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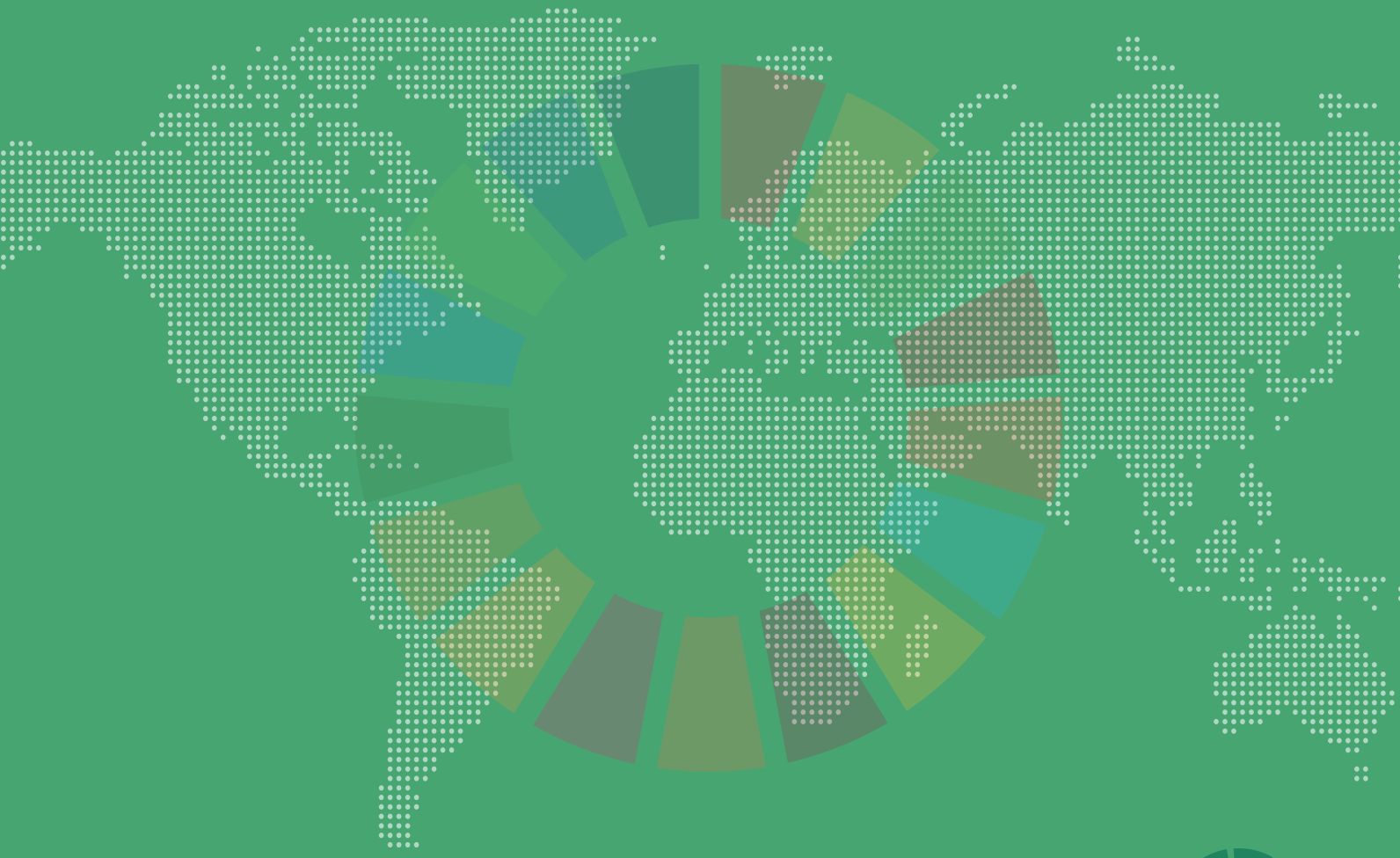
United Nations Office on Drugs and Crime

National Rapporteur on Trafficking in Human Beings and Sexual Violence against Children

Monitoring Target 16.2 of the United Nations Sustainable Development Goals

A multiple systems estimation of the numbers of presumed human trafficking victims in the Netherlands in 2010-2015 by year, age, gender, form of exploitation and nationality

Research brief



UNODC Research

Foreword

The Dutch National Rapporteur on Trafficking in Human Beings and Sexual Violence against Children and the United Nations Office on Drugs and Crime are proud to present a joint report on a multiple systems estimation of the number of presumed human trafficking victims in the Netherlands.

This joint venture was triggered by the need of the Dutch National Rapporteur to gain insight into the actual volume of human trafficking in the Netherlands and is part of UNODC's efforts to assist countries to monitor Sustainable Development Goals indicator 16.2.2 (number of victims of human trafficking per 100,000 population, by sex, age and form of exploitation). Knowing the total number of trafficked victims (detected and not detected) helps the Netherlands to tackle human trafficking more effectively, while the development and application of an innovative methodology can serve as a tool for other United Nations Member States.

Since human trafficking is a hidden crime, statistics on identified trafficking victims only reveal a small part of the problem, and the actual number of victims can only be estimated through statistical techniques. For methodological and definitional reasons, no comprehensive estimation of the true volume of presumed trafficked victims in the Netherlands was available. With this new study the 'dark figure' of trafficking in persons and the 'dark figure ratios' of different groups of presumed victims has been revealed so more targeted policy interventions can now be implemented to improve the detection of – and assistance to – the most hidden populations. In the Dutch context, these include underage victims, Dutch victims, and victims of trafficking for non-sexual exploitation.

By using multi-year data and by including four relevant covariates into the model (gender, age, nationality and form of exploitation), the results are more robust and more stable over time than the previous multiple systems estimation published for the Netherlands. A thorough, scientific approach has been followed to compute the estimates presented in this document and we are confident that the results - between 5,000 and 8,000 presumed victims per year, of which about 2,000-3,000 foreign presumed victims of sexual or non-sexual exploitation - approach the actual order of magnitude of trafficking in persons in the Netherlands.

Presenting such figures is a great step forward in the field of trafficking in persons research, which we hope can be taken up by many other countries so that ultimately a solid global figure on the total number of victims can be computed.

While the estimates are based on a substantially improved MSE methodology, limitations still need to be considered. Therefore, we encourage the continuing development, testing and validation of the MSE methodology and its application to trafficking in persons.

The development of this brief has been a unique and valuable experience for all parties involved. It has showed how close cooperation between methodological experts on multiple systems estimation and national experts on human trafficking and data collection is essential. We hope that this collaboration will incite other countries to initiate similar studies.

Our thanks go to prof. Jan J.M. van Dijk for initiating this important project and bringing together all the different parties, and to dr. Maarten Cruyff and prof. Peter G.M. van der Heijden for their work in further developing the MSE methodology and subsequently applying it to the data of the Netherlands.

Corinne Dettmeijer-Vermeulen, Dutch National Rapporteur on Trafficking in Human Beings and Sexual Violence against Children
Angela Me, Chief, Research and Trend Analysis Branch, United Nations Office on Drugs and Crime

Monitoring Target 16.2 of the United Nations' Sustainable Development Goals; a multiple systems estimation of the numbers of presumed human trafficking victims in the Netherlands in 2010-2015 by year, age, gender, form of exploitation and nationality

Based on a contribution by Jan J. M. van Dijk, Maarten Cruyff, Peter G. M. van der Heijden and Suzanne L. J. Kragten-Heerdink

Executive summary

In September 2015, United Nations Member States adopted the 2030 Agenda for Sustainable Development. At the heart of this bold agenda are the Sustainable Development Goals (SDGs); a set of goals aimed at stimulating action in a wide range of policy areas. Trafficking in persons features prominently in the agenda as three of the goals include targets that specifically mention this crime.

The measurement of crime in general and trafficking in persons specifically is challenging because much of the conduct remains undetected and unreported. While there is data on the number of reported cases of trafficking worldwide, the 'dark (or hidden) figure' remains unknown. The present paper explores the application of a recent methodology to generate a sound estimate of the 'dark figure' of trafficking in persons. The hope is that such studies will be replicated in many countries so that the severity of trafficking can be monitored over time.

The United Nations Office on Drugs and Crime is the guardian of the United Nations Convention against Transnational Organized Crime, and its supplementing Protocol to Prevent, Suppress and Punish Trafficking in Persons, Especially Women and Children. The National Rapporteur on Trafficking in Human Beings and Sexual Violence against Children of the Netherlands is one of the foremost national research centres on this topic.

These two entities carried out a joint, in-depth pilot test of a promising methodology, multiple systems estimation (MSE), to estimate the total presumed yearly number of trafficking victims in the Netherlands, broken down by age, sex, form of exploitation and nationality. The key finding is that in 2014 and 2015, the most recent years for which records are available, the total number of presumed victims of human trafficking in the Netherlands was approximately 6,250-6,500 per year. This means that the estimated numbers are four to five times higher than the recorded numbers of detected victims.

Abstract

A multiple systems estimation (MSE) was carried out using the statistics on possible victims identified by different groups of organizations reporting to CoMensha[1] on behalf of the Dutch National Rapporteur on Trafficking in Human Beings and Sexual Violence against Children over a period of six consecutive years (2010 - 2015). In total six different groups of organizations (lists) reported to CoMensha, among which the Border Police. The presumed victims reported by the Border Police concern presumed victims of a particular type of trafficking that is not informed by the Palermo Protocol. Moreover, this type of trafficking is no longer upheld as human trafficking by the Supreme Court in the Netherlands. For these reasons, two log-linear models were fitted: one including those reported by the Border Police (based on six lists, concerning 8,234 presumed victims between 2010 and 2015), and one excluding those exclusively reported by the Border Police (based on five lists, concerning 6,935 presumed victims between 2010 and 2015). To enhance the robustness of the estimates, they were stratified by four covariates, namely age (minor/adult), gender (female/male), form of exploitation (sexual/non-sexual) and nationality (Dutch/non-Dutch).

The key finding is that in 2014 and 2015, the most recent years for which records are available, the total number of presumed victims of human trafficking in the Netherlands was approximately 6,500 (six lists) / 6,250 (five lists) per year. This means that the estimated numbers are four to five times higher than the recorded numbers of victims that come to the attention of the authorities.

Expressed as rates per 100,000 persons, the rate of presumed victims is about 38/37 (six/five lists) per 100,000 inhabitants per year (based on the estimates for 2014 and 2015). The victimization rates are 32/29 (six/five lists) per 100,000 adult Dutch females, 1 per 100,000 adult Dutch males (in both models), 235/257 (six/five lists) per 100,000 Dutch girls (between 12-17 years old) and 14 (in both models) per 100,000 Dutch boys (between 12-17 years old). The rate of non-Dutch (legal or illegal) residents is 326/311 (six/five lists) victims per 100,000, or about fifteen/fourteen (six/five lists) times higher than for Dutch nationals (22 per 100,000 in both models).

1 The challenge of counting victims of human trafficking

In 2016, the United Nations adopted the target to 'end abuse, exploitation, trafficking and all forms of violence and torture against children' as Target 16.2 of its 2030 Agenda for

[1] CoMensha has been appointed as the official registration organization of all identified possible victims of human trafficking in the Netherlands on behalf of the Dutch National Rapporteur.

Sustainable Development (under Goal 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels). To monitor implementation of this Target, the UN Statistical Commission's Interagency and Expert Group on SDG Indicators (IAEG-SDGs) recommended (among other indicators): 'Number of victims of human trafficking per 100,000 population, by sex, age and form of exploitation.' The United Nations Office on Drugs and Crime (UNODC) has been identified as the custodian international agency responsible for the global reporting of the indicator and for providing support to Member States to collect data on the indicator. In order to fulfill this commitment UNODC has been working with Member States and the academic community to develop methodologies to estimate the number of undetected victims of trafficking in persons.

Statistics on *detected* victims are routinely collected by statistical authorities across the world. These national statistics are periodically collated by international organizations such as UNODC and Eurostat, and used by UNODC as the basis for its biennial *Global Reports on Trafficking in Persons* (GLOTIP). However, these statistics say very little about the true volume of trafficking in persons. They reflect just 'the tip of the iceberg.' If the ratio between the recorded cases and the real numbers would - as is the case with icebergs - be roughly constant over time and across countries, the numbers of recorded cases would provide useful information. In that case, the true numbers could simply be multiplied by the constant factor to arrive at estimates of the true volume. Unfortunately, the presumption of 19th century criminologists of constant ratios between numbers of recorded and real cases of crime has proven to be untenable. The detection rates of law enforcement agencies show great variation both over time and across countries, and so do consequently ratios between recorded crimes and total crimes and victims. Rankings of countries in terms of recorded crimes per 100,000 inhabitants often bear little or no relationship to the ranking of the real total crime numbers. Many countries with high levels of corruption report very few arrests or convictions for corruption (Van Dijk, 2008). This might also be the case with the offence of human trafficking. To give just one example, taken from the GLOTIP report of 2014, the Netherlands, population 17 million, registered about 1,700/1,300 (six/five lists) victims of human trafficking in 2012, whereas the United States of America, population 500 million, a mere 500 victims, and Japan, population 127 million, 27. If these numbers were taken at face value, the rate of trafficking victims per 100,000 would in the Netherlands be 100/76 (six/five lists) times higher than in the United States, and 470/360 (six/five lists) times higher than in Japan. Even assuming that the Netherlands would be faced with uniquely serious problems of

exploitation – an assumption for which there is no basis - these comparative statistics beggar belief. More likely, the lower rates in the United States and Japan reflect a different level of detection and recording of victims.

