried out case studies based on the situations in Denmark, Germany and Sweden [47] and in Norway and Sweden [49]. In those countries, legislation on prostitution was amended during the period covered by their studies [3].

While the authors of both articles employed a refined method to reach their conclusions, some compelling reservations remain ([3]; [23], p. 13). The authors depend on insufficient and partly unreliable data on both the visible part (by way of cross-sectional research) and the invisible part (by way of case studies and estimates). Three major issues stand out. First and foremost, for the cross-sectional research the authors relied on data concerning human trafficking situations that were known.[**] However, what part of human trafficking is visible (known and registered) depends to a great extent on independent factors that have no direct link with the actual scale of human trafficking. Second, for the dark figure, the authors of the above-mentioned articles relied on existing estimates, among others, the ILO estimates published in 2005 [51].[***] As emphasized in the previous section, figures on the total scale of human trafficking are still in their infancy, particularly when the aim is to inform policy. Third, the total scale of human trafficking in the sense of sexual exploitation is not solely dependent on policies regarding prostitution since there are many more push-and-pull factors that may have an impact on the prevalence of human trafficking. These factors can differ greatly from one country to another [3].

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[*] Cross-sectional research is a snapshot of certain issues since this kind of research looks at a single moment in time. The opposite is longitudinal research, where the study is conducted over a certain period in order to document the process. Longitudinal research requires a baseline measurement, for example: "How much human trafficking was there before the policy change?" Such baseline measurements, however, are not always feasible for policy changes that were introduced several years earlier [3].

[**] Cho, Dreher and Neumayer [47] used the 2006 report *Trafficking in Persons: Global Patterns* of the United Nations Office on Drugs and Crime (UNODC) [52] to reach the conclusion that a correlation exists between prostitution legislation in a particular country and the reported stream of human trafficking to that country. In addition to the UNODC report, Jakobsson and Kotsadam used data from a 2006 ILO working paper by Danailova-Trainor and Belser [53].

[***] In 2005, ILO estimated that, in the period 1995-2004, there were a minimum of 12.3 million victims of "forced labour" (standard error: 2.5 million victims); the range of this estimate is between 9.8 million and 14.8 million victims [51].

Evidence-based policy by means of quantitative data

In the absence of reliable figures on the total scale of human trafficking, cross-country comparisons on the prevalence of human trafficking still rely on unreliable and inaccurate data. Essentially, what is left is a "hodgepodge of numbers that hardly lend themselves to evidence-based policymaking" ([8], p. 1354). Research on the total scale of human trafficking seems to be bounded to, among other things, particular geographical sites, forms of human trafficking and trafficked persons or traffickers (e.g. estimates on prostitutes who are indebted in Cambodia ([54], [55])). An expansion of the applied research methods "raises problems of feasibility" ([15], p. 5), perhaps because of the diversity of trafficking contexts ([56], p. 38). Hence, following Weitzer's thoughts, this article advocates more microlevel research in order to formulate "contextually appropriate policy and enforcement responses" ([23], p. 6).

The importance of including statistics in an approach to tackling human trafficking seems to be widely acknowledged in international legal and public documents, including the 1997 Hague Ministerial Declaration on European Guidelines for Effective Measures to Prevent and Combat Trafficking in Women for the Purpose of Sexual Exploitation and the United Nations Global Plan of Action to Combat Trafficking in Persons (see also European Commission ([57], [58])). General Assembly resolution 64/293) (see also European Commission ([57], [58])). In particular, in article 19 of directive 2011/36/EU of the European Parliament and the Council of the European Union on preventing and combating trafficking in human beings and protecting its victims, it is stated that member States "shall take the necessary measures to establish national rapporteurs or equivalent mechanisms. The tasks of such mechanisms shall include the carrying out of assessments of trends in trafficking in human beings, the measuring of results of anti-trafficking actions, including the gathering of statistics in close cooperation with relevant civil society organizations active in this field, and reporting" [59]. In the Netherlands, the task of reporting on the nature and extent of trafficking is mandated to the National Rapporteur on Trafficking in Human Beings and Sexual Violence against Children. The National Rapporteur works independently but in close cooperation with relevant stakeholders such as the Public Prosecution Service, the National Police and civil society, which are responsible for a large part of the data on which analyses have been carried out.

Using as a basis research of the National Rapporteur, the authors suggest a new perspective on how statistics lay the foundation for guiding measures to counter trafficking. The perspective consists of three parts: statistics to inform

policy, to expose bottlenecks and to be used as a starting point for further research. As such, it looks primarily at how figures should be interpreted. In the following examples, hardly any statistics will be mentioned since naming them often does not do justice to the complete quantitative studies. A thorough understanding of statistical analyses requires more qualitative interpretation. This interpretation, in addition to a more detailed description of the methodology and further results, can be found in the reports of the National Rapporteur ([1], [2], [4]).

Statistics to inform policy

First and foremost, statistics in general provide a foundation for guiding the measures that can be taken to fight crime (see, for example, Hashimoto ([60], pp. 33 and 69)). Against this background, an analysis of a sample of 77 human trafficking investigations that were sent to the Public Prosecution Service in 2012, involving 165 suspects and 249 trafficked persons, helps determine what policies to fight human trafficking might be most effective ([2], pp. 133-134). For instance, increased insight into human trafficking situations, the trafficked persons and offenders helps to guide the programmatic approach to countering human trafficking in the Netherlands. The programmatic approach has been developed by the Public Prosecution Service and rests on two pillars: gaining insight into human trafficking; and developing innovative methods, both preventive and repressive, to fight such trafficking. In this approach, various units of the Public Prosecution Service and investigative agencies are cooperating. The so-called "barrier model" is an instrument used in the programmatic approach to highlight preventive and repressive measures that can be taken to tackle human trafficking. It determines the obstacles that perpetrators have to overcome in the human trafficking process. Five initial "barriers" have been determined on the basis of intelligence that is gathered: entry, identity, accommodation, labour and finance ([9], pp. 255-256 and 260-264).

Recruitment lies at the start of the human trafficking process. In order to prevent human trafficking, the barriers that should be raised need to focus, inter alia, on this stage of the human trafficking process. The quantitative analysis of 77 investigations provides knowledge of three specific aspects of the recruitment process that must form part of the barrier model. In the first place, preventive measures can be imposed at locations where trafficked persons were recruited. Generally speaking, two human trafficking situations in the Netherlands can be distinguished: those in which most of the trafficked persons have been recruited in the Netherlands (N=40) and those in which

most have been recruited abroad (*N*=37).[*] A characteristic of human trafficking situations in which recruitment generally takes place abroad is that both the trafficked persons and the suspects are from countries in Central and Eastern Europe. Such a finding highlights the need for operational cooperation with those countries in order to find ways to prevent trafficking in human beings into the Netherlands. When the recruitment took place in the Netherlands, the trafficked persons were usually from the Netherlands and the suspects were from Morocco, Suriname or Turkey, although some foreign men and women had also been recruited in the Netherlands. The recruitment process in the Netherlands mostly occurred in bars and clubs, via the Internet, at school or in prostitution areas (in cases involving sexual exploitation). This is where barriers should be raised in order to prevent human trafficking. Furthermore, the findings invalidate the idea that traditional recruitment methods have entirely been replaced by new means of making contact such as via the Internet ([61], p. 23). Nonetheless, the use of the Internet in daily life has seen a significant increase and, as a result, traffickers of human beings may benefit from social networking sites such as Facebook and Twitter, which seem to be used to facilitate such trafficking, for example in recruiting potential victims ([62], pp. 130 and 132; [63]; [64]). At the same time, the Internet offers new opportunities for intervening ([63]; [65], p. 287; [66]). A large-scale investigation in the United States showed that more than 150 school-girls between 13 and 16 years old had been recruited via the Internet by members of youth gangs. Through the social media, gang members came into contact with girls whose status updates showed that they, for example, had arguments at home or felt lonely. The girls were welcomed into the gangs and received attention that they might not have received at home. In order to really be part of the group, the girls had to prostitute themselves: after school and before their parents would come home. The gang members encouraged the girls to achieve good results at school. The sophisticated modus operandi of the gang members ensured that hardly anyone had suspicions of human trafficking (for further details, see National Rapporteur's report covering the period 2008-2012 ([2], pp. 155-156), National Rapporteur's report ([9], pp. 195-196) and Ingram [67]).

Second, preventive measures have the challenging task of breaking through the modus operandi of recruiters. In order to do so, quantitative—and

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[*]This is the outcome of a two-step cluster analysis in which the following factors have been included: number of trafficked persons and suspects, the sector in which the trafficked persons have been exploited, the suspects' criminal activities besides human trafficking and whether or not suspects operated within a criminal network of more than two members (the latter was supposedly not decisive in forming the two human trafficking situations). Some additional analyses have been conducted in order to obtain a more detailed view of the recruitment processes; for a more detailed description of the results and an explanation of the methodology, see the report of the National Rapporteur covering the period 2008-2012 ([2], pp. 153-156 and 186-188).

qualitative—data are required on aspects that are part of this modus operandi. By way of illustration, an analysis of 77 investigations has shown that in most cases (67.5 per cent) at least one of the trafficked persons was acquainted with the recruiter: as friends or partners, or as acquaintances in prostitution areas (in cases involving sexual exploitation), via social networking sites or cafes or bars ([2], p. 156, for further information on this issue, see Shelley ([68], p. 96), Staring ([69], p. 67) and Verhoeven and van Gestel [70]). It is likely that friends, family members or acquaintances are able to gain more trust than strangers from potential victims. As pointed out by several authors, trust is an important factor in the modus operandi of traffickers in the recruitment phase ([62], p. 55; [68], p. 95; [71], p. 45). By extension, it might be extremely challenging though not less important to break through such trust patterns.

Third, preventive measures should focus not only on potential victims but also on recruiters. For instance, one finding of the analysis of 77 investigations is that the roles suspects play seem to be statistically related with certain characteristics of suspects. As such, recruiters have a criminal background more often than other suspects. To what extent was this criminal background known to the police and to what degree was it related to human trafficking practices? And were opportunities missed that might have prevented this further career in crime? In general, information on the type of roles that suspects play in human trafficking processes provide insight into which suspects can be signalled by whom and in what places. Suspects often (70.3 per cent (N=165)) play a variety of roles in the human trafficking process, such as pimps, border-crossing transporters, guards, drivers within the country and suspects providing trafficked persons with the necessary documents ([2], pp. 167-175).

Statistics to expose bottlenecks

Human trafficking statistics have the potential to expose bottlenecks in the efforts to combat human trafficking. On this basis, suggestions can be made to initiate more efficient policy (see National Rapporteur's report covering the period 2008-2012 ([2], pp. 247-257)). For instance, statistics may contribute to the development of more "rational criminal justice policy and provide a means of assuring equal enforcement of the laws" ([60], p. 33). Building on statistical and legal case law analysis, the National Rapporteur revealed several bottlenecks in sentencing and ruling human trafficking cases in the Netherlands. A qualitative and partially quantitative analysis of all judgements rendered in the period from October 2009 to August 2012 was conducted, in order to answer questions such as "How is the provision of the

criminal code pertaining to human trafficking applied?", "What problems have emerged in relation to its application?", "How is human trafficking punished?", "What reasons are given for the sentences imposed?" and "How are claims by aggrieved parties dealt with in the criminal process?". The bottom line is that in the Netherlands, the provision of the criminal code pertaining to human trafficking is a complex provision to apply in practice. In spite of this, judges were generally inexperienced in human trafficking cases, a fact that becomes visible in some rudimentary figures. For example, more than three quarters of the judges concerned in 2010 had dealt with only a single human trafficking investigation in that year ([4], pp. 15, 170-172 and 193-194). The statistical and legal case law study has led the National Consultative Body for Presidents of Criminal Courts to adopt a number of measures relating to the specialization and training of judges hearing human trafficking cases ([2], p. 192; [4]; [9]).

The quantitative analysis relates to judgements in human trafficking cases in the first instance in 2010 (N=138). This has demonstrated, among other things, that the number of acquittals in human trafficking cases has been consistently high. Out of 138 indictments, the charges led to convictions for human trafficking in 60.2 per cent of the cases. The percentage of acquittals has been higher in cases involving exploitation outside the sex industry (51.7 per cent (N=29)) than in cases involving sexual exploitation (35.5 per cent (N=111)).[*] Factors that explain the higher percentage of acquittals in cases involving exploitation outside the sex industry may relate to the relatively recent criminalization of the offence in the Netherlands,[**] the need to flesh out the definition of the offence in case law or a knowledge gap in general if it comes to this form of exploitation. In addition, the statistical and case law analysis has shown major disparities with regard to sentencing in more or less similar human trafficking cases, and that does not reflect "a clear framework of assessment". The findings of the National Rapporteur's statistical and case law analysis have resulted in a recommendation to develop orientation points for the courts in the interest of sentencing ([4], pp. 37, 117-122, 168-169, 176 and 178).[***] In this regard, it is relevant to look at the situation in other countries. In the United States, for instance, the *Guidelines Manual*, containing federal guidelines that should contribute to appropriate and more

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[*] Two cases were related to both sexual and other forms of exploitation. These cases are only included once in the totals ([4], p. 168).

[**] Exploitation in sectors other than the sex industry was criminalized with effect from 1 January 2005. All forms of sexual exploitation have been a criminal offence since 1 October 2002 ([4], pp. 19-32).

[***] For particular offences other than human trafficking, orientation points for the judiciary already exist [72]. In addition, the Public Prosecution Service has developed Instructions on Human Trafficking in the sense of sexual exploitation, which took effect on 1 September 2010, and in the sense of servitude and labour exploitation, which entered into force on 1 May 2012 ([4], pp. 97 and 99).

consistent sentencing in federal crime cases, has been developed by the Sentencing Commission, which itself consists largely of judges [73]. The terms "human trafficking offense" and "forced labor" are briefly referred to in the federal guidelines, which discuss more extensively the "sexual exploitation of a minor" [73-75]. In addition, some elements of the concept of human trafficking, such as the abuse of a position of vulnerability, are included in the *Guidelines Manual* ([31], p. 42; [73]). There is evidence that guidelines that have been informed by data, together with legislative directives concerning relevant factors for sentencing, might result in a "much more coherent overall sentencing policy" ([60], p. 37). Likewise the *Guidelines Manual* provides guidance for uniform and appropriate sentencing decisions in human trafficking cases.

Statistics as a starting point for looking further

As a final point, statistics regularly lead to questions for which the answers need to be taken into account in the design of policy and implementation (see, for example, National Rapporteur's report covering the period 2008-2012 ([2], pp. 247-257)). One particular question to which statistics can lead concerns the aspects of human trafficking that are still underexposed and other aspects that may be overrepresented. "Without data, we cannot determine the causes of overrepresentation, so we cannot develop effective solutions" ([60], p. 32). This can be further elucidated by two examples. To begin with, statistics that indicate the number of seen and registered trafficked persons, suspects or human trafficking situations in the Netherlands demonstrate that exploitation outside the sex industry seems to be underexposed. By way of illustration, according to the registrations of the Coordination Centre for Human Trafficking (CoMensha),* of 1,711 registered presumed trafficked persons in 2012, 71.1 per cent had supposedly been sexually exploited, 15.0 per cent had supposedly been exploited outside the sex industry (mostly in the agricultural and horticultural sectors), 9.5 per cent had not yet worked (generally the youngest) and for 4.4 per cent the area of exploitation was unknown or not registered. The number of presumed trafficked persons registered at CoMensha depends on which organizations report them and whether they are required to do so. The police and the Royal Netherlands Marechaussee are obliged to report trafficked persons and accordingly account for most notifications ([2], pp. 25-26 and 248-249). Note that the registrations of CoMensha include presumed trafficked persons who are registered at even the slightest indication of human trafficking. Subsequently, it is most likely that those registrations include false positives though it is not

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*Presumed trafficked persons are registered at CoMensha for the purposes of the National Rapporteur's reporting ([1], p. 35; [2], p. 25).

known to what extent. The number of sexually exploited presumed trafficked persons versus those who are exploited outside the sex industry most probably reflects the efforts to tackle human trafficking. In this regard, it is conceivable that a dominant focus on sexual exploitation in addressing human trafficking results in less attention being paid to exploitation outside the sex industry. In this regard, O'Brien writes that "data on trafficking can become skewed due to both politicized data collection, and a primary focus on trafficking for sexual exploitation instead of all forms of forced labor. While the limitations of sampling typically suffer from an underreporting of the crime of trafficking, the skewing of data can result in the overreporting of certain types of trafficking, often resulting in the mischaracterization of the nature of trafficking" ([21], pp. 12 and 16-17; see also National Rapporteur's report covering the period 2008-2012 ([2], pp. 43, 56 and 136), Goodey [19], Weitzer [23], Álvarez and Alessi [76] and Chuang [77]). The opposite, an overreporting of exploitation outside the sex industry, is equally possible. This might be reflected by some international statistics. By way of illustration, in Belgium, labour exploitation has been registered more than sexual exploitation ([78], pp. 44-46).

The following is another example of the importance of statistics in indicating what aspects of human trafficking are underexposed. In the Netherlands, the police deal with a substantial number of complaints in which there seem to be insufficient investigative leads. Consequently, such cases are almost immediately dismissed, obviously not leading to the arrest of an offender. According to the National Rapporteur, there were about 200 such complaints in 2012. It is worth noting that they seemed mostly to involve presumed trafficked persons from African countries. The registrations of CoMensha show for the year 2012 that the largest group of registered presumed trafficked persons were citizens of the Netherlands, closely followed by citizens of countries in Central and Eastern Europe. Another significant group (accounting for 16.9 per cent) were citizens of African countries,* mainly Nigeria. By contrast, suspects from African countries appear relatively infrequently in statistics of the Public Prosecution Service: of the 311 suspects in 2012, only a small percentage (2.6 per cent) came from African countries (Morocco being an exception) ([2], pp. 133, 195-197 and 211-212). This finding is notable in view of the fact that several authors have pointed out that trafficked persons and offenders often come from the same region ([78], p. 50; [79], p. 51).

Most remarkable is the finding that from 2012 onwards fewer citizens of African countries seem to have been identified and registered ([2], pp. 34-36).

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*This group did not include the inhabitants of North Africa (Algeria, Egypt, Libya, Morocco, the Sudan, Tunis and Western Sahara) ([2], p. 311).

However, it is unknown whether there are actually fewer citizens of African countries trafficked in the Netherlands. It is equally possible that they are concealing themselves more than before or that less attention is being devoted to identifying and reporting them. Perhaps the declined number correlates with the demotivation for investigating human trafficking situations involving trafficked citizens of African countries because there generally seem to be insufficient investigative leads in such cases. Their complaints would impose a strain on the resources of the police and the Public Prosecution Service because the complaints would have to be processed and what few leads there are must be investigated ([80], p. 180).

Relatively little is known about human trafficking situations in the Netherlands involving trafficked persons from African countries. The National Rapporteur has stressed in several of her reports that the absence of sufficient investigative leads does not necessarily preclude the possibility of human trafficking ([2], pp. 109, 133, 197 and 257; [9], p. 175; [80], p. 617). The remarkable statistics have led to the conclusion that more quantitative and in-depth qualitative research is needed in order to discern trends and links in human trafficking stories ([2], p. 257). Examples of such research can be found in other countries, for example in Belgium, where an anthropological research has been conducted into 48 judicial files, among which 27 files are Nigerian and 21 are Moroccan. This explorative research provides valuable insight into African human trafficking networks that operate internationally (also in the Netherlands) and, in terms of their modus operandi, differ from Eastern European human trafficking networks [81].

Conclusions

Statistics are important for reinforcing viewpoints and may form the basis for sound decisions in the enactment and implementation of policies. However, positions are sometimes taken on the basis of unverifiable, unreliable or inaccurate data [3]. Scale statistics are often sought in order to demonstrate the supposedly alarming scale of human trafficking or in support of a particular policy on prostitution. In recent years, various studies have attempted to estimate the total scale of human trafficking; however, at the moment, reliable and accurate estimates are absent. The existing estimates seem to take on a life of their own ([32], p. 30) in politics, in academic literature and in the media. In such cases, statistics do the opposite of what is intended: to provide reliable information.

The authors of this article have suggested a shift in perspective from scale statistics towards statistics on the nature of human trafficking at a lower level

of aggregation (see also Weitzer ([23], p. 15) and Zhang and others [24]), in the absence of reliable estimates on the total scale of human trafficking. Statistics often reflect the human trafficking that is visible and the measures that are taken to combat human trafficking. There are three ways in which statistics can be of the utmost importance in the fight against human trafficking: first, to guide the measures taken to combat human trafficking (evidence-based policy); second, to expose bottlenecks that may be used as a basis for suggestions to initiate more efficient policy and implementation; and third, to be used as a starting point for further research providing answers to questions such as why certain aspects still seem to be underexposed in the fight against human trafficking. In conclusion, the authors of this article encourage the collection and analysis of quantitative data in microlevel settings (see also Weitzer [23]). By doing so, efforts to tackle human trafficking can be adapted to particular contexts and policymaking can be done in a more appropriate manner. Furthermore, academics are encouraged not to rely on current estimates (or to reproduce them) but to initiate data collection and analysis within the framework of the relevance of statistics such as has been presented in this article.

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COUNTING LABOUR TRAFFICKING ACTIVITIES: AN EMPIRICAL ATTEMPT AT STANDARDIZED MEASUREMENT

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Abstract

Research on human trafficking faces many challenges, one of which is the lack of consistent measurement. Although there have been efforts throughout the world to collect primary data, researchers have not come close to finding a common set of measures that can be applied consistently in counting trafficking activities or victimization experiences. The development of a common data-collection instrument, especially one that is appealing to researchers in different countries, is no easy task. The authors present one such example in this article, for all to comment on and improve. This instrument, created a few years ago in an empirical study on labour trafficking in the United States of America, is intended for use in large-scale surveys by persons engaged in research or gathering data for estimating prevalence. The instrument has received excellent empirical validation, including item response analysis, and has been adopted in a few other studies. While the instrument is still in need of improvement, the authors would like to publicize their efforts so that others may draw lessons from and build upon what has been accomplished. Although individual circumstances may vary, human trafficking shares sufficient commonalities to allow standardized measurement. A common instrument is a crucial step towards meaningful international or cross-regional comparison, which is sorely missing in the current policy discourse on human trafficking.

Keywords: labour exploitation, labour trafficking, migration, migrant worker, respondent-driven sampling, trafficking in persons, United States of America

Background

By all accounts from either government agencies or international organizations, human trafficking is a serious global problem. International organizations and the Government of the United States of America claim that tens of

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millions of people are trafficked throughout the world for purposes of sexual exploitation and labour exploitation [1-5]. Bales ([6], p. 9) estimated 27 million slaves worldwide, the majority of whom were bonded labourers in Bangladesh, India, Nepal and Pakistan. In 2005, the International Labour Organization (ILO) estimated that there were at least 12.3 million people in forced labour worldwide [7]. About 2.5 million of these are forced to work by the state, the army or rebel military groups. The remaining 9.8 million are exploited by private agents and enterprises. Of these, only about 1.4 million (or 14 per cent) are in commercial sexual exploitation, while most (7.8 million) are in forced labour exploitation.

In a more recent study, ILO [8] updated its estimates of global trafficking victimization based on an analysis of published reports and accounts of identified victims. ILO used two teams of researchers to conduct separate coding schemes to verify all reported cases. Using the capture-recapture method, ILO put the total number of forced labourers at 20.9 million, 18.7 million (90 per cent) of whom were exploited by individual employers or private enterprises [8]. More specifically, among these estimated victims, 4.5 million (22 per cent of the total) were victims of forced sexual exploitation, and 14.2 million (68 per cent) were victims of forced labour, in economic activities such as agriculture, construction, domestic work and manufacturing.

Despite these grim estimates, labour trafficking has not gained much traction compared with sex trafficking among either the research or advocacy communities. Sex trafficking has remained front and centre ever since the beginning of the larger anti-trafficking movement [9]. In an exhaustive review of existing literature, Farrell and others [10] identified 110 sources that provided a count or some estimates of human trafficking. The vast majority of those counts referred to sex trafficking or the sexual exploitation of children. Only 17 sources provided information from which a count or estimate of labour trafficking could be inferred ([10], p. 16). In their review of nine reports from service organizations, Logan, Walker and Hunt [11] found the same scarcity of empirical data on human trafficking in general and labour trafficking in particular. In fact, there is so much attention focused on sex trafficking that some researchers have come to believe that the most common form of human trafficking involves sexual exploitation [12]. Even the United States Government has claimed for years that the majority of transnational victims are women and children "trafficked into commercial sexual exploitation" [5]. In a comprehensive review of literature, Gozdziak and Bump ([9], p. 7) lamented that current research had focused on sex trafficking almost "to the detriment of investigating trafficking for bonded labor and domestic servitude".

For many years, a growing number of researchers have become concerned about the heavy focus on sex trafficking and have advocated a shift in research and policy discourse [13]. For instance, Belser [14] points out that the majority of human economic activities, forced or otherwise, are not concerned with sex. The United Nations Office on Drugs and Crime (UNODC) also acknowledges the uneven coverage and believes that the greater problem of forced labour and domestic servitude has been largely ignored. In a UNODC survey, trafficking activities were identified in 52 countries, and 79 per cent of the victims had been subjected to sexual exploitation. UNODC believes that the underdetection of labour trafficking was universal across regions and even countries ([1], p. 11). The limited knowledge about labour trafficking has long caught the attention of international organizations including UNODC, the International Labour Organization (ILO) ([2], [3]) and the International Organization for Migration [4]. The United States Department of Justice ([15], p. 2), in its *Assessment of U.S. Government Efforts to Combat Trafficking in Persons in Fiscal Year 2006*, called for enhanced efforts "to monitor and combat labor trafficking both domestically and internationally, especially in light of the new mandate in the 2005 TVPRA [Trafficking Victims Protection Reauthorization Act] concerning forced labor and child labor".

The existing literature on human trafficking, in addition to overemphasizing sex trafficking, suffers from an acute case of "empirical anaemia"—lack of primary data collection based on sound sampling procedures. For instance, after reviewing 207 publications of various types, Farrell and others [10] found that nearly all the counts or estimates of human trafficking were based on trafficking cases identified in published documents, mainly in United States and international news reports; and over 80 per cent of the identified sources failed to indicate the sources that led to their estimates. The poor quality and documentation of procedures used to arrive at any estimates create "enormous uncertainty" about the scope of the problem and leave any such estimates open to challenge ([10], p. vi). In a recent ILO publication, reference was made to the methodological inadequacies of the annual report providing global estimates of trafficking victims, particularly in dealing with missing values and quality problems in the original data ([16], p. 8).

The problem of estimating the scope and nature of labour trafficking has been recognized by international organizations and the United States Government. One common feature in current trafficking literature is its heavy reliance on prosecuted cases or secondary sources rather than on primary data collection, which underscores the difficulties and challenges inherent in this type of empirical research. The challenges of producing estimates of the scale of human trafficking are well understood ([17], [18]). As a result, ILO [3] called for high priority to be given to the development of field and

statistical techniques to support actions against forced labour and human trafficking. In the 2005 *Global Report under the Follow-up to the ILO Declaration on Fundamental Principles and Rights at Work* ([2], p. 86), it is stated that the absence of reliable forced labour statistics at the national level prevents the establishment of benchmarks "by which progress can be measured over time". UNODC has also called for the establishment of a continuing international mechanism to gather data on the true size of the trafficking market and to monitor trends and patterns of trafficking in persons [1]. The International Organization for Migration has also called for improved data collection and data-based analysis as the basis for guiding public policy [19]. The United States Government Accountability Office, after issuing a critical report questioning the methodologies used in the report of the Department of State on trafficking in persons, called for the development of reliable and empirically based indicators to better identify human trafficking activities.

