
Drug related deaths in the Nordic countries

- Revision of the statistical definition



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Preface

Recently the official statistics describing drug related deaths in Sweden were scrutinised¹. One of the most important findings was that statistical trend data of drug related deaths in Sweden was not comparable over time. The main reasons behind this being changes in coding practices and in methods used in forensic chemistry. As a result the national Swedish index was revised. It is within that context the revision of the NOMESCO-index should be seen.

In the process of investigating the topic at hand other related issues has emerged, such as the definition of the present index and the implementation of the same.

The participating countries were Denmark, Finland, Iceland, Norway and Sweden. The project was coordinated by The National Board of Health and Welfare, Sweden.

Lars Grönvik

National Board of Health and Welfare.

¹ Socialstyrelsen. Narkotikarelaterade dödsfall. Statistikutveckling och en analys av 2014 års dödsfall. Stockholm, 2016

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Summary

There is no internationally established statistical definition of drug related deaths, and different statistical indexes are used nationally or for groups of countries, the NOMESCO-variant being an example.

The Nordic countries share similarities with respect to forensic and statistic standards, but the toxicology methods has developed at different paces, making comparisons difficult.

The drug situation do diverge even in a Nordic context, with especially Iceland having a drug situation completely dominated by pharmaceutical drugs, whereas the situation in the other Nordic countries involve more traditional street drugs.

It seems clear that the current definition used in the NOMESCO-setting has been poorly communicated, and additionally has been differently interpreted between countries, and over time in one single country.

Taken together this calls for a clear-cut definition with no room for misinterpretations, as well as a definition that is robust to differences in drug markets. Another desired feature would be a definition that can harbour future developments in terms of drug use preferences, not the least appearing new psychoactive substances.

In the report three recommendations are given, in rank order. The most favourable recommendation is a broad definition that share the characteristics mentioned above. The definition includes drug poisonings X40-X44, X60-X64 or Y10-Y14 as underlying cause of death, disregarding the intent.

The second most favorable definition is based on the European definition used by the EMCDDA. The definition is readily available, and widely published regardless.

The third most favorable definition is an updated version of the current NOMESCO-index. Since the respondents report no use of the data, besides for NOMESCO purposes, this seems the least likely route forward.

Background

Measuring drug related deaths is rather complicated and the fact that there is no widely accepted definition of drug related deaths does not make it easier. In the European Union data are presented by the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA), according to a standardized set of diagnoses to be extracted from national cause of death registries. However, it is not uncommon that other national definitions are used at the national level. It is also a fact that data are provided to other international bodies (i.e. UNODC) using different selection criteria.

There are also differences with respect to how the data collection is done at national level. In some countries data originates from general cause of death registries, whilst in others the data originates from what sometimes are referred to as a special registries. Special registries can be run by forensic institutes or police. It is not unusual that both types of registries co-exist.

Drug related deaths and mortality among drug users

Not only are there differences with respect to data collection procedures, there are also a number of different ways to define drug related mortality.

The most common way to describe the situation is the crude numbers of drug related deaths, at a certain point in time (typically during a calendar year) or as the development over a period. A slightly more sophisticated way of describing trends is deaths per capita figures. The base population in the above cases are the population in the country.

An alternative way of describing drug related mortality is by studying the mortality in a defined population. This can be a complicated task, but is fairly simple in Sweden and presumably in the other Nordic countries, with personal identity numbers, allowing a follow-up of a defined population using treatment data.

What is a drug related death?

In general terms the question might seem straightforward and a clear answer could be expected. After a closer examination however, it can be concluded that the question can't be answered without clarifying what kind of aspect we want to examine. Some central features with respect to drugs and mortality worth to consider are listed below:

- Direct poisonings - the substance or substances are toxic alone or in combination
- Health consequences from abuse not in the temporal vicinity of death

- Other harmful consequences related to the psychoactive properties of drugs, such as accidents
- Findings of drugs in body fluids in a toxicology analysis - regardless of the health implications of the drug intake

Another statistical factor is that deaths due to poisoning can be divided into accidental, intentional events of self-harm, undetermined intent and harm inflicted from others. In other words; the poisonings can be categorized as overdoses, suicides and assaults. Due to the difficulties to determine the intent, especially with respect to poisonings, a not negligible number of deaths will be categorized as undetermined intent.