Within the European Union, the rates of identified victims per 100,000 reported to Europol for 2012 vary between lows in Portugal (0.0), Germany (0.8) and Sweden (0.9) to highs in the Netherlands (10.2), Bulgaria (7.9) and Romania (5.2) (Eurostat, 2015). As revealed elsewhere, this variation reflects differences in defining, identifying and recording victims rather than in their actual numbers (Van Dijk et al, 2014). The European rates show highly diverging *trends* in the numbers of identified victims between 2010 and 2012 as well. These changes over time too largely reflect changes in identification strategies and recording policies rather than in the volume of the crime (Eurostat, 2015). In publications on numbers of recorded crimes UNODC and Eurostat have warned against interpreting these statistics as measures of the true volumes of crime. In recent years, Eurostat has refrained from publishing statistics of identified victims per country altogether. Clearly, to monitor progress with SDG Target 16.2, other international human trafficking statistics than the official figures of recorded victims are urgently needed.

The estimation of statistics on *undetected* victims poses a formidable challenge, known in criminology as the old problem of assessing the "hidden figure of crime". Criminologists have made headway with cracking the "hidden figures" through the conduct of annual surveys among the public about personal or household experiences with common types of crime. Examples of such surveys include the National Crime Victims Surveys in the United States (Addington & Rennison, 2014), the National Crime Victims Survey of England and Wales (Jansson, 2006), the National Safety Monitor in the Netherlands (Smit & van Dijk, 2014) and, for comparative purposes, the International Crime Victims Surveys (Van Dijk, 2015). UNODC has developed standards to implement large-scale victimization surveys and has been supporting countries to undertake victimization surveys (UNODC-UNECE Manual on Victimization Surveys, 2010). Surveys to explore the hidden figure of trafficking in persons are more complex than general victimization surveys. Some have experimented with survey methodology to collect data on forced labour, including trafficking in persons for forced labour (ILO, 2012). Gallup International has designed and tested a standardized questionnaire, which is used as module in its annual World Poll. In this questionnaire, respondents are asked about forced labour victimization experiences of themselves or family members over the past year. The first survey results in a sample of developing countries have revealed some limitations. Unlike burglary or street mugging, the crime of human trafficking/forced labour

tends to be statistically rare, and more deeply "hidden" in the population at large. General victimization surveys on common crimes produce victimization rates of, on average, 15 per cent per year. The first surveys conducted by Gallup Int. and others produced prevalence rates for non-sexual exploitation far below 1 per cent. The reliable estimation of annual changes in this phenomenon per country will require large sample sizes, and concomitant budgets. Also, with such small numbers of identified victims, little can be said about the nature of trafficking cases or the characteristics of the victims. In the Western world the challenges are even bigger since exploitation seems heavily concentrated among hard to find migrant workers, especially in the case of labour exploitation (Zhang, 2012; Abraham & Van Dijk, 2017). To complicate matters further, the first batch of Gallup surveys detected almost no cases of sexual exploitation. Respondents seemed reluctant to report cases of sexual exploitation experienced by themselves or family members. Data collection about sexual exploitation through interviewing may prove to be very challenging in many countries if not impossible due to endemic feelings of fear or shame among respondents. Measuring sexual exploitation, just like measuring domestic violence through surveys, requires the use of highly trained interviewers and special interview techniques, which will be hard to sustain on a large scale across the world.

In conclusion, data on numbers of detected victims provide little or no information on the true numbers of total victims and, when presented in a comparative perspective, can easily lead to fundamentally flawed conclusions. Research using sample population surveys may cast light on the true extent of forced labour in developing countries, but not on the volume of sexual exploitation. With current methods, the SDG proposed indicator on numbers of victims, disaggregated by sex, age and form of exploitation, is unlikely to be comprehensively reported through survey research alone.

2 An international definition allowing a range of interpretations

In the past, efforts of the United Nations to collect international statistics on crime were hampered by the lack of internationally recognized definitions of even the most common types of crime such as household burglary, robbery and assault (United Nations, 1950). More recently, the development of the International Classification of Crime for Statistical Purposes (ICCS) has enhanced the collection of comparable crime data although it will take time for all countries to fully implement the classification. Trafficking in persons is among the few types of crime for which a treaty-based international definition exists.

Most national counter-trafficking legislation is largely based on recently adopted international instruments, particularly the United Nations Protocol to Prevent, Suppress and Punish Trafficking in Persons.[2] This so-called Palermo Protocol, adopted in the year 2000, has to date been ratified by 170 countries. Article 3(a) of the Palermo Protocol provides the basis for much national legislation: *""Trafficking in persons" shall mean the recruitment, transportation, transfer, harbouring or receipt of persons, by means of the threat or use of force or other forms of coercion, [...], for the purpose of exploitation."* In this definition, one recognizes a threefold structure: for trafficking in persons to be constituted it is necessary to prove an act with a means and with a purpose of exploitation. The means used in the process of trafficking can be non-violent in nature such as deception or abuse of a person's position of vulnerability. Furthermore, Article 3(b) of the Palermo Protocol states that consent on the part of the victim is irrelevant if one of the means in Article 3(a) is used. Finally, Articles 3(c) and 3(d) of the Palermo Protocol codify that in the case of a victim younger than eighteen years, there is no need to prove the use of a 'means'.

Despite this widely shared definition, the national legal definitions of human trafficking (in national criminal codes), and in particular their interpretations, still differ greatly between countries (Aromaa, 2007; Dutch National Rapporteur, 2012; Esser and Dettmeijer-Vermeulen, 2016; Gallagher, 2010; UNODC, 2013; UNODC, 2014; UNODC, 2015). One of the reasons might be that key aspects of the Palermo Protocol definition, including the element of 'purpose of exploitation', are not uniformly interpreted and, therefore may not be consistently applied in different jurisdictions (UNODC, 2013; UNODC, 2014; UNODC, 2015). Although the Palermo Protocol definition has been duly incorporated in the criminal codes of a large number of countries, the international comparability of statistics on identified human trafficking is still hampered by considerable variation in the national definitions and interpretations.

Because this publication is about the estimated number of victims in the Netherlands, it is important to reflect on the Dutch interpretation of the Palermo Protocol definition of human trafficking. The Netherlands applies a relatively broad interpretation, both with regard to the element 'abuse of a position of vulnerability' as well as with regard to the element of 'purpose of exploitation' (Esser and Dettmeijer-Vermeulen, 2016). Therefore, it is to be expected that the number of identified cases as well as the estimation of the total number of victims, is

[2] Protocol to prevent, suppress and punish trafficking in persons, especially women and children, supplementing the United Nations Convention against Transnational Organized Crime (available at: http://www.unodc.org/unodc/en/treaties/CTOC/index.html)

higher than in countries with a more restrictive interpretation. Moreover, while the Dutch definition (Article 273f of the Dutch Criminal Code (DCC) is predominantly based on the Palermo Protocol, it is not *solely* based on it. Article 273f DCC includes aspects that are not informed by the Palermo Protocol and are based on an older international instrument.[3] For instance Article 273f (1)(3) DCC considers the recruiting, taking or abducting of a person with the intention of inducing that person to make himself or herself available for prostitution in another country. Until recently, neither means nor the intention of exploitation was required. However, in 2016 the Dutch Supreme Court ruled that the intention of exploitation is actually a "latent" part of this subsection of the Dutch definition.[4] This means that since this ruling, the Dutch definition of human trafficking changed and has become narrower.[5]

National laws of other countries may contain similar (historical) peculiarities in their definitions of human trafficking that go beyond the Palermo Protocol. This further compromises international comparisons.

For reasons of international comparability, and because the particular type of trafficking under Article 273f (1)(3) DCC is no longer upheld as human trafficking by the Supreme Court in the Netherlands, this paper presents estimated numbers of victims both *in*cluding and *ex*cluding the victims of this particular type of trafficking (reported by the KMar, the Dutch Border Police, see hereafter).

3 National referral systems and multi - source datasets

As explained above, both the measurement of the hidden figures of human trafficking through population surveys and the lack of uniformity in the definition of human trafficking, pose formidable methodological challenges for the collection of international statistics on this type of crime. On a more positive note, estimating the true volume of human trafficking is favored by one unique feature of data collection on human trafficking victims, namely the involvement of a variety of different institutions besides the police. This multi-agency involvement flows directly from the victim-centeredness of the Palermo Protocol, which stipulates that the fight against human trafficking must be equally focused on the arrest and punishment of offenders and providing protection and assistance to victims. Victims of human trafficking should be allowed to remain temporarily or permanently in the country

[3] The International Convention for the Suppression of the Traffic in Women of Full Age (1933).
[4] Supreme Court 17 May 2016, ECLI:NL:HR:2016:857.
[5] Which emphasizes the prominent role of national judges in the interpretation of the trafficking definition (Esser and Dettmeijer-Vermeulen, 2016) and the fact that national definitions of human trafficking are not univocal/comparable over time.

where they are identified and should be offered protection and assistance. This dual focus on punishment and protection calls for the involvement of other organizations besides police and border control in the identification of victims. As prescribed in the United Nations Model Law against Trafficking in Persons,[6] governmental and non-governmental organizations should play a supporting role in the identification of victims, enabling them to reach out to victims and offer assistance to them independently of action by law enforcement authorities. In Europe, national multi-agency referral and identification systems involving all relevant actors have for years been promoted by, inter alia, the Organization for Security and Economic Co-operation in Europe (OSCE/ODIHR, 2004). Consequently, in many Western and Eastern European countries, national multi-agency systems of identifying and supporting victims, known as National Referral Mechanisms (NRMs) have duly been put in place. For example, in the United Kingdom, dedicated NGOs, municipal agencies and the police work together to identify persons who are entitled to special services and protection as possible victims of human trafficking. In the Netherlands, a coordinated approach to consistently protect possible victims of human trafficking that have been identified by the different relevant actors/organizations (like the National Police, the Royal Netherlands Marechaussee [RNLM, in Dutch: KMar, further: the Border Police], NGOs, municipal institutions, et cetera), has been in practice for years already. The formal establishment of an official NRM is currently under development following the EU Directive on Human Trafficking and the European Commission's Strategy towards the Eradication of Trafficking in Human Beings 2012-2016, and subsequently the recommendation of the Dutch National Rapporteur on Trafficking in Human Beings and Sexual Violence against Children (further: Dutch National Rapporteur) (Dutch National Rapporteur, 2013).

The primary aim of multi-agency identification and referral mechanisms is to assure that all victims, including those who are reluctant to cooperate with the police, are duly offered protection and support. A positive side effect of such mechanisms is that their administrative records can provide comprehensive statistics on all persons identified as victims by any of the organizations in the country participating in an NRM or equivalent arrangement. In Europe, Eurostat in its 2012 questionnaire on human trafficking specifically required Member States to report on the organizations that provided data regarding registration of victims and to indicate the procedures used to collect the data (Eurostat, 2015). In 2012, the police are the principal source for the registration of victims in fifteen Member States. Six Member States

[6] Available at: http://www.unodc.org/unodc/en/legal-tools/model-treaties-and-laws.html.

provided data originating from NGOs, three Member States from 'Border Guards' and two from 'Immigration Services'. 'Labour Inspectors' were reported in one Member State. The category 'Others' as registration source included:

- victim support units (Hungary),
- prosecutors (Lithuania),
- IOM-International Organization for Migration (Poland, the Netherlands, Romania),
- social services (United Kingdom, Romania),
- reception centres (Finland),
- prisons (United Kingdom),
- local authorities, regional councils (the Netherlands, United Kingdom).

The possibility that the same persons might be counted twice or more by different reporting organizations complicates the collection of aggregated statistics. For example, in Germany and Austria, the police and the NGO community maintain parallel data systems of the numbers of victims they have identified. It is certain that many victims identified by the police have received services from NGOs and vice versa, but the extent of the overlap is unknown. For this reason, the numbers of victims recorded by the police and the NGOs cannot be added up for a total count. The victims reported to Eurostat by Germany and Austria are therefore derived from the databases of the national police only and miss out on victims exclusively identified by NGOs.

In order to arrive at more comprehensive counts, controlling for double counting of the same victims, the collation of data from all relevant sources has in many countries been commissioned to single entities. Examples include the United Kingdom Human Trafficking Centre (UKHTC) of the British Home Office, the government funded NGO Coordination Centre for Trafficking in Human Beings (Dutch acronym: CoMensha) on behalf of the Dutch National Rapporteur, the Centre for the Protection of Human Trafficking Victims in Serbia and the Ministry of Interior in Romania. Units responsible for these statistics have for some time promoted the use of unique identifiers in the data collected from the various contributing organizations while safeguarding data protection standards.

Whereas the gathering of statistics on trafficking victims from different organizations was initially seen as a factor complicating statistical analyses, the recording of persons belonging to the same hidden population by different organizations now proves to be an asset for the estimation of the dark figures. The existence of multiple lists of identified victims have in fact become a useful tool to develop methodology based on the capture-recapture approach to estimate total number of victims. In 2012, ILO researchers applied capture-recapture analysis, using two teams of researchers identifying cases of forced labour from public sources, to

estimate the global numbers of forced labour victims at any time (ILO, 2012). However, despite the fact that the methodology of this estimate was innovative in the context of human trafficking at the time, there were still significant reservations (Dutch National Rapporteur, 2012; Gould, 2010). The Dutch National Rapporteur emphasized in this context the importance of combining the substantive knowledge of professionals engaged in the fight against human trafficking and statistical expertise (Dutch National Rapporteur, 2012), especially on methods to estimate the scale of hidden populations. In 2014, at an expert meeting on "Researching hidden populations: approaches to and methodologies for generating data on trafficking in persons", convened by UNODC, Prof Peter van der Heijden elaborated on the potential of multi-source data systems for estimating the true numbers through various techniques (Van der Heijden et al, 2015). He explained the advantages of using three or more different registers in the estimation models, as practiced in MSE.