Challenges in trafficking research

The need for and challenges in producing estimates on the scale of human trafficking have been widely discussed ([17], [18], [20], [21]). Among the multitude of conceptual and methodological challenges in human trafficking research, two stand out: *(a)* definitional problems; and *(b)* representative sampling. In other words, what are to be counted as trafficking violations instead of just abusive or exploitative labour practices, and where are the victims to be found? In this article, the authors have presented an example of how to define and operationalize labour trafficking and have constructed an instrument to standardize the measurement.

The messy business of defining labour trafficking

There remains much ambiguity and uncertainty as to what constitutes labour trafficking, or human trafficking in general. Farrell and others [22] found that most law enforcement agencies do not even recognize the existence of labour trafficking. Definitional ambiguity impedes efforts in operationalizing measures that are needed in data collection. There has been a lack of concerted efforts in translating established legal frameworks into workable measures or survey instruments to assist empirical research. There are currently no standardized or even widely accepted survey instruments within the United States that can be used for data-gathering purposes.

The absence of a common definition has long plagued the development of empirical measures on human trafficking. Some countries and their legal systems do not even recognize the existence of labour trafficking ([23], p. 2).

Without a common conceptual and legal framework, international collaboration is difficult. The lack of shared definitions also prevents the gathering of data that can be used in comparative studies, thus further hampering policy development. Many countries mix trafficking, smuggling and irregular migration in their official data-collection efforts [20]. For instance, as late as 2004, the confusion between smuggling and trafficking and the misuse of the two terms caused the United States Immigration and Customs Enforcement, the lead federal agency on immigration control, to mislabel many cases, thus erroneously inflating the total number of trafficking investigations and arrests ([24], p. 12).

The Protocol to Prevent, Suppress and Punish Trafficking in Persons, Especially Women and Children, supplementing the United Nations Convention against Transnational Organized Crime, opened for signature in Palermo, Italy, in December 2000, helped clarify the issue by introducing two essential elements to the definition of human trafficking—the use of either force or fraud in extracting labour to achieve monetary gains [25]. However, the Protocol did not end the debate on the definition, because human trafficking in practice often involves multiple stages and individuals, from recruitment to transportation, and from harbouring to employment [20]. The diverse situations in which players of varied interests enter and exit the process of trafficking make it difficult to tell when smuggling ends and trafficking begins, or when voluntary participation becomes coerced or deceived.

To complicate the matter further, different countries have also developed their own operational definitions. For instance, in the United States, legal definitions of sex trafficking and labour trafficking are provided in section 103, paragraph 8, of the Victims of Trafficking and Violence Protection Act of 2000 [26], in which the term "severe forms of trafficking in persons" is defined as follows:

"*(a)* Sex trafficking in which a commercial sex act is induced by force, fraud, or coercion, or in which the person induced to perform such act has not attained 18 years of age; or

"*(b)* The recruitment, harboring, transportation, provision, or obtaining of a person for labor or services, through the use of force, fraud, or coercion for the purpose of subjection to involuntary servitude, peonage, debt bondage, or slavery."

ILO has for years applied its own definition to highlight the labour perspective. The genesis of the ILO definition can be traced back to its Forced Labour Convention, 1930 (No. 29), in which forced or compulsory labour was

defined as "all work or service which is exacted from any person under the menace of any penalty and for which the said person has not offered himself voluntarily" [27]. Two key elements in this definition are involuntariness and the penalty or menace of a penalty. ILO also drew a link between forced labour and human trafficking, arguing that the definition of trafficking in persons in article 3 of the Trafficking in Persons Protocol complements the ILO definition. However, ILO ([27], p. 19) acknowledged the various interpretations of the Trafficking in Persons Protocol that had been developed by Governments, international organizations and other stakeholders in their laws, policies and practices.

Although ILO sees few differences between the two legal frameworks, its efforts in operationalizing data-collection instruments recognize the slippery elements of movement across national borders and the involvement of a third party as implied in the terminology "trafficking" ([27], p. 19). While the inclusion of such elements may assist law enforcement agencies in separating "trafficked" from "non-trafficked" victims, leading to different policy responses, ILO has decided not to adopt a position on this issue. Furthermore, ILO has clarified that forced labour can happen to all workers, irrespective of the employment relationship. In other words, people on contracted jobs or self-employed vendors can also be subjected to forced labour because "recruiters and employers increasingly oblige workers to adopt the legal status of 'self-employed', thus disguising the underlying employment relationship" ([27], p. 13).

In general, ILO offers a more precise, albeit narrower, definition of what constitutes labour trafficking than the Trafficking in Persons Protocol. The ILO definition places greater emphasis on the victims' subjective assessment of their circumstances, as opposed to the judgement of third parties such as researchers or advocacy groups. In its most recent technical guideline to assist the global estimation of forced labour, ILO once again sought to clarify the legal and operational definitions of forced labour and cautioned that national laws often differ from the international definitions ([27], p. 11). In practice, many researchers apply a range of definitions to their data: some do not explicitly distinguish between labour and sex trafficking, while others include additional provisions or language [28]. Researchers such as Bales ([29], [30]) and Kara [31] see few differences in these terms or they see no need to differentiate them and opt instead to highlight the theme that they all share—the control of one person over another and the complete power of the employer to determine working conditions, remuneration and contract terms. In fact, Kara ([31], p. 67) is against replacing "slavery" with "forced labour" and "slave trade" with "human trafficking" because the terms weaken the moral intensity required to mount effective campaigns against those crimes.

Current state of labour trafficking measurement

The lack of clarity in the definition of labour trafficking also hampers the development of measurement for empirical studies, although there have been independent efforts to construct so-called trafficking indictors. There remains a major gap between what is known conceptually and what specific questions must be asked in a survey to gather information on labour trafficking victimization. Both ILO and the International Organization for Migration have in various publications claimed to be conducting studies on labour trafficking in different parts of the world. Thus far, they have not published any specific survey instruments so others may learn and adopt. However, several of their publications have listed specific categories or items that suggest the domains of information to be considered and how such instruments should be constructed. For example, the *Handbook on Anti-Trafficking Data Collection in South-Eastern Europe*, developed by the International Centre for Migration Policy Development, provides guidelines for constructing "victim-centred" or "trafficker-centred" databases; the handbook suggests that forms of trafficking include "sexual exploitation, forced labour, begging, delinquency, adoption, removal of organs," and proper values such as "sexual, physical, psychological" for entries in the databases ([32], pp. 58-59, 73, 78 and 176).

The most elaborate attempt to operationalize indicators of human trafficking has been made by ILO [33].[*] Using the Delphi method, essentially a consensus-building exercise among selected experts, ILO conducted two surveys in 2008 to establish a list of operational indicators of trafficking victimization. The Delphi panellists were selected from police, government, academic and research entities, non-governmental organizations, international organizations, labour and trade organizations and judiciaries in 27 European Union member States. Specific indicators were developed along six dimensions graded as "strong," "medium" or "weak": *(a)* deceptive recruitment; *(b)* coercive recruitment; *(c)* recruitment by abuse of vulnerability; *(d)* exploitative conditions of work; *(e)* coercion at destination; and *(f)* abuse of vulnerability at destination. ILO also determined that, to qualify as a trafficking victim, a combination of the "experiences" or levels of intensity (i.e. strong, medium or weak) is needed—an exercise similar to the *Diagnostic and Statistical Manual of Mental Disorders* used by mental health professionals in the United States to render a clinical diagnosis. Such an elaborate screening and intake process requires well-trained staff and ample time, something most survey researchers cannot afford.

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[*]An updated technical manuscript on measuring labour trafficking was issued by ILO in 2011.

San Diego labour trafficking instrument

Between 2009 and 2012, a labour trafficking study, funded by the United States Department of Justice, was carried out by a research team in San Diego, California. The main goal of the study was to apply the respondent-driven sampling method to estimate the prevalence of labour trafficking among undocumented migrant labourers in San Diego County [34]. An instrument had to be developed for screening purposes. At the time of the study, no instruments were available in any open source, so the research team had to develop its own, based on a review of existing literature, interpretation of different legal frameworks and a series of focus groups.

Instrument development

An immediate challenge that confronted the San Diego research team in the construction of the measurement instrument was whether to conceptualize human trafficking as an incident or a state of existence. By convention, crime has mostly been studied on an incident basis. For instance, every crime, whether it is a burglary or a robbery, is counted as an incident, where a single occurrence will suffice for definitional purposes. It is not so simple when it comes to defining human trafficking, especially labour trafficking, in which victimization is often presumed to have lasted for some time. While the criminal justice system in the United States is now charged with the primary responsibility of fighting human trafficking, the conceptualization and clarification of the nature of this crime are not well developed. Another challenge in the San Diego study was the requirement of an instrument to be applied to a large sample so that quantitative data could be captured in consistency for the purpose of estimating the prevalence of the trafficking problem.

It is beyond the scope of this article to sort out the conceptual nuances on whether human trafficking as a crime should be incident-based (i.e. a particular event) or state-based (i.e. a type of existence); however, it should be noted that the San Diego team was fully aware of the many challenges at the time that it developed its instrument. In its effort to reconcile this conceptual dilemma, the San Diego team opted for a structure that would capture both. As a result, the basic format of the San Diego labour trafficking instrument is modelled on the questionnaire format used in the international self-report delinquency study—a format first developed by criminologists from 15 countries in the late 1980s [35-37]. Because that format has gone through numerous field applications for more than two decades and become a widely adopted standardized instrument for measuring delinquent and criminal behaviour, this study borrowed its basic structure, which is designed to measure both the

prevalence (i.e. the extent of the problem) and the incidence (i.e. the frequency of victimization) of trafficking activities.

Measurement domains

The survey questionnaire was intended to capture different trafficking violations (those that qualify under both international and United States Government definitions of human trafficking), as well as abusive or exploitative labour practices. The San Diego labour trafficking instrument contains both structured and open-ended items. Structured questions aim at capturing common elements for statistical analysis, such as demographics, trafficking and exploitation experiences and the respondent's financial situation. Open-ended questions are intended to capture unique incidents of victimization. The instrument covers the following domains of information:

- Demographical characteristics: age, marital status, number of children (if any), education, place of birth, family members in the home country and the United States, length of time in San Diego and the United States

- Work and earnings: measured for the past month, followed by more general history over the past 12 months, and prior to and after arrival in the United States; the amount of money made in those periods, the amount saved and/or the amount remitted to the home country

- Employment activities in San Diego: emphasis placed on interactions with employers, wage negotiations and payment methods

- Various measures of trafficking victimization and labour exploitation, including: not being paid for work performed, receiving bad checks, being underpaid, being abandoned at work, hazardous work conditions, extended hours without compensation, no breaks, verbal and/or physical abuse or threats of abuse, confiscation of documents and restriction of freedom of movement

- Migration decision: the circumstances under which the subject came to know his or her recruiter and trafficker, the characteristics of the recruiter, terms and conditions between the subject and the recruiter, and the types of arrangements for embarking on the journey[*]

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[*]Although it is assumed that most subjects wanted to come to the United States, it is unclear whether at the time of making the decision to migrate they had any idea of the abuse and exploitation that they might have to face when crossing the border.

- Transportation stage: description of the trip, including way stations, stopovers or layovers, length of time and conditions of travel

Trafficking violations and abusive practices

Because of the overlapping nature of trafficking violations and labour exploitation, the San Diego team took the approach of constructing a wide range of items to capture different levels of human rights violations and unfair treatment of undocumented migrants. Furthermore, because the target population was undocumented migrant labourers, consideration was given as to whether the violations or abuses took place: *(a)* during illegal migration; or *(b)* at the workplace in the United States.

Two broad, though sometimes overlapping, categories of measures were constructed in the survey instrument—trafficking violations and abusive practices. To reduce possible definitional confusion and for the sake of conceptual clarity, a conservative (or narrow) interpretation of what constitutes "trafficking" was adopted in this study. To qualify for trafficking violations, the nature of the victimization must include actual or threatened infringement of freedom of movement (e.g. holding a migrant hostage in order to extort ransom during transportation) or actual or threatened violation of the person's physical integrity (e.g. physical or sexual assault). Everything else was grouped under the category of abusive practices. Most of these measures are in line with the United States Government's interpretation of what constitutes labour trafficking, since they are taken directly from the two pamphlets issued by the federal agencies primarily responsible for current anti-trafficking programmes.

Two items (items 020 and 070) were specifically designed to capture the trafficking nature of any violations that happened during the transportation phase (see table 1). Another 19 items (items 090 through 270) were designed to capture trafficking violations at the workplace.

Measures of abusive practices are those practices which are grossly unfair or exploitative in nature but are not necessarily serious enough to rise up to the level of trafficking. These practices can be perpetrated by either a smuggler during transportation or an employer at a workplace; they include practices such as forbidding someone from leaving the travelling group during transportation, or working in a hazardous environment without protective gear. Although somewhat subjective, the abusive practices measured in this study also included practices that were clearly fraudulent and deceptive, definitional elements present in all international and United States legal frameworks. The

authors opted to exclude fraudulent and deceptive practices from the category of trafficking violations because they wanted to obtain a set of "clean" measures by focusing on "force" and "coercion". Examples of such fraudulent practices include promising to pay migrants for a certain job and then abandoning them at the workplace after the work was completed or instructing them to lie about their employer's identity or their own identity at the workplace. The items on abusive practices during transportation are items 010, 030-060 and 080; and the items on abusive practices at the workplace are items 280-390.

Although far from perfect, these measures represent the first attempt in the United States research community to produce a standard instrument for primary data collection in labour trafficking research. For future data collection or analysis, researchers may consider different ways to configure these categories of measures and decide how to count different violations. For instance, an even stricter or narrower definition may be adopted to count only direct and actual violations of physical integrity or freedom of movement; or a wider definition may be used to include elements of fraud and deception. Many more studies are needed to replicate and improve these measures so that uniform data and comparable estimates can be produced to guide policymaking and resource allocation in anti-trafficking campaigns.

It should be noted that because the data-gathering procedure was self-report (i.e. face-to-face interview) in this study, the authors relied on the subjective evaluation of the participants' own experiences. Because of concerns for human subject protection, the authors made no attempt to verify the participants' stories among their peers and relatives or to interview their employers or smugglers. Furthermore, a single incident of violation or abuse would qualify for victimization. The authors used this counting method because in no other research on crime is repeated exposure required to define victimization.

Vetting, pilot testing and instrument refinement

The questionnaire used in the San Diego labour trafficking study underwent a rigorous vetting process in its development phase. During its initial development, the instrument was reviewed by the main legal office at the United States Department of Justice, which provided comments and suggested a closer alignment with the trafficking legislation in the United States and the operational indicators contained in the public announcement pamphlets issued by the federal agencies. Two federal agencies, the Department of State and the Department of Health and Human Services, publish pamphlets

containing operational indicators on human trafficking.[*] These pamphlets are intended to raise awareness among immigrants and foreign nationals of their basic human rights and forewarn them on various rights violation situations. Based on the pamphlets and comments of the legal office of the United States Department of Justice, the research team revised and expanded the questionnaire to include measures of scholarly interests, as well as practitioner-relevant indicators contained in the government documents. The revised version was again submitted to the United States Department of Justice for review. No further suggestions were made.

Following the face-validity phase, the questionnaire went through two additional stages of refinement. First, after the questionnaire was translated into Spanish, the project's community partner agency, the San Diego Center for Social Advocacy, reviewed the questionnaire and compared it with the English version to detect any deviations in the intended meanings. The Spanish translation was adapted for use with Mexican migrants, which included culturally and linguistically sensitive probes for the respondents' idiomatic expressions of labour and travel experiences. The Spanish version was also back-translated into English to ensure fidelity. An item-by-item review of the translation was made by the bilingual project staff, paying special attention to cultural and linguistic adaptations appropriate for the subject population. Following the translation, mock interviews were conducted in Spanish to test the length and flow of the questions. Adjustments and rewording were made based on those efforts.

Second, two focus groups were conducted with six unauthorized migrant labourers recruited from the project area using the instrument. The focus groups were immediately followed by a debriefing in which the migrant labourers were asked to comment on the structure, flow and wording of the questions. Further refinements were made before the instrument was put to use in the field.

Empirical test of the instrument

Using this instrument, a total of 826 subjects were interviewed. It was found that 30 per cent of the undocumented migrant labourer were victims of labour trafficking, 55 per cent were victims of other labour abuses and about half of

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[*]The State Department pamphlet can be found at: http://www.travel.state.gov/pdf/Pamphlet-Order.pdf; and the brochure from Department of Health and Human Services is available at: www.acf.hhs.gov/trafficking/campaign_kits/tool_kit_social/social_service_brochure.pdf.

these victimization experiences occurred within the past 12 months. The rate of trafficking violations varied markedly across business sectors that typically hire unauthorized migrant workers. Construction and janitorial services had the most reported trafficking violations and labour abuses. The findings in this study also suggest that it is likely that the illegal status in the country is the most significant factor contributing to vulnerability to trafficking violations. More details of the findings can be found in the final report of the study [34]. Using as a basis the estimate of the undocumented Mexican migrant population in San Diego County, the study found that there were roughly 38,000 undocumented migrant labourers who had experiences that could meet the definition of labour trafficking used in the instrument. This number does not include those whose experiences only involved abuses or exploitations that do not meet the definition of human trafficking.

Since there are no national-level respondent-driven sampling data on labour trafficking topics, both the victimization rate and national estimates of labour trafficking victims are impossible to derive. However, if the San Diego labour trafficking rate were to be applied to the national scale, the number of trafficking victims would be staggering. Even if the narrowest definition of human trafficking is adopted (i.e. counting only direct and actual violations to physical integrity), the number of trafficking victims would still be large enough to warrant serious policy debate. This is because the population base of undocumented immigrants in the United States is so large. Any small percentage, once applied to such a large population, will produce many victims. Obviously these findings require additional empirical verification because of their serious implications for policymaking and law enforcement initiatives.

Classical discriminant properties of the San Diego instrument

Aside from the significance of the prevalence estimates, more importantly the integrity and structure of the measurement instrument was also tested in this study. The San Diego instrument was found to possess excellent discriminant properties. A visual presentation of the instrument's discriminant properties is included in the figure below, which shows the clusters of measures and their frequencies relative to their perceived severity. By convention, the severity of a crime is generally inversely related to the frequency of its occurrence. In other words, homicide is a less frequent crime than robbery, which in turn is a less frequent crime than burglary. An instrument attempting to capture criminal activities ought to be able to differentiate between the more serious crimes and the less serious ones. As shown in the figure, the instrument was clearly able to differentiate the more serious labour trafficking offences (e.g. violations of physical integrity) from the less serious ones (e.g. abusive labour practices).

Figure I.   Severity of violations/abuses and frequency of occurrence

(Percentage)
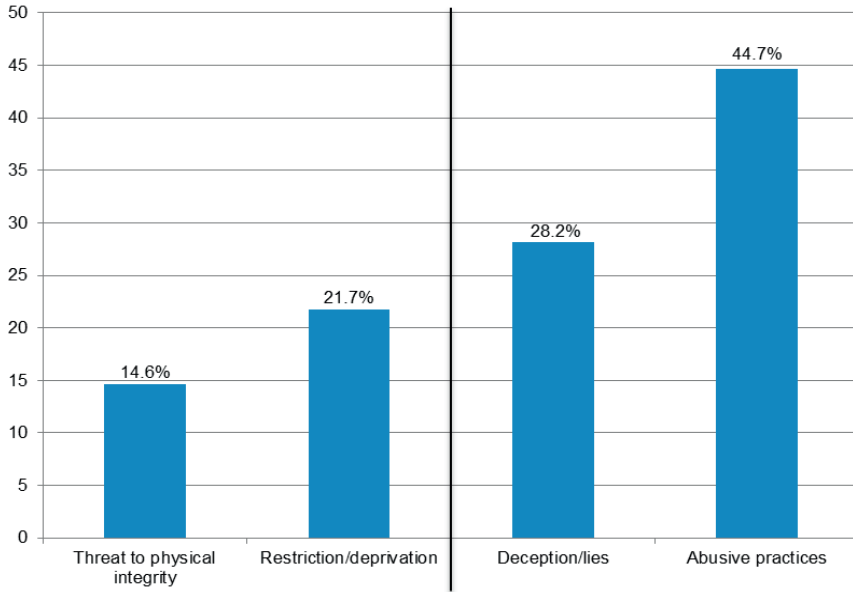
Psychometric analysis

The ability to distinguish more serious offences from less serious ones is not enough for the validation of the instrument. The authors performed additional tests to examine the psychometric properties of the specific items. Their analytical strategies follow many of the established procedures. At the core of their analytic approach is a novel application of item response theory (IRT) and related item factor-analytic methods for instrument development and psychometric evaluation. IRT is a state-of-the-art method that has supported most, if not all, contemporary large-scale educational assessments (for an introduction to IRT, see Yen and Fitzpatrick [38]). Researchers are also increasingly becoming aware of the potential benefits of IRT methodology in health-related outcomes research [39] and in mental health assessment [40]. One of the most recent large-scale applications of IRT in behavioural measurement is the Patient-Reported Outcomes Measurement Information System (PROMIS) initiative [41] of the National Institutes of Health. The application of IRT to measurement research in criminal justice is relatively new, with only few examples [42].

IRT offers distinct practical advantages over traditional classical test theory-based methods such as Cronbach's alpha [43-45]. The benefits of IRT include but are not limited to a "built-in" mechanism to align scores from different forms of measurement onto the same scale, create or maintain item banks with known characteristics to facilitate the assembly of tests (sometimes in a hurry, as in computerized adaptive testing) tailored to specific purposes or individuals, and to detect potential differential item functioning across groups of individuals or over time to disentangle group differences from measurement artefacts. Recent technical developments [46-49] also made possible the routine application of multidimensional IRT for more realistically complex measurement models (e.g. longitudinal situations) and enhanced precision of the resulting scaled scores.

The basic building block of parametric IRT is the item characteristic curve (also known as the traceline) that is defined by item parameters such as severity and discrimination. The item parameters place an item on the same scale as the latent construct that is being measured (e.g. violations of physical integrity or restriction of physical freedom). This is an essential feature of IRT-based measurement, in contrast with classical measurement methods. Instead of reporting a single reliability coefficient for an entire scale (e.g. Cronbach's alpha), IRT models characterize the reliability of a measurement instrument as a function of the level of the underlying latent construct that is being measured. This feature of IRT can be used to identify the best item to administer for a given level of a latent variable. By using the most informative items for a given individual or a given purpose, short and tailored instruments (e.g. computerized adaptive testing) with many fewer items can be just as reliable as longer but static assessments. In sum, IRT promises significantly reduced respondent burden, potentially increased fidelity and a robust framework for further measurement development. These are welcome features for research and evaluation in the area of criminal justice. To establish the psychometric properties of the San Diego labour trafficking core measures, several steps of IRT analysis were carried out.

Initial classical item analysis. First, basic item-level descriptive statistics were generated. The 39 items were dichotomously scored (endorsement of the statement vs. not). The item responses were examined for potentially unendorsed categories and the proportions in each response category for highly skewed univariate distributions that might cause problems for subsequent analysis. Next, after appropriate recoding so that the responses were along the same direction for all items, the authors plotted, for each item, the summed-score by response category table to examine the empirical category response functions for gross departures from the presumed order of the category response characteristics. The task for this analytic phase was to screen for

unusual items that have to be dropped from further IRT analysis. At this level of analysis, all 39 items were found to have performed well and thus returned for the next step of validation.

Exploratory and confirmatory item factor analysis. Having retained all 39 items from the last step, item factor analyses (also known as multidimensional IRT analysis) were then conducted with Reckase's [50] multidimensional extension of the 2-parameter IRT model. The purposes of this step were: *(a)* to examine the number of dimensions as well as the factor structure underlying the items; and *(b)* to identify problematic items for deletion, such as items that loaded poorly on all dimensions. The authors employed the full-information item factor analysis approach using a maximum marginal likelihood estimator with the raw item response data [51]. They used IRTPRO software for full-information item factor analysis estimation.

IRT calibration and model fit diagnostics. Next, the entire sample was subjected to the calibration run. A variety of model fit diagnostics were used to identify sources of potential misfit to settle on a final model [52]. IRTPRO software was used because of its flexibility and its ability to test competing unidimensional and multidimensional models. The item parameters obtained from the calibration run with an item bi-factor model are shown in the table on page 54 [49].

IRT diagnostic results. As shown in the table, the factor structure exhibits the classical item bi-factor pattern, widely recognized as a valuable model for measurement research [53], with the first/general dimension capturing the variation in the primary labour trafficking latent variable and the subsequent dimensions representing additional/residual dependence due to context or content. The San Diego labour trafficking instrument performed well with all items achieving strong primary dimension item discrimination parameters (see α_1 slopes, which are analogous to factor loadings, and associated standard error). At a reasonably large sample size (N=826) for IRT parameter estimation, the primary discrimination parameters were statistically significantly different from zero, indicating each item contributes significantly to the measurement of the underlying labour trafficking dimension. The item location *(c)* parameters are real numbers negatively associated with the severity of the item. Thus a more severe item will tend to have a smaller c value and vice versa. The varying location parameters provide relatively wide coverage of the underlying labour trafficking dimension, despite the intent of the instrument being primarily for screening.

More importantly, the bi-factor structure showed excellent discriminating properties, by clearly differentiating subscale items on trafficking violations during transportation (items 1-8, see α_2 factor loadings and associated

standard error) and violations involving physical elements (i.e. violence) at the workplace (items 9-20, see α_3 factor loadings and associated standard error). Three additional pairs of items (items 28 and 35—deceptions regarding work/pay conditions; items 32 and 33 —fraudulent representations; and items 36 and 37—wage theft) were found to exhibit extra residual dependence and hence additional item-doublet dimensions were included in the bi-factor model to appropriately handle the dependence.

To test the statistical model fit, the authors also fitted a unidimensional (i.e. single-factor) 2-parameter IRT model to the data set. This model is formally nested within the bi-factor model and hence a likelihood ratio test can be conducted to compare the degree of model fit. The unidimensional model has 78 parameters (one pair of α and c parameters for each of the 39 items). The -2 x log-likelihood value is 12430. The bi-factor model has 101 parameters and the corresponding -2 x log-likelihood value is 11971. Standard likelihood theory suggests that the difference in -2 x log-likelihoods is distributed as a central chi-square variable with 101 – 78 = 23 degrees of freedom under the null hypothesis that the two models provide the same fit. Of course, the obtained chi-square value of 459 is highly significant on 23 degrees of freedom, indicating that the bi-factor model fits substantially better than the unidimensional model. All other model fit diagnostics (e.g. the local dependence indices of [52] point to the bi-factor model as the preferred model choice). Furthermore, the M_2 statistic [54] and the corresponding root mean square error of approximation (RMSEA) index provide an overall statement of model fit. The obtained M_2 is 948 on 679 degrees of freedom, and the associated RMSEA is equal to 0.02, well below the usual threshold of 0.05, indicating excellent model fit.

