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ARE ICD-10 CATEGORIES SUITABLE FOR DIAGNOSING INJURIES?

MULTIDISCIPLINARY ANALYSES OF THE ENGLISH, GERMAN, AND HUNGARIAN ICD-10 DIAGNOSIS CATEGORIES

Abstract

ICD-10 is a standardized diagnostic tool of the World Health Organization (WHO) for the documentation of findings to facilitate statistical comparability. It enhances fast diagnosis documentation using a globally readable coding. Physicians can therefore rely on a predefined, although not very complex diagnostic formulation even if it cannot replace a detailed diagnosis. However, in cases of bodily harm, unambiguous diagnoses and highly detailed descriptions of injuries are essential to allow forensic experts to assess injuries in criminal procedures within the continental legal system. A previous study (Fogarasi, 2012) showed that forensic assessment is impaired in Germany, Hungary, and Austria when terms in the diagnoses of injuries are not explicit enough from a forensic perspective. The methodology of diagnosing injuries is not standardised in the analysed countries. As diagnoses are primarily written for medical purposes, occasional subsequent forensic assessments of injuries may rely exclusively on the documentation, and are therefore hindered by the lack of forensic aspects. This study aims to investigate the prevalence of ICD categories in diagnoses, and the extent to which ICD-10 categories are terminologically suitable for diagnosing injuries for subsequent forensic assessment in Germany and Hungary. The terminology of ICD categories was examined and analysed from forensic and criminal legal perspectives. An inability of forensic assessment to determine the nature and severity of injuries with certainty may have consequences on the criminal legal procedure. LSP instructors should therefore make their students aware of the importance of acquiring and using exact terminology that would enable them to prepare accurate documentation in their practice.

Keywords: diagnoses, ICD-10 Classification, injuries, forensic assessment, criminal procedure, different degrees of terminological equivalence

1. Introduction

Diagnoses comprise the most important piece of information in medical documentation, because accurate treatment plans can only be determined based on them. On the other hand, exact diagnoses are also essential to adequately inform patients about their treatment options, and to offer them the possibility to make a decision regarding their treatment and to give their consent to surgeries or other therapeutic measures. In practice, diagnosis categories established for statistical purposes are widely used instead of individually formulated diagnoses. Such categories are derived from the International Classification of Diseases (ICD), a classification system for Mortality and Morbidity Statistics developed collaboratively by the World Health Organization (WHO) and 10 international centres for medical statistics. The purpose of ICD is to facilitate the international comparability of the collection, classification, processing, and presentation of morbidity and mortality statistics. In 1893, the USA started to record statistics on the causes of deaths, and in 1948, the WHO was entrusted with devising the ICD. Since then, morbidity has also been included in the classification system (Moriyama, Loy, & Robb-Smith, 2011). This classification system is primarily used in research outcome monitoring, in health care management to allocate resources, and in epidemiology as an important indicator of health status in 117 countries and 44 languages. The sources of the classification are death certificates and health records. 43 national translations, and several national modifications (e.g. Australian, German modifications, etc.) have been created, and they slightly differ from the original version. In the USA, a very detailed version called *Clinical Modification*, which includes 68.000 diagnostic codes, is used. ICD is revised regularly, and the next revision is under preparation (Moriyama et al., 2011).

ICD-10 consists of 22 groups of diseases organized in chapters. Each chapter is marked by different blocks of alphanumeric codes. The classification system contains about 14.400 codes in total. These codes define the type of disease or condition and the affected body region using an alphanumeric coding scale. From a forensic aspect, Chapter XIX, titled *Injury, poisoning and certain other consequences of external causes*, and Chapter XX, titled *External causes of morbidity and mortality*, bear the most relevance, being in practice the two chapters used for the coding of injuries. Types of injuries are listed in Chapter XIX; therefore, this chapter is the most frequently cited one by medical professionals. Chapter XX lists further information relative to the circumstances of the injury: accident or bodily harm, medical intervention or complication of medical intervention, allergic reaction, poisoning, etc. These categories are divided in even more sub-categories describing the kinds of accidents, assaults, or other conditions. Diagnoses of injuries included in Chapter XIX are more relevant to the medical documentation than the circumstances of the incident included in Chapter XX so the latter is only provided to record additional data. Thus, the structure of Chapter XIX is more similar to that of all remaining chapters, which deal with conditions due to natural causes. Table 1 presents the coding system used in Chapter XIX.