Depending on the question at hand, in most countries there are numerous ways to approach the phenomenon of drug related deaths. At least from a statistical point of view there are a number of choices that can, and should, be made as to carve out a definition fitting a certain purpose. Further, what substances should be included also have to be decided. Should only substances that are assumed to have an abuse potential be included? Only illicit drugs? Or should toxicity be a guiding principle?

Results from a Swedish study on drug related deaths

The National Board of Health and Welfare (NBHW) were in 2015 instructed by the Government to develop statistics on drug-related mortality. Within the framework of the mandate, the NBHW conducted an indepth analysis of drug-related deaths in 2014.

According to the measure of drug-related mortality in the NBHW official statistics, the number of drug related deaths has increased. In recent years, the increase has been significant and between 2013 and 2014 the increase was 30 percent. Up until 2011 the increase is largely associated with the construction of the measurements used and improved information on death certificates. For example, certain drugs have been phased out from the market and replaced by others, which have not been taken into consideration when the number of deaths have been reported.

The increase from 2012 onwards coincides with the National Board of Forensic Medicine (NBFM), which examines the causes of most drug-related deaths, introduced new analytical procedures in 2011. The new methods improved the sensitivity of the analyses and meant that the RMV performed analyzes on a greater number of substances, including certain NPS.

The NBHW overall assessment is that the increase in drug-related deaths reported mainly is explained by the changes in methodology. However, a real increase in drug related deaths in recent years cannot be ruled out¹.

¹ Socialstyrelsen. Narkotikarelaterade dödsfall. Statistikutveckling och en analys av 2014 års dödsfall. Stockholm, 2016

A brief description of the Nordic countries

Definitions on what should be regarded as drug related deaths differ. Often there are specific national definitions in different countries. There are also definitions that are used for a set of countries. Examples are EMCDDA and NOMESCO.

Below each country is described shortly with respect to their specifics regarding the drug situation. Comparing figures between countries should always be done with great caution, something that holds particularly true for drug-related deaths. Most information for an overall picture of the drug problems in the respective countries, except Iceland, are retrieved from the country overviews, at the EMCDDA website².

Additional information was collected through on site interviews in Iceland and in Norway. Information from Finland and Denmark was collated through a questionnaire, see appendix 1.

Denmark

Injecting drug use was estimated to 13 000 persons in 2006 and the opioid substitution program currently include over 6 000 clients. There is also a heroin program for the most seriously affected heroin users. There is no information available on the numbers of syringes distributed. Overdose deaths according to the EMCDDA definition has been rather stable for the last decade and the rate per million population (15-64 years) is 57, 6 drug induced deaths.

Registration of drug related deaths in Denmark

A forensic examination (not necessarily a forensic autopsy) should be undertaken when death is unclear or when drug abuse is suspected. The death certificate is issued by a physician. The death certificates are then forwarded to the Danish Health Data Authority. Usually this is done electronically. The national mortality statistics are published by the Danish Health Data Authority.

Development of forensic toxicology has been continuous and methods has been developed “as the drugs appear on the market”. Mass spectrometry technology (TOF) was introduced in 2009. The number of toxicology tests has not increased however.

Finland

According to EMCDDA there are close to 14 000 high-risk opioid users in Finland (mainly illegally used buprenorphine) and some 3 000 clients in opioid substitution treatment. Over 5 000 000 syringes was distributed in 2015 from syringe exchange programs.

The trend show some increase of the numbers of overdose deaths over the last decade, including a clear decrease since 2012. When population growth is accounted for the rate per million population (15-64 years) is 43 drug induced deaths.