The authors believe that the San Diego instrument is, at a minimum, valid for detecting a broad spectrum of labour trafficking violations and abuses, though further instrument refinement by adding or subtracting items or revising certain items will improve its sensitivity to measurement dimensions.

Discussion

While much more can and should be done to further test and validate the San Diego labour trafficking instrument, the authors believe the instrument has established several major criteria that ought to be followed, as well as scrutinized, in all future efforts in developing human trafficking measures. First, if labour trafficking is to be defined as a social problem, then there

Table 1.   Psychometric properties of the San Diego labour trafficking instrument

Item	Label		a_1	Standard error		a_2	Standard error		a_3	Standard error
1	f_travel	[2]	1.37	0.28	[3]	2.12	0.44		0	-----
2	w_id	[5]	1.21	0.39	[6]	1.6	0.5		0	-----
3	f_family	[8]	2.06	0.5	[9]	3.07	0.85		0	-----
4	f_other	[11]	1.42	0.34	[12]	1.71	0.53		0	-----
5	Assult	[14]	1.4	0.3	[15]	1.57	0.4		0	-----
6	Threaten	[17]	1.59	0.3	[18]	1.92	0.42		0	-----
7	hostage	[20]	0.82	0.25	[21]	1.69	0.4		0	-----
8	pay_smug	[23]	0.92	0.19	[24]	1.32	0.27		0	-----
9	p_abuse	[26]	1.22	0.29		0	-----	[27]	1.05	0.37
10	s_abuse	[29]	1.09	0.43		0	-----	[30]	0.7	0.57
11	threat_p	[32]	1.98	0.37		0	-----	[33]	0.93	0.41
12	threat_s	[35]	1.44	0.28		0	-----	[36]	0.42	0.36
13	lock	[38]	3.28	0.49		0	-----	[39]	0.12	0.49
14	harm	[41]	2.99	0.42		0	-----	[42]	1.95	0.6
15	threat_fam	[44]	3.08	0.82		0	-----	[45]	2.48	0.72
16	threat_deport	[47]	2.35	0.65		0	-----	[48]	2.23	0.46
17	threat_arrest	[50]	3.62	0.94		0	-----	[51]	3.28	0.64
18	threat_polic	[53]	2.08	0.45		0	-----	[54]	2.26	0.68
19	harm_phy	[56]	1.65	0.81		0	-----	[57]	1.98	1.33
20	anymanner	[59]	2.68	0.8		0	-----	[60]	1.6	0.44
21	forb_leave	[62]	2	0.27		0	-----		0	-----
22	restrict	[64]	2.28	0.55		0	-----		0	-----
23	takeID	[66]	1.68	0.75		0	-----		0	-----
24	nofood	[68]	2.61	0.31		0	-----		0	-----
25	forb_family	[70]	3.84	1.9		0	-----		0	-----
26	forb_cowork	[72]	2.88	0.61		0	-----		0	-----
27	forb_outside	[74]	2.63	0.56		0	-----		0	-----
28	conditions	[76]	2.99	1.74		0	-----		0	-----
29	nofam_permi	[78]	3.89	0.77		0	-----		0	-----
30	nogo_permi	[80]	2.07	0.32		0	-----		0	-----
31	seekhelp	[82]	1.88	0.25		0	-----		0	-----
32	lie_urself	[84]	2.66	0.46		0	-----		0	-----
33	lie_employer	[86]	2.65	0.54		0	-----		0	-----
34	deny_pay	[89]	2.78	0.34		0	-----		0	-----
35	less_pay	[91]	2.72	1.59		0	-----		0	-----
36	badcheck	[94]	1.23	0.21		0	-----		0	-----
37	disappear	[96]	2.02	0.29		0	-----		0	-----
38	haza_envion	[99]	1.92	0.24		0	-----		0	-----
39	other_exp	[101]	1.35	0.23		0	-----		0	-----

Notes: The column headings a_1, a_2, a_3 … refer to factor loadings.

a_4	Standard error		a_5	Standard error		a_6	Standard error		c	Standard error
0	-----		0	-----		0	-----	[1]	-3.96	0.54
0	-----		0	-----		0	-----	[4]	-5.7	0.78
0	-----		0	-----		0	-----	[7]	-5.15	1.12
0	-----		0	-----		0	-----	[10]	-4.53	0.57
0	-----		0	-----		0	-----	[13]	-4.7	0.55
0	-----		0	-----		0	-----	[16]	-4.54	0.57
0	-----		0	-----		0	-----	[19]	-4.34	0.51
0	-----		0	-----		0	-----	[22]	-3.09	0.3
0	-----		0	-----		0	-----	[25]	-4.25	0.43
0	-----		0	-----		0	-----	[28]	-5.15	0.58
0	-----		0	-----		0	-----	[31]	-5.33	0.56
0	-----		0	-----		0	-----	[34]	-4.18	0.36
0	-----		0	-----		0	-----	[37]	-7.52	0.92
0	-----		0	-----		0	-----	[40]	-8.63	1.08
0	-----		0	-----		0	-----	[43]	-10.1	1.36
0	-----		0	-----		0	-----	[46]	-5.34	0.71
0	-----		0	-----		0	-----	[49]	-9.9	1.14
0	-----		0	-----		0	-----	[52]	-4.53	0.81
0	-----		0	-----		0	-----	[55]	-7.44	3.03
0	-----		0	-----		0	-----	[58]	-6.49	1.13
0	-----		0	-----		0	-----	[61]	-3.46	0.33
0	-----		0	-----		0	-----	[63]	-5.56	0.93
0	-----		0	-----		0	-----	[65]	-6.14	2.01
0	-----		0	-----		0	-----	[67]	-2.58	0.28
0	-----		0	-----		0	-----	[69]	-7.75	3.08
0	-----		0	-----		0	-----	[71]	-5.65	0.88
0	-----		0	-----		0	-----	[73]	-5.83	0.89
[92] 1.94	2.17		0	-----		0	-----	[75]	-2.44	1.39
0	-----		0	-----		0	-----	[77]	-7.91	1.29
0	-----		0	-----		0	-----	[79]	-4.19	0.44
0	-----		0	-----		0	-----	[81]	-3.3	0.28
0	-----		0	-----	[87] 2.58	0.52	[83]	-7.05	0.52
0	-----		0	-----	[87] 2.58	0.52	[85]	-7.79	0.55
0	-----		0	-----		0	-----	[88]	-1.65	0.21
[92] 1.94	2.17		0	-----		0	-----	[90]	-2.2	1.18
0	-----	[97] 1.65	0.37		0	-----		[93]	-3.07	0.2
0	-----	[97] 1.65	0.37		0	-----		[95]	-3.74	0.27
0	-----		0	-----		0	-----	[98]	-2.24	0.25
0	-----		0	-----		0	-----	[100]	-2.14	0.23

must be shared experiences (as opposed to unique individual encounters) with common characteristics to allow for the development of common measures. The development of different construct dimensions (e.g. violation of physical integrity, restriction of freedom of movement or deceptive employment tactics) thus becomes important, as they serve as guideposts for instrumentation purposes.

Second, while acknowledging the differences across countries or regions or economic sectors, there need to be consistent items to closely reflect all international legal frameworks, and the research community must agree to adhere to those items. Consistent wording in the construction of such common measures will facilitate cross-national comparison and enable informed policy discourse on the direction of and investment in anti-trafficking programmes.

Third, following the model widely adopted in psychology and education, the trafficking research community needs to engage in deliberate and thoughtful efforts to construct a common core of measures and to field test and validate them in multiple settings. All steps of validation and test results need to be fully disclosed to allow others to confirm and modify them for their own research purposes. Finally, a test bank or something to that effect needs to be established, perhaps under the auspices of UNODC, to host various examples of trafficking instruments, together with their supporting documents and validation studies, so that others do not have to reinvent the wheel every time they want to gather data on human trafficking. The lack of consistent measurement of labour trafficking is hampering empirical research and policy discourse. A valid and reliable instrument is a major building block of empirical methods to obtain valid and reliable data that are badly needed to support anti-trafficking initiatives ([55], p. 2).

The San Diego instrument was constructed to align with the United States Government's interpretation of labour trafficking, and it has a flexible structure that permits different configurations to build a severity index. The core measures of this instrument have also been successfully field-tested in North Carolina in a separate study with a sample of 380 migrant farmworkers [56]. Currently another state-wide survey using multi-stage probability sampling strategy is under way in North Carolina; the San Diego labour trafficking instrument will be adapted for use in this new study. As more examples of trafficking measurement are made available by researchers or agencies that have conducted empirical studies, it will be possible to move steadily towards greater precision in the estimation of the scope of the trafficking programme.

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CALCULATIONS VERSUS COUNTING OF HUMAN TRAFFICKING NUMBERS

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Abstract

Thomas M. Steinfatt argues in his article in favour of counting the actual number of human trafficking cases as an alternative to estimating the size and range of human trafficking through statistical projections. With his research on sex workers in Cambodia he shows how data on victims of trafficking for the purpose of sexual exploitation can be obtained by analysing communication methods used in the sex industry, locating the actual premises and directly observing the criminal activity in progress.

Keywords: counting numbers, trafficking in persons, sex work, Cambodia

Introduction

The author currently serves as an adviser on human trafficking to two non-governmental organizations, one in Australia and the other in the United States of America, and he works with the United Nations Inter-Agency Project on Human Trafficking and the United Nations Office on Drugs and Crime (UNODC). His interest in human trafficking came about through a 1988 meeting with Werasit Sittitrai, who was with the Thai Red Cross Society. His suggestion to study factors affecting condom use probabilities among foreigner-oriented Thai sex workers led to him being one of two United States scholars invited to conduct such a study, with the support of the Chulabhorn Research Institute. Under the patronage of Princess Chulabhorn of Thailand, it provided travel support for the international congress on AIDS in developing nations, held in Bangkok in 1990. Data gathering for this study continued throughout the1990s, resulting in the publication of *Working at the Bar: Sex Work and Health Communication in Thailand* [1].

Information from some of the workers interviewed included situations of potential human trafficking outside of Thailand, leading to initial data collection on human trafficking in Cambodia in 1996. An initial study of potential

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sex trafficking in Phnom Penh was completed in 2002 and presented to a conference sponsored by the United States Department of State [2]. This was followed by data collection throughout Cambodia in 2002, which was funded and, in 2003, published by the State Department.

The United Nations Inter-Agency Project on Human Trafficking sponsored a competition beginning in 2006 on the Best Methods of Studying Human Trafficking. Entries by the author, the School of Public Health of Johns Hopkins University and a Vietnamese non-governmental organization received the top awards. The funding from this award made it possible for data on sex trafficking to be collected on a large scale throughout Cambodia in 2008 and published in 2011 by the United Nations Inter-Agency Project on Human Trafficking as *Measuring the Extent of Sex Trafficking in Cambodia: 2008* [3], which is discussed in more detail below.

Trafficking in persons occurs in every country. It is based on the economics of greed, on the desire to profit from the work of others without providing just compensation to the workers. Human trafficking may also involve various forms of deception and illegal behaviour in order to make this profit. One form of trafficking in persons is trafficking in women and children. The economic activity involved in such trafficking is often sex work. Sex trafficking occurs when persons are induced to engage in sex work through force, fraud or coercion, or when the sex worker is under 18 years of age. Sex trafficking is often divided into: *(a)* trafficked workers who are over 18 and not paid (or are grossly underpaid); and *(b)* workers who are under 18 and who are trafficked regardless of the level of payment. The presence of workers under 18 increases profit and also may attract paedophiles.

Theory and rationale

In what lines of work does human trafficking occur?

This article is mainly concerned with methodology—the procedures through which the data are obtained and analysed in coming to conclusions about trafficking. While the author's work has concentrated on sex trafficking, labour trafficking involving men, especially in the fishing industry, and unpaid or underpaid domestic work, usually involving women, make up substantial portions of the persons trafficked throughout the world. The women involved may be middle-aged or older women who live outside under the stairs of their employer's house in a middle- or upper-class neighbourhood or sleep under a

tarpaulin near their employer's car and who are often paid so little or so infrequently that they cannot afford to leave; and if they do attempt to leave, their prospects of succeeding are not good. Sex trafficking is not as common as these forms of trafficking, but it has become a focal point for action against all forms of human trafficking.

Why does human trafficking occur?

The motivation of traffickers is primarily monetary—obtaining money for the labour of those trafficked and either underpaying or simply not paying the workers. Sex work is a business. Its goal is to make money, and sex trafficking is a small but important portion of this business. Sex trafficking occurs in the context of the sex business. It is not a separate enterprise but a part of the business of sex work. The motivation for sex trafficking is commercial and monetary—to make money, not to enslave. Sex trafficking is not motivated by evil people who set out to do harm; it is motivated by greed. It occurs when people are not concerned about the harm they cause to others. It occurs when people are willing to allow or even sponsor the harming of others if a profit can be made from it. Sex traffickers are evil because they do not care about the harm and suffering they cause. The evil of human trafficking is incidental to the malicious behaviour of traffickers. It is a result, not a cause.

Observing and collecting data on the operation of sex work enterprises in Thailand in the 1990s and Cambodia in the decade that followed led to several generalizations concerning the points at which sex work is most likely to be observed and the nature of the clientele at those points, as discussed in Steinfatt and Baker [3].

Where do sex work and sex trafficking occur?

Data gathered by the author indicate that sex work is not evenly distributed across geographical areas. It normally occurs only at or near geographical points: *(a)* where a sufficient population of males in the age group 16-60 exists (permanently or sporadically) or travels past; *(b)* where there is a minimum of limiting factors such as easy observability by neighbours and relatives; *(c)* where the males have sufficient disposable income to support sex work; *(d)* where the males have knowledge of the norms of sex work or are part of a network of men that includes some who have this knowledge; and *(e)* where sex work exists and at least some of the males know about its existence.

While cities and larger population centres have brothels, not all villages have a sex work venue. The probability of a sex work venue existing increases both

with the size of the population of the village and with the increasing distance to the nearest village with a sex work venue. Thus, sex work is far less likely to occur in rural areas that are not gathering places and is more likely to occur in or near more populated locations and along or near transportation routes where substantial numbers of people regularly pass in the course of their everyday activity.

Assumptions and rationale for the methods used in the Cambodia studies

A commercial enterprise wishing to maximize profits must communicate its existence and location to potential customers. Once a customer encounters a specific brothel, its location is known to him and he will be able to inform friends who may not know of it. Such repeat customers and their friends provide only a small level of profits for the business. In order to achieve high profits, a larger customer base is needed. There must be a way—other than word of mouth—of informing potential customers of the existence, purpose and location of the business. Typical methods of communicating this information for sex work businesses include developing personal contacts with local transportation and lodging workers who are likely to encounter potential customers.

Sex work businesses in Cambodia typically inform taxi drivers of the kickback they will receive if they bring new customers interested in their particular services to their enterprise. This amount usually varies between 5 and 20 per cent of the cost for sex, per customer, but it may be higher in certain cases. Taxi drivers in all parts of the world are aware of such kickbacks and are motivated to know many sex work locations in their areas. This allows them to satisfy customers, receive tips and receive kickbacks from sex businesses. Newly arrived males often hint at or ask taxi drivers to take them to a place where sex is available. Thus, taxi drivers become an excellent source of information concerning the location of sex work, both from satisfying customers and receiving payment from them and from satisfying sex businesses and receiving payment from them. Since sex trafficking occurs within sex work venues, all sex trafficking venues ought to be found within the set of sex work venues located within a given area.

It is sometimes claimed that there are "hidden brothels"—brothels that "cannot be found" but contain trafficked women and children. The concept of brothels that cannot be found could not exist simply because they would not be economically viable. If few people know of their existence and if word of their existence and how to locate them is not spread, then their profits will be

limited. A brothel that cannot be found by potential customers would fail immediately.

Locations where victims of kidnapping might be held, such as the house discovered in 2013 in Cleveland, Ohio, where the victims had been held for over a decade, are not brothels.

Some brothels, such as those with children, will be far more cautious in admitting customers than others and will provide information on their existence only to individuals whom they trust, usually including specific taxi drivers. Information on the location of such brothels will exist, but there are fewer persons and places to act as sources from where the information can be obtained. Conversations with multiple unattached males who are visiting the country and are encountered at bars and restaurants are often helpful in obtaining such location. Understanding the method of communication used in the advertising of sex workers' services and of other illegal enterprises requiring customers for profitability, including sex trafficking, can be helpful in developing a method for locating such services. Some such places are hinted at in websites, but specific information on locations is almost never present.

Once a researcher has located a place with trafficked women and children, he or she should contact the management personnel, as the management personnel in such places know who is under age and who has been trafficked. The researcher must determine methods of obtaining this information from management without arousing suspicion. Brief conversations with management are part of the everyday work of brothels, can normally be conducted in English and arouse less suspicion than attempts to extract such information from workers. Most sex workers in a bar, brothel or other sex venue are available to leave with a customer. One indication that a sex worker may been trafficked is the inability of the sex worker to leave the venue. Another indication is the existence of a debt contract.

Elaboration of assumptions and rationale as they lead to location theory

Sex trafficking is a commercial enterprise. Its purpose is to make money. Repeat customers keep a sex venue afloat, but they alone cannot form the sizeable customer base for the level of profits that are its primary motive. In any society, some individuals are willing to provide sexual labour in exchange for something of value if the monetary reward is sufficient given their current economic position. As the management cost of sexual labour—the money received by the sex workers from management for their labour—increases, the

desire of management in sex work venues to lower labour costs becomes more apparent. Using underpaid or unpaid labourers—persons who are forced to work at a rate that is lower than the going rate or children, who provide a greater profit margin—are possible solutions. This desire and its solutions lead to the trafficking of sex workers.

Greater profits are dependent on a constant stream of new customers. Some form of advertising is required in order to provide new customers for sex venues. Information about sex venues is often communicated by word of mouth, by contacting a population likely to be interested in the purchase of sexual services.

One efficient method of establishing such contact is through local persons who normally encounter potential customers and also serve to pre-screen potential customers to see if they are interested in sex venues. Local individuals generally make up the majority of the customer base for most sex venues. Local customers know the local price structure for sex and alternative locations where sexual services can be obtained. Thus, they provide less revenue per customer than travelling businessmen, military personnel, transportation workers such as truck drivers, and tourists, who may not know the prices or may not know whether similar services are available nearby. Increased profits are often related to the ability to contact this potential customer base.

Because of the nature of sexual services, such contact requires a level of discreetness and privacy. Public advertising, using, for example, the media or announcements made by a bus driver carrying a load of passengers into town from an airport, does not provide the necessary discreetness and privacy. Taxi and limousine services encounter the desired groups of travelling businessmen, military personnel and tourists. They normally transport passengers in smaller groups, providing the desired level of discreetness and privacy. Thus, taxi drivers provide an ideal medium for word-of-mouth advertising of sex businesses. They are often a principal source of new customers for sex venues in any area with sufficient population to support a taxi business. This position led to the method used in the study for locating women and children trafficked for sexual purposes.

Obtaining knowledge related to sex outlet locations can also occur by observing public locations such as airports, other transportation stations, restaurants, bars, hotel lobbies and the like. Such observational methods can be aided, if required, by considering the likely and the possible methods of transmitting such information. The channels usually are not standard advertising methods—radio and television, billboards etc.—though they may provide hints of the existence of the illegal activity. Consideration of the demographic

characteristics of typical and prospective customers of the type of vice in question will often provide strong hints as to where to look, and perhaps a direct answer.

Once initial information on possible locations is obtained, it can be used to approach and enter the venues in question and to access information concerning what, if any, forms of the activity in question are available. How is it that persons seeking sex locate places that sell it? Some form of communication of this information is occurring. The method is to determine that form and then to tap into it using informants who are demographically similar to the principal customer base of the establishment to be entered.

Statistical analysis and direct observation

Statistical methods of studying crimes such as human trafficking provide important information on the size and often on the nature of the illegal activity over both large and small areas of land. Many researchers are rightly concerned with estimating the size and range of human trafficking through statistical projections from available data. An alternative to such calculations is counting. Counting requires something to count, perhaps through the observation of human trafficking in progress. It is often more time-consuming than statistical projections and almost always involves a more limited geographical area in any one study. It often involves direct observation of the criminal activity in progress. Studies of the communication methods used in human trafficking and other illegal activity can provide information on the size and nature of trafficking, though such studies are usually restricted by the constraints of time and money and almost always require male rather than female informants concerning customers. An additional plus for methods based on communication systems is that they can provide information on the physical location of victims, an important item that statistical methods cannot provide with precision.

Why study brothels rather than points of origin of sex trafficking?

Human trafficking is potentially visible throughout its sequence, from the victim's point of origin, through any transit stages that may occur, to its destination forms. The origin and transit stages are money losers for the traffickers. Only in the destination stage, where the victim is put to work, does the trafficker begin to recoup any expenses incurred during the origin and transit stages. Human trafficking need not involve transportation to a new location. Such transportation, when it occurs, is often intended to remove the victim from familiar surroundings, where help for the victim is most likely to be

available, and also to locate the victim at a point of destination that is likely to maximize profit and minimize risk of detection. Human trafficking is most often observed in that destination stage, due largely to the far longer period where trafficking victims may be held at a single location or at a few locations nearby. Once transported, victims may be kept in the vicinity of the same destination for weeks or months, sometimes longer.

Many methods of locating human trafficking in its destination stage are available. It is possible to simply stumble upon human trafficking in the process of daily living; yet it is highly unlikely that this will occur. Most persons encountering human trafficking would not recognize it for what it is. This is also true of the point of origin and the transit stage of trafficking. Well-meaning campaigns against trafficking often propose raising awareness of this form as the principal—and often the only—method of location, a suggestion doomed to failure for the vast majority of victims and observers. Most human trafficking is not visible in any of its forms or stages to the general public through casual observation. If attempts by anti-trafficking groups to motivate the public to immediately report to police or to a hotline any suspected instance of such trafficking were to succeed, the police or the hotline would be inundated with such reports. A likely result would be to store all the reports with the police, probably without prioritizing them, and the police would examine the reports when the time, money and officers became available. As the volume of reports increases, true reports become more difficult to sort out from the overload of false reports, and hotlines are of little help in processing such information accurately.

How might sex trafficking victims be located in addition to counting?

How might sex trafficking victims be located in addition to counting? The author asked this question in Cambodia. The methods used in three studies in Cambodia were similar, varying only in detail. Such data were first gathered in Cambodia in 2001. Three methods were used initially in Phnom Penh: moto taxi drivers; local government counts provided by the police; and a small-scale study using city block sampling. Information from a study by the United Nations Development Programme (UNDP) [4] and information from the World Gazetteer website was used to project the results obtained in Phnom Penh to the larger cities, towns and main highways of Cambodia outside of Phnom Penh to create a countrywide estimate of sex trafficking in Cambodia.

Taxi drivers were initially sought out as a principal source of information. The drivers usually operate motorbikes, referred to as motodops or simply motos. Moto drivers are among the principal customers of brothels and are aware of

most entertainment venues in their service area, in addition to receiving kick-backs for customers they bring to those locations. They are often called upon by local customers to transport the customers to a location where sex is sold.

Typically, a moto driver passing by in traffic is hailed by a lone team member and asked if the driver knows where sex can be purchased. (Drivers who are waiting for passengers are not selected.) The answer is invariably "yes". The driver is then asked to transport the passenger to that location. On arrival, the team member unobtrusively clicks the Global Positioning System (GPS) in order to record the location, looks briefly at the venue from the outside and asks the driver if he would like to be paid or if he would like to show the passenger another venue. In almost all cases the driver wishes to continue. The driver is encouraged to drive to "hidden" locations, in addition to popular locations, perhaps locations not often visited, or visited only by people with money, or locations with sex workers who are unusual in some way, or young. After several such locations have been recorded, the passenger pays the driver what is owed and asks if the driver would like to work with him longer for a set amount. The driver usually agrees to work longer, in which case the process continues until the driver wants to stop or can think of no new places. If the driver does not agree to work longer, he is simply paid and, if there is time left, the team member then walks one or two blocks, hails another moto that is driving down the street (never one parked at a location) and continues the process. This provides a clean break between each successive moto driver on a given day and none know of the other's work, or of any prior actions of the researcher. This process continued between 8 a.m. and 4 p.m., seven days a week.

In the evening, the teams meet and the information from each GPS is transferred to a computer map of the area under study. The mapping of the obtained locations of sex venues was essentially ruled complete when independent informants familiar with sex work locations in a given area produced no new venues in that area over several days. The product of this method is a GPS mapping of potential sex work locations for each area. In addition to these counts, which provided the main data for the study, local government counts of "entertainment places" (a euphemism for places where sex is sold) were provided by the police, and a small-scale study using city block sampling was carried out to check the reliability of the moto driver results. The 2002 data were collected only in Phnom Penh and a study of the area outside of it was not carried out until the following year.

The estimated number of sex workers found in Phnom Penh in 2002 was 5,250, of whom 642 had probably been trafficked; it was estimated that 2,488 sex workers had been trafficked throughout Cambodia (see tables 1-4).

Data provided by UNDP [3] on national highways and on city size from the World Gazetteer website [5] were used in estimating trafficking outside of Phnom Penh for the 2002 report.* These methods are presented in more detail in Steinfatt, Baker and Beesey [6].

In 2003, in a study funded by the United States Agency for International Development (USAID), data on human trafficking were gathered in all 24 Cambodian provinces using the geographical mapping methods employed in Phnom Penh in 2002 [7].

Research teams

In 2008, funding from the award competition sponsored by the United Nations Inter-Agency Project on Human Trafficking on Best Methods of Studying Human Trafficking was used for the large-scale collection of data on sex trafficking throughout Cambodia [2]. While the 2002 and 2003 studies used only two research teams, six research teams were used in the 2008 study: five for gathering data in specific sections of the country and one for studying the entire country. The five teams studying specific sections of the country (teams A, B, C, D and E) each had four members: an expatriate as team leader and three local assistants. The team leader and the primary research assistant were experienced in trafficking research and were made aware of the purpose and nature of the research concerning trafficking. The other two local assistants on each team were hired as day labourers on the basis of their familiarity with the sex venues in a specific area. The sixth team, team F, was used only to locate sex venues throughout Cambodia in both the areas studied and those not studied by teams A-E.

The teams worked independently, did not meet each other and did not share information. Workers were not hired as team members if they were not familiar with sex work venues catering to local males of their economic and socio-demographic class. Their task was to do throughout Cambodia what the research teams had begun in Phnom Penh in 2002: to locate and then obtain data on possible trafficking in all populated locations in the country. Teams A and B studied Phnom Penh independently, while studies of the provinces outside of Phnom Penh were conducted independently by teams A, C, D and E. Each used different starting points and starting dates during July 2008 (see the map).

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*The author subsequently learned that the data on city size from the World Gazetteer website were inaccurate. The World Gazetteer depends on figures provided by each country; in the case of Cambodia, the Ministry of Planning lists the entire population of each of the provinces in the country as though it were the population of the largest town or village in that province.