(S00–S09) head
(S00) Superficial injury of head
(S00.0) Superficial injury of scalp
(S00.1) Contusion of eyelid and periocular area
Black eye
(S00.2) Other superficial injuries of eyelid and periocular area
(S00.3) Superficial injury of nose
(S00.4) Superficial injury of ear
(S00.5) Superficial injury of lip and oral cavity
(S00.7) Multiple superficial injuries of head
(S00.8) Superficial injury of other parts of head
(S00.9) Superficial injury of head, part unspecified

Figure 1. Extract from Chapter XIX of ICD-10

The alphanumeric codes used in Chapter XIX represent the following categories: The letter (S or T) stands for a kind of disease, in this case for '*injury*'. The next two numbers specify the injury and the body region, here '*superficial injury of head*'. The last number separated by a dot indicates the anatomical unit in question even more precisely.

Within the Continental legal system, court-appointed forensic experts assess the severity of the injuries and the weapon involved, and then they reconstruct the underlying mechanisms of the injuries. This assessment is based on the clinical documentation of accidents and bodily harms (in case the victim survives; otherwise, a forensic autopsy takes place).

Chronologically, the first clinical treatment and the documentation of injuries are both performed by primary treating doctors, who are the first contact assessing the injury prior to, for example, the involvement of investigative authorities. These statements can be decisive in a criminal procedure at a later date (Schneider, 2017). However, in numerous cases, primary treating doctors are not aware of the fact that they are not only the first, but most probably also the only source of a lot of relevant information (Schneider, Fogarasi, & Riepert, 2014; Schneider, 2017). Following the treatment and after the healing process begins, the forensic interpretation of injuries cannot be carried out completely; that is, the underlying mechanisms or the age of injuries cannot be reconstructed. By that time, essential characteristics of soft tissue injuries like haematomas and wounds may change, or, in case of open wounds, the wound characteristics such as margins, edges, walls may not be seen anymore due to surgical wound care (Fogarasi, 2012). A previous study showed that not even in those German and Austrian forensic institutions, where there is a possibility to perform an almost immediate forensic examination, can the forensic assessment of already closed injuries be performed completely (Fogarasi, 2012). Consequently, in cases of insufficient clinical documentation, important evidence can be lost forever (Schneider, 2017).

In order to enhance forensic interpretability and application as evidence in a criminal procedure, clinical documentation of bodily harm should ideally include the *exact types*, the *exact numbers* and the *exact locations* of injuries, the *size*, the *extent* and the *depth* of each particular injury, information about the *approximate age* of injuries (especially in case of haematomas), possible *negative findings* and, if applicable, also *photo documentation* (Schneider, 2017).

As diagnoses are essential in assessing the inflicted injuries, ICD categories in Chapter XIX and XX may form the basis of the forensic expert opinion, unless the primary treating doctor involved in the case has decided to form their diagnoses individually. However, ICD categories were established for statistical reasons; therefore, they do not necessarily serve forensic purposes. Moreover, physicians are not obligated to document a case from criminal legal aspects at the time of medical treatment.

Current clinical documentation is inadequate as a basis to assess soft tissue injuries in about 20% of the cases due to information missing from the external descriptions of injuries and several terminological problems in the diagnoses, as proved in a large-scale corpus analysis of 106 German, 101 Austrian, and 339 Hungarian medical reports and related forensic expert opinions in 2012 (Fogarasi, 2012). The analysis focused on soft tissue injuries because they tend to heal faster and, as a result, there is no possibility for further examinations at a later date. The analysis showed that limited forensic interpretability results from a high degree of interdiscursivity. Interdiscursivity was defined by Bhatia (2010: 32) as a 'variety of discursive processes and professional practices, often resulting in mixing, embedding, and bending of generic norms in professional contexts.' In clinical documentation of soft tissue injuries, 'the mixing of technical expressions from various vertical and horizontal layers of LSP (language for specific purposes) and from different levels of terminologisation [...] frequently lead to interdiscursivity' (Fogarasi, 2012: 100). The consequences of interdiscursivity were frequently detected in the diagnoses of soft tissue injuries, most notably observed in inconsistent terminology pertaining to the types of injuries (Fogarasi 2012). In numerous cases, overly generalized diagnoses (e.g. *open wound*, *superficial injury*) were established. Furthermore, in about 50% of the injuries, *the side-aspect* was not recorded, although diagnoses should contain the injury location (Fogarasi, 2012).