Registration of drug related deaths in Finland

In Finland, the police initiate the medico-legal investigation of unexpected deaths after consulting the doctor making the clinical examination. The grounds of these investigations are declared in the law resulting in a very high rate of forensic autopsies (about 18 per cent of all deaths).

The development of forensic toxicology took an important step in 2003 when time-of-flight mass spectrometry was introduced. Since then the development has been gradual and should not affect statistics more than marginally.

Death certificates are issued by forensic pathologists, verified at the National Institute for Health and Welfare. Statistics on causes of death are published by Statistics Finland.

Iceland

The drug situation in Iceland is rather different from that in the other Nordic countries, probably resulting from the country's geography. The situation is probably best described as propelled by diversion from the pharmaceutical drugs market. It can also be noted that prescription figures for classified drugs are remarkably high. Per capita prescription of methylphenidate was the highest in the world in 2012³.

Additionally, sales of opioid analgesics in Iceland was at a comparatively high level during the period 2005-2016. The trend in Iceland also deviated from the other countries with a successive increase, whereas sales in Denmark, Finland, Norway and Sweden showed a stable or decreasing trend⁴.

Registration of drug related deaths in Iceland

A forensic investigation is decided by the police, if the circumstances call for it. The development in forensic chemistry has been more or less constant since the 1960:s and the present standards are in line with other Nordic countries. In some cases forensic tests have, and still are, carried out in Denmark or Norway but the results interpreted in Iceland. Coding of death certificates are made at the Directorate of Health, and one interesting feature in this context is that the coder has access to all information in the forensic report.

The statistical information on drug related deaths is collected from the Causes of Death Register maintained at the Directorate of Health. Statistics on causes of death are published by the Directorate of Health and Statistics Iceland. There is no national definition of drug related deaths available in Iceland.

Norway

There are around 9 000 reported high-risk opioid users in Norway, in addition to approximately 7 500 opioid substitution clients. Clients entering treatment report more than one drug, and opioids are frequently reported in a poly drug context. The number of persons estimated to inject drugs was 8 400 in 2012. Around 2 500 000 syringes was distributed in 2015.

Overdose deaths has been stable over the last decade and the rate per million population (15-64 years) is 76 drug induced deaths.

Registration of drug related deaths in Norway

According to the Norwegian Criminal procedure Act, a forensic autopsy is only mandatory where death is suspected to have been caused by a punishable act, in cases where the deceased is unidentified or among deceased younger than 18 years. However, a forensic autopsy is also recommended in suicides, accidents and cases of sudden, unexpected death. Further, the doctor is obliged to report such cases to the police, also including cases of suspected drug related deaths [6]. A forensic autopsy is thus not performed in all suspected intoxication deaths, but it is estimated that approximately 90 percent of the cases are subject to such an autopsy [7]. The police decide whether a forensic investigation should be undertaken.

There is no national definition of drug related deaths in Norway, instead the EMCDDA definition is used. Unlike Sweden no major methodological changes has been made in Norway. Some detection levels were lowered in 2012. Due to the fact that essentially nonlethal concentrations are being detected, and thus not registered as poisoning, this would most likely have had minor effects on the mortality statistics.

The number of substances screened for has increased as new substances appear. There has also been a slight increase in the number of forensic examinations since 2012.

Sweden

In Sweden the numbers of problem drug users has been estimated to be around 29 500 [8], and the estimated numbers of intravenous drug users to be approximately 8 000 [9]. The number of patients in opioid substitution treatment is reported to be 3 679, a proxy figure that most probably are slightly underestimated.

The numbers of syringes distributed from syringe exchange programs are relatively minor, compared to the other Nordic countries, just above 281 000. The number of overdoses show an increased trend and the latest available year there was 101 such deaths per million. Trend data are not reliable, as was described earlier, and 2006 as starting year (as in the EMCDDA country drug report) particularly unsuitable, since that year marks a low one important reason for this being a high rate of missing information on death certificates previous years.