Location methods

Some data-gathering methods were modified to suit different conditions in the provinces. While there are hundreds of moto drivers in Phnom Penh, in smaller areas such as villages there are few drivers and they know each other. In such cases, one driver passing by is hailed and employed for brothel location. The assistance of two or more local males is then requested, depending on the population size. If a male approached by a local assistant says that he knows the sex outlets in the area, he is asked to show the location to the assistant if it is not far. If it is some distance away, the male is then asked for specific directions, which are recorded. This process continues between 8 a.m. and 4 p.m., seven days a week. The location data obtained in this manner were transferred at the end of each day to both a GPS map and a hardcopy map.

The mapping of the obtained sex venue locations is considered to be essentially complete when five consecutive independent informants familiar with sex work locations in a given area are no longer able to locate new venues in that area. The outcome of this method is a GPS mapping of potential sex work locations for each area. This location method was used by teams A, C, D and E.

Team B, which focused on Phnom Penh and did not visit the countryside, used a different location method. Team B traversed each of the streets of the city and investigated each building for sex work and trafficking. The results for all teams in Phnom Penh were similar regardless of the method used.

Routes covered by research teams A, C, D and E

Legend for routes covered

■ Black lines indicate routes covered by at least two of the five research teams.

■ Blue lines indicate routes covered by at least one of the five research teams.

Local team members were successful in locating many places with predominantly local clientele, usually brothels, massage establishments and karaoke clubs, and occasionally common evening meeting areas for dating, at times with freelance workers. Expatriate team members were also shown such venues, but they were often shown considerably higher-priced establishments as well, such as large expensive clubs. In some areas, particularly Bavet, Phnom Penh, Battambang, Pailin and Poipet, the clubs were occasionally part of a complex involving a hotel, or a hotel and casino. As in all of the studies, demographic similarity with the customers of each individual venue, including their language and, where possible, their accent, was used as the selection criterion for the team members entering the establishments to gather data.

Data-gathering methods

Once the mapping is ruled to be complete for an area, the locations are visited to observe the demographics and languages of the customers entering and leaving the specific venue. When the customer demographics are determined for a specific brothel, club, hotel or any other location where sex is sold, a team member closely matching those demographics is selected.

The team member enters the venue and makes a mental note of the number of sex workers present, including the number of "small ladies" (workers appearing to be under the age of 18), and their ethnicity, likely age, language, demeanour and other characteristics. He then asks whether any worker he chooses would be able to leave the establishment with him. If any cannot leave, he asks which ones or how many. He was encouraged to talk with the workers and management informally, just as he would in entering any brothel or other such venue. Informant reports to team members were often brief and in a simple form such as "five Vietnamese, one small and she cannot leave". They were told to memorize the information, instead of taking notes, and never to take notes within or near any venue they surveyed. If an informant needed to make written notes, he could do that when he was out of sight of the venue.

At least two teams visited each located venue. Interviewers visited venues during normal working hours and, in populated areas such as a city, town or large village, at least one day apart between team visits. In smaller villages and rural areas, only one interviewer entered and collected data. The expatriate team member entered and obtained data from venues with an expatriate customer base. If one of the local team members matched the venue's customer demographics, that team member served as interviewer. If no team member

matched the customer demographics, a local person, usually a moto driver who had not been encountered previously, was engaged in conversation by a local team member and asked if he was familiar with the venue in question. Potential interviewers were selected for the task only if they were reasonably talkative and responsive in their meeting with the team member, as they were to talk with the brothel workers and management and find out typical brothel information, such as whether particular workers could leave the brothel and whether any "small ladies" worked there but were not currently visible.

None of the research teams had contact with each other prior to submitting their final reports. GPS coordinates were used to identify venues and to collate data from the teams. Team F travelled the highways and all backroads of Cambodia over a period of several months to count and record GPS locations for all sex venues in the country. They did not enter locations and gather data. This provided a check on the coverage obtained by teams A-E. Their task was to travel through each province outside of Phnom Penh, principally to compile a list of all sex venues located in Cambodia outside of Phnom Penh. Its members counted the total number of venues of each type in each area independently of all other teams. These data were then compared with the data located, mapped and reported in the data set produced by teams A, C, D and E, creating a basis for an estimate of the extent of trafficking in the venues located by team F but missed by the other teams.

Conversations with sex workers in Cambodia occurring since 1996 support the view that workers are normally free to leave the workplace with a customer and are free to return to their homes when their work hours for the day are completed. Many sex venues do not have a place where sex can occur on the premises, and workers are expected to leave with customers. Brothels have areas used for sex on the premises and are always open for business, 24 hours a day, even when the doors are locked and everyone inside is asleep. Police raids occurring between 2004 and 2008 may have increased caution among brothel management about openly providing information on women working off a debt. If management is concerned that a worker may run out on a debt, go to authorities or do something similar, that worker is probably not allowed to leave the premises. These were used as indications of trafficking in the 2008 study. Trafficked workers were defined as those under 18 years of age or those wanting to leave the venue but not allowed to do so (see tables 1-4).

Table 1. Observed number of venues and estimated number of sex workers, by type of venue and province, corrected for workers not present and missed venues, 2008

	Province	Variable	Direct			
			Brothel	Massage establishment	Subtotal	
1	Banteay Meanchey	Venues	15	13	28	
		Workers	79	72	151	
2	Battambang	Venues	23	11	34	
		Workers	139	30	169	
3	Kampong Cham	Venues	34	2	36	
		Workers	144	101	245	
4	Kampong Chhnang	Venues	12	2	14	
		Workers	103	17	120	
5	Kampong Speu	Venues	23	1	24	
		Workers	69	4	73	
6	Kampong Thom	Venues	9	0	9	
		Workers	21	0	21	
7	Kampot	Venues	10	2	12	
		Workers	33	7	40	
8	Kandal	Venues	6	8	14	
		Workers	16	25	41	
9	Koh Kong	Venues	9	2	11	
		Workers	60	11	71	
10	Kratie	Venues	11	1	12	
		Workers	33	3	36	
11	Mondul Kiri	Venues	5	2	7	
		Workers	10	7	17	
12	Phnom Penh	Venues	34	219	253	
		Workers	217	2 277	2 494	
13	Preah Vihear	Venues	33	4	37	
		Workers	101	9	110	
14	Prey Veng	Venues	17	1	18	
		Workers	54	3	57	

	Indirect				
Karaoke club	Bar or restaurant	Beer pub	Freelance	Subtotal	Total
36	40	3	15	94	122
696	411	21	75	1 203	1 354
46	81	4	9	140	174
891	578	91	113	1 673	1 842
43	13	2	1	59	95
427	118	19	6	570	815
10	6	2	9	27	41
81	26	35	29	171	291
21	2	2	1	26	50
158	8	11	6	183	256
25	18	3	8	54	63
188	111	18	53	370	391
11	2	7	1	21	33
59	9	61	7	136	176
11	70	1	1	83	97
337	155	3	5	500	541
27	6	2	0	35	46
159	87	6	0	252	323
14	2	2	0	18	30
126	5	22	0	153	189
9	2	0	0	11	18
91	8	0	0	99	116
136	317	13	49	515	768
4 986	6 416	361	813	12 576	15 070
47	29	4	5	85	122
64	46	15	34	159	269
36	1	0	0	37	55
188	4	0	0	192	249

Table 1.   Observed number of venues and estimated number of sex workers, by type of venue and province, corrected for workers not present and missed venues, 2008 *(continued)*

| | Province | Variable | Direct | | | |
			Brothel	Massage establishment	Subtotal	
15	Pursat	Venues	7	3	10	
		Workers	42	14	56	
16	Ratanak Kiri	Venues	9	1	10	
		Workers	37	9	46	
17	Siem Reap	Venues	18	8	26	
		Workers	104	434	538	
18	Sihanoukville	Venues	23	3	26	
		Workers	114	62	176	
19	Stung Treng	Venues	1	1	2	
		Workers	5	2	7	
20	Svay Rieng	Venues	13	0	13	
		Workers	69	0	69	
21	Takeo	Venues	38	2	40	
		Workers	145	5	150	
22	Odar Meanchey	Venues	12	0	12	
		Workers	67	0	67	
23	Kep	Venues	0	1	1	
		Workers	0	3	3	
24	Pailin	Venues	15	3	18	
		Workers	147	12	159	
	Outside Phnom Penh	Venues	343	71	414	
		Workers	1 592	830	2 422	
	Cambodia	Venues	377	290	667	
		Workers	1 809	3 107	4 916	

Notes:

Venues: the observed number of venues, meaning the number of venues of a given type observed by team F during 2008

Workers: estimated number of workers

	Indirect				
Karaoke club	Bar or restaurant	Beer pub	Freelance	Subtotal	Total
9	12	2	5	28	38
42	61	23	56	182	238
13	4	0	0	17	27
135	25	0	0	160	206
55	22	9	0	86	112
1 560	621	306	0	2 487	3 025
55	17	3	2	77	103
766	267	49	37	1 119	1 295
20	2	1	0	23	25
74	9	6	0	89	96
22	2	0	0	24	37
131	5	0	0	136	205
41	8	0	0	49	89
175	46	0	0	221	371
21	9	0	0	30	42
145	45	0	0	190	257
2	0	0	0	2	3
9	0	0	0	9	12
6	6	0	0	12	30
36	143	0	0	179	338
580	354	47	57	1 038	1 452
6 538	2 788	686	421	10 433	12 855
716	671	60	106	1 553	2 220
11 524	9 204	1 047	1 234	23 009	27 925

Table 2. Observed number of venues with trafficking and management/sex worker estimates of trafficked women and children, by ethnicity and trafficked status, 2008

	Area	Observed number of venues with trafficking				
		Total	Type of venue			
	Name		Brothel	Massage establishment	Other	
1	Banteay Meanchey	3	3	0	0	
2	Battambang	2	2	0	0	
3	Kampong Cham	7	7	0	0	
4	Kampong Chhnang	0	0	0	0	
5	Kampong Speu	0	0	0	0	
6	Kampong Thom	0	0	0	0	
7	Kampot	1	1	0	0	
8	Kandal	4	2	2	0	
9	Koh Kong	2	2	0	0	
10	Kratie	1	1	0	0	
11	Mondul Kiri	0	0	0	0	
12	Phnom Penh	25	13	7	5	
13	Preah Vihear	0	0	0	0	
14	Prey Veng	1	1	0	0	
15	Pursat	0	0	0	0	
16	Ratanak Kiri	0	0	0	0	
17	Siem Reap	6	5	1	0	
18	Sihanoukville	6	4	0	2	
19	Stung Treng	0	0	0	0	
20	Svay Rieng	4	4	0	0	
21	Takeo	6	6	0	0	
22	Odar Meanchey	0	0	0	0	
23	Kep	0	0	0	0	
24	Pailin	0	0	0	0	
	Outside Phnom Penh	43	38	3	2	
	Cambodia	68	51	10	7	

[a] Numbers under "Trafficked status" are not always independent, as the same individual, can be classified as both "Under 18 years of age" and "Cannot leave", and will not necessarily add to numbers under "Number of trafficked women and children".

	Number of trafficked women and children				Trafficked status[a]				
	Total	Ethnicity			Under 18 years of age		Cannot leave		
		Viet-namese	Khmer	Chinese	Viet-namese	Khmer	Viet-namese	Khmer	Chinese
	12	0	12	0	0	7	0	5	0
	11	0	11	0	0	5	0	7	0
	43	4	39	0	4	3	0	36	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	5	5	0	0	5	0	0	0	0
	16	12	4	0	0	3	12	4	0
	11	5	6	0	0	0	5	6	0
	4	1	3	0	0	0	1	3	0
	0	0	0	0	0	0	0	0	0
	200	35	142	23	22	37	28	129	23
	0	0	0	0	0	0	0	0	0
	4	4	0	0	0	0	4	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	39	15	24	0	15	5	12	19	0
	29	7	22	0	3	8	7	20	0
	0	0	0	0	0	0	0	0	0
	21	16	5	0	3	3	14	4	0
	38	38	0	0	4	0	38	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	233	107	126	0	34	34	93	104	0
	433	142	268	23	56	71	121	233	23

Table 3. Comparison of high-end estimated number of trafficked women and children, by ethnicity and trafficking type, in Cambodia, 2002, 2003 and 2008

Year	Ethnicity					
	Khmer	*Vietnamese*	*Other*	*Cambodia (total)*	*Under 18 years of age*	
2002	117	2 363	7	2 488	..	
2003	378	1 607	15	2 000	369	
2008	668	334	56	1 058	3 104	

Source: Thomas M. Steinfatt and Simon Baker, *Measuring the Extent of Sex Trafficking in Cambodia: 2008* (Bangkok, United Nations Inter-Agency Project on Human Trafficking, 2011), table 7.

[a] The entries under the column headings "Under 18 years of age", "Debt contract" and "Cannot leave" are not independent so they may not add up to the total for Cambodia.

[b] 31.2 per cent of 5,250.

Table 4. Estimated number of sex workers in Cambodia, based on 10 national studies, 1997-2008

Study	Research group	Year	Number of sex workers		
			Direct	*Indirect*	*Total*
1	National Assembly	1997	14 725	-	14 725
2	NCHADS	1997	6 002	5 309	11 311
3	NCHADS	1998	6 235	6 119	12 354
4	NCHADS	2000	3 872	7 004	10 876
5	NCHADS	2002	4 403	4 154	8 557
8	Steinfatt, Baker and Beesey	2002	5 324	15 505	20 829
6	NCHADS	2003	3 764	7 049	10 813
7	NCHADS	2003[a]	5 009	10 292	15 301
9	Steinfatt	2003	5 011	13 245	18 256
10	Steinfatt and Baker	2008	4 916	23 009	27 925
Mean of studies 1-10			5 926	10 187	15 095
Mean of studies 2-10			4 948	10 187	15 136
Mean of studies 2-7			4 881	6 655	11 535
Mean of studies 8-10			5 084	17 253	22 337

Sources: Thomas M. Steinfatt, Simon Baker and Allan Beesey, "Measuring the number of trafficked women in Cambodia: 2002", part I, November 2002; and Thomas M. Steinfatt and Simon Baker, *Measuring the Extent of Sex Trafficking in Cambodia:* 2008 (Bangkok, United Nations Inter-Agency Project on Human Trafficking, 2011), table 8.

Note: NCHADS: National Center for HIV/AIDS, Dermatology and STD of Cambodia.

[a] Data listed by NCHADS as its most reliable data collected to that date.

	How trafficked[a]			Area of trafficking		
	Debt contract	*Cannot leave*	*Cambodia (total)*	*Phnom Penh*	*Provinces*	*Cambodia (total)*
	2 488	..	2 488	1 638[b]	8 503	2 488
	1 631	..	2 000	..	..	2 000
	..	9 214	1 058	445	613	1 058

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PROPOSED UTILIZATION OF THE NETWORK SCALE-UP METHOD TO ESTIMATE THE PREVALENCE OF TRAFFICKED PERSONS

By Janie F. Shelton[*]

Abstract

Trafficking in persons is one of the gravest of crimes, but the scope and extent of the crime as measured by the number of victims have scarcely been quantified. Generating data on the population of trafficked persons presents a unique challenge because it tends to be a very hidden population—much more hidden than other hidden populations, such as the homeless population or the drug-injecting population. Epidemiological methods to detect hidden populations have advanced in recent years, with a variety of research papers describing the use of the network scale-up method to detect key affected and other subpopulations. The approach relies on conducting a survey of the general population, in which questions are asked about the number of individuals of interest in the personal network of the respondent and a specific set of questions are devised to estimate the size of the respondent's network. Advantages include the detection of multiple populations of trafficked persons in one survey, the minimization of harm to respondents for divulging first-hand knowledge, and improved statistical accuracy achieved by averaging over a large sample. Disadvantages include limited knowledge of the covariates of the population being surveyed.

Keywords: epidemiological methods, hidden populations, network scale-up method, trafficking in persons

Introduction

Trafficking in persons is a complex criminal act whereby a person is coerced into an exploited circumstance, for the purposes of slavery, organ removal, sexual exploitation or other form of forced labour, and it involves a wide range of

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[*] Statistics and Surveys Section, United Nations Office on Drugs and Crime.

transportation scenarios, either within or across national borders.[*] Trafficking in persons is a crime most often detected from reported incidents—which represents only a fraction of all cases, with the vast majority of victims hidden from view. In 2012, the International Labour Organization (ILO) estimated that there were 20.9 million persons in forced labour and recommended more national surveys to produce better global estimates in the future [1].

Because of the extremely hidden nature of trafficking in persons and the varied aspects of the exploitation that takes place, estimating the prevalence or number of victims of such trafficking presents a unique challenge. While various established epidemiological methods to survey hidden populations could be considered, in the present article, a less known technique is discussed: the network scale-up method, a method that is implemented in a survey of the general population. The network scale-up method was specifically designed to estimate the size of hard-to-count or impossible-to-count populations.[**] Owing to recent developments in the field, it holds promise as a research method for estimating the dark number of trafficked persons at the national level for a variety of reasons.

Primarily, the network scale-up method is distinguished from other methods used to detect hidden populations (e.g. multiplier methods, the capture-recapture method or respondent-driven sampling) because it leverages data from a survey conducted among the general population instead of among victims or perpetrators of trafficking in persons, who may be difficult or impossible to find or unwilling to talk.

The underlying principle is that some fraction of the general population will know someone who fits the case definition (in this case, someone who has been trafficked)—and the average prevalence of trafficked persons within networks of individuals from the general population will approximate the population prevalence of the subpopulation itself (see the figure). While this article does not include a comprehensive review of the methodology, it presents some of the key ideas to consider prior to designing a study that uses the network scale-up method to measure the prevalence of trafficking in persons at the national or subnational level.

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[*]In article 3 of the Protocol to Prevent, Suppress and Punish Trafficking in Persons, Especially Women and Children, supplementing the United Nations Convention against Transnational Organized Crime [2], "trafficking in persons" is defined as follows: "Trafficking in persons shall mean the recruitment, transportation, transfer, harbouring or receipt of persons, by means of threat or use of force or other forms of coercion, of abduction, of fraud, of deception, of the abuse of power or of a position of vulnerability or of the giving or receiving of payments or benefits to achieve the consent of a person having control over another person, for the purpose of exploitation. Exploitation shall include, at a minimum, the exploitation of the prostitution of others or other forms of sexual exploitation, forced labour or services, slavery or practices similar to slavery, servitude or the removal of organs" (General Assembly resolution 55/25, annex II).

[**]A comprehensive review of this methodology can be found in Bernard and others [2].

Principle of the network scale-up method

The average prevalence of the subpopulation across a sample of networks of individuals from the general population will reflect the distribution, or overall prevalence, of that subpopulation in that society:

$$\frac{m}{c} = \frac{e}{t}$$

where:

m = number of people in a subgroup that the respondent knows

c = social network size of the survey respondent

e = population size of the subgroup

t = general population size

Background

The network scale-up method was first developed and published by H.R. Bernard and C. McCarty, professors at the University of Florida. One of the earliest surveys was based on a need to estimate the number of deaths from the earthquake in Mexico City in 1985, where it was observed: "There must be thousands dead—everyone knows someone who died." While it is relatively straightforward to ask a sample of the general population how many people they knew who had died in the earthquake, estimating their personal network size proved more challenging. Using research methods and social network theory, the idea that it is possible to estimate the population prevalence by leveraging information stored within the social network has evolved.

In 1998, Killworth and others [3] compared estimates of the seroprevalence of HIV, rape and homelessness in the United States with other known estimates and found them to be comparable in all three cases.[*] Since then, the network scale-up method has been used by a variety of researchers to estimate hidden populations such as the number of heroin users in cities in the United States [4], populations at risk of HIV in Ukraine [5], heavy drug users

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[*]In other words, the estimates were within the confidence intervals of previously published estimates.

in Curitiba, Brazil [6], HIV-affected populations in Chongqing, China [7], groups at risk of HIV/AIDS in Kerman, Islamic Republic of Iran [8], and the population size of men who have sex with men in Japan [9].

In the study evaluating the population size of men who have sex with men in Japan, an Internet-based survey approach was used; the results were similar to other reported estimates. The approach offered a variety of benefits, including efficiency, simplicity and low cost compared with conventional methods [9]. In the study to evaluate the size of groups at risk of HIV/AIDS in Kerman, Islamic Republic of Iran, two different methods were contrasted: probability (that you know just one person in the subpopulation of interest); and frequency (the number of people you know) [8]. Both of these approaches can be used at the analytical phase without consideration in the survey design, but for highly stigmatized issues it is worthy of consideration to ask "Do you know at least one person who …?" as opposed to "How many people do you know who…?".

The broad international spectrum of publications using this method has produced a rich literature on the effectiveness and constraints of the method itself, as well as validation of the approach by comparison with other reliable sources or previous estimates. Perhaps most useful are the questions posed to estimate the personal network sizes in each publication, which relies on culturally specific information and available data in each milieu.

Methodology

The calculation of the prevalence of a hidden population using the network scale-up method requires two key components:

   (a)   Estimating the personal network size of members of a random sample of the population using:

$$\hat{c}_i = \frac{\sum_j m_{ij}}{\sum_j e_j} * t$$

where:

$\hat{c}_l$ = personal network size of person i

m_{ij} = number of people in subpopulation j known by person i (e.g. the number of women known to person i who gave birth)

e_j = size of subgroup j (e.g. the number of women who gave birth in the total population (known))

t = size of the general population (known)

(b) Estimating the number of members of a hidden subpopulation (e.g. trafficked persons) and standard error of the estimate:

$$\hat{e} = \frac{\sum_i m_i}{\sum_i \hat{c}_i} * t$$

$$S.E.(\hat{e}_j) = \sqrt{\frac{\hat{e}_j}{\sum_i \hat{c}_i} * t}$$

where:

$\hat{e}$ = estimated size of the hidden population

m = number of people known by person i

$\hat{c}$ = estimated personal network size of person I

t = size of the general population (known)

Note: m and $\hat{c}$ can come from different sources.

Challenges to consider

What does it mean to "know someone"? How to estimate $\hat{c}$?

In 2010, a critical development in this area came from a paper by McCormick, Salganik and Zhen describing the best ways to estimate the denominator, or the personal network size of the survey respondents. The suggested working definition of "to know someone" is "that you know them and they know you by sight or by name, that you could contact them, that they live within [your country] and that there has been some contact (either in person or by telephone or mail) in the past 2 years" [10].

There are two prevailing approaches to estimating personal network size (e.g. the denominator of the respondent): the scale-up method and the summation method. The scale-up method relies on the fraction of a known population who are known to an individual (e.g. the number of police officers known to a (fictitious) person named Sam). If Sam knows 2 police officers and there are 30,000 police officers in the country, Sam knows 2/30,000 people in the country). For most surveys, approximately 15-20 known population sizes are estimated. For examples of known populations, see the table.

Examples of known populations used to estimate personal network size of respondents using the question "How many … do you know?"

Examples of known populations in the context of China (drawn from Guo and others)	Examples of known populations in the context of the United States[a]
Males aged 20-24 years	Women named Rose
Females aged 20-24 years	Men named Jack
Females aged 70 or older	Women named Gloria
Government officials	Women who gave birth in the past year
Registered policemen	Men who are in the armed forces
Registered physicians	Postal workers

Sources: Wei Guo and others, "Estimating the size of HIV key affected populations in Chongqing, China, using the network scale-up method", *PLoS One*, vol. 8, No. 8 (2013); and Tyler H. McCormick, Matthew J. Salganik and Tian Zhen, "How many people do you know?: efficiently estimating personal network size", *Journal of the American Statistical Association*, vol. 105, No. 489 (2010).
  [a] Names deserve careful consideration and must only represent 0.1-0.2 per cent of the population (according to McCormick, Salganik and Zhen).

Research on known population sizes shows that the best results are obtained when the known population size is between 1 and 5 per cent of the population [6]. The scale-up method requires that the survey include a range of questions regarding known populations so that the estimated network size is averaged over a broad grouping of people. The summation method involves adding together the respondents' answers for segments of their network (e.g. family members, work colleagues, sports teammates, church associates). (For more details on each technique, see McCormick, Salganik and Zhen [10].)

Estimation effects: recalling characteristics of people who are known is not perfect

If a person lives in a community where trafficking victims are known to be targeted, it is likely that the person knows something about some people, but not everything about everyone the person knows. Though larger sample sizes can account for random sampling error, response error cannot be accounted for [11].

Barrier effects: there are different probabilities of knowing someone in the hidden population among members of the general population

Victims of trafficking may be known only to members of certain villages, or among marginalized subpopulations. Therefore, sampling methods would need to consider the likelihood of encountering someone who knows a trafficking victim in the general population, and potentially oversample in areas

where those persons may be found to ensure that the survey does not only detect null responses. In this case, sampling weights would be needed to account for the sampling scheme.

Transmission error: would a person know if someone in his or her personal network had been a victim of human trafficking?

It is likely that many victims of exploitation do not reveal to their friends and family the full extent of their condition—which may vary depending on the type of exploitation. For example, in some countries, qualitative research shows that families are involved in facilitating the process for remuneration—but in many cases, the true nature of the event is only known to the traffickers and victims themselves. Transmission error, defined as the limited number of persons within an individual's network who will know about the crime or circumstances of the individual, is a particular challenge for research on the subject of trafficked persons. Further, it has been shown that transmission error is more likely with highly stigmatized behaviours. Qualitative research in advance of developing a survey method would allow for an estimate of transmission error to be developed—and a correction factor can be calculated to compensate for this bias.

Implementation

The implementation of the network scale-up method survey requires a planning trajectory similar to that of the general population survey and can be easily embedded in a national population survey with a different focus—but it differs in terms of formative research. Pilot testing is critical to understanding the best known populations to use for the scale-up network size estimates, to avoid wasted time and missed opportunities in the final survey. For example, in advance of designing the survey questionnaire, researchers must establish a list of 15-20 known population sizes to generate the network size estimates and pilot test the size estimates. Once the pilot test results come in, back-calculation methods are used to validate the population sizes and isolate network size estimation to the populations that fell within a reasonable range of the true population size. The questionnaire can be shortened once poorly performing known population sizes are identified. (For a good example of how this is done, see Guo and others [7].)

One key component of the formative research component of measuring the prevalence of human trafficking using the network scale-up method is the

estimation of transmission error. How many people who are trafficked tell anyone they know what has happened to them? Interviews with a sample of the population of interest should lend insight into the size of the network of people who "know" about the condition of their contact. It has been documented that key affected populations such as HIV-positive individuals only reveal their status to approximately one third of the people in their personal network. Thus, the correction factor for transmission error is quite important in estimating the true size of the population of interest.

Strengths and weaknesses of using the network scale-up method to estimate the prevalence of trafficking in persons

A key weakness of the network scale-up method approach is the lack of covariates. If interviewers made direct contact with victims, covariates such as age, race, education and other data on other characteristics could easily be collected to further describe the subpopulation of victims of trafficking in persons—but because the estimate is produced based on the number known to members of the general population, these microdata would not be available.

However, with data obtained by the network scale-up method, estimates of the age and gender profiles of the target population (e.g. trafficked persons) can be made using statistical methods. These methods are based on leveraging information about the respondents' network characteristics to impute covariate data. (For more on this, see McCormick and Zheng [12]).

The strengths of using the network scale-up method include minimization of random error, the ability to estimate several hidden populations simultaneously, and lower risk to victims of the crime. Because of the natural averaging over an adequate sample size, the effects of random error from small numbers will be minimized when the network scale-up method is used, which not the case in surveys of victims. While in surveys of victims, valuable qualitative information can be learned, such quantification relies on larger numbers, as random error declines as the sample size increases. Finally, the network scale-up method can be used as a survey module within a larger national survey, both to increase the sample size and minimize the costs.