In about 20% of the cases examined, the above-mentioned terminological problems observed in the diagnoses resulted in limited forensic interpretability (Fogarasi, 2012), which may potentially lead to legal consequences in criminal procedures. Further interdisciplinary analysis revealed that 'the use of inconsistent terminology together with insufficient description of injury characteristics might impair the work of the investigation authorities as well as jurisdiction.' (Fogarasi & Schneider) 'The investigative results can be distorted due to incorrect clinical documentation [...]. Secondly, different national standards in documentations can cause impairments in cross-border investigations' (Fogarasi & Schneider, 2015: 133).

Because of the mobility of patients, medical documentation should be explicit enough to allow unambiguous translations into other languages too. This aspect is essential if patients decide to obtain medical care abroad, and also, if patients are treated as victims of accidents or bodily harm in a foreign country and their medical documentation is written in a foreign language. However, extensive corpus and terminological analyses showed that there are terminological differences between different countries pertaining to the same types of injuries, e.g. between Hungary and Austria, even in the Latin terminology (Fogarasi & Schneider, 2015).

As ICD Classification is standardized by the WHO and has been translated into numerous different languages, it is intended to facilitate fast and consistent translations of diagnoses into other languages. Terminological incongruence is often found in translations and even in dictionaries (Šarčević, 1990). It results from a lack of equivalence between the terminology in the source and the target language, which can manifest itself on a conceptual level or on the

level of the terms used (Fischer, 2010). According to the traditional Wüsterian terminology theory, equivalence can only be understood as 'a relation between concepts having the same characteristics' (Sandrini, 1996: 346, based on Arntz & Picht, 1989: 159). Consequently, the lack of equivalence between the terms of two languages can be only based on the difference between the concept systems[1] of the source and the target language. The later theories accept the possibility of lacking equivalence on the level of designations (Arntz, Picht, & Mayer, 2004), but they still emphasize the differences on the conceptual level (Fischer 2010). On the other hand, a lack of equivalence at the level of designations was proved in studies, which detected a lack of terms representing the same part of speech in the target language (Heltai, 1998, and Drößiger, 2007 cited by Fischer, 2010: 83).

The analysis of conceptual relations in the terminology of injuries based on German, Austrian, and Hungarian corpora and literature revealed some conceptual differences between the (accident) surgical and the forensic medical approaches in both examined languages (German and Hungarian) (Fogarasi, 2012). On the other hand, conceptual equivalence regarding the terms of injuries (in the two fields respectively) was detected between the three languages (German, Hungarian, and English) (Fogarasi, 2012). Consequently, the accident surgical concepts of injuries are shared by English, German and Hungarian; although, they might differ from the concepts used in the forensic medical discourses within the same language, respectively.

In case of ICD-10 categories, terminological equivalence between the original English version and the national translations can be analysed on the conceptual level, because injuries are designated by nouns and the concepts were proved to be shared by the clinical discourse. As for the degrees of conceptual terminological equivalence, this paper follows Fischer's classification (2010) based on Arntz et al. (2004). According to this classification, *total equivalence* occurs if the all characteristics of two concepts are absolutely identical. If two concepts have only certain characteristics in common, the degree of equivalence is referred to as *intersection* (Šarčević, 1990). *Inclusion* refers to a relation of superiority or subordination between concepts. In the latter two cases, Šarčević (1990, 1997) speaks of *partial equivalence*. If the concepts in two languages are only partially equivalent, 'lexicographers tend to cite the closest analogous concept in the target language, [...] designating a concept, the function of which is the same as that of the source term' defined as *functional equivalent* (Šarčević, 1990: 439). *Non-equivalence* means that no characteristic is shared by two concepts. In such a case, a *translational equivalent* has to be created by translators in the target language to describe a concept of the source language (Fischer, 2010).

1 Concept systems are referred to as sets of concepts structured according to the relations among them (ISO 1087-1:2000, 3.2.11).

2. Research design

2.1. Aims of the study

The aim of the present study is to analyse the terminological congruence between the original English version of ICD-10 and the German and Hungarian versions. As previous studies (Fogarasi, 2012; Fogarasi & Schneider, 2015) have suggested that generalized diagnoses impair forensic assessment, the present study aims to examine the extent to which ICD diagnoses are suitable for substituting individually formulated diagnoses in case of injuries. In order to answer the above question, the frequency of ICD-categories used as diagnoses in the corpora of authentic clinical documentation of injuries needs to be established first (Fogarasi, 2012; Fogarasi & Schneider, 2015). Then, the English, German, and Hungarian versions of chapters XIX and XX of ICD-10 (including categories of types and causes of injuries) are compared, and their suitability to document injuries is analysed from various aspects, i.e. the aspect of terminological congruence, the forensic medical approach, the approach of the investigation authorities, and their relevance in criminal procedures.