Registration of drug related deaths in Sweden

The physician who determines the death shall decide whether there is reason for a forensic autopsy and, if so, report this to the police. These cases include cases such as murder, suicide, accidents or unexpected deaths. The police then request a forensic autopsy. Death certificates are then forwarded to the National Board of Health and Welfare where they are coded, registered and mortality statistics published.

Development of methods in the field of toxicology has been more or less constant, with new substances added to screening, lowered sensitivity etc. The great leap forward however was made in mid-2011 when present-day mass spectrometry techniques became available.

Similarities between the Nordic countries

To sum up, there are great similarities among the Nordic Countries on a system level; an examination by a physician makes a starting point, and the police then decides if a forensic investigation should be undertaken. The death certificates are then

transformed into ICD-codes at a national authority, usually also responsible for publishing national mortality statistics as the endpoint. The most striking dissimilarity is how the toxicology methods evolved in the Nordic countries, which potentially affects the comparability between countries.

On a more detailed level there are also other differences. In Iceland and Norway for example, the organization responsible for coding death certificates, also have full accesses to forensic reports. In Sweden, as a comparison, this information is not accessible.

Factors influencing data

Several factors might influence the data, besides the true levels of drug related deaths. One factor is the technical development in the field of forensic chemistry, another is coding procedures. Sociocultural factors are there of course, but the scope of this report will be limited to technical issues.

The development in forensic chemistry does differ between the countries, with Sweden scaling up with time-of-flight mass spectrometry relatively late, in 2011 and 2014. This has also affected trend data to some extent, as more cases were identified. In Denmark on the other hand, the development of forensic chemistry methods is reported to have no impact on the mortality statistics.

Unclear NOMESCO-definition

One obvious weakness relates directly to the design of the current index. A definition of drug related deaths in terms of ICD-codes can leave more or less room for interpretation. In the case of the NOMESCO-definition, this room has been relatively large. This has most likely led to that different interpretations have been made over time, as well as different interpretations between countries. By the data presented in table 1.1 it seems plausible that at least Norway and Sweden have made different interpretations. The levels in Norway far exceed those in Sweden in almost all age groups (see table 1.1). According to the EMCDDA drug related mortality is somewhat higher in Sweden than in Norway.

Table 1.0 Deaths from drug related causes per 100 000 inhabitants by age and gender (partial), 2014

	Denmark	Finland	Iceland ¹	Norway	Sweden
<i>Men</i>					
0-34	2.7	2.4	2.2	8.2	7.1
35-44	10.9	3.6	4.7	19.2	8.8
45-64	6.7	1.3	2.5	21.0	7.8
65-74	0.7	0.4	3.7	5.7	1.7
75+	1.2	0.6	2.4	5.6	1.1
Total	4.6	1.9	2.7	12.7	6.5
<i>Women</i>					
0-34	1.4	0.5	1.8	2.1	1.8
35-44	2.7	1.2	2.9	6.6	2.9
45-64	2.7	1.2	2.5	11.3	3.6
65-74	1.3	0.8	1.8	8.0	2.5
75+	1.6			6.5	1.0
Total	1.9	0.8	2.0	6.0	2.4
<i>Men and Women</i>					
0-34	2.1	1.4	2.0	5.2	4.5
35-44	6.8	2.2	3.8	13.1	5.9
45-64	4.7	1.4	2.5	16.3	5.7
65-74	1.0	0.9	2.7	6.9	2.1
75+	1.4	0.8	1.0	6.2	1.0
Total	3.2	1.3	2.4	9.3	4.4