A particularly relevant advantage for using the network scale-up method for national surveys of human trafficking is its ability to ask about several subpopulations in one survey. For example, if both men and women are trafficked in a given country, but for different reasons, questions could be asked about women trafficked for the purpose of sexual exploitation, men trafficked

for the purpose of forced labour and persons who may be vulnerable to such trafficking, such as sex workers or day labourers.

Finally, using the network scale-up method does not require researchers to find victims of such trafficking, who may be inaccessible for a number or reasons or who may themselves obfuscate their situation out of fear. Researchers must also be mindful of the fact that asking victims sensitive questions may put the victims at risk of becoming involved in other crime.

Specific recommendations on using the network scale-up method for estimating the prevalence of trafficking in persons at the national level

Researchers using the network scale-up method to estimate the prevalence of trafficking in persons at the national level should:

(a) *Conduct in-depth interviews with a number of victims or family members of victims to understand the dynamics of information transmission to the family and community from the victim.* Who would they tell or not tell about their circumstances? When did they become fully aware of the situation and when did their families and community become aware? For example, do all men trafficked for the purpose of forced labour tell their wives of their circumstances right away? Or do they wait until they see them in person to reveal the truth? There are examples of studies using the network scale-up method where this type of formative research on transmission error improved estimates considerably;

(b) *Consider adding a module to evaluate the stigma associated with each type of exploitation.* For example, in a study of key affected populations in China, respondents were asked to rank their respect for each type of population (men who have sex with men, injection drug users etc.), from 1 (very low) to 5 (very high). This approach was then used to weight the responses with the assumption that those with a neutral opinion were less likely to underreport or overreport than those with a non-neutral opinion;

(c) *Whenever possible, use multiple methods to estimate the number of victims of trafficking in persons in the same place to validate network scale-up method against other indirect estimation techniques (e.g. the network scale-up method alongside multiplier methods or the capture-recapture method).* This approach and the publication of this approach will help to move forward research in this field and to identify the most effective techniques in each circumstance.

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DEVELOPING A SAMPLING FRAME OF POTENTIAL TRAFFICKING VICTIMS USING GEO-MAPPING TECHNIQUES

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Abstract

Given the hidden nature of trafficking in labourers, it is inherently difficult to research. Although identifying victims who are currently being exploited may be the most effective mechanism for generating estimates of the prevalence of trafficking, most research on trafficking in labourers has focused on cases known to law enforcement or service providers. To overcome this obstacle and generate a prevalence estimate of trafficking in persons for the purpose of agricultural labour, a sampling frame of potential victims needs to be constructed. This article contains a description of an innovative technique for developing a sampling frame of migrant farmworkers using geographical data on farming practices to identify where workers may live and employing mobile devices to capture digital images and Global Positioning System coordinates to serve as a surrogate for a household's address or description with traditional field enumeration. Results of a pilot test demonstrate the feasibility and efficiency of developing a sampling frame using this technique.

Keywords: labour trafficking; migrant farmworkers; hidden populations; sampling

Background

Human trafficking is a global problem of unknown numbers and unsubstantiated estimates. Among known human trafficking cases, nearly 80 per cent have been cases trafficking for the purpose of sexual exploitation. However, it is suspected that trafficking in labourers is under identified. It is incumbent on researchers to develop valid and reliable estimates of the magnitude of the problem in order to ensure that appropriate actions are taken by law enforcement agencies and the criminal justice system, as well as to inform the development of empirically based mechanisms to prevent trafficking. However, given the hidden nature of labour trafficking, it is inherently difficult to research. It is

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not surprising, then, that most of the existing research on human trafficking has relied on surveys of law enforcement agencies and victim service providers about their experiences with trafficking cases and reviews of known cases. Those cases are uncovered when an arrest occurs or the victim seeks services. However, victims only rarely come to the attention of law enforcement or service providers; and when they do, they may not be recognized as trafficking victims. Labour trafficking hides within the confines of legitimate employment, and law enforcement authorities have relatively little experience with such cases. Moreover, the victims who come forward or are otherwise found may not be representative of the entire victim population. Thus, looking for labour trafficking cases solely in law enforcement and court files will likely result in the majority of labour trafficking incidents being overlooked. This makes it difficult to use standard statistical techniques, such as applying a multiplier to the population of known victims, in order to estimate the true number and characteristics of victims. Although identifying victims who are currently being exploited may be the most effective mechanism for generating estimates of the prevalence of trafficking, most research on labour trafficking has focused on cases known to law enforcement authorities [1-4]. (For a recent groundbreaking exception using respondent-driven sampling, see Zhang [5].)

Most cases of forced labour involve migrant workers in economic sectors where the share of labour in the cost of production is highest and a main determinant of competitiveness [6]. One such sector is agriculture. There are more than 2.1 million farms in the United States of America, and the market value of agricultural products sold in 2012 reached nearly $400 billion [7]. In the United States, about 1.2 million labourers work on farms and ranches, 70 percent of whom are hired directly by the farm operators [8]. North Carolina is one of the leading agricultural states in the United States, and it produces a variety of table crops that require extensive manual labour to grow and harvest. In 2012, North Carolina had over 50,000 farms, yielding agricultural products with a market value of over $12 billion, including $4.3 billion from crops [7]. According to the North Carolina Farmworker Institute, about 150,000 migrant farmworkers and their dependants work in North Carolina, the state with the sixth highest number of migrant farmworkers in the United States [8]. The combination of a large agricultural industry and reliance on migrant workers makes North Carolina an ideal location to study labour trafficking.

In 2013, the authors completed a study that documented the characteristics and indicators of labour trafficking in North Carolina [9]. The study was funded by the National Institute of Justice (the research, development and evaluation agency of the United States Department of Justice). One component of this multimethod study was conducting interviews with migrant farmworkers

who may be at risk for exploitation and trafficking. To ensure a representative sample of the population of interest, survey samples are typically drawn from a known population of eligible participants; however, there is no such sampling frame for migrant farmworkers. In the United States, farms that employ agricultural workers on a temporary visa are required to register; other farms may rely on undocumented immigrants and would not be found on a farm registry. Some advocacy organizations provide outreach services to workers living at some unregistered farms; however, their lists only include labour camps of which they are aware, and the lists are admittedly incomplete. Because a sampling frame for migrant farmworkers does not exist, the authors employed various techniques for identifying and recruiting a convenience sample of respondents. This included reaching out to workers at farmworker festivals, visiting labour camps identified through the state registry and outreach organizations and reaching out to farmworkers at other public locations (e.g. laundromats (launderettes), stores frequented by Spanish-speaking customers and bus stations). Those techniques enabled the authors to conduct in-person interviews with 380 farmworkers during a period of about six months in 2012. The interview instrument covered the core measures of trafficking and other forms of labour exploitation that had been successfully used in a study of labour trafficking in San Diego, California [5].

The results of the study in North Carolina revealed a high level of labour trafficking (25 per cent of respondents) and other forms of labour exploitation that did not rise to the level of trafficking (39 per cent) [9]. However, because a convenience sample was used, these findings may not be representative of all migrant farmworkers in North Carolina. To overcome this obstacle and generate an estimate of the prevalence of labour trafficking among all migrant farmworkers in the state, a sampling frame of migrant farmworkers would have to be developed. In 2013, the authors successfully piloted a method that relies on innovative geo-mapping techniques to identify farmworker dwellings. The authors are in the process of applying this technique to enumerate farmworker dwellings throughout North Carolina. A sample of dwellings will be drawn from this frame and used to recruit a representative sample of migrant farmworkers for participation in interviews about labour trafficking and exploitation. The strategy for establishing a sampling frame of migrant farmworkers, as well as the results of the pilot project demonstrating its feasibility in the field, is described below.

Research objectives

The current study seeks to achieve three primary objectives. First, a field-tested enumeration strategy will be applied to establish a sampling frame of migrant farmworkers. This sampling frame will support the use of multistage sampling

procedures and yield a representative sample of migrant farmworkers in North Carolina. Second, a sample of migrant farmworkers will be interviewed in order to produce reliable estimates of the prevalence of labour trafficking victimization among farmworkers in North Carolina. The authors will adopt the core measures that were successfully used in the San Diego study [5] and in their own earlier study in North Carolina [9]. In addition to estimating prevalence, the authors will be able to produce social and demographic profiles of identified victims. Third, the authors will investigate the severity and types of victimization that migrant farmworkers endure. The results will inform law enforcement agencies and policymakers about the scale and scope of trafficking among migrant farmworkers and will result in recommendations for potentially effective strategies to combat and prevent trafficking.

Methods

The methods described below are limited primarily to the innovative process currently being applied to generate a representative sample of farmworker dwellings across North Carolina. The primary steps for developing the sampling frame of migrant farmworkers and selecting a representative sample include: using data on agricultural practices to select geographical segments to include in the sample, enumerating all dwellings in the selected segments, selecting dwellings to include in the household survey, validating the eligibility of dwellings and selecting individuals within a household to participate. Results from a pilot study using methods similar to those described here will be presented to demonstrate the feasibility of the sampling and data-collection strategies.[*] Because the collection of data has not begun, prevalence estimates for trafficking are not yet available.

Geographical sample selection

The first step in generating the sampling frame is to identify where farmworkers may live. Resting on the assumption that migrant farmworkers live near the farms on which they work, an effort was made to identify areas in North Carolina where crops are grown. Because much of the farming in the United States is highly mechanized and does not require much manual labour (e.g. field corn and soybeans), the authors have focused on "high-labour" (labour-intensive) crops (e.g. apples, cucumbers, strawberries, tobacco, tomatoes and

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[*] The strategies used in the pilot study have been refined and technological improvements have been made. These changes are expected to result in improved ability to identify and validate farmworker dwellings, in addition to easing the enumeration and interview process.

watermelon). The United States Department of Agriculture maintains those data at the census block level.*

The map shows the distribution of high-labour crops across North Carolina. The map indicates that those crops are produced in various clusters within the state and are not evenly distributed. This information is useful as it makes it possible to eliminate large areas in the state in which migrant farmworkers are not expected to be found because no high-labour crops are produced in those areas. Spatial aggregation techniques will be used to divide North Carolina into geographical "segments" by joining adjacent census blocks to create areas of a size that makes field enumeration feasible. The geographical segments will then be aggregated into larger units that will serve as the primary sampling units, which will cluster the sites, reducing travel and making enumeration and data collection less time-consuming and more cost-efficient. Probability-proportional-to-size sampling will be used, with land area for high-labour crops as the measure of size, to select 20 primary sampling units. From within each of the 20 primary sampling units, probability-proportional-to-size sampling will again be used to select 5-6 segments within each primary sampling unit. Field staff will then be dispatched to each selected segment to create a list of dwelling units.

Figure I.   Distribution of high-labour crops in North Carolina

Areas of high labour farmland

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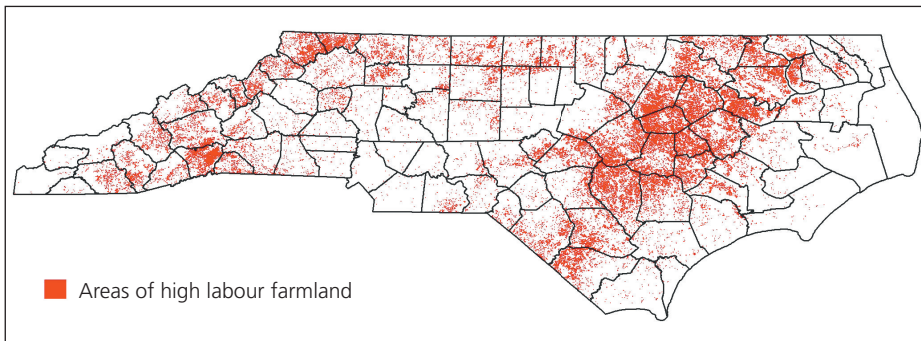
*A census block is a statistical area bounded by visible features (e.g. streets, streams, railroad tracks) and non-visible boundaries (e.g. property lines, city limits). Census blocks are small in area but may be large or irregularly shaped in rural areas. The United States Census Bureau distinguishes between census tracts, block groups and blocks. Census block groups are smaller than census tracts and can be further divided into census blocks for understanding locations at the lowest aggregate level. In the 2010 census, North Carolina had 2,195 tracts, 6,155, block groups and 288,987 blocks (www.census.gov/).

Enumeration of dwellings

The authors developed a method of field enumeration that employs the capture of digital images with Global Positioning System (GPS) coordinates. In short, field staff are deployed to the geographical areas of interest, drive all roads (paved and unpaved) and photograph each dwelling they pass. Combined, the digital image and GPS coordinates serve as a surrogate to what would be a household's address or description with traditional field enumeration. This method was introduced in the summer of 2007 for an in-person household survey for which a suitable frame could not be generated by traditional techniques, such as address-based sampling, traditional field enumeration or random digit dialling [10]. Two survey methodologists were deployed to the field and enumerated the entire target household population, approximately 9,000 dwelling units, in five days.

This method is being updated and adapted for the current project. When it was used for the first time, the method relied on the use of a particular camera with a GPS receiver to capture photographs of dwellings and GPS coordinates. Paper maps were developed for the target area and were used to aid in navigation. However, advances in technology allow for a simpler, more user-friendly system that will operate entirely on an Android tablet. The authors also developed a mobile application for spatial field data collection that will serve as the navigation system, as well as the GPS-enabled camera. The application does not require a live Internet connection, which makes it particularly useful in rural areas where there may not be consistent cellular service. This application connects with geographic information system (GIS) web services to download customer map layers and transmit map markups back to the servers. In addition to photographing the dwelling, the application will also make it possible to record a code indicating the likelihood that a dwelling is a farmworker dwelling (the likelihood being high (code 1), medium (code 2) or low (code 3)). The mapping application will have three buttons, one for each likelihood code; when one of the buttons is clicked, it will take a photograph of a dwelling and record the code indicating the likelihood of the dwelling being a farmworker dwelling.

The field team will determine which likelihood code is to be given to a dwelling. The decision will be based on a protocol that describes observations indicating that a dwelling may be a farmworker dwelling. The observation list includes community, dwelling, resident and vehicle indicators. The protocol was initially developed by a member of the research team who has experience engaging in migrant farmworker outreach and was subsequently reviewed by

local farmworker advocates.* A team of enumerators will be trained on the protocol, both in a classroom setting and in the field, to ensure that they interpret it as intended. Teams consisting of one driver and one navigator/photographer will be dispatched to each segment selected on the basis of the geographical distribution of high-labour crops. The photographs and geographical coordinates will be downloaded from the tablet and will serve as the sampling frame.

Validation and selection of eligible dwellings and respondents

Once the sampling frame has been established, a sample of dwellings will be selected for approaching and recruiting respondents to participate in in-person interviews. Because relatively few dwellings are expected to be given the code indicating a high likelihood of being the housing of migrant farmworkers, all such dwellings will be visited to attempt an interview. A large proportion of those dwellings given the code for medium likelihood and a small proportion of those given the code for low likelihood will also be visited. The proportion of dwellings within each of these strata to be selected will be determined after reviewing characteristics of the entire sampling frame. After selecting the dwellings, efforts will focus on validating whether the coding decision was correct and identifying eligible respondents to recruit for participation in the interview.

Interviewers will make at least three attempts to make contact with residents at each selected dwelling. Visits will be made on different days of the week and at different times of the day to increase the likelihood of the dwellings being occupied. The interviewers will first confirm that the dwelling is occupied by migrant farmworkers. If multiple residents are eligible to participate in the interviews, one will be randomly selected. The respondents will be read a description of the study and what participation in the study entails. If they agree to participate, the interviewer will begin conducting the interview. The interview instrument will contain the core items from the San Diego labour trafficking study [5] and will be used to estimate the prevalence of labour trafficking among migrant farmworkers in North Carolina.

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*Although this protocol was developed for a specific geographical and industrial setting, it is adaptable to other regions, countries and industries. In this part of the process, the key is the reliance on experts to ensure that the protocol used to identify the population of interest is accurate and inclusive.

Research team and other resources needed

Completing the data collection and analysis requires a strong team with expertise and research experience in the field of trafficking in persons and in sampling hidden populations, sampling statistics and weights, GIS analysis, data analysis and bilingual/bicultural field interviewing. A principal investigator and a co-investigator will be responsible for the design and execution of the study, instrumentation, implementation and other administrative activities. Both have experience conducting research with migrant workers who are at risk of being victims of labour trafficking. A sampling statistician is systematically developing the geographical segments, randomly selecting segments for inclusion in the study, and generating weights for use in the data analysis. The sampling statistician works closely with a GIS analyst and a senior GIS expert who are extracting the geographical data, making programing adjustments to the mobile application as needed to meet project requirements and conducting all other mapping activities. Additionally, an experienced data-collection task leader will be responsible for executing all fielding activities as designed and planned, including coordinating and supervising the daily activities of field teams. The task leader will be supported by field supervisors, who will lead teams of field enumerators and interviewers. Finally, a team of field staff will conduct the enumeration and conduct interviews with the selected participants. All field interviewers will be bilingual; most interviews will be conducted in Spanish. The enumeration and interview teams will each consist of two or three staff members. The number of teams will depend on the geographical distribution of the selected segments and the time available for conducting interviews. If the selected segments are clustered in a few areas in the state, it may be feasible for one team to conduct the entire enumeration; however, if the segments are dispersed more evenly throughout the state, then two or three teams may be needed to cover the state in a timely fashion. The same logic holds for the sample of dwellings that will be selected for interviews; greater dispersion of dwellings may require additional teams.

In addition to the research team, this type of data-collection effort requires some special equipment and software. Given the rural nature of the areas of interest, small sports-utility vehicles will be rented for the fieldwork so that the team can easily access unpaved roads. Each field team will also need a tablet that is equipped with the mobile mapping application. The research team will also need access to other mapping and statistical analysis software.

The final resource required is time. This project is expected to be completed in a total of three years. The first three months of the project are dedicated to getting the project set up, which includes finalizing instrumentation, developing field

protocols and obtaining approval from the institutional review boards to conduct research with human subjects. All field staff will also undergo intensive training on interviewing techniques, field protocols and procedures for the protection of human subjects before data collection may begin. The enumeration will be conducted in year 1 and is expected to be completed in less than one month. Field staff will conduct interviews with eligible migrant farmworkers during the growing season (approximately from May to November) of years 1 and 2. The goal will be to complete 400 interviews in two years, averaging about 200 interviews each year. Data analysis and reporting will occur in year 3.

Challenges faced in the pilot study

A few challenges were faced in piloting the enumeration strategy for migrant farmworkers, and plans are in place to mitigate these as the method is applied state-wide. One of the initial challenges in the process is assessing the likelihood that a dwelling is inhabited by migrant farmworkers. In the interest of time, these assessments must be made fairly quickly by the members of the field team while they are driving and photographing the dwelling. Because the assessments are used to determine the probability that a dwelling will be revisited for validation and interviewing, it is important to err on the side of assuming that a dwelling is more, rather than less, likely to house migrant farmworkers. At this stage, it is better to be more inclusive and eliminate ineligible dwellings during the validation process than to exclude a dwelling that may be eligible. Developing the protocol for determining the likelihood that a dwelling unit may be inhabited by farmworkers and providing adequate training to field staff are critical in this process.

There were some logistical issues with planning the most efficient driving route for enumerating a segment and validating whether each dwelling is eligible. In rural areas, census block boundaries frequently follow rivers, levees, ditches or other geographical features that are not directly accessible by road. In these situations, it is necessary to exit a segment and re-enter at another point that is accessible by road. Enumerating every dwelling in a selected segment may require driving on the same roads repeatedly and backtracking to ensure that all small roads and unpaved roads are included. This can be mitigated by more thorough pre-planning of routes by the field team. Additionally, because residents are not always at home, it is necessary to make multiple visits to some dwellings in order to validate whether they are farmworker dwellings. Plans have been made to conduct most of the validation/interview visits in the early evening and on weekends, when farmworkers are most likely to be at home. However, the working hours are often long and farmworkers may work on weekends as well.

Finally, conducting the enumeration may generate some negative attention, as some residents may want to know why people are driving around photographing houses. The enumeration team members must drive slowly in order to photograph each dwelling and make a determination about the likelihood that it is a farmworker dwelling. They also must backtrack and drive the same roads repeatedly to capture the entire segment. This increases the likelihood that residents will notice them and become concerned. The key to overcoming this challenge is to train the enumeration team members to expect questions about their presence and be prepared to explain their presence and their role in the research project.

Main results of the pilot study

The authors conducted a pilot study of this approach early in 2013. The purpose of the pilot study was to determine whether it was feasible to enumerate dwellings in a timely fashion, whether the predictions regarding the likelihood of a dwelling being a migrant farmworker dwelling were accurate and whether it was a less time-consuming and more cost-effective approach to developing a sampling frame. Clusters of census blocks with large areas of high-labour crops were purposefully selected for inclusion in the pilot study.

The authors enumerated 542 dwellings in four counties of North Carolina. Each dwelling was assigned a code indicating its likelihood of being a farmworker dwelling ("almost certainly", "very likely", "somewhat likely" or "not likely"). Most (85 per cent) of the dwellings were not expected to be farmworker dwellings; only 8 per cent were predicted to be very likely or almost certainly a migrant farmworker dwelling (see table 1). Return trips were attempted to verify whether the coding was accurate.

Table 1.　Field predictions about the likelihood of a dwelling being migrant farmworker dwelling

	Percentage
Almost certainly eligible	4
Very likely eligible	4
Somewhat likely eligible	7
Not likely eligible	85

After the dwellings were enumerated, the authors returned to each of the dwellings that had been initially coded as "almost certainly", "very likely" or "somewhat likely" to be a migrant farmworker dwelling and to a sample of 20 per cent of the dwellings that had been assessed as "not likely" to be

migrant farmworker dwellings. The authors then attempted to verify the original prediction by visiting each dwelling and asking some basic screening questions to confirm that the dwelling was the primary place where a migrant farmworker stayed during non-working hours.

As shown in table 2, the validation results suggest that it was easier to identify ineligible than eligible dwellings; this is desirable, as it means that the authors will be able to eliminate ineligible dwellings during the validation process and can be more confident that all eligible dwellings are included. It was determined that, of the 90 dwellings coded as "not likely" to be farmworker dwellings, 88 were not farmworker dwellings, 1 actually was a farmworker dwelling and 1 was "undetermined".* Only 44 per cent of the dwellings "very likely" and 53 per cent of those "almost certainly" to be farmworker dwellings were confirmed as farmworker dwellings. The results also suggest that only a small sample of houses given the code indicating a low likelihood of being farmworker dwellings need to be sampled in the full study. There was also a relatively high proportion of dwellings for which a determination about eligibility was not made. This occurred because residents were not at home during the validation visits. The inability to make a determination about some dwellings contributed to the low confirmation rates; 30 per cent of the dwellings coded as being "very likely" and 16 per cent of those coded as being "almost certainly" farmworker dwellings were "undetermined". This underscores the need to plan for multiple return trips to selected segments in order to increase the chances of visiting dwellings at a time when the residents are at home. It is anticipated that most of this work will occur in the early evening and on weekends.

Table 2. Verification of the predictions about the likelihood of a dwelling being a migrant farmworker dwelling

	Number of dwellings sampled	Prediction confirmed		Prediction not confirmed		Undetermined	
	f	*f*	*Percentage*	*f*	*Percentage*	*f*	*Percentage*
Almost certainly eligible	19	10	52.6	6	31.6	3	15.8
Very likely eligible	23	10	43.5	6	26.1	7	30.4
Might be eligible	33	3	9.1	14	42.4	16	48.5
Not eligible	90	88	97.8	1	1.1	1	1.1
Total	**165**	**111**	**67.3**	**27**	**16.4**	**27**	**16.4**

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*A dwelling was considered "undetermined" if it was unoccupied during the follow-up visits and the presence of migrant farmworkers could not be determined.

Conclusion

Overall, the pilot results demonstrate the feasibility of developing a sampling frame of the migrant farmworker population using geographical data on agricultural practices and the newly developed enumeration technique. Several advantages and disadvantages of this approach are described below.

Advantages of the approach

One advantage of this approach is it enables researchers to identify victims who are currently being exploited rather than relying on databases of cases known to law enforcement agencies or service providers. Trafficking cases are under identified and underreported, which reduces the value of extracting secondary data on the few cases that come to light in order to estimate the magnitude of the problem. This is more problematic among victims of labour trafficking than among victims of trafficking for the purpose of sexual exploitation, as labourers are less likely to come in contact with law enforcement authorities in the course of their daily activities than are victims of sex trafficking.[*] Because victims are rarely identified by law enforcement or service providers, they are probably not representative of the entire victim population. Research relying on such data will overlook most trafficking incidents and run the risk of drawing incorrect assumptions about the size or characteristics of the victim population.

The primary advantage of this strategy over other methods that seek to identify hidden populations is that it allows for the recruitment of physically and socially isolated populations that may not be reachable through other techniques. For example, respondent-driven sampling has been successfully used to estimate the prevalence of labour trafficking among undocumented workers in San Diego [5]; however, it is best suited for use in smaller geographical areas and may not be feasible for nationwide prevalence estimates. Moreover, because it relies heavily on the subjects' immediate social networks, it is difficult to use with populations that are socially isolated. The approach presented in this article relies on the geographical location of worksites rather than on immediate social networks and thus may identify individuals with little or no opportunities to socialize with friends and family outside of the work environment.

There are also advantages gained by using geographical data on farming practices in the sample selection process. A straightforward alternative to the

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[*] Police officers routinely handle vice cases and may initially arrest a sex trafficking victim who was misidentified as a prostitute; victimization may be uncovered after the original arrest. However, labour trafficking does not have an analogous criminal activity (i.e. work in jobs that may result in exploitation is legal), making it even more difficult to identify the victims of such trafficking.

approach presented in this article would be to randomly select census blocks for inclusion in the sample. However, using data on crop location improves the efficiency of using geographical sampling techniques by eliminating areas that are unlikely to include the population of interest. It also improves the precision of prevalence estimates over simple random sampling. This approach also makes use of technological innovations (e.g. Android-based tablet, mobile mapping application) that result in time and cost savings in developing the sampling frame and in conducting the interviews.

Although the focus of the current study is labour trafficking among migrant farmworkers in the United States, this framework is flexible and adaptable to different countries, industries, forms of trafficking and hidden populations. The primary requirement is the existence of geographical data that can be used to narrow down where the population of interest may work or live. The case of migrant farmworkers can be viewed as an example of how the strategy may be used in the field.

Disadvantages of the approach

Although this enumeration strategy has proved useful in examining trafficking among migrant farmworkers, it has a few limitations. One of its primary disadvantages involves its reliance on geographical information about the industry; it is most useful when geographical characteristics can be used to narrow down where the population of interest works and lives. This approach also assumes that farmworkers live near the farms on which they work, thus excluding those who may live further away and commute to work. Although the approach has proved useful in identifying potential trafficking victims in the agricultural sector, it may not be particularly useful in identifying victims in other industries that are less geographically clustered, such as construction, landscaping and domestic help. It is also limited to examining one specific industry at a time; the geographical indicators for agriculture will be quite different from those for mining or fishing. Other techniques, such as respondent-driven sampling, may be more effective when the research focuses on a broader population (e.g. experiences of all undocumented migrant workers).