In 2014 a team of researchers under the leadership of Prof. Bernard Silverman, chief scientist of the Home Office in London, actually applied MSE to the integrated multi-source dataset on persons identified as possible victims of human trafficking in the United Kingdom in 2012 (Silverman, 2014; Bales et al, 2015). This exercise was replicated in the Netherlands with the data CoMensha collected in 2014 on behalf of the Dutch National Rapporteur (Van Dijk and van der Heijden, 2016). The following section first describes how MSE works, illustrated by the British and Dutch studies just mentioned. Then the results of an MSE of the total number of victims (detected and undetected) in the Netherlands are presented, disaggregated by age, sex, form of exploitation and nationality per year for the period between 2010 and 2015 using an integrated, multi-year dataset with four covariates provided by the Dutch National Rapporteur.

4 The alternative of multiple systems estimation (MSE)

The statistical technique to estimate the volume of hidden populations, known as capture-recapture analysis, multiple systems analysis or multiple record systems analysis, was originally developed by biologists to estimate animal populations. Although the precise historical origins of the technique are disputed, Danish marine biologist Johannes Petersen (1860-1928) is often credited with the early use of the capture-recapture method to estimate the sizes of fish populations.

The quintessential idea to estimate the number of fish in a pond is as follows. One catches a number of fish (say 100), tags them, and then throws them back into the same pond. Some time later, one takes a new catch (say another 100) from the same pond, and counts how many

of the second catch are tagged, as being part of the returned original first catch. If the overlap between the two catches is zero, or very small, this suggests that the population of fish in the pond is much larger than 100. If the overlap is considerable, say 50, this suggests that the population is smaller. The larger the overlap, the smaller the size of the fish population. If of the 100 fishes in the second catch, 20 are tagged, it follows that tagged fishes in the pond had a chance of one in five of being caught. Assuming that the non-tagged fishes have similar catchment chances, the total number of fishes in the pond can be estimated at 500, of which 400 untagged.

The capture-recapture approach of biologists has translated into a well-known method for estimating the size of a hidden human population using two independent recording systems (or registers) which partially list its members. Linking the individuals in the two registers allows for the estimation of the number of individuals that are not recorded in any of the registers. For example, with two registers A and B, linkage gives a count of individuals in A but not in B, a count of individuals in B but not in A, and a count of individuals in both A and B. The counts form a contingency table denoted by A × B, with the variable labeled A being short for "inclusion in register A" differentiating between the categories "yes" and "no," and likewise for register B. The statistical problem is to estimate the value in the cell "no, no". An estimate of the total population size is obtained by adding the estimated count of doubly missed individuals to the counts of individuals found in at least one of the registers.

The capture-recapture method has been successfully applied to estimate the size of hidden human populations by determining the overlaps between unique individuals appearing in separate recording systems (or lists). Using such capture-recapture analysis, estimates have, for example, been made of the numbers of casualties of human rights violations in Peru and irregular migrants in the Netherlands (Lum, Price & Banks, 2013; Van der Heijden, et al, 2015).

Capture-recapture analysis depends on certain assumptions about the lists and the population from which they are drawn. Arguably the most problematic condition to fulfill when using recording systems of human individuals is the condition that recording systems are independent of each other. In the case of records of persons, this assumption of independence of lists is usually not met. For example, persons identified by law enforcement authorities as possible victims of human trafficking are likely to be referred to social assistance programs, and they consequently have a higher probability of being included in the recording systems of the involved NGOs. In this case the inclusion in the list of a service provider is far from independent from registration by the police. This is an example of positive dependence. Since

such positive dependence increases the overlap between the two lists, the number of the unobserved population is consequently underestimated. In practice negative dependence may also occur, for example, when inclusion in one register lowers the chance of being registered in another register, which leads to an overestimation.

A promising approach to relax the condition of independence is to include a third register, or multiple registers, and to analyze the three way, or multiple way contingency tables. With three (or more) lists the independence assumption in the two-list case is replaced by the less severe assumption that three (or more) factor interaction is absent. In official statistics, this extension of the two-list capture-recapture method is known under the name of multiple systems estimation (MSE).

In the United Kingdom, the obligation to identify presumed victims of human trafficking is discharged by the NRM, a framework for identifying victims and ensuring they receive appropriate protection and support. Its datasets are managed by the United Kingdom Human Trafficking Centre (UKHTC) of the Home Office. The National Crime Agency (NCA) of the Home Office collates data from various sources to produce Strategic Assessments of presumed victims. In 2013, 2,744 unique presumed trafficking victims were identified. The information about presumed victims came from a large number of separate source organizations. This information can be summarized into five lists based on the source type:

- LA: Local Authority
- NG: Non-governmental organization
- PF: Police force/National Crime Agency
- GO: Government Organization (mostly Home Office agencies e.g. UK Border Force, Gangmasters Licensing Authority)
- GP: The general public, through various routes

Of the 2,744 victims included in the 2013 database some appeared on two and a few on three or four of the five lists. Table 1 shows the distribution of the identified victims over the five lists.

Table 1: Contingency table for the National Crime Agency Strategic Assessment data, 2013*

LA	X					X	X	X								X	X	X
NG		X				X			X	X	X				X	X	X	X
PF			X				X		X			X	X		X	X		X
GO				X				X		X		X		X	X		X	X
GP					X						X		X	X				
number	54	463	995	695	316	15	19	3	62	19	1	76	11	8	4	1	1	1

Source: Silverman (2014).

*Each column shows the number of cases which fall in the combination of lists indicated by the cells marked. Columns corresponding to patterns which do not occur in the observed data are omitted.

The bottom row of Table 1 gives the numbers of presumed victims falling under each of the possible categories. MSE allows an estimation of the number of individuals not appearing on any of the lists, given the distribution of individuals in the contingency table. This is done by assuming that each of the counts is derived from a Poisson distribution, a distribution for the occurrence of rare events. A restrictive Poisson log-linear model is estimated for each of the cells and the parameter estimates are projected on the cell with the non-appearing (or hidden) individuals (Baillargeon & Rivest, 2007). With log-linear modeling, it is possible to assess how much being on one particular list affects a person's chances of being on another. Possible interactions between lists can be detected, and controlled for in the estimates. The condition of independence can therefore be relaxed.

Bales, Hesketh and Silverman (2015) fitted a log-linear model to the data in Table 1 which allows for individual list effects, and also for interaction between lists. The estimated number of victims was 11,304. The 95 per cent confidence interval for the actual population size was estimated as between 10,000 to 13,000, including the 2,744 victims already known. This suggests that the Strategic Assessment was aware of roughly 20 per cent to 30 per cent of all possible victims in the UK in 2013. In round numbers, therefore, the dark figure is around 7,000 to 10,000.

There is a positive correlation between list LA and each of lists NG and PF, so that being known to the local authority apparently increases the chance of being known to NGOs or the police. This may reflect the existence of referral pathways for potential victims between these agencies, in particular in relation to minors who, unlike adults, do not need to consent to referral to the NRM, or joint operations between the local authorities and other agencies. The upshot of the exploratory MSE carried out on the lists of the National Crime Agency is that

the true number of victims during 2013 is estimated at 11,300, or four times the numbers of detected victims (2,744).

The case of the Netherlands

In the Netherlands, CoMensha has been appointed as the official registration organization of all identified possible victims of human trafficking on behalf of the Dutch National Rapporteur. Ideally, all possible victims identified by any organization or person in the Netherlands should be reported to CoMensha. Institutions authorized to carry out criminal investigations into human trafficking are: the National Police (comprising ten regional police districts and one central police unit) coming across all forms of trafficking, the Border Police typically coming across cross-border (sex) trafficking, and the Inspectorate Social Affairs and Employment (Inspectorate SZW) typically coming across cases of labour exploitation. There is no legal obligation for these institutions to report victims they have identified to CoMensha but they are strongly urged to do so. In addition, designated regional coordinators and other governmental as well as non-governmental institutions – such as organizations providing services to victims/migrants/prostitutes specifically; organizations providing social or legal services; and youth welfare agencies – are invited to report on all cases of presumed victimization. Finally, concerned citizens (or even victims themselves) can identify possible victims and report them to CoMensha directly. Although this system has been in place for several years already, and reporting and registering has steadily improved, it can still not be assumed that every identified possible victim in the Netherlands is always duly reported. In order to report to CoMensha, the organizations/persons that come across potential victims should (1) be capable of identifying possible victimization (be capable of recognizing and interpreting signals); (2) be aware of CoMensha as the national registration organization; (3) be willing to report to CoMensha/acknowledge the importance of reporting (youth welfare agencies are much more reluctant to report to CoMensha than for example service providing organizations specialized in human trafficking victims) and; (4) be able to report to CoMensha (with regard to consent of the presumed victim to reporting, that is currently required for privacy reasons, especially when it concerns minors). These are not constant omnipresent factors, they vary per organization/person, per region, in time et cetera and might constitute possible limitations in MSE-based estimation.

In the CoMensha registration covering 2014, a total of 1,561 uniquely defined cases were registered once or more. In roughly one in eighteen cases, victims have been reported by more than one organization, usually two, and in a few cases three. Many of the theoretically

possible combinations of two lists occurred. Using this contingency table, Van Dijk and Van der Heijden (2016) applied log-linear models to estimate the dark figure of victims not recorded on any of the lists. Six lists were used: P = National Police; K = Border Police; I = Inspectorate SZW; R = regional coordinators; O = residential treatment centers and shelters; Z = others (for example, ambulatory care centers, organizations providing legal services, Immigration and Naturalization Service). A model search was carried out using the stepwise selection procedure of the R-package STEP. This procedure is similar to well-known stepwise regression analyses, that is, it starts with a simple model and includes significant and deletes non-significant interaction terms between the lists until the fit of the model to the data is deemed adequate.

In Table 2, the first five models are reported. The standard approach for goodness-of-fit assessment of these models is to evaluate the chi-squared value based on the deviance in combination with the degrees of freedom through the Aikake Information Criterion (AIC) or the Bayesian Information Criterion (BIC). Considering the relatively large sample size of 1,561 cases, the BIC was chosen, which better prevents overfitting. For the data at hand, the goodness-of-fit assessment of the BIC model is still problematic because of the many empty cells (there are no observations for certain combinations of registers), as a result of which the chi-squared approximation does not hold. As an alternative, the parametric bootstrap was used to simulate the chi-squared distribution, and determined the p-value of the model as percentile in the simulated distribution. 20,000 random samples were simulated under the fitted model to estimate the distribution of the Pearson chi-square, and took the percentile of the chi-square of the fitted model as the p-value. For example, the third model in Table 2 (M3) has a chi-square value of 66, and the Pearson values of approximately 2,600 simulated samples were larger than this value, which corresponds to 13 per cent. This shows that the M3 fits adequately, because 13 per cent is larger than the significance level of 5 per cent.

A first analysis looked at a model assuming independence of all lists (Model M1). This model showed an inadequate fit (the p-value is smaller than .05). In subsequent models, interactions have been fitted between the residential treatment centers and shelters and others and between the Inspectorate SZW and others. Models M2 and M3 showed better fits (with the latter having a p-value above .05). Models fitting more interactions proved to be overfitting, that is, they were more complicated than necessary to describe the data well which may result in unstable estimates. The fit of model 3 is adequate ($p = 0.130$), and the p-values of models 4 and 5 are not substantially better. Therefore, model 4 and 5 were ignored. The preferred

model 3 was the model fitting the interactions between the residential treatment centers and shelters and others (OZ) and between the Inspectorate SZW and others (IZ).

Table 2: Results of log-linear modelling of six lists of human trafficking victims in the Netherlands, 2014

	Estim	Confidence Interv.	Pearson	p
M1. P,R,K,O,I,Z	10,542	(8,802 - 12,956)	577	.007
M2. P,R,K,OZ,I	15,711	(12,552 – 20,576)	226	.017
M3. P,R,K,OZ,IZ	17,812	(14,026 – 23,874)	66	.130
M4. R,K,OP,OZ,IZ	22,270	(16,871 – 32,275)	49	.175
M5. K,PR,OP,OZ,IZ	32,646	(22,299 – 56,048)	46	.173

Source: Van Dijk & van der Heijden, 2016.

As can be seen, the preferred model 3 gives an estimate of about 17,800 victims. These 17,800 victims include the 1,560 recorded by CoMensha. The estimate suggests that roughly ten per cent of all victims were detected. Or, in other words, that there were approximately ten times more victims present on the Dutch territory in the course of 2014 than those recorded. The 95 per cent confidence interval ranges from approximately 14,000 to 24,000.