1 2010-14

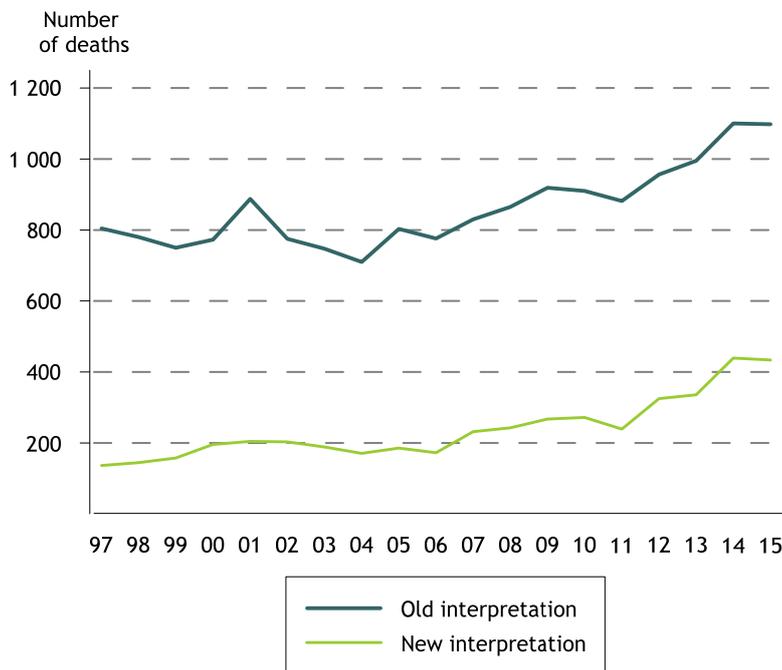
Source: Health statistics for the Nordic countries, 2016⁴

Critic of the index for drug-related mortality

In the annually published NOMESCO-report the index is defined as: “ICD-10: F11-F16. F18-F19. O35.5. P04.4. X40-X49. X60-X69. Y10-Y19. T40.0-T40.3. T40.5-T40.9. T43.6⁴”.

The ambiguity of the index is perhaps best described by the fact that Sweden at first interpreted the definition as any death with the mentioning of any of the codes F11-F16. F18-F19. O35.5. P04.4. X40-X49. X60-X69. Y10-Y19 as underlying cause of death or T40.0-T40.3, T40.5-T40.9, T43.6 as main injury. However, after communication with NOMESCO this was reinterpreted as any death with F11-F16, F18-F19, O35.5 or P04.4 as underlying cause of death or X40-X49, X60-X69 and Y10-Y19 as underlying cause of death in combination with T40.0-T40.3, T4.05-T40.9 or T43.6 as main injury, see figure 1.1.

Figure 1.1 Drug-related mortality in Sweden according to the old and new interpretation of the NOMESCO-index, 1997-2015



Source: National Board of Health and Welfare

The main problem with the first interpretation is that it includes poisoning by and exposure to alcohol, poisoning by and exposure to organic solvents and halogenated hydrocarbons and their vapors, poisoning by and exposure to other gases and vapors and poisoning by and exposure to pesticides without considering whether any narcotic has been involved. Thus, this will overestimate the number of deaths, mainly due to the impact from alcohol poisonings.

No matter the interpretation of the index it does not include poisonings with some of the substances that are commonly abused: fentanyl, buprenorphine and tramadol among other opioids are not included (code T40.4). Another group of substances that is widely abused is benzodiazepines coded as T42.4.

Please find the SAS-code used for the different Swedish interpretations of the index in appendix 2.

Recommendations for the future

Based on the report on the Swedish situation, as well as information gathered from the respondents in this project, our first recommendation is a broad definition taking into account recent development at the drug market, as well as differences between the Nordic countries.

Today's drug market are to a larger extent than before affected by the availability of psychoactive pharmaceutical drugs. In combination with this the markets are constantly changing, one example is new psychoactive substances (NPS) entering drug markets as to evade legislation, nationally or internationally.