Another potential disadvantage of this approach relates to the amount of travel that may be needed to develop the sampling frame and conduct return trips to validate the dwelling type and conduct interviews. In this approach, unlike the situation in other approaches, the interviews are not scheduled in advance and are not conducted in one location. Instead, the respondents are spread across an entire state, and the field interviewer must identify and recruit each respondent and conduct the interview during a short period in which the respondent is available. Although this can be labour-intensive, the amount of travel required will depend on both the geographical size of the area and the ability to identify and recruit

respondents outside of working hours. Proper planning for best days and times to conduct fieldwork should help reduce the number of trips to an area that are needed to recruit respondents and conduct interviews. In relatively small geographical areas, such as a city, this should not pose a problem. However, generating prevalence estimates for larger areas, such as an entire state or country, requires more time and money (to meet travel-related costs). However, this may be mitigated through the use of online mapping services or similar software to virtually "drive" through the selected segments to identify best driving routes and potentially eliminate some areas prior to fieldwork. These tools could be used to identify areas with no dwellings or high-income subdivisions that would be coded as "highly unlikely".

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ESTIMATING THE SIZE OF HARD-TO-REACH POPULATIONS USING CAPTURE-RECAPTURE METHODOLOGY, WITH A DISCUSSION OF THE INTERNATIONAL LABOUR ORGANIZATION'S GLOBAL ESTIMATE OF FORCED LABOUR[*]

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Abstract

The authors present an overview of capture-recapture methodology and the multiplier method so that researchers interested in estimating the size and characteristics of a population in the area of trafficking in persons can have an idea of how to approach this problem and what the advantages and drawbacks of this methodology are. The methodology can be used for the production of local estimates as well as national or global estimates. Suggestions are made for improving the International Labour Organization's global estimate of forced labour.

Keywords: capture-recapture, population size estimation, multiplier method, hard-to-reach populations, trafficking in persons, forced labour, homeless, domestic violence

Introduction

Several major international institutions recognize the importance of knowledge on the scale and nature of human trafficking and rely on international statistics on human trafficking to describe the practice [1-3]. However, there still is a scarcity of knowledge on the total scale of human trafficking. Existing estimates on the magnitude of human trafficking have been criticized for being based on false or unfounded assumptions or for being inaccurate because of insufficient

and unreliable data and inadequate use of methodologies [4-14].[*] Estimating the total scale of human trafficking is a challenging task.

Among the multitude of challenges in producing estimates, one challenge that is related to definitional ambiguity stands out. Despite the internationally accepted legal definition of trafficking in persons established in the Protocol to Prevent, Suppress and Punish Trafficking in Persons, Especially Women and Children, supplementing the United Nations Convention against Transnational Organized Crime [15],[**] in practice there are a variety of interpretations of what constitutes human trafficking. Definitional ambiguity plagues discussions in research on human trafficking: are all researchers studying the same phenomenon? The use of different interpretations of human trafficking can make statistical data incomparable and, by extension, complicates international comparative research based on such data. This challenge has been widely referred to in research on human trafficking ([9] p. 93; [11], p. 7; [13], pp. 472-474; [16], p. 50-52; [17], pp. 180-184; [18]).

In this article the authors intend to contribute to a methodological discussion on how to obtain more accurate estimates in the area of human trafficking. Knowledge on the magnitude of human trafficking is crucial for effective policymaking in terms of, for example, establishing government-sponsored countermeasures, planning and assessing anti-trafficking initiatives (both governmental and nongovernmental) and determining the most effective funds ([7], p. 6; [9], p. 111; [14], pp. 67 and 84; [19], p. 2). Yet inaccurate estimates may be misleading to anti-trafficking efforts ([14], p. 67; [20]).

The aim of this article is to give an overview of capture-recapture applications so that researchers interested in estimating the size and characteristics of a population in the area of human trafficking can obtain an idea of how to approach this problem and what the advantages and drawbacks of this methodology are. The people involved in human trafficking situations belong to a so-called hard-to-reach population, for which a reliable sampling frame is absent, and this hampers representative sampling ([11], p. 2; [13], p. 475; [14], pp. 66-68; [16], p. 50; [21], p. 18). In this article, methods are described

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[*] See also the article by Ieke de Vries and Corinne Dettmeijer-Vermeulen in this volume of *Forum on Crime and Society*.

[**] "'Trafficking in persons' shall mean the recruitment, transportation, transfer, harbouring or receipt of persons, by means of threat or use of force or other forms of coercion, of abduction, of fraud, of deception, of the abuse of power or of a position of vulnerability or of the giving or receiving of payments or benefits to achieve the consent of a person having control over another person, for the purpose of exploitation. Exploitation shall include, at a minimum, the exploitation of the prostitution of others or other forms of sexual exploitation, forced labour or services, slavery or practices similar to slavery, servitude or the removal of organs" ([15], article 3).

that can be used to deal with this challenge. As an example, another hard-to-reach population, the homeless population of Utrecht, a city in the Netherlands, is discussed. Three examples are given of how the population size can be estimated. First, there is a discussion on a methodology that makes use of one single registration (list). The authors recently carried out a study aimed at estimating the size of this population and its characteristics. Data were collected for two weeks in a shelter home. For each homeless person appearing in the shelter home during the two weeks, the number of days he or she slept there were recorded. A total of 231 homeless were observed in the shelter, of whom 32 slept there only once, 13 twice and so on. Owing to the design of the study, the homeless that did not appear in the shelter home (in other words, those who appeared zero times), were missed. The problem was to estimate the number of homeless that appeared zero times. Using methods discussed in more detail below, in the section entitled "Capture-recapture methodology using a single list", it was estimated that an additional 39 homeless were part of the homeless population who did not sleep in the shelter home. This led to a population size estimate of 270 with a 95 per cent confidence interval of 247-327.

The second type of methodology, which was not used for Utrecht but for the Netherlands as a whole, makes use of multiple registers. Here, three registers were used, namely a register of persons who receive social benefits, a police register and a register of drug users. In each of these registers, it is indicated whether an individual is homeless or not. With three registers, there are in principle 23 = 8 combinations possible for an individual to be present or not in each of the registers; and for each of these combinations, the number of homeless can be counted. The cell that refers to the homeless persons who are absent in each of the three registers is empty, as it is not known how many homeless are missed by each of the registers. However, there are statistical models with which this number can be estimated; and if there is an estimate of this number, then it is possible to obtain an estimate of the population size by adding up the number of homeless who are seen at least once.

The third type of methodology is called the multiplier method. There is a list of homeless persons who receive benefits; there are, say, 240 homeless persons on the list. Yet the number of homeless who do not receive benefits is not known. Locations frequented by homeless persons, such as shelter homes, general practitioners' offices and centres for drug users are visited and the homeless persons there are asked whether they receive benefits or not. If, for example, 60 per cent of those homeless people say that they receive benefits and 40 per cent do not, then 240 corresponds to these 60 per cent and it follows that the estimate of homeless who do not receive benefits is 160; thus, the estimate of the size of the total population is 400.

The capture-recapture methodology is one of the viable methods that could be used for producing local estimates of human trafficking. The sections that follow contain descriptions of how the capture-recapture methodology can be applied by using multiple sources, by using a single list and by using the so-called multiplier method. Then there is a section containing a discussion of how the International Labour Organization (ILO) applied the capture-recapture methodology in order to reach a global estimate of the total number of victims of forced labour.[*] Some suggestions for improving the ILO estimate are provided. The last section in the article contains some practical notes for applying the capture-recapture methodology in research on human trafficking.

Capture-recapture methodology using multiple sources

A well-known method for estimating the population size of human populations makes use of linked lists of individuals. The following is a hypothetical example involving prostitutes in a big city:[**] In the month of January 2014, the police went to the prostitution areas in the city and they registered 400 prostitutes. In the same month, public health officials kept a register of the prostitutes who were treated, and they registered 125 prostitutes. Using official papers, names, dates of birth and so on, it was possible to find an overlap of 100 prostitutes. That would then yield the data shown in table 1.

Table 1.   Hypothetical example showing observed numbers of prostitutes registered by police and public health officials

	Registered by public health officials		
Registered by police	*Yes*	*No*	*Total*
Yes	100	300	400
No	25		
Total	125		

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[*]ILO estimated that there were 20.9 million victims of forced labour at any given moment in the period 2002-2011, with a confidence interval of 68 per cent ([3], p. 13).

[**]Note that this hypothetical example does not necessarily refer to human trafficking. In some countries (e.g. the Netherlands), prostitution is not always considered to be human trafficking. In other countries, moral attitudes dictate that prostitution is, by definition, regarded as human trafficking. Regardless of the discussion on whether there is a causal link between the prostitution policy and the magnitude of human trafficking, the different interpretations of what constitutes human trafficking need to be taken into account when measuring the magnitude of the practice (see the report of the National Rapporteur on Trafficking in Human Beings and Sexual Violence against Children [9], p. 93; see also the article by Ieke de Vries and Corinne Dettmeijer-Vermeulen in this volume of *Forum on Crime and Society*)

Thus, a total of 425 prostitutes were registered. The problem is to estimate the unknown number of prostitutes, those missed by the police and by the public health officials. This unknown number refers to the empty ("No/No") cell in table 1. If this number is estimated, then adding the estimate to the observed number of prostitutes (425) will yield an estimate of the size of the population of prostitutes in the city in January 2014.

A standard approach to making such an estimate is to assume that, for the prostitutes in the police register and for the prostitutes not in the police register, the proportions seen by the public health officers are identical. In other words, in both the "Yes" row and the "No" row of table 1, this proportion is 0.25. For the "Yes" row this proportion is derived from 100/400. For the "No" row there is only the numerator 25, and it follows that the denominator should be 100, as 25/100 = 0.25. The missing number in the table for the empty ("No/No") cell is 75, and this yields a population size estimate of 500 (see table 2). (For more examples, see Bishop, Fienberg and Holland [22], International Working Group for Disease Monitoring and Forecasting [23], Chao and others [24] and van der Heijden and others [25]).

Table 2. Hypothetical example showing observed and estimated numbers of prostitutes registered by police and public health officials

	Registered by public health officials		
Registered by police	*Yes*	*No*	*Total*
Yes	100	300	400
No	25	*75*	*100*
Total	125	*375*	*500*

Note: Estimated numbers are in italics. Data are hypothetical.

The assumptions of this estimation procedure are discussed in some detail below.

Independence of inclusion probabilities

A first assumption is that the inclusion probability of one list is statistically independent from the inclusion probability of the other list. For table 2, the estimated inclusion probabilities are 400/500 = 0.80 for the police register and 125/500 = 0.25 for the public health register. In human populations, independence of inclusion probabilities is often unlikely. Typically in population size estimation, it is likely that some humans are more visible than others and therefore the more visible humans will have higher inclusion probabilities in both registers and the less visible humans will have lower inclusion probabilities. An example of this is given below.

Table 3. Hypothetical example showing observed numbers of prostitutes registered by police and public health officials, subdivided into more and less visible prostitutes

More visible prostitutes	Registered by public health officials		
Registered by police	Yes	No	Total
Yes	75	75	150
No	10	10	20
Total	85	85	170
Less visible prostitutes			
Registered by police	Yes	No	Total
Yes	25	225	250
No	15	135	150
Total	40	360	400

Note: Estimated numbers are in italics. Data are hypothetical.

Whereas in tables 1 and 2 the inclusion probabilities are 0.80 and 0.25, in table 3 the more visible prostitutes have inclusion probabilities 150/170 = 0.88 (police) and 85/170 = 0.50 (public health officials); for the less visible prostitutes, the inclusion probabilities are 250/400 = 0.63 (police) and 40/400 = 0.10 (public health officials). The observed numbers in table 3 add up to the observed numbers in table 1, but the estimated numbers do not add up: in table 3, by assuming independence of the inclusion probabilities, it is estimated that only 10 more visible prostitutes were missed by both the police and the public health officials whereas 135 fewer visible prostitutes are missed. These two numbers add up to an estimated number of 145, whereas in table 2 it is estimated that only 75 prostitutes were missed by both registers. This shows what happens under violation of the assumption of independence of inclusion probabilities: when the inclusion probabilities are positively related, then, if information on visibility is not used, the estimate in table 2 will be too low (i.e. in table 2 it is 75 but it should have been 145). When the inclusion probabilities are negatively related, then the estimate in table 2 will be too high.

Inclusion probabilities can also be negatively related. Consider again the homeless as a hard-to-reach population. Assume that there are two locations in a city where they can sleep. Then some homeless may have a preference for being at the first location (so the inclusion probability is higher for location 1 and lower for location 2) whereas other homeless persons may have a preference for being at the second location.

This independence assumption is sometimes misunderstood: it appears that sometimes people think that "the independence assumption" for the inclusion

probabilities is fulfilled if the lists are constructed independently, for example because they are constructed by different organizations or (groups of) people. However, the independence assumption refers to independence of inclusion probabilities, not the independent construction of lists.[*]

It is clear that the independence assumption is restrictive and violation of the assumption may result in a large bias (for sensitivity analyses to quantify this bias, see Gerritse, van der Heijden and Bakker [26]). One way to get around this independence assumption is by including a third list. So-called loglinear models may be used that allow for pairwise dependence of lists, and the remaining assumption is that there is no so-called three-factor interaction. An example of three-factor interaction is that the relation between a pair of lists is different for those who are included in the third list compared with those who are not included in the third list. However, it regularly happens that it is impossible to find a third list that can be linked to two other lists.

Homogeneity of inclusion probabilities

It is often stated that an assumption underlying the calculation in table 2 is that each of the inclusion probabilities is homogeneous—that is, the individuals have the same inclusion probability for the first list and the individuals have the same inclusion probability for the second list.[**] However, this statement is incorrect, and the actual assumption made is much less restrictive. Consider the following three situations:

   (a)   If there is a covariate that is related to the inclusion probabilities to be on one list (i.e. for list one, the inclusion probabilities are not homogeneous but) and also related to the inclusion probabilities on the other list, this covariate does influence the population size estimate. An example was provided for table 3, where visibility was related both to the inclusion probabilities of the police register and to the list generated by the public health officials;

   (b)   However, if there is a covariate that is related to the inclusion probabilities to be on one list but not to the inclusion probabilities on the other, this

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[*]As an example, in a recent ILO report [3], there are two teams of people collecting reported cases of forced labour. It would be incorrect to assume that inclusion probabilities for the two lists generated by each of the teams are statistically independent.

[**]See, for, example, a recent ILO report ([3], p. 24): "According to this model, a forced labour report is either 'captured' or 'not captured' by a given team with respective probabilities p and 1 – p. The values of p are the same for all reports but may differ between the teams, say p = p1 for team 1 and p = p2 for team 2."

covariate does not influence the population size estimate (see Chao and others [24], van der Heijden and others [25] and Zwane, van der Pal-de Bruin and van der Heijden [27]);

   (c)   If there are two covariates, where one is related to the inclusion probability to be on the first list and the second is related to the inclusion probability to be on the second list, yet the two covariates are statistically independent, then these covariates do not influence the population size estimate (see van der Heijden and others [25]).

Even though the homogeneity assumption is more complicated than simply saying that inclusion probabilities should be homogeneous, ignoring the heterogeneity in the first situation may lead to serious errors in the population size estimate, as seen in table 3. However, errors like these can be circumvented by including such covariates into the calculations. This can be done by making use of so-called loglinear models (see, for example, Bishop, Fienberg and Holland [22], International Working Group for Disease Monitoring and Forecasting [23] and van der Heijden and others [25]). In fact, a basic example is shown in table 3, where the covariate visibility can be included into the model by simply making separate calculations for more and less visible prostitutes and then adding the estimated numbers.

The population is closed

A further assumption is that the population is closed. Closeness means that there are no individuals entering or leaving the population. There are models proposed for open populations but these models need much more detailed data than the data that are discussed here (see the Cormack-Jolly-Seber model, described in Pledger, Pollock and Norris [28]).

If openness of the population may be a problem, the extent of this problem can be lowered by limiting the period of observation. In a shorter period, there will be fewer individuals entering or leaving the population than in a larger period. For example, for studies on homelessness (see the introduction of this article), the homeless are only observed for a period of two weeks, because over a longer period new homeless persons may enter the homeless population or some homeless persons may find a home or leave the region, thereby leaving the population. However, the cost of choosing a shorter period of observation is that the overlap between lists will become smaller, which will yield population size estimates that have relatively larger confidence intervals.

Correct linkage

A last assumption is that it is possible to link two lists correctly, that there are no missed links or incorrect links. In table 2, one missed link would have changed the counts 100, 300 and 25 and the estimated 75 to 99, 301 and 26, and an estimated 79. So, for this example, one missed link would lead to an increase of 5 in the population size. If a similar calculation is made for an incorrect link, then the counts would become 101, 299 and 24 and an estimated 71, leading to a decrease of 5. Much more about linking and space limitations can be found by searching in the literature under the term "record linkage" (see also Herzog, Scheuren and Winkler [29]).

Some design considerations

There are a few design issues that may be taken into account when setting up a population size estimation study along the lines of linking two or more data sources:

(a)   If possible, strive for using more than two lists. The reason is that under two lists the unrealistic assumption has to be made that inclusion in one list is independent of inclusion in another list, and in human populations this is a heroic assumption;

(b)   If possible, include covariates in the analysis, in particular covariates that are related to inclusion probabilities. Even though technically the assumption is a complicated one, as discussed above, it is clear that in general by including covariates the model allows for heterogeneity of inclusion probabilities and this makes the model (and the resulting estimates) more realistic;

(c)   If possible (and relevant), make the period of observation short, so that the problem of an open population is smaller. Strive for a balance because if the period is too short, there will not be enough overlap between the lists, and this will lead to relatively large confidence intervals. In other words, it is a problem of bias versus variance;

(d)   In record linking of individuals or cases, if decisions have to be taken that may be partly incorrect, create multiple data sets that reflect different decisions that could have been taken and analyse them separately. This will then show the sensitivity of the outcomes of the analysis for the choices that can be taken.

A last suggestion is to consider whether it is necessary to make use of existing lists or whether it is possible to create lists. Examples in the literature are estimating the size of the web using lists created by search machines [30] and searches for scientific literature to come to an estimate of the number of studies missed [31]. This last option was also chosen by ILO [3], which made use of two teams that each created a list of cases of trafficking in persons.

Capture-recapture methodology using a single list

The methodology presented in this section makes use of a single list. This list may be an existing register, such as a police register or a register of homeless people, or it may be data collected especially for the purpose of estimating the size and characteristics of a population, as in the ILO report [3]. Estimation based on a single list may have important advantages: first, it does not require the unverifiable assumption that inclusion in one list is statistically independent from inclusion in the second list; and, second, it does not require the elaborate process of database linkage that may be troubled by privacy regulations. Also, there is not always sufficient reliable information to be certain that all linkages made are correct and that there are no linkages missed. A single list that contains (re)captures circumvents these problems. The methodology also has a drawback: the assumptions that the models make are not always fulfilled (see below).

One example of a single list that can be used for population size estimation involves data on victims of domestic violence in the register system of the police in the Netherlands. The police show every contact related to domestic violence. Thus, a list of victims can be constructed including a variable that denotes the number of times each victim was recorded in the police register system, with values 1, 2, 3 and so on. Victims who did not have contact with the police are not part of this victim-based data set. Yet, if their number is estimated, this would yield an estimate of the total number of victims of domestic violence (for a review of the literature, see van der Heijden, Cruyff and Böhning [32]). The list of victims can be used for this purpose. Some principles that play a role in such an estimation are discussed below.

It is important to note that a single list may also be derived from a multiple list database. That is what happened in the ILO report [3] that is discussed in more detail in a separate section below. Consider table 1 discussed in the previous section. If the researcher ignores in which register a case has been found, then there are cases seen in only one list and cases seen in two lists.

Thus, a list of cases can be set up where every case has a count of 1 or 2, depending on how many of the two original lists the case has been seen. For table 1, these numbers would be 325 (seen once) and 100 (seen twice).

Poisson distribution

In the example of victims of domestic violence, the aim is to estimate the number of victims who never came in contact with the police, using the data about victims who saw the police at least once. These estimates are derived using Poisson distributions. The Poisson distribution is characterized by a Poisson parameter denoted by λ. The parameter λ expresses the probability of a given number of events (i.e. the count) under two assumptions:

(a) That events occur with an average rate in a fixed interval of time;

(b) That events occur independently of the time since the last event.

The probability that count *Y*, generated by a Poisson distribution with Poisson parameter λ, is equal to *j* (*j = 0, 1, 2,…*) is:

$$p_j = P(Y = j) = \frac{e^{-\lambda}\lambda^j}{j!}$$
(1)

Two arbitrary examples of a Poisson distribution are provided in table 4. In the first example an individual has a Poisson parameter $\lambda = 0.5$. Then the probability of the individual being seen zero times is 0.607, being seen once is 0.303, being seen twice is 0.076 and so on. These probabilities add up to 1 (see table 4, row 1). In the second example it is assumed that there is an individual with Poisson parameter $\lambda = 1$. The probability of that individual not being seen is 0.368, the probability of him or her being seen once is 0.368, being seen twice is 0.184 and so on (see table 4, row 2). Note that the individual with Poisson parameter $\lambda = 1$ has a larger probability of being seen at least once, namely $(1 - 0.368) = 0.632$, whereas the probability of the individual with Poisson parameter $\lambda = 0.5$ being seen is only $(1 - 0.607) = 0.393$. It follows that the individual with Poisson parameter $\lambda = 1$ has a larger probability of being seen.

Table 4.   Two examples of Poisson distributions (rows 1 and 2) and their corresponding truncated Poisson distributions (rows 3 and 4)

		Number of times an individual is seen							
Row	*Poisson parameter*	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*Total*
1	$\lambda = 0.5$	0.607	0.303	0.076	0.013	0.002	0.000	0.000	1.000
2	$\lambda = 1$	0.368	0.368	0.184	0.061	0.015	0.003	0.001	1.000
3	$\lambda = 0.5$	−	0.771	0.193	0.032	0.004	0.000	0.000	1.000
4	$\lambda = 1$	−	0.582	0.291	0.097	0.024	0.005	0.001	1.000

Note: The entries show the probability.

How do these Poisson distributions allow an estimate to be made of the size of the population? Assume that there is a count distribution with numbers of victims seen once, seen twice and so on. There is no count for the number of victims seen zero times, as this count is unknown and has to be estimated. This is called a truncated count distribution. A basic model is introduced that (usually unrealistically) assumes that all victims have the same Poisson parameter, and a truncated probability distribution is fitted to the truncated count distribution. Examples of the truncated probability distributions for $\lambda = 1$ and $\lambda = 0.5$ are shown in rows 3 and 4 of table 4. They are derived by dividing the probabilities in rows 1 and 2 of table 4 by the probability of being seen at least once, i.e. by $(1 - 0.607)$ and by $(1 - 0.368)$. Fitting a truncated Poisson distribution to a truncated count distribution gives an estimated Poisson parameter.

As a hypothetical example, assume that that there is a list of 100 victims, where $f_1 = 77$ victims have been seen once, $f_2 = 20$ victims have been seen twice and $f_3 = 3$ victims have been seen three times, then the estimated Poisson parameter will be approximately 0.5 (the number of victims seen once, twice and three times were generated by multiplying by 100 the probability entries in row 3 of table 4). When the Poisson parameter is 0.5, the 100 victims who have been seen correspond to 0.303 of the population (see table 4, row 1), so approximately 30 out of every 100 victims in the population have been seen. This means that, when 100 victims have been seen, the estimated total number of victims is $100/0.303 = 330$. Thus an estimate can be made of the size of the population of victims.

Van der Heijden and others [33] discuss the assumption underlying the use of a Poisson distribution to model human behaviour in some detail. To summarize:

(a)   A Poisson distribution for an individual is reasonable if there is constant probability of an event (e.g. a police contact) occurring;

(b)   An individual's count still follows a Poisson distribution, even if the individual's Poisson parameter has changed during the period of observation. It follows for the type of applications being discussed that victims do not need to have a constant probability to see the police, but it suffices if they can see the police a number of times. In this sense the use of a Poisson distribution is not restrictive;

(c)   One restrictive feature, however, is that the Poisson assumption is only valid if a change in the individual Poisson parameter of a victim is unrelated to any prior police contact or non-contact. This assumption is violated if, for example, an event makes the next event more likely or less likely. For example, a visit by the police may influence the behaviour of a perpetrator so that he or she becomes less violent; but the victim may contact the police more easily after a first successful visit by the police;

(d)   The assumption of a closed population has to be made. This assumption is usually tackled by observing events for a limited amount of time, similar to the approach taken for multiple lists (see the previous section of this article).

Extensions of the basic model

So far, the Poisson distribution has been fitted to data assuming that all victims have an identical Poisson parameter. This is referred to as the homogeneity assumption. In most applications where humans are involved, this assumption is very unlikely to hold. For example, some victims are expected to have higher probability (resulting from higher Poisson parameters) of seeing the police than other victims. If this is the case, there is heterogeneity of Poisson parameters.

If the Poisson parameters are heterogeneous but this heterogeneity is ignored by fitting a homogeneous Poisson model, the estimated population size will be too low (see van der Heijden and others [34]). There are two ways to take heterogeneity into account. One way is to include covariate information in the model, such as age, marital status and so on. This is done by using a regression model, where the Poisson parameter is a function of covariates. In the regression model, the Poisson parameters are still assumed to be homogeneous for individuals with identical values on the covariates, but they are allowed to be heterogeneous for individuals with different values. Since here the

differences in Poisson parameters are determined by the observed covariates; this is referred to as "observed heterogeneity". The resulting model is known as the truncated Poisson regression model ([33], [34]).

If, in addition to observed heterogeneity, there are differences in the Poisson parameters that cannot be explained by the observed covariates (referred to as "unobserved heterogeneity"), then an extension of the truncated Poisson regression model known as the truncated negative binomial regression model can be used [35].

A second way to deal with heterogeneity is to use only the lower counts of the distribution. This approaches gives special emphasis to the number of victims seen once and twice. This approach is quite popular in estimates of drug-using populations (see van Hest and others [36]), and it is also used in the ILO report [3]. Two attractive features of this approach are that heterogeneity of Poisson parameters that is revealed in victims seen more than twice does not play a role in the estimation of the population size and thus it leads to estimates that are robust. A second important attractive feature of these models is that the victims missed (i.e. the victims with a count of zero) are likely to be more similar to the victims not often seen (i.e. those seen once or twice) than to the victims seen more than twice, and therefore it makes sense to use only counts for victims seen once or twice.

A first model that only makes use of the lower counts of a distribution is the model originally proposed by Zelterman [37]. He estimates the Poisson parameter λ using only the first two frequencies f_1 and f_2 by:

$$\hat{\lambda} = \frac{2f_2}{f_1}$$

This estimate of parameter λ can then be used to estimate the population size as $N_Z = n / (1 - \exp(-\lambda))$. This estimator is also mentioned in the ILO report ([3], p. 25).

The authors have extended the Zelterman estimator so that it can take covariates into account [38]. In this extension, the estimated Poisson parameter is a function of covariates. Thus, the resulting Zelterman regression model is able to take observed heterogeneity into account that is present in victims with a count of 1 or 2, and it is robust against violations of the homogeneous Poisson distributions in counts higher than 2.