5 A model with six or five lists, four covariates and data from six years

As discussed above, one of the agreed global statistical indicators for SDG Target 16.2 to end abuse, exploitation, trafficking and all forms of violence against and torture of children consists of the number of victims of human trafficking per 100,000, disaggregated by sex, age and form of exploitation. The proposed disaggregation serves, inter alia, to inform anti-human trafficking policies. Victims of cross-border (sex) trafficking are typically identified by border police units during transportation (while entering the Netherlands). During exploitation, victims of sexual exploitation (Dutch or non-Dutch) are typically identified by special police forces and service providing NGOs. Victims of forced labour are mostly identified by Inspectorates for fair, healthy and safe working conditions or NGOs advancing migrant rights. Underage victims can be detected by a variety of organizations including youth welfare agencies. Ideally, each of these institutions needs to be informed about the total numbers of victims, identified and non identified, and on the proportions of potential clients reached by them.

The disaggregation of estimated numbers of undetected victims by gender, age, form of exploitation and nationality does not only serve important policy purposes but can also, as will be explained hereafter, improve the overall estimates themselves. A well-documented complication of the MSE method is that the likelihood of persons to be listed or included can vary across subgroups of the population. In the analogy of estimating numbers of fishes, some species might have larger chances of getting caught than others. If these subgroups' probabilities are structurally different, the condition of homogeneity of inclusion chances is violated. In such cases, estimates based on average probabilities might result in erroneous estimates (Van der Heijden et al., 2012; Van der Heijden et al., 2015).

The phenomenon of human trafficking manifests itself in a multitude of different forms. Four main types can be distinguished: internal trafficking for sexual exploitation, cross-border trafficking for sexual exploitation, internal trafficking for non-sexual exploitation and cross border trafficking for non-sexual exploitation.[7] Each of these sub-types might have different capture (inclusion) probabilities. For example, Dutch victims of sexual exploitation may have different capture (inclusion) probabilities than non-Dutch victims of labour exploitation, because, inter alia, different sets of organizations are involved in their identification (Kragten-Heerdink, Dettmeijer-Vermeulen & Korf, 2017).

The condition of homogeneous inclusion probabilities on at least one of the lists can be approximated by stratification of the analysis according to relevant covariates. If, for example, certain categories of victims are more likely to be recorded than others, estimates can, and should, be made for each of these groups of victims separately (Van der Heijden et al, 2012).

For policy purposes the CoMensha registration includes the covariates age, sex, form of exploitation experienced by the victim (for example, sexual services, forced labour or forced crime) and nationality. In the reports of the Dutch National Rapporteur the numbers of victims presented are broken down by these variables. In the initial study using the 2014 data on identified victims, the modeling did not, as presented above, include any covariate. The

[7] Note that according to Kragten-Heerdink, Dettmeijer-Vermeulen & Korf (2017) the different types of trafficking are based on the 'form of exploitation' (sexual or non-sexual) times the 'route of trafficking' based on the country of recruitment and the country of exploitation (internal or – arrived/departed/traversed - cross-border). Because in the Netherlands the registration of the country of recruitment and the country of exploitation is for the most part lacking, the route of trafficking is based on the nationality of the victims instead. This is legitimate because Dutch victims are all/predominantly victims of internal trafficking and non-Dutch victims are all/predominantly victims of cross-border trafficking. However, note that nationality/country of origin can only determine the route of trafficking (internal or cross-border) in countries where cross-border trafficking exclusively/predominantly involves cross-border trafficking from other countries to the country in question, i.e. arrived cross-border trafficking (instead of (also) from the country in question to other countries, i.e. departed cross-border trafficking).

present round of estimations of the total number of victims (detected and undetected), incorporates in the log-linear models the covariates male/female, adult/minor, sexual exploitation/other forms of exploitation and Dutch/non-Dutch. In order to increase the number of cases and to explore changes over time of the estimated numbers of victims (detected and undetected), data on presumed victims from six consecutive years, 2010 up to 2015 have been incorporated. An integrated dataset with these variables was prepared by the Dutch National Rapporteur.

As mentioned before (see 2: An international definition allowing a range of interpretations), the Dutch definition of trafficking included a type of trafficking that is not informed by the Palermo Protocol (under Article 273f (1)(3) DCC): the recruiting, taking or abducting of a person with the intention of inducing that person to be available for, in brief, prostitution, in another country, while no means nor the intention to exploitation is required. Research into the human trafficking case files of the Border Police conducted by the Dutch National Rapporteur, showed that the victims reported to CoMensha by the Border Police predominantly concern presumed victims of this particular type of trafficking (Nationaal Rapporteur, 2014). To allow for better international comparisons, and because this type of trafficking without the requirement of any means or the intention of exploitation, is no longer upheld as human trafficking by the Supreme Court[8] in the Netherlands, two MSE-based models were developed. In the first analysis, all 8,234[9] reported presumed victims in the period 2010-2015 were included, and used the same six lists as before: P = National Police; K = Border Police; I = Inspectorate SZW; R = regional coordinators; O = residential treatment centers and shelters; Z = others (such as ambulatory care centers, organizations providing legal services and Immigration and Naturalization Service). In the second analysis, the presumed victims who were solely reported by the Border Police were excluded, and therefore used five of the aforementioned six lists (excluding K = Border Police), concerning 6,935 reported presumed victims in the period 2010-2015. Figure 1 shows the trends in the numbers of presumed victims reported to CoMensha by the six organizations just mentioned.

[8] Supreme Court 17 May 2016, ECLI:NL:HR:2016:857.

[9] In total 8,245 presumed victims were reported to CoMensha in 2010-2015 (Nationaal Rapporteur, 2016). 11 victims were excluded because the reporting organizations were not registered.

Figure 1: Numbers of presumed victims reported to CoMensha by six organizations or sets of organizations during the years 2010-2015

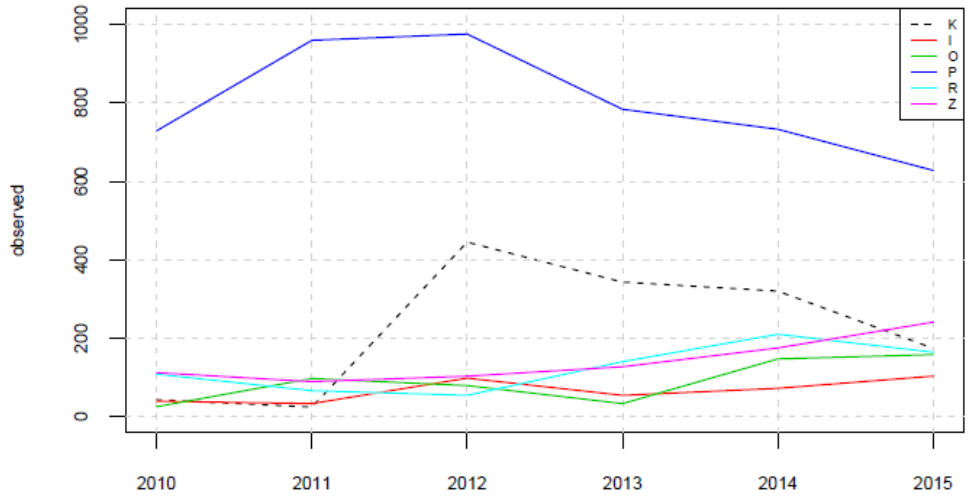


Figure 1 shows at a glance that the National Police reported the largest part of all victims in all years. The second feature that catches the eye is that the numbers reported by the National Police peaked in 2011 and 2012 and the numbers reported by the Border Police in 2012. After 2012, the numbers reported by the National Police and by the Border Police have both moved downwards.

In order to give further insight in the statistics underpinning the model, Table 3 presents the distribution of the 8,234 victims over the six lists, broken down to the occurring combinations. In the far right column the frequencies are given for the 6,935 victims that were not solely reported by the Border Police.

Table 3: Contingency table for CoMensha registration on presumed victims,* 2010-2015

I (Inspectorate SZW)	K (Border Police)	O (residential centers/shelters)	P (National Police)	R (regional coordinators)	Z (others)	frequency (N=8,234)	frequency (N=6,935)
X		X	X			4	4
X		X				1	1
X			X		X	4	4
X			X			18	18
X				X		3	3
X					X	16	16

X						352	352
	X	X				1	-
	X		X			44	-
	X				X	4	-
	X					1,299	-
		X	X	X		2	2
		X	X		X	7	7
		X	X			59	59
		X		X		2	2
		X			X	57	57
		X				403	404
			X	X	X	1	1
			X	X		82	82
			X		X	125	125
			X			4,466	4,510
				X	X	2	2
				X		650	650
					X	632	636
398	1,348	536	4,812	742	848		

*Each row shows the number of cases which fall in the combination of lists indicated by the cells marked. Rows corresponding to patterns which do not occur in the observed data are omitted.

The cells in the bottom row of Table 3 show the totals recorded by each of the six sets of organizations. By far the largest numbers are recorded by the National Police and the Border Police. The cells in the column 'frequency (N=8,234)' show the total number of cases falling into each of the occurring combinations. The largest categories of victims are those exclusively listed by the National Police (4,466), the Border Police (1,299), the regional coordinators (650), and others (632). The most common pairwise combinations were National Police and others (125), National Police and regional coordinators (82), National Police and residential centres/shelters (59), residential centres/shelters and others (57) and National Police and Border Police (44).

It is noticeable that of the 1,348 cases reported by the Border Police, only 49, or 3.6 per cent, have been co-recorded by another organization, mainly the National Police (44). There is little overlap between the cases recorded by the Border Police and those recorded elsewhere. This validates the aforementioned observation that the Border Police identifies and reports a different type of trafficking than the other five reporting organizations; that is, a particular type of trafficking that is not informed by the Palermo Protocol and is no longer upheld as

human trafficking by the Supreme Court in the Netherlands. Between 2010 and 2015, the cases exclusively reported by the Border Police showed a pronounced curved trend. These cases amounted to only 39 and 22 in 2010 and 2011 respectively. Thereafter they went up to 427 in 2012, 325 in 2013 and 314 in 2014. Subsequently they decreased to 172 in 2015. The sudden rise in reported cases by the Border Police is explained by the fact that in 2012 the Border Police considerably stepped up its efforts to identify presumed victims of the aforementioned particular type of trafficking. The recent drop in 2015 has probably to do with increased attention required by other established priorities (for example human smuggling) at the expense of available capacity to identify signals of human trafficking (Nationaal Rapporteur, 2016).

The model selection procedure was basically the same as for the models presented in Table 2. The model search started with a simple model and included interaction terms until the fit of the model to the data became adequate. As explained, this time the additional variables age (L), sex (S), exploitation (U), nationality (N), and year (Q) were included. The variable Q comprises 5 polynomial variables from the 1st to 5th degree, which model potential trends in the main effects of and interactions between the registers and covariates over the years. The missing values on the covariates age (256), sex (3), exploitation (689) and nationality (103) were imputed using the EM algorithm (Van der Heijden, et al., 2009).

In the STEP procedure, the BIC was again preferred over the AIC as the selection criterion, because of its protection against overfitting when the sample is relatively large, and an additional restriction on the parameters of the model was imposed. Given that many pairs of registers show little or no overlap over the six-year period (see Table 3), the 3-factor interaction parameters for such pairs of registers and the variable Q with the five polynomials for modelling trends over time are numerically unstable in the sense that they lead to highly inflated population size estimates and confidence intervals. To protect against this type of inflation, the restriction that only 2-factor interactions are allowed to enter the model was imposed. This restriction implies that no corrections are made for possible higher order interactions between the lists.

Evaluation of the fit of the selected model by empirically generating the distribution of the Pearson chi-square statistic using the parametric bootstrap with 20,000 samples, shows that the STEP procedure selects a model that may be underfitting: the p-value is .038. However, it should be noted that the observed n is rather large with 8,234 or 6,935 cases, and it is well known that with such large n even minor misspecifications make a test for model fit

significant. Therefore, the 5-per cent criterion is not rigorously applied, but rather, the current model is chosen as its fit is adequate in the light of the large *n.*

The model with six lists (concerning 8,234 presumed victims) that was selected as the most parsimonious one is presented in Table 4a, and the model with five lists (concerning 6,935 presumed victims) in Table 4b.

Table 4a: Parameters in the selected model with six lists
KP, KR, KZ, KO, RZ
IQ, KQ, OQ, RQ, ZQ, UQ, NQ,
IU, IL, IN, IS, KN, KS, KU, KL, OL, ZL, UN, ZN, ON, OZ, OU, PN, PU, RU
SL, SN, SU, LN, LU, PL, RL, OS, ZS

Table 4b: Parameters in the selected model with five lists
RZ
IQ, OQ, RQ, ZQ, UQ, LQ,
IU, IL, IN, IS, OL, ZL, UN, ZN, ON, OZ, OU, PN, PU, RU
SL, SN, SU, LN, LU, PL, RL, OS, ZS

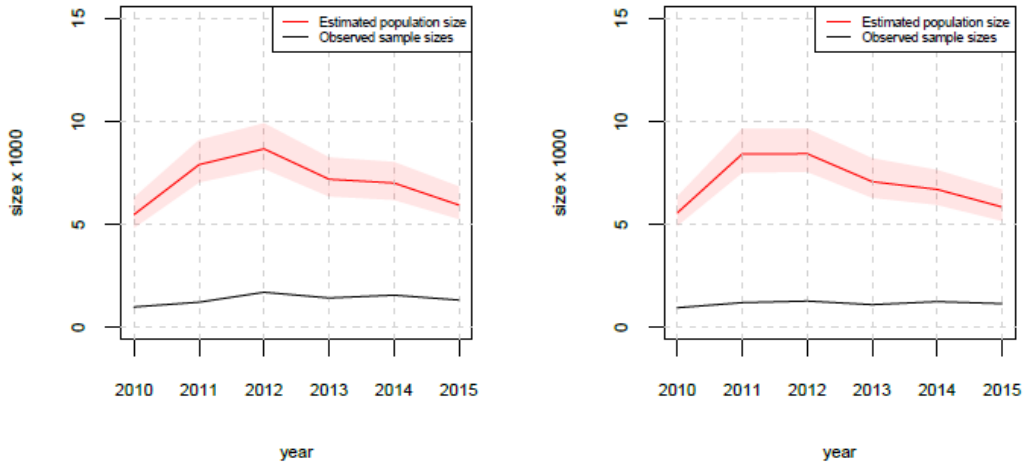
The first row in both tables show the interactions between registers for which corrections have been made. As explained, interactions between lists can be both positive and negative. Notice that in Table 4a this part of the model is considerably more complicated than the model for 2014.[10] This may simply be due to the fact that a larger number of observed cases makes it easier to detect such interactions (n = 1,561 in 2014 versus n = 8,234 in 2010-2015) and the inclusion of covariates. The model in Table 4b is similar to the model in Table 4a – it includes the same interactions except of course the (negative) interactions between list K (Border Police) and others – but does lead to slightly lower estimates for some years (see for example Figure 2a and 2b).