Below are three different recommendations as to describe the development of drug related deaths within the NOMESCO framework. The suggestions are made in rank order, thus the first being most favorable from our point of view. NOMESCO will have to take a decision based on the report at hand. Regardless of which recommendation is chosen, the definition should be applied retrospectively.

The number of substances screened for has increased as new substances appear. There has also been a slight increase in the number of forensic examinations since 2012.

Recommendation 1

The recommended definition includes deaths with drug poisoning as underlying cause of death, disregarding the intent. The only exception is poisoning by assault which is not included.

Thus, no difference is made between accidental poisonings (X40-X44) or poisonings due to intentional self-harm (X60-X64). Poisonings where the intent is unclear (Y10-Y14) are also included.

Table 2.1 Description of the recommended index

Underlying cause of death	Selected ICD-10 codes
Accidental poisoning	X40, X41, X42, X43, X44
Intentional poisoning	X60, X61, X62, X63, X64
Poisoning undetermined intent	Y10, Y11, Y12, Y13, Y14

Properties

- Straightforward definition, no risk for mix-up
- Improved comparability
- Makes room for changes (in the drug situation or changes in coding procedures)
- Includes suicide by poisoning with the mentioned substances
- Does not include abuse (F11-F16, F18-F19)

Taken in consideration that the current composite measure of drug related deaths has been interpreted differently both between countries and over time, it seems necessary to opt for a clearer definition.

The drug situation differs even between the Nordic states; i.e. misuse in Iceland tend to be more related to use of pharmaceutical drugs, compared to the other Nordic countries, and a broader definition which embraces these differences is requested.

Recommendation 2

All Nordic countries, except Iceland, report data on drug related deaths to EMCDDA. The index is described below and data readily available.

Table 2.2 Description of the EMCDDA index for drug related deaths

Underlying cause of death	Selected ICD-10 code(s)
Disorders	F11-F12, F14-F16, and F19
Accidental poisoning	X42 ¹ , X41 ²
Intentional poisoning	X62 ¹ , X61 ²
Poisoning undetermined intent	Y12 ¹ , Y11 ²

1 In combination with the T-codes: T40.0-9

2 In combination with T code: T43.6. Several ICD-10 updates for codification of deaths due to drug intoxications were adopted by WHO in 2002 and 2003 by the Heads of WHO Collaborating Centres for International Classifications in Health Care and entered into force in 2006. For the countries that have already implemented these ICD-10 updates some additional combination of codes should be included. They are: X44, X64 and Y14 in combination with main injury codes (T codes) T40.0 through T40.9 and T43.6 [10]

Properties

- Clear definition, little risk for mix-up
- Available
- More uniform reporting to international bodies
- No inclusion of benzodiazepines

Recommendation 3

According to available information there is no more information available than a series of ICD-codes with respect to the current NOMESCO-index, namely the following:

ICD-10: F11-F16. F18-F19. O35.5. P04.4 or X40-X49. X60-X69. Y10-Y19. T40.0-T40.3. T40.5-T40.9. T43.6

As was mentioned earlier in this report, this gives room for alternative interpretations, which certainly is a problem in itself. The index does also have some features that has to do with validity. One problem refers to the code X45, X65 and Y15, which are connected to alcohol. If the definition is applied without caution this means that alcohol poisonings will be included.

The other validity problem refers to the absence of the code T40.4. The code include, among other substances, fentanyl, buprenorphine and tramadol. With alterations made to deal with these issues, the index-measure can be described as an updated version of the existing NOMESCO index measure.

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Appendix 1

The data collection was made through personal interviews with experts on site in Iceland and Norway. Information from Finland and Denmark was collected in a questionnaire presented below.

Review of the drug Nomesko related death index

The Nomesco-index describing drug-related mortality has not been revised since 2004, when it first appeared. A review of the index and its use in the respective countries would help to increase knowledge, quality and comparability.