A closely related estimator that is also used is the Chao estimator [39]:

$$N_C = n + f_1^2/(2f_2)$$

The Chao estimator and the Zelterman estimator are used for similar purposes. The Chao estimator has the important property that, if the data are generated by a homogeneous Poisson distribution, the estimator N_c is unbiased; but when there is heterogeneity then N_c is to be interpreted as a lower bound for the population size. So, for example, if the Chao estimator provides an estimate of 2,000, then the population size will be larger than 2,000, where the discrepancy will be larger under larger heterogeneity. Also, often the Chao estimator and the Zelterman estimator are very close, although under certain circumstances the latter can experience strong overestimation bias [40]. Recently, Böhning and others [41] extended the Chao estimator so that it can take covariates into account. They show that, as covariates take (part of the) heterogeneity into account, the lower bound provided by the Chao regression estimator will be higher than the lower bound when no covariates are taken into account. Hence the lower bound will also get closer to the true population size.

Conclusion

The methodology yields the following results: *(a)* an estimated population size, and a 95 per cent confidence interval; *(b)* an estimated number of unseen victims; *(c)* if a regression model is used, a distribution of this unseen number over covariates; and *(d)* insight into which part of the estimated population size is visible in the register and which part is missed, stratified by the levels of the covariates.

There is a reasonable amount of experience with these models, but their development is more recent than the models for multiple lists discussed in the previous section. As indicated above, the Chao estimator was used in the ILO study [3]; both the Chao estimator and the Zelterman estimator were used in Hest and others [36]. The authors of this article have made ample use of regression models in contract research for the Government of the Netherlands on subjects such as domestic violence (using police data to estimate the number and characteristics of victims and perpetrators of domestic violence) [32], undocumented aliens (using police data) ([34], [38]), homeless persons (using shelter data), illegal gun ownership (using police data) [33], drunk driving (using police data) [33] and drug users (using hospital data) [42].

Multiplier method

The multiplier method is another method used to estimate the size of a population. It is closely related to capture-recapture methodology that makes use of two lists (see the section in this article entitled "Capture-recapture methodology using multiple sources"). Multiplier methods are user-friendly, known for their mathematical simplicity and the absence of linkage, and their use is straightforward in the sense that calculations are easily made (although it takes more time to derive the correct confidence interval of the estimate). At least two data sources are needed to use the multiplier method, usually a comprehensive register (that may already exist or is prepared specifically for the purpose of coming to a population size estimate) and a survey.

For example, to estimate the number of undocumented prostitutes in a city, it is assumed that the city has an official register of documented prostitutes working in the city and that the register lists 400 prostitutes. It is also assumed that it is possible to take a random sample of the population of documented and undocumented prostitutes in the city. If the sample size is, say, 100, and 80 of the prostitutes in the sample are documented and 20 are undocumented, then the 80 correspond with the 400 prostitutes in the register and 20 corresponds to an unknown number u, i.e. $80/400 = 20/u$. It follows that the estimated number of undocumented prostitutes is $(20/80) \times 400 = 100$. The estimated total number of prostitutes is then $400 + 100 = 500$. So the idea of the multiplier method is that the number of prostitutes in the register (400) is multiplied by the multiplier ($20/80 = 1/4$) and this yields the number of undocumented prostitutes.

Table 5. Hypothetical example showing the relation of the multiplier method with capture-recapture methodology using two lists

Number in the register	Number in the sample		
	Yes	No	Total
Yes	80	320	400
No	20	80	100
Total	100	400	500

Note: Estimated numbers are in italics.

The close relation with two-source capture-recapture methodology becomes apparent when the data are displayed as in table 5. In this set-up, the italic numbers are not provided. The number in the "No/No" cell (80) is estimated. The set-up in table 5 is identical to the set-up in a table for two-source capture-recapture methodology. The size of the confidence interval for 500 is dependent on, first, the stability of the multiplier (20/80). In this case, the multiplier

is based on 100 observations, but the number of observations becomes larger, and then its stability becomes larger and hence the estimate of 500 becomes more stable and has a smaller confidence interval. And second, the size of the confidence interval depends on the size of the multiplier: the smaller the multiplier, the lower the total number not in the register (currently corresponding to 100) will be.

The attractiveness of the multiplier method lies in the absence of linkage of two sources. When estimating hidden or hard-to-reach populations, it is probably difficult to obtain identifying variables to link the individuals in the sample to the register. The absence of linkage is what makes the multiplier method different from capture-recapture methodology. However, the above example shows that the multiplier method also relies on the underlying assumption that the proportion of registered prostitutes in the sample is identical to the proportion of non-registered prostitutes in the sample.

The multiplier method is regularly used in research on the prevalence of drug use and HIV ([43], [44]). It is also used in the ILO study [3], discussed in the next section. In Italy, it is used to estimate the size of communities of undocumented aliens: for example, the number of documented people from Algeria in a town is known from the town register. Then locations are visited where Algerians meet and a multiplier is derived by asking those Algerians whether they have official documentation or not. Thus an estimate of the size of the community's population can be derived.

International Labour Organization estimate of 2012

Now that multiple-source capture-recapture methodology, single-source capture-recapture methodology and the multiplier method have been discussed, the recent ILO global estimate of forced labour [3] can be discussed. ILO presented an estimate of 20.9 million victims of forced labour (an estimate with a 68 per cent confidence interval of 19.5 million-22.3 million) at any given moment in the period 2002-2011. Although the definition of forced labour used by ILO corresponds for a the most part to the definition of trafficking in persons in article 3 of the Trafficking in Persons Protocol, the ILO estimate of victims of forced labour is not exactly the same as an estimate of the total number of trafficked persons ([2], p. 68; [3], pp. 19-20).*

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*The ILO definition of forced labour refers to "all work or service which is exacted from any person under the menace of any penalty and for which the said person has not offered himself voluntarily". The term forced labour encompasses trafficking in persons as defined in the Trafficking in Persons Protocol and similar practices such as slavery, practices similar to slavery, debt bondage and serfdom. One major difference is that human trafficking for the purpose of organ removal falls under the definition of trafficking in persons in the Protocol but not under the ILO definition of forced labour ([3], pp. 19-20; [9], pp. 26-27).

The ILO approach has three steps. In the first step, a capture-recapture estimate of reported cases of forced labour is found and that estimate is used to find the number of reported victims of forced labour. In the second step, the stock of forced labour is estimated by taking into account the duration of exploitation as recorded in the database ([3], p. 360). In the third step, the number of unreported cases of forced labour is estimated using the multiplier method. In the present article, the focus is on capture-recapture methodology and the multiplier method and therefore only the first and third steps of the estimation procedure are commented on. (For further discussion of the ILO estimate, see, for example, National Rapporteur ([9], pp. 26-30) and United Nations Office on Drugs and Crime ([2], p. 68); for a general discussion on estimates of human trafficking, see De Cock [4], Farrell and others [5], Goodey [6], Gould [7], Goździak and Collett [8], National Rapporteur [9], O'Brien [10], Tyldum [11], Zhang [13] and Zhang and others [14]).*

Interestingly, in the capture-recapture approach, ILO starts by collecting data for use in two-source capture-recapture methodology that are then transformed into data for use in single-source capture-recapture methodology, in order to arrive at estimates of the number of reported cases and victims of forced labour. At the end, the multiplier method is used to estimate the number of unreported victims of forced labour. Thus the ILO report brings together nicely the previous three sections of this article. Below is a summary of the ILO research, followed by some suggestions for future research.

Data collection

In the ILO research, the unit of analysis is a reported case. The case represents a "recorded piece of information" ([3], p. 21) and it may involve one or more persons who are currently, or have been, victims of forced labour during the reference period ([3], p. 21). So data were collected on cases found in media reports, official sources, NGOs, academic reports, trade union reports and so on (for details, see the ILO research ([3], p. 29)). The data were independently collected by two teams, each composed of four graduate research assistants of different nationalities. The teams collected reported cases for 13 consecutive weeks and were based in ILO headquarters in Geneva. Thus team 1 produced a list of cases and team 2 produced a list of cases. By linking the cases found by team 1 to the cases found by team 2, a 2 x 2 contingency table could be constructed, with cases found by both teams, cases found by team 1 but not by team 2, and cases found by team 2 but not by team 1. These three counts added up to 5,491 reported cases found by at least one team.

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*See also the article by Ieke de Vries and Corinne Dettmeijer-Vermeulen in this volume of *Forum on Crime and Society*.

The number of reported cases missed both by team 1 and by team 2 was unknown and had to be estimated. As a last step, the number of unreported cases was also estimated.

Assumptions and data analysis

The two-list estimate for the 2 x 2 table is likely to be biased because it assumes that the probability that a reported case is found by team 1 is independent of the probability that a case is found by team 2 (see the discussion in the section of this article entitled "Capture-recapture methodology using multiple sources"). This assumption will be violated for the obvious reason that some cases can be found more easily and then they are likely to be found by both teams, and other cases are less likely to be found, and then they will be found more often by only one team or by none of the teams. Thus the probability that a reported case is found by team 1 will be correlated to the probability that it is found by team 2.

For this reason, the ILO researchers transformed the two-source data into single-source data, by counting the number of times that a reported case was found (i.e. once, twice and so on). Here a case could be found multiple times by each of the teams (i.e. duplicates in a team were not removed). Thus the estimation problem changed from an estimation problem under multiple-source capture-recapture methodology (see the section in this article entitled "Capture-recapture methodology using multiple sources") to single-source capture-recapture methodology (see the section entitled "Capture-recapture methodology using a single list"). The 5,491 reported cases found consisted of 4,069 cases found only once and 1,422 cases found more than once. Using the observed count distribution, the number of reported cases missed was then estimated using the Chao estimator (see the section entitled "Capture-recapture methodology using a single list"). This was done separately for so-called incidents and aggregates (for details, see the ILO report [3]). In the estimation, incidents were further split into "strata", according to the geographical region and form of forced labour (no details were provided on how this was done, but it is assumed that a separate estimate was made for each combination of a region and form of forced labour).

A complication to the simple capture-recapture problem is that each reported case possibly involved more than one victim. This was solved by calculating the mean number of victims per case for the 5,491 cases. This mean number was then multiplied by the estimated number of cases to arrive at an estimated number of reported victims.

The estimated number of reported victims was then corrected taking into consideration the amount of time that each person was a victim. This made it possible to arrive at an estimate of the number of reported victims at any point in time (a so-called "stock estimate") (see the ILO report ([3], p. 35)).

As a last step, a multiplier method was used to estimate the number of unreported victims at any point in time. Here the multiplier was derived from data from four national surveys of returned migrants residing in their home areas.

Discussion of the International Labour Organization estimate

Before discussing the ILO report in more detail, the authors of this article would like to emphasize that they appreciate the work that has been done and basically have a positive evaluation of the approach. Nonetheless, they think that the work can be improved. Some suggestions have to wait until ILO works on a third global estimate (the 2012 estimate was the second estimate, following an earlier estimate, in 2005). Other suggestions may in principle be considered now; the authors believe that this will lead to better estimates using the current data.

(a)   Three teams instead of two

ILO researchers were right in not making an estimate using the two-list estimator, as the independence assumption for the probabilities of the two teams is for obvious reasons clearly violated. However, there are two ways to try to tackle this problem.

One way would be to make use of more than two teams. As discussed above in the section entitled "Capture-recapture methodology using multiple sources", with two lists (i.e. two teams) it is necessary to assume independence of inclusion probabilities. However, with three lists this is not necessary: pairwise dependence between sources is allowed and the independence assumption is replaced by the absence of a loglinear three-factor interaction, which is much less restrictive.

If the ILO report for 2012 were to disentangle the cases found by a team and separate them into cases found by each of the eight team members, it would result in eight separate lists. By linking these lists, an 8-way contingency table could be constructed that could be analysed using not only standard loglinear models, but also latent variable models that assume that some team members are more successful in finding cases than other team members (for further details, see Fienberg, Johnson and Junker [30]).

(b)   *Covariates*

A second way to move away from the unrealistic two-list estimator while staying in the two-list capture-recapture approach is by directly including covariates into the estimation problem.[*] One likely reason that the inclusion probability of a case for team 1 is related to the inclusion probability of a case for team 2 is the dependence of these probabilities on covariates. Taking such covariates into account in the modelling phase can make the model more realistic.

Two examples of covariates that will probably be related are: *(a)* the place where the piece of recorded information is found (cases reported in some places will be easier to find by both teams than cases reported in other places or not reported at all); and *(b)* the number of victims involved in a case. Of course, other covariates can be explored, as the data set has about 70 covariates that can be investigated. Thus the question of which covariates to use becomes an empirical question that can be answered by analysing the data.

As for the question of the number of victims involved in a case, as mentioned above, in the ILO report, the mean number of reported victims was multiplied by the estimated number of cases. However, it is also stated in the ILO report that "cases found more than once tended to contain higher numbers of victims than those found only once. For example, the average number of victims in cases found just once was 223. In cases found twice, it was 253 and in cases found more than twice, it was 812" ([3], p. 25). This makes it problematic to multiply the estimated number of cases by the mean number of victims. It is likely that, if there is a positive relation between the number of victims included in a case and the number of times a case is found, then cases that are not found (but estimated) are very likely to have on average a number of victims that is lower than 223.

One solution to this problem is to bring in the number of victims of a case as a covariate in the statistical model. Thus the model would yield an estimated number of victims for each case that was unobserved but estimated; in other words, the model will estimate not only the number of cases missed but also the number of victims involved for each of the cases.

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[*] Covariates are considered in the ILO report for the incidents, namely region and form of forced labor, but the authors of this article have the impression that these variables are taken into account by doing separate capture-recapture analyses for each of the subgroups. The suggestion here is to estimate a statistical model along the lines discussed in this article in the section entitled "Capture-recapture methodology using a single list": using the Chao estimator that takes covariate information into account.

(c)   *The Chao estimator*

Turning to the single-source capture-recapture approach, as mentioned above in the section entitled "Capture-recapture methodology using a single list", the Chao estimator provides a lower bound estimate of the population size and this lower bound is closer to the true population size when the counts are generated by a homogeneous Poisson distribution. The ILO report is overly optimistic about the fit of the Poisson distribution to the data (see the ILO report [3], p. 26).

One way to ensure that (the lower bound of) the Chao estimate is closer to the true population size is by including covariates. This can be done using the approach where the Poisson parameter in the Chao estimator is a function of covariates (see Böhning and others [41]). For the ILO estimate, this implies that the current estimate may well be too low and that by including covariates into the model, the estimate will become larger and closer to the true estimate. The number of victims involved in a case is a natural candidate for being a covariate.

(d)   *Multiplier method*

As a last step, a multiplier method was used to estimate the number of unreported victims at any point in time. Here the multiplier was derived from four national surveys, mostly surveys of returned migrants residing in their home areas.[*] The estimate arrived at was that 3.6 per cent of the cases of forced labour are reported. This leads to a multiplier of (100 – 3.6) / 3.6 = 26.8. In other words, for each reported case of forced labour there are an estimated 26.8 unreported cases.

Closer examination of this multiplier produces at least two concerns. The first concern is that the percentage is very low and this makes the multiplier very unstable. For example, 3.6 per cent every reported case is to be multiplied with 26.8. With a slightly different percentage, say, 5 per cent, this multiplier changes to 19. Thus this makes the final ILO estimate very unstable. It appears that, in the ILO report, random variation of about 3.6 per cent has not been taken into account in the confidence interval of the final ILO estimate.

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[*]The results of four of the pilot surveys discussed in the ILO survey guidelines to estimate forced labour of adults and children have been used in the context of the generation of the ILO global estimate of forced labour in 2012 ([45], p. 9). ILO did not disclose the names of the four countries used.

The second concern is related to the first concern. In the surveys the percentage of cases reported is 3.6 per cent. Similar to two-sample capture-recapture methodology, there is an independence assumption underlying the multiplier method. This independence assumption relates to the question: will 3.6 per cent also be the percentage of the cases reported not in the surveys? This is the assumption made. However, it is unclear how this percentage relates to percentages in countries other than the four countries with a survey, whether this percentage is actually higher among those victims who came back than among victims who did not come back, and so on. It follows from the first point that minor deviations from the independence assumption will lead to large deviations in the estimate of the population size.

Discussion

The capture-recapture method is a well-known method used in social sciences and public health research for estimating the total size of hidden or hard-to-reach populations (see, for example, International Working Group for Disease Monitoring and Forecasting [23] and Chao and others [24]). In this article, the aim has been to provide an overview of the different ways in which the capture-recapture method can be applied.

The authors consider the methodologies discussed in this article to be some of the viable methods that can be used to obtain local estimates of the total number of trafficked persons. The capture-recapture methodology has also been applied for the purpose of producing global estimates. ILO has applied the capture-recapture method by using a combination of all the methodologies discussed in the last three sections of this article, in order to reach the estimate of 20.9 million victims of forced labour globally, and the authors have provided some suggestions to further improve that estimate. When comparing the production of local estimates with the production of global estimates, it seems that, because of extrapolation issues in producing the global estimates, the global estimates have to meet a greater number of assumptions, which seems to make them more vulnerable than local estimates in terms of their reliability and validity.

In practical situations, when local estimates for a particular type of human trafficking are needed, the main challenge is to find the methodology that best fits the problem. When applying the capture-recapture methodology in the field of human trafficking in a particular location and time, it is likely that not all the assumptions of the capture-recapture method will be met (see National Rapporteur [9], p. 28). This, however, does not necessarily mean that no single method can be used to estimate the size of the target population. As an example, consider

one of the capture-recapture assumptions that there must be a closed population (discussed above in the sections entitled "Capture-recapture methodology using multiple sources" and "Capture-recapture methodology using a single list"). In many locations in the world, this assumption will be violated in research on trafficked persons—for instance, trafficked persons who have been sexually exploited: research has shown some kind of (local) mobility (e.g. between cities) of trafficked persons in the sex industry (see, for example, Siegel [46]). In these locations, the research population is open and this hinders the capture-recapture estimation procedures discussed above in the sections entitled "Capture-recapture methodology using multiple sources" and "Capture-recapture methodology using a single list". One solution discussed in those sections, namely limiting the period of observation, may help to circumvent the problem but the effectiveness of this solution will depend on the time intervals in circulating the trafficked persons. Yet choosing this alternative implies an estimate on trafficked persons that has the disadvantage of having a relatively larger confidence interval. On the other hand, it may still be viable to estimate the size of the population using the multiplier method. Here two elements are needed, a register and a multiplier, and these are not necessarily hampered by an open population problem when they are suitably chosen. Also, it is worth considering that violation of one or more of the capture-recapture assumptions in research on a particular form of human trafficking does not necessarily imply that the same assumptions are also violated in research on another form of human trafficking. For instance, persons who are trafficked for the purpose of being exploited as agricultural workers may be circulated less often; thus the assumption of a closed population might be met more easily.

In closing, it should be noted that there are also other methods that can theoretically be used in specific situations to estimate the size of populations. Those methods include respondent-driven sampling, the network scale-up method, detection controlled estimation and randomized response. Space limitations have prevented the authors from discussing those methods in any detail in this article. They are only mentioned here, as introductions on the use of those methods can be found on the web.

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STEALING LABOUR: AN ECONOMIC ANALYSIS OF FORCED LABOUR AND HUMAN TRAFFICKING

By Fabrizio Sarrica[*]

"*Labour was the first price, the original purchase-money that was paid for all things. It was not by gold or by silver, but by labour, that all wealth of the world was originally purchased …*" (Adam Smith, The Wealth of Nations, 1789)

Abstract

The author approaches trafficking in persons and forced labour from the perspective of the labour market. The basic consideration is that traffickers and exploiters are robbing the communities of victims of trafficking in persons of their most valuable resource: labour. He compares the economic conditions of the labourer and the employer in an exploitative situation against conditions where the labourer is free to choose his or her working conditions. He calculates the economic losses and the benefits in each account of trafficking in persons, revealing who gains and who loses as a result of such crimes. According to the author, not only do forced labour and human trafficking have an economic impact on the victims and their communities, but also society as a whole suffers economic losses when coerced labour is used.

Keywords: trafficking in persons, forced labour, labour market, elasticity of labour demand and supply, exploiter, victim, development and crime

Cheap labour and its maximum use are the quest of persons who engage in human trafficking. These criminals are recruiting, deceiving, buying, selling, transporting, segregating and coercing other people for the economic value that can be squeezed from the victims' labour. Traffickers steal the economic value of this labour from their victims. Of course, this is just part of the story. While the traffickers are pursuing this economic goal, the victims of human trafficking are, in addition to being deprived of the value of their labour, are also often deprived of their dignity, their health and their lives. Victims of human trafficking or forced labour suffer terrible human rights violations that will affect them for the rest of their lives.

Forced labour, including trafficking in persons for the purpose of forced labour, slavery and similar practices, is a crime driven by the demand for cheap labour.

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The demand for forced labourers, including trafficked persons, is ultimately the demand for the services provided by the person who is forced to work [1].

The aim of this article is to understand how such crime is affected by the dynamics of the labour markets in which the victims of such crime are forced to operate. The article also includes a discussion on the economic impact of forced labour and human trafficking on society as whole, on the victims and on their communities.

Forced labour is defined in the Forced Labour Convention, 1930 (No. 29), as "all work or service which is exacted from any person under the menace of any penalty and for which the said person has not offered himself voluntarily" [2]. The definition comprises two elements: the work is undertaken involuntarily; and this happens because the labourer is under the menace of a penalty. It is clear that the first element is the consequence of the second. In short, forced labour is about forcing persons to accept employment, or terms of employment, that they would otherwise reject [3].

The concept of human trafficking is closely connected with that of forced labour. It can be summarized as the acquisition of people by improper means such as force, fraud or deception, for the purpose of exploiting them.[*] So, if a victim of forced labour has been recruited, transported or harboured with improper means, he or she can be legally defined as a trafficking victim, and the recruiter, transporter or harbourer is a trafficker.

The economics of slavery

These forms of labour exploitation are not just recent phenomena. Historically, a large part of labour transactions have been coercive [4]. Slavery and forced labour were common forms of labour in many civilizations, from the time of the Roman Empire to rural Russia in the eighteenth century and to the cotton fields of the United States of America in the nineteenth century. Nowadays, forms of slavery and forced labour are still present—the International Labour Organization (ILO) has estimated that there are over 20 million forced

[*]In article 3 of the Protocol to Prevent, Suppress and Punish Trafficking in Persons, Especially Women and Children, supplementing the United Nations Convention against Transnational Organized Crime [4], "trafficking in persons" is defined as follows: "Trafficking in persons shall mean the recruitment, transportation, transfer, harbouring or receipt of persons, by means of threat or use of force or other forms of coercion, of abduction, of fraud, of deception, of the abuse of power or of a position of vulnerability or of the giving or receiving of payments or benefits to achieve the consent of a person having control over another person, for the purpose of exploitation. Exploitation shall include, at a minimum, the exploitation of the prostitution of others or other forms of sexual exploitation, forced labour or services, slavery or practices similar to slavery, servitude or the removal of organs" (General Assembly resolution 55/25, annex II).

labourers worldwide [5], including in the sex industry. ILO research indicates that the global illegal profit made through the economic exploitation of forced labourers, outside the sex industry, has reached $10.4 billion ([6], para. 145).

For decades, economists have been debating about the viability of an economy where the labour market included forms of coerced labour. In 1789, Adam Smith stated that assessing the costs of the labour conducted by slaves to be the most expensive form of labour, argued that, to satisfy the demand for labour, it was cheaper to use the free labour supply than slave labour.

Studies have recently been conducted on the effect of coerced labour on the economy in the nineteenth century (see Loria and Bouchard [8] and Wakefield [9]). In the 1970s, Fogel and Engerman [10] concluded that during the period of slavery in the United States, African slaves had a relatively high productivity and the slave system was economically efficient. In the discussion below, the conclusions of Fogel and Engerman are challenged.

Domar [11] provided an analysis of the contribution of coerced labour to economic development throughout history, using as examples the Roman Empire, Russia in the fifteenth century and slavery in the Americas. He hypothesized that an increased supply of labour reduces the economic attractiveness of making use of forced labour, and this is the reason why in ancient times slavery and serfdom were introduced during periods of demographic decline due to war, famine or disease. According to Domar, the development of capital-intensive economic sectors made slavery economically unattractive. Domar's view is also discussed below.

In 1971, Bergstrom argued that slavery was an economically viable system in the United States prior to the Civil War; he described it as an efficient means of distributing wealth in a manner favourable to slaves [12]. Conversely, Barzel [13] argued that slave labour was economically efficient only for certain types of work activity, such as working on large cotton plantations, because free labourers refused to work under the inhumane conditions that slaves were forced to work under, even if the remuneration offered for working under those conditions was higher than the wages offered for other jobs. Thus, while it is true that slaves received better remuneration than free labourers, it is also true that the type of work done by slaves would have never been accepted by the slaves if they had been free to choose [13].

Basu [14] defines labour coercion as forcing a worker into an exchange for labour from which he or she obtains a negative utility. Naqvi and Wemhöner [15] consider that, given a person's feasible set of actions, labour coercion implies compelling an agent to engage in transactions that he or she would not have chosen to engage in.

More recently, Acemoglu and Wolitzky [3] proposed a microeconomic model of labour coercion. They demonstrated that, under equal conditions, greater demand for labour increases the economic incentive to make use of labour coercion. They hypothesized that the relation between labour scarcity and intensity of coercion may be positive or negative depending on the structure of the market where coerced labour is used. Finally, they demonstrated that coercion is always socially inefficient, as it involves costly ways of transferring resources and utility from workers to employees. Their conclusions are also discussed below, together with an alternative to their analysis.

The labour market

In order to assess how the dynamics of the labour market may influence trafficking in persons and forced labour and how these crimes do have an economic impact on the victims and their communities, the analysis starts with the basics of labour economics and compares a situation of free labour and one of trafficking.

Figure I shows the demand for labour (D) and the labour supply (S).

Figure I.   The labour market: in a free labour market and under exploitative working conditions
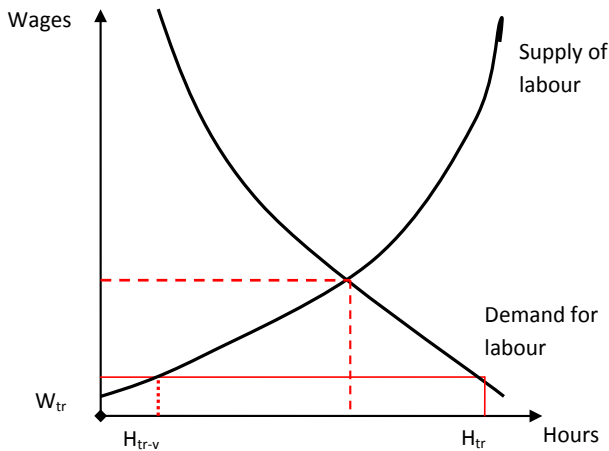
The horizontal axis shows the quantity of labour demanded (in hours per day). The vertical axis shows the hourly wages. The labour demand curve (D) shows how much the employer would pay to receive a certain amount of labour. The labour supply curve (S) shows the quantity of hours that the labourer would be ready to work for that hourly wage. At the same time, it shows the wages that the

labourer would accept to provide a specific quantity of labour [16]. The shape and the inclination of the curve depend on the type of labour demanded and on the individual preferences of the person demanding such working activity.