[10] See Van Dijk, J.J.M. and P.G.M. van der Heijden (2016), *Research Brief. Multiple Systems Estimation for estimating the number of victims of human trafficking across the world*. Vienna: UNODC.

Results overall

Figure 2 (a and b) shows in black the trend in the total presumed victims recorded by CoMensha and in red the total estimated numbers of victims. The 95 per cent confidence interval around the estimates is depicted in shaded red**.**

Figure 2: Trends in observed presumed victims and estimated totals of presumed victims in the Netherlands, 2010-2015 (a: based on model with six lists, b: based on model with five lists)



In Figure 2a the numbers of observed presumed victims depicted at the bottom show a peak at about 1,700 in 2012. The trend line of estimated total victims does roughly mirror the one in observed cases. The trend lines, however, seem to show some divergences. Unlike the observed numbers, the estimated numbers seem to have jumped up between 2010 and 2011. The downward trend from 2012 onwards is steeper in the estimated numbers than in the observed cases.

In Figure 2b the clear peak in observed presumed victims is absent, which means that this peak in Figure 2a is the result of observed presumed victims of the particular type of trafficking reported by the Border Police. However, in Figure 2b the trend line of the estimated total seems to peak in 2011 and – as in Figure 2a - in 2012 (although the 2012 peak is a bit lower: Figure 2a: about 8,700 versus Figure 2b: about 8,400). As opposed to the peak in the observed number in 2012 (in Figure 2a), the peak in the estimated number in 2012 (in both Figure 2a and 2b) is therefore probably not exclusively related to the inclusion of the aforementioned particular type of trafficking reported by the Border Police.

As discussed, the earlier one-year model for 2014 without covariates produced an estimate of 17,800 with confidence intervals between 14,000 and 23,900. The new – fuller and more complex - model estimates the totals of victims in 2014 at around 7,000. The new estimate is considerably lower than the older estimate and falls outside its 95 per cent confidence interval.

The difference is partly explained by the inclusion of more years in the model, which may have smoothed the findings. The second probable explanation is the use of covariates in the new model. This explanation was put to the test by replicating the six year model without covariates. This simpler model produced estimates per year that indeed differed considerably from those of the full model (see appendix A1 for results for all years). For the year 2014 the new estimated number was 10,500. For this year the multi-year model without covariates apparently produced a higher estimate than the fuller model.

Observed and estimated numbers

As shown in Table 5, the estimated numbers of presumed victims are five to six times higher than the numbers of observed victims (see appendix A2 for full data).

Table 5: Ratio between estimated and detected victims, 2010-2015

	2010	2011	2012	2013	2014	2015
Six lists	5.5	6.5	5.1	5.0	4.5	4.5
Five lists	5.8	7.0	6.6	6.4	5.4	5.1

Over the period of 2010-2015, the hidden figure of trafficking victims seems to have declined somewhat according to both analyses.

An MSE using covariates provides insight in the ratios between estimated and observed presumed victims per group. The ratios for 2010 up to 2015 for the subgroups of victims of sexual exploitation and of non-sexual exploitation are shown in Tables 6 and 7 (see Appendix A2).

Table 6: Ratio between estimated and detected victims of sexual exploitation, 2010-2015

	2010	2011	2012	2013	2014	2015
Six lists	5.2	5.4	4.6	4.6	3.9	4.1
Five lists	5.6	6.0	6.2	6.1	4.9	4.8

Table 7: Ratio between estimated and detected victims of non-sexual exploitation, 2010-2015

	2010	2011	2012	2013	2014	2015
Six lists	7.4	10.4	7.8	7.8	6.8	5.6
Five lists	7.6	11.0	8.2	8.1	7.0	5.7

On average, the ratios between estimated and observed cases were 1.6 (six lists) / 1.4 (five lists) times higher for presumed victims of non-sexual as for those of sexual exploitation. In other words, the hidden part of non-sexual exploitation, in the Netherlands mainly consisting of labour exploitation, is 1.6/1.4 times higher than that of exploitation in the sex industry. Figure 3 conveys the results graphically (observed cases represented by dotted lines).

Figure 3: Trends in observed presumed victims and estimated totals of presumed victims in the Netherlands, 2010-2015 by form of exploitation (sexual/other) (a: based on model with six lists, b: based on model with five lists)

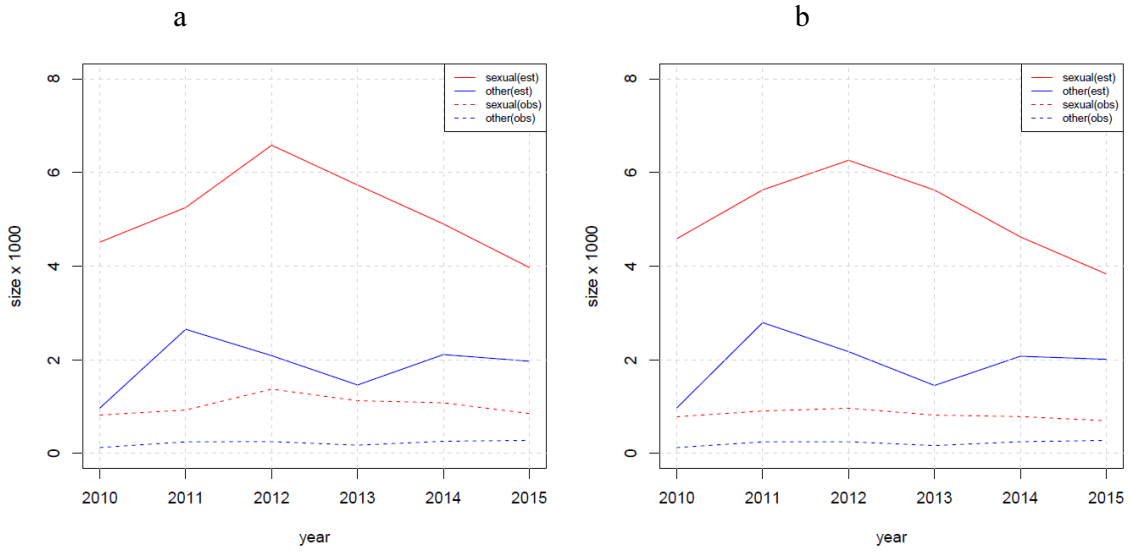


Figure 3 (a and b) conveys, first, that the numbers of estimated cases of sexual and non-sexual exploitation seem to follow different trends. Cases of sexual exploitation show a curved trend with a peak in 2012. Cases of non-sexual exploitation seem to have peaked in 2011. The ratios between estimated and observed cases are consistently smaller for sexual exploitation than for non-sexual exploitation over the years.

The trend lines of observed and estimated numbers of non-sexual exploitation in Figure 3a correspond to those in Figure 3b. The lines for sexual exploitation show some differences. As

opposed to Figure 3a, the number of observed cases does not clearly peak in 2012 in Figure 3b. Furthermore, the number of estimated cases of sexual exploitation in 2011 seems higher in Figure 3b than in Figure 3a. These estimated cases of sexual exploitation seem to peak in 2012 in both Figure 3a and 3b, although the peak in Figure 3b is a bit lower.

Next, possible differences between the ratios between estimated and observed cases for the covariates of sex, age and nationality have been examined. In the model based on six lists the relative dark figures of male victims are comparable to those of female victims (on average 1 out of 4.8 male victims is observed, and 1 out of 5.2 female victims). In the model based on five lists however, the relative dark figure of female victims (1 out of 6.3 female victims is observed) is higher than that of male victims (1 out of 4.9 male victims is observed). The results also show that the ratios between estimated and observed cases are 1.7 (six lists) / 1.5 (five lists) times as high for underage victims as for adult victims. The victimization of minors of both sexual and non-sexual exploitation seems to be more hidden than that of adults.[11] Finally, the dark figure ratios for Dutch and non-Dutch nationals is considered separately. These results show that non-Dutch victims are 2.8 (six lists) / 2.5 (five lists) times as likely to be detected, or at least reported, than Dutch victims (for full results see appendix A2, A3, A4 and A5).

Estimations disaggregated by sex, age, form of exploitation and nationality

Before portraying the other key results in graphs, first, the breakdowns of the estimated total numbers of victims by sex, age, form of exploitation and nationality are presented below in a summary table (Table 8). In every cell, two numbers are presented: the first number represents the estimate based on the model with six lists, and the second number, the estimate based on five lists.

[11] Since the numbers of victims in these subcategories of underage victims are very small, the results have not been included.

Table 8: MSE-based estimates based on respectively six and five lists of the population of presumed victims of human trafficking in the Netherlands in 2010-2015 (x 1000), totals and disaggregated by year, sex, age, form of exploitation and nationality (first figure refers to six list and second figure to five lists)

	female	male	minor	adult	sexual	other	Dutch	non-Dutch	total
2010	**4.9/5.0**	**0.6/0.6**	**1.6/1.3**	**3.9/4.2**	**4.5/4.6**	**1.0/1.0**	**3.1/3.3**	**2.4/2.2**	**5.5/5.6**
2011	**6.5/7.1**	**1.4/1.3**	**2.0/1.9**	**5.9/6.5**	**5.3/5.6**	**2.7/2.8**	**3.7/4.6**	**4.2/3.8**	**7.9/8.4**
2012	**7.5/7.3**	**1.1/1.1**	**2.4/2.2**	**6.3/6.2**	**6.6/6.3**	**2.1/2.2**	**4.7/4.9**	**3.9/3.5**	**8.7/8.4**
2013	**6.4/6.3**	**0.8/0.8**	**2.1/2.6**	**5.1/4.5**	**5.7/5.6**	**1.5/1.5**	**4.4/4.4**	**2.8/2.7**	**7.2/7.1**
2014	**6.0/5.7**	**1.1/1.0**	**1.9/1.9**	**5.1/4.8**	**4.9/4.6**	**2.1/2.1**	**3.8/3.8**	**3.2/2.9**	**7.0/6.7**
2015	**5.0/4.8**	**1.0/1.0**	**1.7/2.1**	**4.2/3.8**	**4.0/3.8**	**2.0/2.0**	**3.4/3.3**	**2.5/2.6**	**5.9/5.8**

The results given in Table 8 indicate a strong overrepresentation of females among the estimated total numbers of victims in all years. Since 2012, the numbers of female victims have declined as opposed to the number of males.

The estimated numbers of underage victims fluctuate around 2,000 per year (in both models). Their proportion of the total is on average 28/29 per cent (six/five lists).

The estimated numbers of victims of non-sexual exploitation also centered around 2,000 in the period 2012 – 2015. In these years, the proportion of victims of non-sexual exploitation has increased somewhat (from 24 per cent (six lists) / 26 per cent (five lists) in 2012 to 33 per cent (six lists) / 34 per cent (five lists) in 2015). Finally, it can be observed that Dutch victims are in the majority with the exception of 2011 in the model with six lists when the numbers of non-Dutch victims surpassed those of Dutch victims.

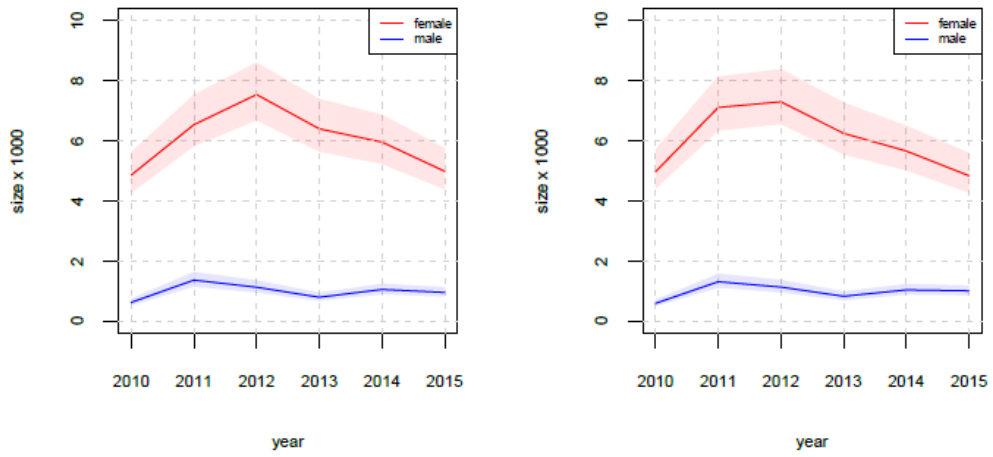
In comparison to the estimated numbers based on the model with six lists (the first numbers given in each cell), the estimated numbers based on the model with five lists (the second numbers) include, as from 2012, less females, adults, victims of sexual exploitation and non-Dutch victims (the latter with the exception of 2015). This corresponds to the fact that the particular type of trafficking reported by the Border Police by definition concerns cross-border trafficking for sexual exploitation which involves predominantly female victims (because of the required element of sexual exploitation), adults, and non-Dutch (because of the required cross-border element).