- 1 Is there a national index of drug related deaths (other than NOMESKO or EMCDDA)? If so, how is the index constructed?
- 2 Are there any principles when a forensic examination should be undertaken?
- 3 Please describe in general terms the process for toxicological analysis:
 - a. What methods are used?
 - b. What changes have taken place?
 - c. Has the number of screened substances changed over time?
 - d. Has the number of tests changed?

In Sweden a number of changes have taken place, which potentially has an impact on drug related mortality statistics. The table includes some of these events. Please use the table to describe the development concerning toxicology (delete the Swedish examples).

Year	Event
2000	
2001	
2002	
2003	Buprenorphine can be detected
2004	
2005	Oxycodone is included in the drug analysis
2006	
2007	
2008	Drug-analysis is carried out on all cases where urine is available
2009	
2010	Buprenorphine is included in the drug-analysis
2011	New screening method (TOF)
2012	New method for methadone. L47-method starts to be routinely used. One substance included in L47 is methylphenidate
2013	
2014	The proportion and number of deaths among young adults, 15-39 years, where forensic examination is carried out increases while at the same time the total number and proportion of deaths that are not examined decreases
2015	

- 4 In your assessment, have the method development in forensic medicine affected the statistics regarding deaths due to poisoning?
- 5 Is it possible to extract information on specific substances from the death certificates?
- 6 How is the reporting to the national cause-of-death registry organized?
 - a. Who issues death certificates?
 - b. Where are the death certificates sent?
 - c. Who publishes the national mortality statistics?
- 7 How is the current NOMESKO-index used?
- 8 Do you think a specific Nordic index is relevant?
- 9 What authority/organization is responsible for national reporting to NOMESKO, EMCDDA?
- 10 Do you have any ideas with respect to improvements of the current NOMESKO-index describing drug related mortality?
- 11 Please feel free to provide other information you find relevant.

Please provide some basic morality data in the table below:

Cause of death	Year	N	Clinical autopsy	Forensic investigation	Toxicology
All deaths X40-44, X 60-64, Y10-14 as underlying cause of death NOMESCO-index	Latest available		N	N	N

Finally, please do not hesitate to contact me if something is unclear.

Appendix 2

In Sweden two different interpretations has been made out of the NOMESCO-codes at different point in time. Below the SAS-codes are presented.

Old interpretation

```
data na;
  set r_dors.r_dors9711(keep=ar kon alder lkf ulorsak kap19);
  where ar eq 2011 and ('F11'<=:ulorsak<=: 'F16' or 'F18'<=:ulorsak<=: 'F19 ' or
  ulorsak=: 'O355' or
    ulorsak=: 'P044' or 'X40'<=:ulorsak<=: 'X49' or 'X60'<=:ulorsak<=: 'X69' or
    'Y10'<=:ulorsak<=: 'Y19' or 'T400'<=:kap19<=: 'T403' or
    'T405'<=:kap19<=: 'T409' or
    kap19=: 'T436');

run;
```

New interpretation

```
data na;
  set a_dors.a_dors(keep=ar kon alder ulorsak kap19);
  where ar eq 2012;
    if 'F11'<=:ulorsak<=: 'F16' then nark='1';else
    if 'F18'<=:ulorsak<=: 'F19' then nark='1';else
    if ulorsak=: 'O355' then nark='1';else
    if ulorsak=: 'P044' then nark='1'; else
    if ('X40'<=:ulorsak<=: 'X49' and ('T400'<=:kap19<=: 'T403' or
    'T405'<=:kap19<=: 'T409' or kap19=: 'T436')) then nark='1'; else
    if ('X60'<=:ulorsak<=: 'X69' and ('T400'<=:kap19<=: 'T403' or
    'T405'<=:kap19<=: 'T409' or kap19=: 'T436')) then nark='1';else
    if ('Y10'<=:ulorsak<=: 'Y19' and ('T400'<=:kap19<=: 'T403' or
    'T405'<=:kap19<=: 'T409' or kap19=: 'T436')) then nark='1';
    if nark='1';

run;
```