The labourer would like to receive as much wages as possible, and the employer would like to pay as little wages as possible. If all the theoretical assumptions are satisfied, in a free labour market the demand for and supply of labour may find stability (see figure I).

In a free labour market, supply and demand may also never meet (see figure II), and thus there may be no equilibrium on the labour market. For example, Barzel [13] reported on the inhumane working conditions in the cotton fields at the time of slavery in the United States. Such working conditions prevented free labourers from accepting wages that would have been higher than in other types of field labour. Certain types of work would be accepted by potential employees only if they were paid wages higher than what the employer would be willing to offer. In these cases, there would be no equilibrium on the labour market.

Figure II.   When supply and demand do not meet
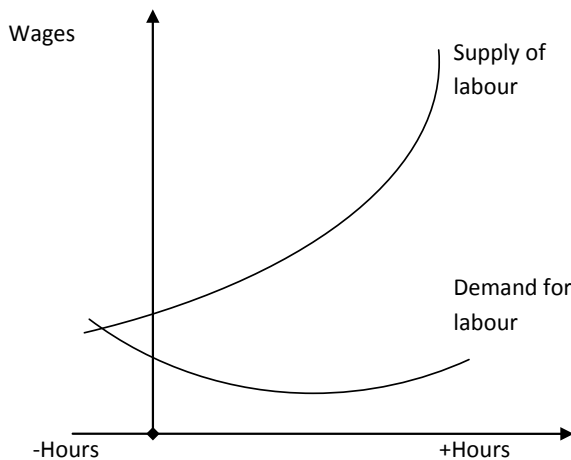
In addition, there are working activities that would never be accepted regardless of the wages offered. In such cases, the supply curve would always coincide with the vertical axis.

If and when equilibrium is reached, the number of hours worked H_{eq} and the amount of wages paid W_{eq} satisfy both parties. The surplus of the supplier of labour represents the labourer's economic benefit for working each hour up to H_{eq}, at an hourly wage (W_{eq}) greater than he or she would have requested to work that hour. Similarly, the surplus of the demand for labour is the economic

benefit that the employer gains for each working hour up to H_{eq} paid less (W_{eq}) than what he or she would have paid the labourer for that working hour.

In figure III, area A represents the surplus of the labourer for agreeing to work an amount of hours H_{eq}, and area B represents the surplus of the supplier for agreeing to pay an hourly wage W_{eq}.

Figure III.   Equilibrium in the labour market and benefits for the stakeholders
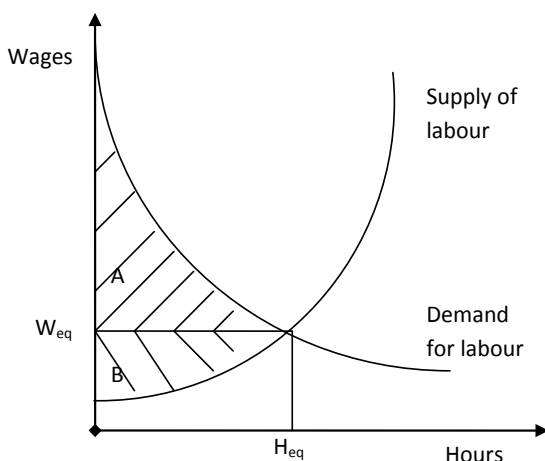
The economics of forced labour and human trafficking

In a context of coerced labour, whether the supply of and the demand for labour meet or not is totally irrelevant. The quantity of hours worked and the salary are imposed on the victim, who has no possibility of negotiating or refusing.

Under exploitative circumstances, the victim is forced to work more than he or she ordinarily would and for a salary that is much lower than he or she ordinarily would have accepted.

The exploitative working conditions that are typical in cases of forced labour and human trafficking are shown in figure I and can be mathematically summarized as follows:

$$(a) \quad H_{tr} > H_{eq} > H_{tr\text{-}v} \; and \; W_{tr} < W_{eq} < W_{tr\text{-}v}$$

where H_{tr} is the number of hours that the victim of trafficking is forced to work, $H_{tr\text{-}v}$ is the number of hours that the victim would work for the salary received, W_{tr} is the salary that the victim receives and $W_{tr\text{-}v}$ is the salary that the victim would require for that amount of work.

The hours the victim is forced to work are more than the hours the victim would work for the salary received. The salary the victim receives is less than the salary the victim would require for that amount of work. An increase of the extent of exploitation can be mathematically represented by an increase in the difference between the desired salary and the salary actually given ΔW: $W_{tr} - W_{tr-v}$ and between the desired hours worked and the actual hours worked under coercion ΔH: $H_{tr} - H_{tr-v}$.

The victim's economic loss

Under exploitative working conditions, mathemically summarized in *(a)*, the victim will be paid much less than he or she would in a free market. Not only the victim's income, but also the surplus of the labour supply will be reduced compared with the free market situation. In figure IV, area C represents the victim's income loss due to reduced salary.

Figure IV.   Economic loss of victims of forced labour
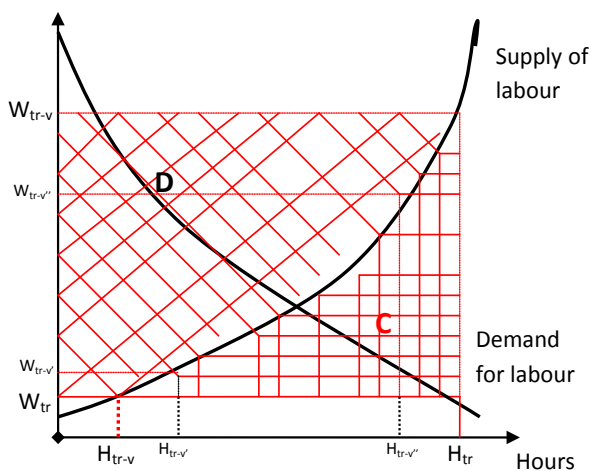
Area D is the loss of the victim's economic surplus. The victim's total economic loss[*] is shown in figure IV as area C + D:

$$\text{Victim's loss} = C + D = (Wt_{r-v} - W_{tr}) * H_{tr} \qquad (1)$$

Equation (1) is not only an abstract mathematical exercise, but also a practical tool for calculating the compensation of the victim for at least some part of the economic damages he or she suffered.

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[*]In addition, most victims of forced labour are exposed to violence, abuses and threats that cannot be measured in terms of money.

Equation (1) can be further developed as follows:

$$\text{Victim's loss} = (W_{tr-v} * H_{tr}) - (W_{tr} * H_{tr}) \qquad (2)$$

Factor 1 is defined as the salary the victim would demand multiplied by the total number of hours he or she has been coerced into working ($W_{tr-v} * H_{tr}$). Factor 2 is defined as the salary offered multiplied by the number of working hours imposed on the victim ($W_{tr} * H_{tr}$).

Equation (2) can be simplified as follows:

$$\text{Victim's loss} = \text{factor 1} - \text{factor 2} \qquad (3)$$

The greater the demand for labour, the higher the salary demanded, and thus, the higher factor 1. Equation (3) implies that increased demand for labour on the market results in greater economic damages for the exploited worker.

Furthermore, the greater the labour supply, the less the salary offered. Conversely, the less the supply of labour, the greater the demand (and the more the employer is willing to pay for a certain number of hours worked). Equation (3) implies that under exploitative working conditions, the victim's loss is greater when the labour supply is smaller. As shown in figure V, when the initial labour supply S_1 changes to a reduced labour supply S_2, the area indicating the victim's loss increases.

Figure V.   Victim's economic losses for different labour supplies
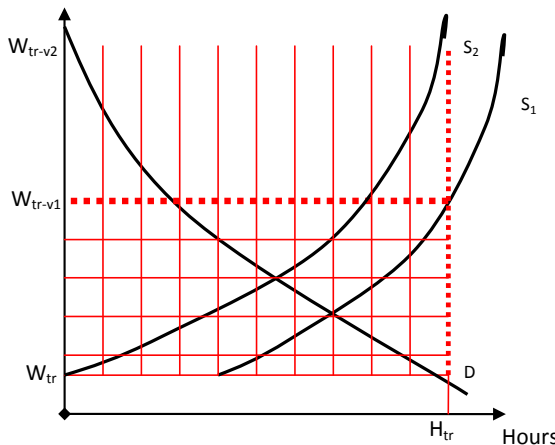
Equation (2) can also be developed as follows:

$$\text{Victim's loss} = H_{tr} \left[(W_{tr-v} - W_{tr})/(H_{tr} - H_{trv}) \right] (H_{tr} - H_{trv}) \qquad (4)$$
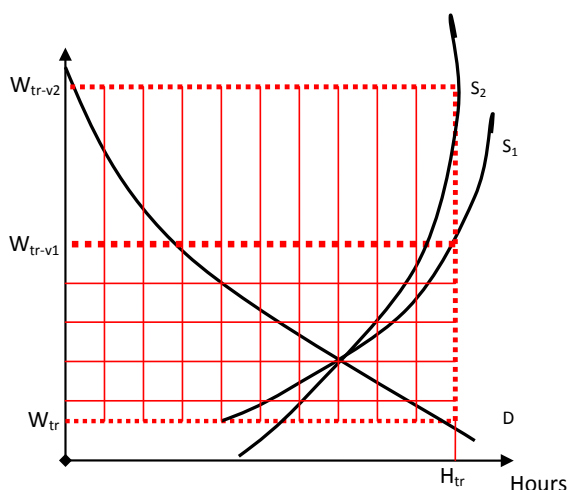
$$\text{Victim's loss} = H_{tr} \left(\Delta H / \Delta W \right) \left(H_{tr} - H_{trv} \right) \tag{5}$$

When calculated over the labour supply curve, $\Delta H / \Delta W$ is the own wage elasticity of the labour supply ε_w. Hence:

$$\text{Victim's loss} = H_{tr} * \varepsilon_w \left(H_{tr} - H_{trv} \right) \tag{6}$$

According to equation (6), the more rigid the labour supply curve, the greater the economic loss of the victims of forced labour. Equation (6) is represented by area C+D in figure VI. This area is greater when, *rebus sic stantibus*, the labour supply curve is more rigid compared with a more elastic labour supply. When the initial labour supply S_1 changes to a more rigid labour supply S_2, the area indicating the victim's loss increases.

**Figure VI. Victim's economic losses for different elasticities of the labour supply**

In practice, when the labour supply is more rigid to variation of salary, labour activities become particularly hard for the worker: for an additional hour of work, the labourer would demand a substantially higher remuneration. Victims are more affected economically when exploited in more difficult labour activities. What is less evident is that the elasticity of the demand for labour also has an impact on the victim's economic loss. The same $\Delta H / \Delta W$, when calculated over the labour demand curve, is the own wage elasticity of the demand for labour η_w. The more elastic the demand for labour, the greater the victim's economic loss. As shown in figure VII, when the initial labour demand D_1 changes to a more elastic labour demand D_2, the area indicating the victim's loss increases.

Figure VII.   Victim's economic losses for different labour demands
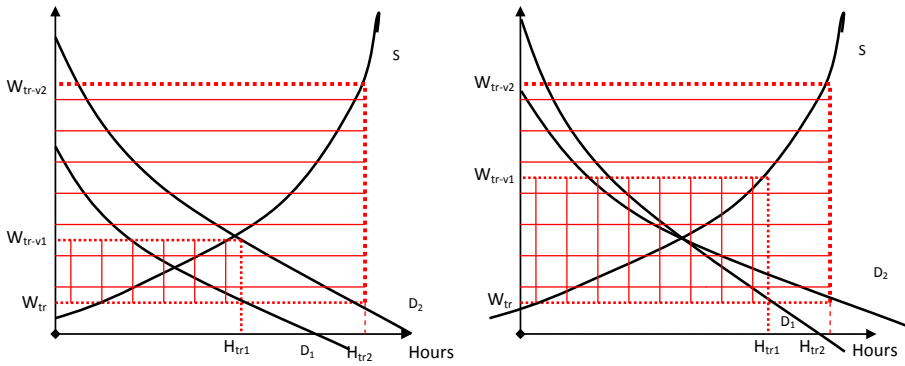
The victim's economic loss is also affected by the structure of labour supply and demand in the free market, as the structure is a function of the elasticity of the supply and demand curves. Some forms of trafficking end in exploitation that is not acceptable to the victims regardless of the remuneration. In such cases, for every $H_{tr} > 0$, $W_{tr-v} \to \infty$; thus, according to equation (3), victim's loss $\to \infty$. This type of labour can be represented graphically by a labour supply curve that never appears in the positive quadrant (see figure VIII).

Figure VIII.   Labour market when the supply is never positive
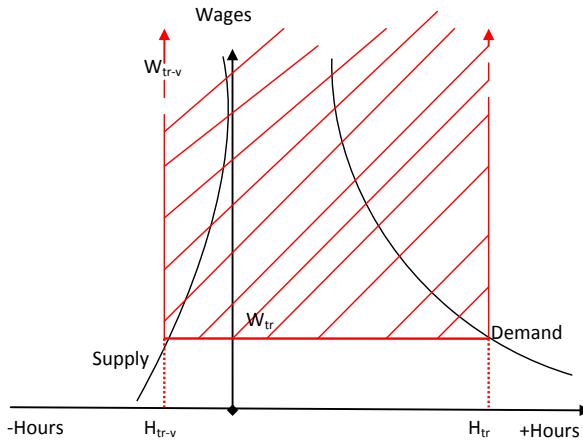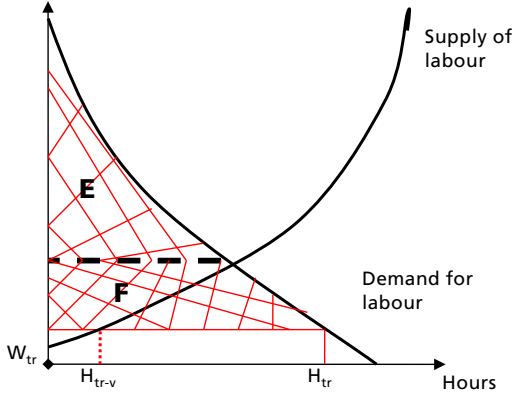

The economic gain of the exploiter

Obviously, there are more economic benefits to be gained by using victims of forced labour than by using free labourers. This additional economic surplus of the demand for labour is shown as area F in figure IX. The exploiter's increased economic benefits are directly derived from the victim's reduced

benefits. In the words of Acemoglu and Wolitzky, coercion allows the producer to steal utility from the agent [3].

Figure IX.   Economic gain of the demand in situations of forced labour

This additional economic surplus of the exploiter is shown in equation (6):

$$F = (W_{eq} \, H_{eq}) + \int_{Heq}^{Htr} W \, d(h) - (W_{tr} \, H_{tr}) \qquad (6)$$

$$F = (W_{eq} - W_{tr})^2 \, (H_{eq} - H_{tr})/(W_{eq} - W_{tr}) + H_{tr}W_{eq} + H_{eq}W_{tr} + \int_{Heq}^{Htr} W \, d(h) \quad (7)$$

where factor 3 is defined as $((W_{eq} - W_{tr})^2 \, (H_{eq} - H_{tr})/(W_{eq} - W_{tr})$ and

factor 4 is defined as $H_{tr}W_{eq} + H_{eq}W_{tr} + \int_{Heq}^{Htr} W \, d(h)$.

Thus, equation (7) becomes:

exploiter's gain = factor 3 + factor 4   (8)

If the exploitative working conditions, mathemically summarized in *(a)* on page 142, are applied to equation (7) and then to equation (8), equation (8) will always be > 0.

It is always economically advantageous for the employer to exploit workers, regardless of the labour market or the economic situation, unless an efficient criminal justice system serves as an adequate disincentive.

Of course, such exploitation is more economically advantageous under some economic conditions than under others. By definition, factor 3 is a function of the own wage elasticity of the demand for labour η_w: $(H_{eq} - H_{tr})/(W_{eq} - W_{tr})$, multiplied by the squared variation of the salary. Thus, according to equation (8), the more rigid the demand for labour, the greater factor 3—and the economic gain of the employer who makes use of forced labour—will be.

According to the Hicks-Marshall laws of derived demand ([17], [18]), more rigid demand for labour is characterized by short run productions, difficulty in finding substitutes, reduced proportion of labour costs to production costs and rigid demand for the final services or goods produced. These are the production contexts where it is more profitable to make use of exploitative working conditions, and where more attention should be paid by the criminal justice system.

Figure IX shows the transfer of welfare from the victim to the exploiter. This is not a linear function. By definition of factor 3, the exploiter's gain is a negative exponential function of the salary reduction. By reducing a unit of salary per hour worked, the exploiter would increasingly and exponentially gain in terms of economic surplus. Not only does the exploiter have an economic interest in exploiting the victims, but this interest grows exponentially with the intensity of the exploitation. By definition of factor 4, equation (8) implies that the exploiter's gain is positively related to the demand for labour. This has two implications: first, when the demand for labour is low, there is a reduced interest in using forced labour; second, the analysis confirms Domar's idea that the diffusion of capital-intensive production reduces the advantages of forced labour. Economies based on labour-intensive production are more interested in making use of forced labour.

The social cost of forced labour

The analysis above shows forced labour and human trafficking are about transferring economic wealth from labour supply to the demand for labour, from the victims to the exploiters, from the victim's community of origin to his or her community of destination. As mentioned above, the economic benefits gained from the demand are stolen directly from the victim of forced labour. At the same time, not all the labourer's loss is transferred to the demand for labour. Acemoglu and Wolitzky [3] demonstrated that utilitarian social welfare is always lower under coercion than in a free labour market; in this article an alternative analysis is proposed.

What is the part of economic wealth that is lost by forcing a person to work under exploitative working conditions? In a society comprising two persons, the exploiter and the victim, this can be easily calculated by subtracting the victim's loss, as represented in equation (2), to the exploiter's gain, as represented in equation (6).

$$\text{Social balance} = W_{eq} \, H_{eq} + \int_{Heq}^{Htr} W \, d(h) - W_{tr} \, H_{tr} - W_{tr-v} \, H_{tr} + W_{tr} \, H_{tr} \quad (10)$$

$$\text{Social balance} = W_{eq} \, H_{eq} - W_{tr-v} \, H_{tr} + \int_{Heq}^{Htr} W \, d(h) \quad (11)$$

The element $\int_{Heq}^{Htr} W \, d(h)$ varies according to the hours of exploitation H_{tr}, as well as the shape and inclination of the demand for labour. This element ranges from a minimum value $\int_{Heq}^{Htr} W \, d(h) = 0$, when $H_{tr} = H_{eq}$ (i.e. when the curve representing the demand for labour is vertical) to a maximum value $\int_{Heq}^{Htr} W \, d(h) = (H_{tr} - H_{eq}) W_{tr}$, when $W_{tr} = W_{eq}$ (i.e. when the curve representing the demand for labour is horizontal).

Assuming $\int_{Heq}^{Htr} W \, d(h)$ reaches the maximum value, equation (11) turns into:

$$\text{Social balance} = W_{eq} \, H_{eq} - W_{tr-v} \, H_{tr} + (H_{tr} - H_{eq}) W_{tr} \quad (12)$$

$$\text{Social balance} = H_{eq}(W_{eq} - W_{tr}) - H_{tr}(W_{tr-v} - W_{tr}) \quad (13)$$

Applying the exploitative working conditions, mathemically summarized in *(a)* on page 142, to equation (13) will result in:

$$\text{Social balance always} < 0 \quad (14)$$

Equation (14) indicates that the exploiter's economic gain does not compensate for the victim's economic loss. A society comprised of the aggregated supply and aggregated demand of labour always loses, passing from free labour to forced labour. This result is in line with Acemoglu and Wolitzky [3] while contradicting Bergstrom's hypothesis that slavery is an economically viable system [12].

Furthermore, equation (13) indicates that the total welfare is a function of $(H_{eq} - H_{tr})$ and $(W_{tr-v} - W_{tr})$; thus, the higher the degree of exploitation, the more the loss will be to society as a whole. The more forced labour and trafficking for the purpose of forced labour are used, the higher the economic costs to society as a whole. The social costs do not include public spending related to the provision of assistance to the victims of forced labour, law enforcement activities and measures connected with the prevention campaigns.

Discussion

Moving from the microlevel to the macrolevel, the passage of wealth from the demand for labour to the supply of labour by means of coercion can be

substantially represented as the transfer of wealth from the victims to the exploiters. If the exploitation takes place within the same community, this wealth is transferred between the parties involved and remains within the same community. If the victim is recruited in one community and then exploited somewhere else, the economic value of the stolen labour is also transferred from the community of origin to the community where the victim is exploited. The element of "movement" brings economic losses to the victim's community of origin, which are partly transferred into economic gains for the community of destination.

In practice, the victims' loss takes the form of reduced gross national product (GNP)[*] for the victim's country or community of origin as a result of, for example, fewer remittances, and thus less savings, consumption and investment. At the same time, the exploiters will be able to consume, invest and save more, mainly in the community where the exploitation takes place.

The above considerations can be used to calculate the extent of the economic impact of human trafficking and forced labour on the parties involved. Under normal circumstances, migrant agricultural workers would receive a freely negotiated salary reflecting their wishes and needs, and that would contribute to the GNP of their country or community of origin. Their remittances would be in the form of consumption, savings and investment; thus, the migrants' salaries would also have a positive impact on the local economy in their home communities and the gross domestic product (GDP) in their home country. If the migrant workers were to become victims of forced labour, their exploitative working conditions would have a negative economic impact on them and their community of origin in terms of their country's GDP.

As mentioned above, part of the economic loss of victims of forced labour is directly transferred to the country of destination. The greater surplus of demand for labour will take the form of cheaper labour at the disposal of the community of destination. Eventually, this will mean more profits and thus more investments for the demand for labour, and that will be translated into greater GDP for the community of destination. Eventually, the entire community of destination will profit from the labour stolen from the victim's community of origin, in terms of greater GDP and lower-priced final goods produced under exploitative working conditions.

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[*]GNP is the total value of all final goods and services produced by a country's factors of production, in this case labour, and sold on the market in a given time period. In the case of trafficking, the victim's loss is partially transferred to another community or country, which is the victim's country of destination.

As an example, in 2006, the Italian authorities investigated a case of trafficking in persons for the purpose of forced labour in the agricultural sector. The operation was called "Terra Promessa". Persons were recruited in Poland to work in the agricultural sector in the south of Italy. Before leaving for Italy, the workers agreed to certain working standards; eventually, they were forced at gunpoint to work under exploitative conditions. They had to work for 15 hours per day, for a fee of about 3 euros per hour. In addition, the victims had to pay their exploiters for accommodation and food, as well as about 300-500 euros as an initial fee for being given access to this "work opportunity" [19]. The number of victims officially identified by the Italian authorities was 113.

Calculations using equation (1) and the information reported above and in the court file on this trafficking cases how that, in this single account of trafficking, about 10,000 euros per day were stolen from the victims' community of origin.[*] The Polish authorities estimated that about 1,000 victims were involved in this type of trafficking during the 2006 agricultural season. The production period for this specific case would normally take 30-40 days. Thus, if all the assumptions are correct, this single account of trafficking would have had an economic impact on Poland amounting to about 3.5 million euros for slightly more than one month of exploitation.[**]

In 2008, the International Labour Organization (ILO) conducted a study on the migrant labour force in the Republic of Moldova. As a result of this study, ILO estimated that 25,500 Moldovans were victims of trafficking for forced labour ([6], para. 62), working under conditions very similar to those uncovered in operation "Terra Promessa". If the parameters for the Polish victims are applied to the Moldovan victims, it can be calculated that the Republic of

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[*]According to information concerning operation "Terra Promessa" and reported by the Italian authorities and by investigative reporter Fabrizio Gatti [20], the victims were forced to collect tomatoes for 15 hours per day and received about 3 euros per hour, when remuneration was actually provided. As a consequence, these persons received at most about 40 euros per day. It is impossible to estimate the labour supply curve of those particular labourers; however, it can be assumed that Polish labourers willingly migrating to Italy to do some agricultural work would not have accepted economic conditions inferior to those they would have found in Poland at that time. According to ILO, minimum wages in Poland for agricultural work was in 2006 70 euros for an eight-hour working day. These persons would have agreed to work an additional seven hours for another 70 euros, as it is clear that they would normally have requested much more as compensation for the greater degree of fatigue. According to this very minimal working condition they would have accepted voluntarily, the total daily salary could have been 140 euros per day. As a result, it can be said that the exploiter stole from each victim 100 euros per day (140 – 40 euros). Multiplying 100 euros by the number of victims (113) yields 11,300 euros per day.

[**]The season for the collection of tomatoes normally lasts between 30 and 40 days per year. The value of the labour stolen to these victims was calculated to be about 11,300 euros per day, thus ranging from 340,000 to 452,000 euros per season for the 113 victims detected by the authorities. If the number of victims was about 1,000 for the same season, the estimated total value of the labour stolen from the worker's community of origin would be at least about 3.5 million euros in one season.

Moldova lost about 2 million euros per working day, about 3 per cent of the country's annual GDP.[*]

In field research conducted in the United States in 2012, Zhang [21] estimated 38,458 victims of labour trafficking violations in San Diego County, California, the vast majority of the victims being Mexican nationals. Even if in this case not all the victims suffered the same level of exploitation as in the Italian case, it gives an idea of the severity of the problem, and thus of its economic impact on the Mexican economy.

According to a similar study conducted in Samut Sakhon province of Thailand [22], about 30 per cent of the migrants from Myanmar (probably about 60,000 persons) may be victims of trafficking for forced labour, working under extremely exploitative conditions. Such situations have a devastating economic impact on the home communities of the victims.

Conclusions

This article presents an analysis of the losses and gains in a situation of forced labour and in which conditions those losses and gains are more significant. Free labour and forced labour are compared on the basis of an analysis of the labour market. In the first case, the supply of and demand for labour can set working conditions according to the shape, inclination and size of the labourers' wishes and needs. In the second case, the demand for labour exploits the labourers who are forced to accept working conditions that they would otherwise refuse. The author assesses the conditions under which these gains and losses change, thus qualifying the labour sectors that are more vulnerable to coerced labour, including trafficking in persons.

The article provides tools for measuring the opportunity costs and thus the economic losses of the labourer under exploitative working conditions, and the monetary gains of the exploiter and the trafficker in a situation of forced labour. These gains are in the form of lower costs for the employers and thus greater profits for the producers and dividends for the shareholders. The profits feed the demand for forced labour, including trafficking in persons. To prevent such forms of exploitation, deterrents should be introduced to compensate for such gains, in order to prevent human trafficking.

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[*] According to the World Bank, the GDP of the Republic of Moldova in 2006 was about $2.988 million (http://data.worldbank.org/indicator/NY.GDP.MKTP.CD/countries).

Trafficking in persons has a clear and quantifiable impact on the economic development of the countries of origin of the victims. Exploiters steal the most important productive factor of these countries—labour. Labour is quantifiable and can be monetized. The author provides a tool for estimating the economic damage to these communities resulting from forced labour. The analysis shows that the impact of human trafficking is decisive in hindering proper economic development in countries affected by this crime.

Finally, the author investigates one of the debated topics in the economics of slavery. The analysis shows that utilitarian social welfare is always greater in a situation with a free labour market than in a situation of forced labour. Not only do forced labour and human trafficking have an adverse economic impact on the victim and his or her community, but they result in society as a whole suffering economic losses.

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