Graphs with estimated rates

The following figures will graphically present the trends in estimated numbers of the various subgroups defined by age, sex, form of exploitation and nationality (for absolute numbers see appendices A2 to A5).

Figure 3, above, showed the separate trends for sexual and non-sexual exploitation. These will not be repeated. Figure 4 depicts the trends in female and male victims. The distribution according to gender roughly resembles that of form of exploitation, with few male victims of sexual exploitation. The 95 per cent confidence intervals are shown in shaded colours.

Figure 4: Trends in estimated totals of presumed victims in the Netherlands, 2010-2015 by sex (female/male) (a: based on model with six lists, b: based on model with five lists)

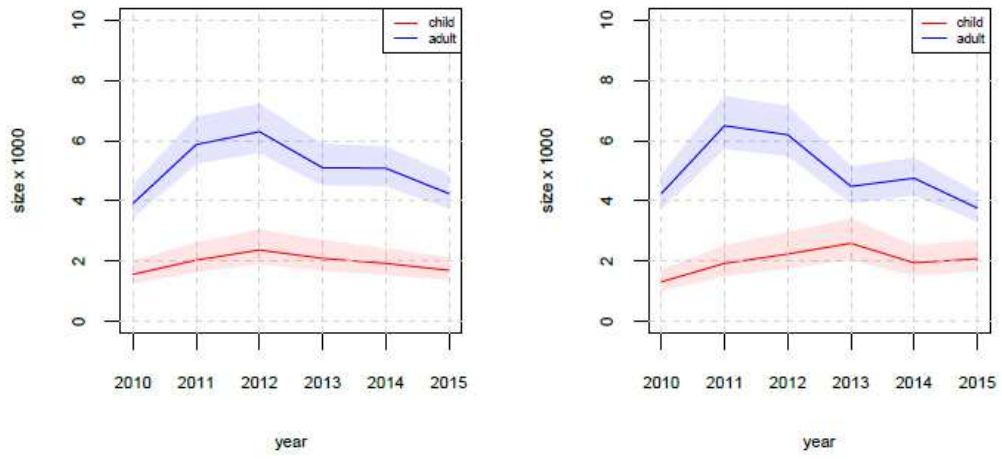


As expected, the trend lines in both Figure 4a and 4b of female victims closely resemble the ones for sexual exploitation. The estimated numbers of female victims seem to have peaked in 2012 and thereafter gradually declined to the 2010-level in 2015. The estimated numbers of male victims seem to have remained fairly stable over the years, although the trend lines in both models show a peak in 2011 that relates to the estimated cases of non-sexual exploitation (see Figure 3a and 3b).

The trend line of male victims in Figure 4a corresponds to that in Figure 4b. The trend lines of females, however, show some differences. In Figure 4b the number of estimated females seems higher, and as expected, in comparison to Figure 4a, Figure 4b shows, as from 2012 somewhat fewer female victims.

Figure 5 shows the separate trends in estimated numbers of adult and underage victims.

Figure 5: Trends in estimated totals of presumed victims in the Netherlands, 2010-2015 by age (minor/adult) (a: based on model with six lists, b: based on model with five lists)

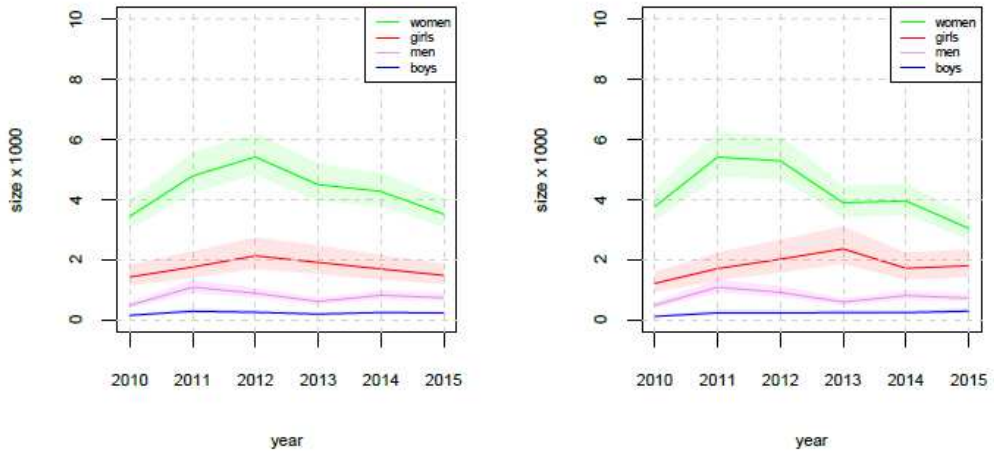


On average, underage victims make up at least a quarter of all victims in both models, varying between 26 per cent in 2011 and 29 per cent in 2010, 2013 and 2015 based on the model with six lists, and between 23 per cent in 2011 and 37 per cent in 2013 based on the model with five lists. The trend lines of estimated numbers of adult victims roughly mirror the curved trend in victims of sexual exploitation discussed above. The trends in underage victims seem to show less variation.

The two trend lines in Figure 5a largely correspond to those in Figure 5b, with the exception that adults peak in 2011 according to Figure 5b, instead of in 2012 (as in Figure 5a), and minors peak in 2013 according to Figure 5b, instead of in 2012 (as in Figure 5a). As expected, in comparison to Figure 5a, Figure 5b shows, as from 2012 somewhat fewer adult victims.

The next figures (Figure 6a and 6b) show the results for the four demographic subgroups defined by the covariates of sex and age.

Figure 6 Trends in estimated totals of presumed victims in the Netherlands, 2010-2015, by sex (female/male) and age (minor/adult) (a: based on model with six lists, b: based on model with five lists)



The disaggregation by age and sex reveals that both adult and underage victims of human trafficking are predominantly female. The trend line of adult females confirms the now familiar curve with peaks in 2011 (five lists) and, 2012 (six lists). As expected, in comparison to Figure 6a, Figure 6b shows as from 2012 somewhat fewer adult females. The numbers of girls also seem to have peaked in 2012 in the model with six lists, but based on the model with five lists in 2013, as opposed to adult females. The subcategories of males seem to have stayed fairly stable over the years, although the trend lines of adult males in both models seem to show a peak in 2011 that relates to the peak of estimated cases of non-sexual exploitation (see Figure 3a and 3b).

Figure 7 shows the results for the subgroups defined by sex and form of exploitation.

Figure 7 Trends in estimated totals of presumed victims in the Netherlands, 2010-2015 by sex (female/male) and form of exploitation (sexual/other) (a: based on model with six lists, b: based on model with five lists)

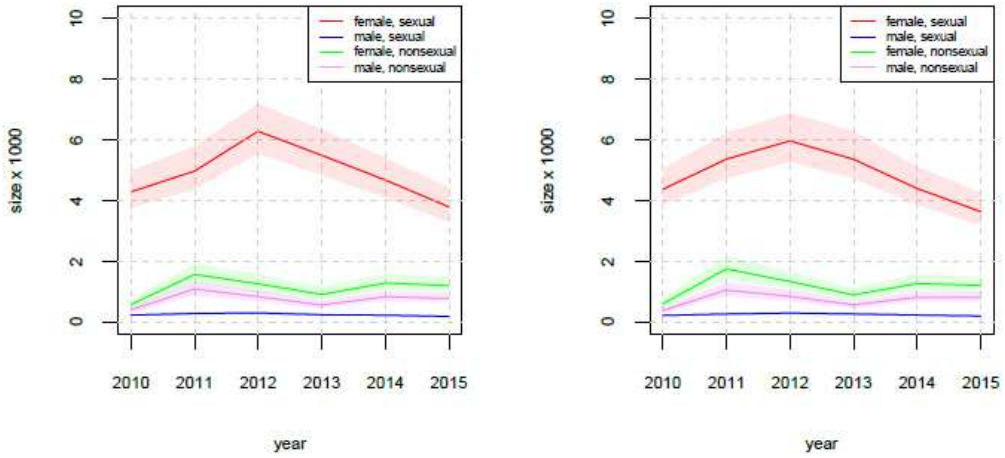


Figure 7 confirms that female victims of sexual exploitation make up the bulk of all victims in all years and seem to have peaked in 2012. The estimations indicate that the victims of sexual exploitation are rarely males (only 5 per cent in both models). Numbers of such victims, represented by the blue line, seem to have remained at a very low level in all years. Male and female victims of non-sexual exploitation seem to show very similar trend lines, with a peak in 2011 (which relates to Figure 3a and 3b).

As expected, in comparison to Figure 7a, Figure 7b shows, as from 2012, somewhat fewer female victims of sexual exploitation.

Figure 8 depicts the separate trends in estimates of victims of sexual and non-sexual exploitation disaggregated by age.

Figure 8 Trends in estimated totals of presumed victims in the Netherlands, 2010-2015 by age (minor/adult) and form of exploitation (sexual/other) (a: based on model with six lists, b: based on model with five lists)

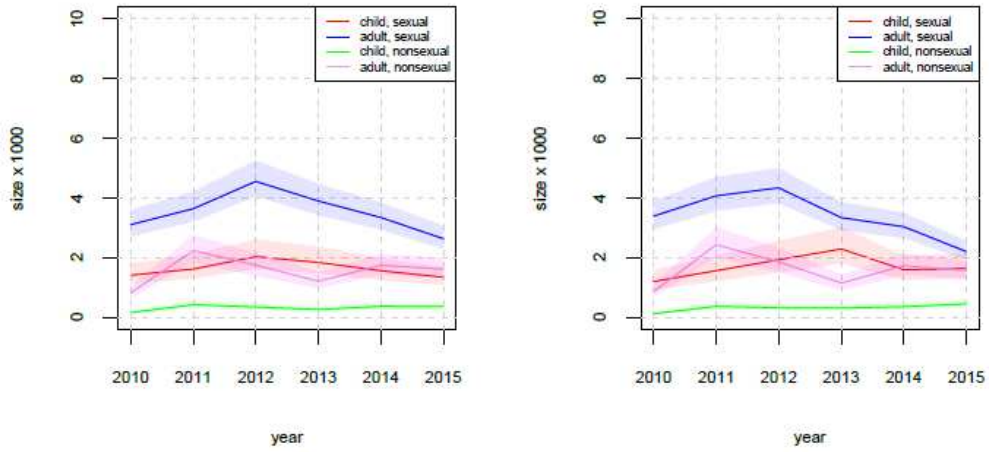


Figure 8 shows that the estimated numbers of the four categories of victims defined by age and form of exploitation each followed somewhat different trends. Estimated adult victims of sexual exploitation, mostly comprising females, seem to have peaked in 2012 and adult victims of non-sexual exploitation in 2011 (which relates to Figure 3a and 3b). The numbers of estimated underage victims of both sexual and non-sexual exploitation, for example, trafficking for criminal activities or forced begging, seem to show less pronounced changes over time since 2010. However, both trend lines in Figure 8a seem to follow those of adult victims in a somewhat flattened way: underage victims of sexual exploitation show a small peak in 2012 (also relating to the peak of girls in Figure 6a), and underage victims of non-sexual exploitation in 2011.

As expected, in comparison to Figure 8a, Figure 8b shows, as from 2012, somewhat fewer adult victims of sexual exploitation.

Estimations disaggregated by nationality

As explained, the estimation model included the covariates mentioned in the relevant indicator of the SDG Target 16.2 (age, sex and form of exploitation). In the Netherlands a large part of presumed victims of sexual exploitation recorded in recent years are Dutch victims of internal trafficking for sexual exploitation (Nationaal Rapporteur, 2016). For the reasons mentioned before, the Dutch National Rapporteur suggested to include as fourth covariate the dichotomous variable Dutch nationals/non-Dutch nationals. Figure 9 shows the

observed and estimated numbers of presumed victims for the years 2010-2015 disaggregated by nationality (for details see Appendix A4).

Figure 9 Trends in estimated totals of presumed victims in the Netherlands, 2010-2015 by nationality (Dutch/non-Dutch) (a: based on model with six lists, b: based on model with five lists)

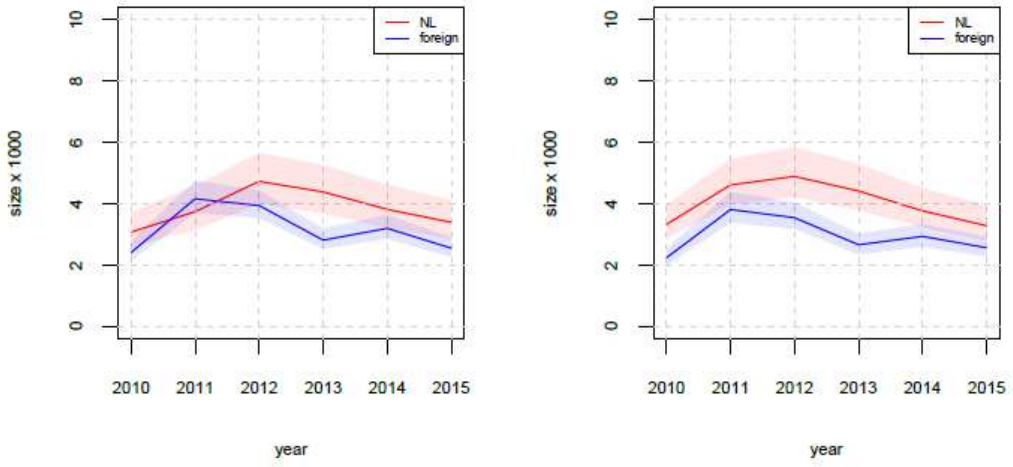
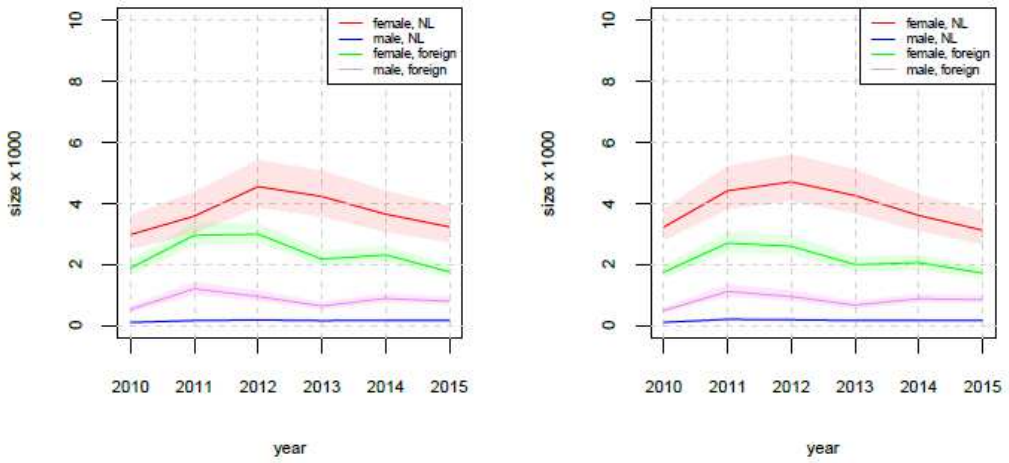


Figure 9 shows that the estimated numbers of presumed victims with Dutch nationality seem to have peaked in 2012, which relates to sexual exploitation (see Figure 3a and 3b). This confirms the assumption mentioned before (below Figure 2), about the peak in 2012 not being (exclusively) related to the particular type of trafficking reported by the Border Police (concerning female, adult, *non-Dutch* victims of trafficking for sexual exploitation). Instead, it turns out to be mostly related to (female) *Dutch* victims (of sexual exploitation). The numbers of estimated victims with non-Dutch nationality show the by now familiar peak in 2011 (and 2012), relating to non-sexual exploitation (see Figure 3a and 3b).

As expected, in comparison to Figure 9a, Figure 9b shows somewhat fewer non-Dutch victims (except for 2015).

Figure 10 shows the trends in the four categories defined by the variables nationality and form of exploitation.

Figure 10 Trends in estimated totals of presumed victims in the Netherlands, 2010-2015 by sex (female/male) and nationality (Dutch/non-Dutch) (a: based on model with six lists, b: based on model with five lists)

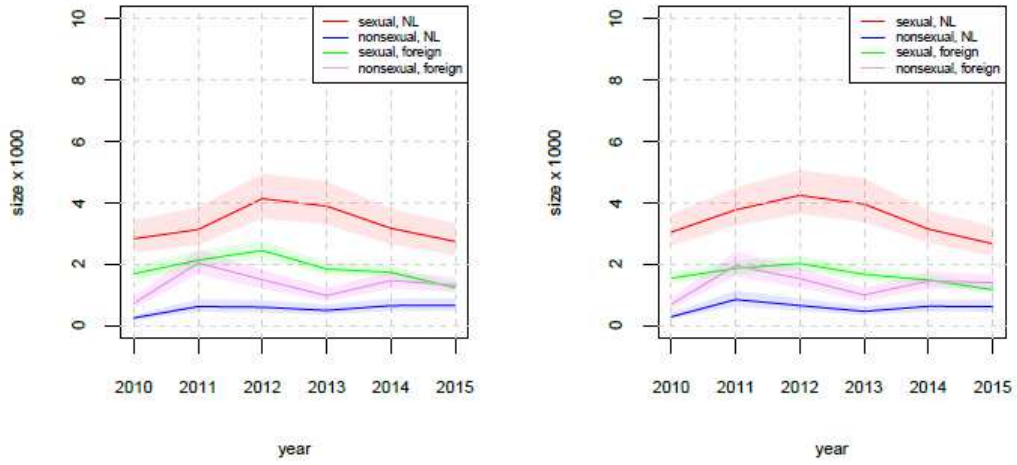


The results indicate that the estimated numbers of Dutch victims peaked in 2012 whereas the non-Dutch victims peaked in 2011 (and 2012) (see Figure 9). This finding highlights the peaking of the numbers of Dutch female victims in 2012 and of non-Dutch female victims in 2011 and 2012. The numbers of non-Dutch male victims also seem to have peaked in 2011, thereby contributing to the overall peak of non-Dutch victims in that year.

As expected, in comparison to Figure 10a, Figure 10b shows somewhat fewer non-Dutch female victims.

Figure 11 shows the results for Dutch victims of sexual exploitation, non-Dutch victims of sexual exploitation, Dutch victims of other forms of exploitation and non-Dutch victims of other forms of exploitation.

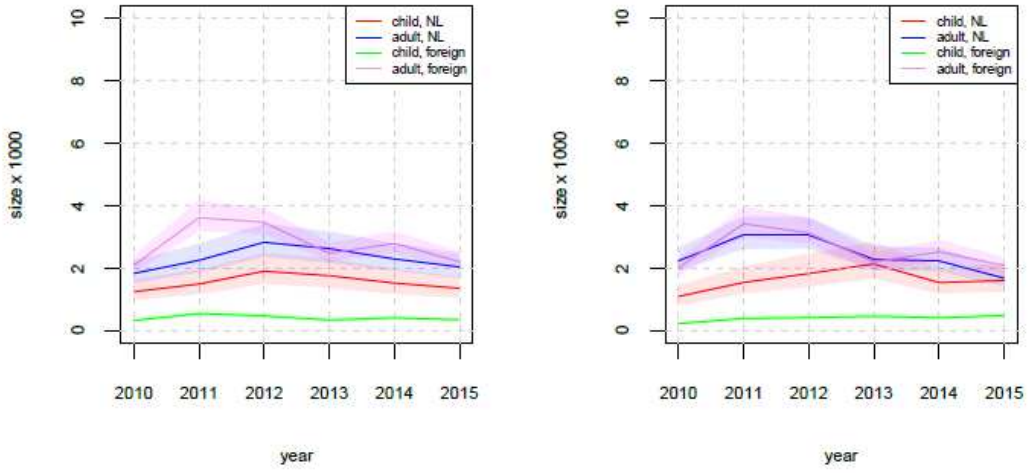
Figure 11 Trends in estimated totals of presumed victims in the Netherlands, 2010-2015 by form of exploitation (sexual/other) and nationality (Dutch/non-Dutch) (a: based on model with six lists, b: based on model with five lists)



The results in Figure 11a show that Dutch victims of sexual exploitation seem to have peaked in 2012, non-Dutch victims of sexual exploitation in 2012 and non-Dutch victims of non-sexual exploitation in 2011. Figure 11b shows similar trends, and as expected somewhat fewer non-Dutch victims of sexual exploitation.

Finally, below are the breakdowns of the estimated numbers by age and nationality.

Figure 12 Trends in estimated totals of presumed victims in the Netherlands, 2010-2015 by age (minor/adult) and nationality (Dutch/non-Dutch) (a: based on model with six lists, b: based on model with five lists)



The results show that adult non-Dutch victims seem to have peaked in 2011 (and 2012), and according to the model based on six lists, Dutch victims (both adults and minors) in 2012. According to the model based on five lists, however, adult Dutch victims seem to have peaked in 2011 (and 2012) and minor Dutch victims in 2013 (just as minors in Figure 5b, minor females in Figure 6b and minor victims of sexual exploitation in Figure 8b). As expected, in comparison to Figure 12a, Figure 12b shows, as from 2012, somewhat fewer non-Dutch adults.

6 Conclusions and discussion

The present study builds on the exploratory multiple systems estimation (MSE) by Silverman and Bales of the total numbers of presumed victims in the United Kingdom in 2013 based on data collected by various organizations, and the exploratory estimation of the numbers of presumed victims in the Netherlands recorded in 2014 (Van Dijk and van der Heijden, 2016). In the Netherlands, data on presumed victims are systematically reported by both involved state agencies and relevant NGOs to the NGO CoMensha on behalf of the Dutch National Rapporteur on Trafficking in Human Beings and Sexual Violence against Children. In the Dutch context, the concept of a presumed victim is defined as a person showing any signs of having possibly been trafficked/exploited, according to the broad definition of trafficking applied in the Netherlands. Persons with such status are entitled to special services and, when irregularly on the territory, protection from expulsion.

In order to make the estimates more robust, firstly, all presumed victims identified by different organizations and reported to CoMensha over a period of six consecutive years have been included (2010-2015). In total six different groups of organizations (lists) reported to CoMensha, among which the Border Police. The presumed victims reported by the Border Police concern presumed victims of a particular type of trafficking that is not informed by the Palermo Protocol. Moreover, this type of trafficking is no longer upheld as human trafficking by the Supreme Court in the Netherlands. For these reasons, two log-linear models have been fitted: one including those reported by the Border Police (based on six lists, concerning 8,234 presumed victims), and one excluding those exclusively reported by the Border Police (based on five lists, concerning 6,935 presumed victims).

Secondly, to enhance the robustness of the estimates they have been stratified for covariates with possibly different inclusion chances, namely age (minor/adult), sex (female/male), form of exploitation (sexual/other) and nationality (Dutch/non-Dutch). The incorporation of these covariates allows the calculation of one of the official indicators for SDG Target 16.2, namely

(16.2.2) the number of victims per 100,000 inhabitants disaggregated by sex, age and form of exploitation. In addition, the model allows the calculation of estimated numbers of Dutch and non-Dutch victims.

The key finding of this analysis is that in 2014 and 2015, the most recent years for which records are available, the total number of presumed victims of human trafficking in the Netherlands was approximately 6,500 (six lists) / 6,250 (five lists) per year. Expressed as rates per 100,000 population, the rate of presumed victims is about 38/37 (six/five lists) per 100,000 inhabitants per year.[12]

Disaggregated rates for sex, age and nationality should be calculated not per 100,000 inhabitants but per 100,000 inhabitants of the relevant population groups. The rates per year (based on the estimates for 2014 and 2015) are 32/29 victims (six/five lists) per 100,000 adult Dutch females and 1 per 100,000 adult Dutch males (in both models).[13] Assuming that no or very few victims of human trafficking in the Netherlands are younger than 12 years of age, the victimization rates of minors are: 235/257 (six/five lists) per 100,000 Dutch girls (between 12-17 years old) and 14 (in both models) per 100,000 Dutch boys (between 12-17 years old).[14] The rate of non-Dutch (legal or illegal) residents is 326/311 (six/five lists) victims per 100,000, or about fifteen/fourteen (six/five lists) times higher than for Dutch nationals (22 in both models) per 100,000).[15]

[12] According to Statistics Netherlands (in Dutch: CBS), in 2015 there were 16,900,726 legal residents with a Dutch or a non-Dutch nationality in the Netherlands and Van der Heijden, Cruyff and van Gils (2015) estimated that there were about 35,530 illegal residents in the Netherlands in the twelve month period July 2012 up to and including June 2013: which makes an estimated total of 16,936,256 residents (Dutch and non-Dutch, legal and illegal).

[13] According to Statistics Netherlands, in 2015 there were 16,053,457 legal residents with a Dutch nationality in the Netherlands (victimization rate of 22/22 (six/five lists) per 100,000 of the total Dutch population), of which 12,750,976 adults (victimization rate of 17/15 (six/five lists) per 100,000 of the total adult Dutch population): 6,486,646 females and 6,264,330 males.

[14] According to Statistics Netherlands, in 2015 there were 1,178,462 minors of twelve years or older with a Dutch nationality in the Netherlands (victimization rate of 122/133 (six/five lists) per 100,000 Dutch minors of twelve years or older, which is seven/nine (six/five lists) times higher than for Dutch adults): 576,043 girls and 602,419 boys.

[15] According to Statistics Netherlands, in 2015 there were 847,269 legal residents with a non-Dutch nationality in the Netherlands and Van der Heijden, Cruyff and van Gils (2015) estimated that there were about 35,530 illegal residents in the Netherlands in the twelve month period July 2012 up to and including June 2013: which makes an estimated total of 882,799 legal and illegal non-Dutch residents. Furthermore, there are about 754,259 legal and illegal non-Dutch adult residents (victimization rate of 331/306 (six/five lists) per 100,000), of which 376,373 females and 377,886 males (victimization rates of 481/430 (six/five lists) per 100,000 legal and illegal non-Dutch adult females, and 183/182 (six/five lists) per 100,000 legal and illegal non-Dutch adult males), and about 39,343 legal and illegal non-Dutch minors of twelve years or older (victimization rate of 954/1129 (six/five lists) per 100,000), of which 18,835 girls and 20,508 boys (victimization rates of 1,205/1,436 (six/five lists) per 100,000 legal and illegal non-Dutch girls of twelve years or older, and 724/846 (six/five lists) per 100,000 legal and illegal non-Dutch boys of twelve years or older).

In all years, female victims of sexual exploitation made up the largest part of the estimated total numbers of victims of human trafficking. However, these numbers seem to have somewhat declined since 2012. Almost all victims of sexual exploitation are females (on average 95 per cent in both models), and even the majority of victims of non-sexual exploitation are females (on average about 60 per cent is female in both models). The estimates indicate that male victims in the Netherlands are mostly victims of non-sexual exploitation. Only about a quarter of all males are victims of sexual exploitation, and they seem to account for only 5 per cent of all victims of sexual exploitation. However, since there is only a small number of *observed* male victims of sexual exploitation, the estimate for this subgroup has relatively large margins of error.

Furthermore, it is concluded that underage victims make up more than a quarter of the total number of victims. The estimated number of (Dutch and non-Dutch) minors victimized by either sexual or non-sexual exploitation is in 2014 and 2015, at 149/165 (six/five lists) per 100,000 persons in the age group of 12-17 years, staggeringly high. Finally, the study showed that in recent years among presumed victims of human trafficking Dutch nationals are in the majority.

Interpreting trends

The estimates of the total numbers of presumed victims during 2010-2015 show a curved trend. The numbers jumped from about 5,500 in 2010 (both models) to 7,900/8,400 (six/five lists) in 2011 and reached a plateau at 8,700/8,400 (six/five lists) in 2012. Thereafter the numbers dropped to 7,200/7,100 (six/five lists) in 2013, 7,000/6,700 (six/five lists) in 2014 and 5,900/5,800 (six/five lists) in 2015. This curved trend roughly mirrors the movement in recorded victims including the victims reported by the Border Police (see Figure 2a). Note that the numbers of recorded victims excluding the victims exclusively reported by the Border Police, present a more or less steady line, without clear peaks. The apparent estimated peaks in 2011 and 2012 based on these observed cases (model with five lists) therefore do not mirror the number of recorded victims excluding the victims exclusively reported by the Border Police (see Figure 2b).

The increase in the estimated number of victims in 2011 (in both models) seems for a large part (48 per cent/40 per cent) related to an increase in the estimated number of adult, non-Dutch victims of non-sexual exploitation, both females and males.

The peak in the estimated number in 2012 based on the model with six lists seems only to a limited extent accounted for by an increase in female, adult, non-Dutch victims of sexual

exploitation. Female Dutch victims of sexual exploitation (both minors and adults) seem to be mostly accountable for the estimated increase in 2012. Also, in the model with five lists, female Dutch victims of sexual exploitation (both minors and adults) seemed to increase. However, this did not result into a considerable increase in the total number of victims in this year, for this increase did not (as opposed to the model with six lists) surpass the decrease in the number of victims of non-sexual exploitation.

In conclusion

The most recent available estimates of the total number of presumed victims of human trafficking in the Netherlands are the ones for 2014 and 2015, namely 7,000/6,700 (six/five lists) and 5,900/5,800 (six/five lists) respectively, or approximately 6,500/6,250 (six/five lists) victims on average per year, as discussed above.

Since respectively 1,561/1,247 (six/five lists) and 1,321/1,149 (six/five lists) presumed victims were *recorded* in 2014 and 2015, this means that the estimated totals in the Netherlands of approximately 7,000/6,700 (six/five lists) and 5,900/5,800 (six/five lists) are four to five times higher than the recorded numbers (see Appendix A2 for details).

Dark figure ratios

MSE using models with covariates provides insight in the ratios between estimated and observed victims of the different subgroups. The findings reveal that this ratio is, consistently over the years, considerably higher for cases of non-sexual exploitation than for sexual exploitation (Appendix A2). Cases of non-sexual exploitation, in the Netherlands mainly consisting of labour exploitation in agriculture, the leisure industry, construction or the domestic sphere, are apparently more hidden than exploitation in the sex industry. The results also show that the exploitation of minors is in general less likely to be recorded than that of adults (Appendix A3). The policy implication of these results on the differential hidden figures is that the relevant organizations, notably the Inspectorate SZW and youth welfare agencies in the country, should step up their efforts to detect and report cases of labour exploitation and the exploitation of minors respectively. Finally, the results indicate lower detection rates for Dutch nationals than for non-Dutch nationals. This finding calls for sustained efforts of, inter alia, the Dutch police to detect cases of internal trafficking for sexual exploitation of Dutch women and girls.

The way forward

The inclusion of covariates such as age, sex, form of exploitation and nationality is recommended for policy reasons. Anti-trafficking policies should ideally be informed by data on the separate trends in various sub categories of human trafficking and in trends in the varying detection rates/dark figure ratios per category.

The breakdowns according to form of exploitation (sexual or non-sexual) and route of trafficking (internal or cross-border) – in the case of the Netherlands determined by nationality [16] – offer the possibility to improve international comparisons of estimated numbers by equalizing the definition of trafficking victims in these respects. If, for example, a country excludes victims of internal trafficking from its definition, both its recorded and MSE-estimated numbers of victims will be relatively low compared to those of other countries which cover exploitation of nationals. MSE cannot control for the use of widely divergent definitions of presumed or identified victims. International comparisons could be restricted to a common denominator such as the estimated numbers of victims of cross-border trafficking for sexual exploitation. Although such post hoc corrections in comparative MSE estimates seem feasible to some extent, further harmonization of definitions of human trafficking should remain a priority in future efforts to produce comparable international statistics regarding SDG Target 16.2 (Van Dijk & Van der Heijden, 2016).

The inclusion of covariates where available is also important to increase the robustness of the overall estimates per country. The current estimate for 2014 of 7,000 (six lists) victims in the Netherlands is considerably lower than the older estimate of 17,800 based on a one-year model without covariates (also based on six lists). A replication of the new, multi-year model without covariates also produced an estimate for 2014 considerably above 7,000.[17] These diverging findings suggest that inclusion of covariates such as age, sex, form of exploitation and nationality does, as expected, lead to different and more accurate estimates. The multi-year results also show that estimates based on models incorporating covariates are more stable over time. For technical reasons inclusion of these covariates is therefore to be recommended in future MSE-based estimations of the numbers of trafficking victims to the extent that the available numbers of recorded cases allow for it.

[16] Note that nationality/country of origin can only determine the route of trafficking (internal or cross-border) in countries where cross-border trafficking exclusively/predominantly involves cross-border trafficking from other countries to the country in question (instead of (also) from the country in question to other countries).

[17] The estimates of a model without covariates are consistently different from those of more complex models, though not necessarily always higher (see appendix A1).

The results also suggest that the use of larger, multi-year samples, although complicating the fitting of the models, ultimately produces more robust results. In countries were no historical data are available, multi-year models can be developed incrementally by replicating MSE studies in the future.

The overall recommendation for future studies is to use, where possible, multi-year datasets with the covariates age, sex, and form of exploitation. In countries where both nationals and non-nationals are subject of anti-trafficking policies, the covariate of nationality should also be included. A requirement for the use of such complex models seems to be the availability of relatively large datasets. When using large datasets, the use of BIC for model selection and bootstrapping is recommended for assessing the goodness-of-fit of the models. In the goodness-of-fit assessment the requirement that p-values are higher than 0.05 can be relaxed in order to avoid overfitting.

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Appendices

Appendix A1: Population size estimates (x 1,000) based on model with four covariates and on model with six registers only

	Model with covariates	Model without covariates
2010	5.5	4.0
2011	7.9	7.0
2012	8.7	18.0
2013	7.2	13.0
2014	7.0	10.5
2015	5.9	5.3

Appendix A2: Observed and estimated presumed victims, and ratio estimated/observed for totals and by form of exploitation (sexual/non-sexual) [18]

	Observed totals, 6 lists	Observed totals, 5 lists	Estimated totals, 6 lists	Estimated totals, 5 lists	Estimated ratio, 6 lists	Estimated ratio, 5 lists
2010	992	953	5,484	5,562	5.5	5.8
2011	1,222	1,200	7,905	8,424	6.5	7.0
2012	1,704	1,277	8,671	8,435	5.1	6.6
2013	1,428	1,103	7,196	7,078	5.0	6.4
2014	1,564	1,249	7,013	6,702	4.5	5.4
2015	1,325	1,152	5,942	5,846	4.5	5.1

	Observed sexual, 6 lists	Observed sexual, 5 lists	Estimated sexual, 6 lists	Estimated sexual, 5 lists	Estimated ratio, 6 lists	Estimated ratio, 5 lists
2010	861	824	4,513	4,586	5.2	5.6
2011	967	946	5,253	5,629	5.4	6.0
2012	1,437	1,013	6,582	6,260	4.6	6.2
2013	1,240	923	5,732	5,625	4.6	6.1
2014	1,255	952	4,901	4,625	3.9	4.9
2015	972	801	3,971	3,834	4.1	4.8

	Observed non-sexual, 6 lists	Observed non-sexual, 5 lists	Estimated non-sexual, 6 lists	Estimated non-sexual, 5 lists	Estimated ratio, 6 lists	Estimated ratio, 5 lists
2010	131	129	971	975	7.4	7.6
2011	255	254	2,652	2,795	10.4	11.0
2012	267	264	2,090	2,175	7.8	8.2
2013	188	180	1,463	1,453	7.8	8.1
2014	309	297	2,112	2,077	6.8	7.0
2015	353	351	1,971	2,012	5.6	5.7

[18] In some cases the reported observed frequencies slightly diverge from the observed frequencies in the data. (e.g. the reported observations sum to 8,235 instead of 8,234 in the case of 6 lists, and to 6,934 instead of 6,935 in the case of 5 lists). This is due to rounding error when imputing missing values on the covariates.

Appendix A3 Observed, estimated, and ratio estimated/observed presumed victims by age (minor/adult)

	Observed minor, 6 lists	Observed minor, 5 lists	Estimated minor, 6 lists	Estimated minor, 5 lists	Estimated ratio, 6 lists	Estimated ratio, 5 lists
2010	153	138	1,564	1,315	10.2	9.5
2011	198	194	2,035	1,928	10.3	9.9
2012	222	217	2,371	2,239	10.7	10.3
2013	262	261	2,093	2,594	8.0	9.9
2014	295	290	1,926	1,946	6.5	6.7
2015	349	343	1,698	2,082	4.9	6.1

	Observed adult, 6 lists	Observed adult, 5 lists	Estimated adult, 6 lists	Estimated adult, 5 lists	Estimated ratio, 6 lists	Estimated ratio, 5 lists
2010	839	815	3,920	4,246	4.7	5.2
2011	1,024	1,006	5,869	6,496	5.7	6.5
2012	1,482	1,060	6,300	6,196	4.3	5.8
2013	1,166	842	5,103	4,484	4.4	5.3
2014	1,269	959	5,087	4,756	4.0	5.0
2015	976	809	4,244	3,764	4.3	4.7

Appendix A4 Observed, estimated and ratio estimated/observed presumed victims by nationality (Dutch/non-Dutch)

	Observed Dutch nationals, 6 lists	Observed Dutch nationals, 5 lists	Estimated Dutch nationals, 6 lists	Estimated Dutch nationals, 5 lists	Estimated ratio, 6 lists	Estimated ratio, 5 lists
2010	321	320	3,075	3,325	9.6	10.4
2011	341	340	3,743	4,613	11.0	13.6
2012	434	432	4,731	4,891	10.9	11.3
2013	458	458	4,384	4,417	9.6	9.6
2014	482	476	3,815	3,768	7.9	7.9
2015	446	445	3,392	3,281	7.6	7.4

	Observed non-Dutch nationals, 6 lists	Observed non-Dutch nationals, 5 lists	Estimated non-Dutch nationals, 6 lists	Estimated non-Dutch nationals, 5 lists	Estimated ratio, 6 lists	Estimated ratio, 5 lists
2010	671	633	2,409	2,236	3.6	3.5
2011	881	860	4,161	3,811	4.7	4.4
2012	1,270	845	3,940	3,544	3.1	4.2
2013	970	645	2,811	2,661	2.9	4.1
2014	1,082	773	3,198	2,934	3.0	3.8
2015	879	707	2,549	2,564	2.9	3.6

Appendix A5 Observed, estimated and ratio estimated/observed presumed victims by sex (female/male)

	Observed female, 6 lists	Observed female, 5 lists	Estimated female, 6 lists	Estimated female, 5 lists	Estimated ratio, 6 lists	Estimated ratio, 5 lists
2010	879	843	4,862	4,972	5.5	5.9
2011	995	974	6,540	7,114	6.6	7.3
2012	1,505	1,083	7,544	7,303	5.0	6.7
2013	1,262	939	6,403	6,252	5.1	6.7
2014	1,315	1,005	5,961	5,665	4.5	5.6
2015	1,048	876	4,989	4,839	4.8	5.5

	Observed male, 6 lists	Observed male, 5 lists	Estimated male, 6 lists	Estimated male, 5 lists	Estimated ratio, 6 lists	Estimated ratio, 5 lists
2010	113	110	622	589	5.5	5.4
2011	227	226	1,364	1,311	6.0	5.8
2012	199	194	1,127	1,131	5.7	5.8
2013	166	164	793	826	4.8	5.0
2014	249	244	1,052	1,037	4.2	4.3
2015	277	276	953	1,006	3.4	3.6