2.2. Methods

A comparative terminological analysis of chapters XIX and XX of ICD-10 in the original English version as well as the German and Hungarian versions (all publicly accessible via the internet) was performed using manual, concordance, and statistical analysis. In addition, these two chapters were compared in the English version and in the greatly detailed Clinical Modification applied in the USA. All statistical data were processed in Microsoft Excel 2013.

Furthermore, corpora examined in previous studies (Fogarasi, 2012; Fogarasi & Schneider, 2015) were reanalysed to detect the frequency of diagnoses adapted from the ICD Classification. It was necessary to establish whether ambiguity in diagnoses results from the use of ICD, or from individual errors. A large-scale corpus of 339 Hungarian, 101 Austrian, and 106 German clinical documentation of soft tissue injuries and the related forensic expert opinions provided by the University Departments of Forensic Medicine of Pécs and Debrecen (Hungary), Freiburg, Mainz (Germany), and Graz (Austria) as well as by Institutes of Forensic Experts and Forensic Research (ISZKI) located in various different regions of Hungary from the time period between 1995 and 2011. Secondly, a corpus of 51 anonymized clinical documentation of soft tissue injuries (made available by the Department of Traumatology of the Johannes Gutenberg University of Mainz in 2011), and a corpus of 37 anonymized Austrian clinical documentation of injuries (not limited to a specific injury type and provided by the University Department of Forensic Medicine at the University of Graz, Austria in 2013) were reanalysed using the WordSmith 5.0 concordancing software. The results of the terminological analysis were interpreted from forensic and criminal legal perspectives, based on forensic medical literature. A criminal legal evaluation of the results was performed by a criminal lawyer, co-author of the present study.

3. Results

3.1. Structural comparison of the original English version (WHO, 2016) and the Clinical Modification of ICD-10 (2017) with the German (2014) and Hungarian (1995, 2009) versions

Regarding the structure of the classification, no differences could be detected between the original English version and the Hungarian translation. Chapter XX in the German version contains much fewer categories and subcategories than the original English version and the identical Hungarian one, because it lists the external causes of morbidity and mortality categorized into causal groups instead of giving a separate code to every single subtype. In contrast, Chapter XIX in the German translation was found to be more detailed than the English original and the Hungarian version, which is why it is called German Modification (ICD-10-GM) instead of simply the German version. However, even the German Modification turned out to be far less detailed than the Clinical Modification of the USA. Unlike the original ICD-10, the Clinical Modification allows for creating more accurate diagnoses using codes, as it contains subcategories and further subcategories for injury types on various body regions. Table 1 summarizes the numbers of categories, subcategories, and further subcategories of injuries, which can be coded with the different national versions of ICD.

Table 1
Structural differences between the original and national versions of ICD-10

Chapter XIX	English ICD-10 (vs. CM)	German Modification	Hungarian version
categories	1276 (CM: 1100)	1285	1276
subcategories	0 (CM: 3255)	577	0
further subcategories	0 (CM: 8680)	0	0
Chapter XX	**English ICD-10 (vs. CM)**	**German Modification**	**Hungarian version**
categories	335 (CM: 1266)	20	335
subcategories	87 (CM: 934)	22	87
further subcategories	0 (CM: 434)	0	0

3.2. The occurrence of vague expressions referring to types of injuries and locations in Chapter XIX

In Chapter XIX of ICD, a number of phrases are used to (over-)generalize categories for statistical purposes. These expressions are: *open wound* (*offene Wunde* in German, and *nyílt seb* in Hungarian), *superficial injury* (*oberflächliche Verletzung* in German and *felületes sérülés* in Hungarian), *unspecified* or *no other specification* / NOS (*ohne besondere Bezeichnung* in German, and *külön megnevezés nélkül / kmn* in Hungarian) or simply *other* (*anderer* in German, and *egyéb* in Hungarian). It is impossible to specify the diagnoses of soft tissue injuries by ICD categories. For example, *incised wound*, *animal bite*, *laceration*, etc., all fall within the category of *open wound* without individual specifications to distinguish them. The same applies to *abrasions*, *bruises,* and *blisters*, which can be recorded merely as *superficial injury*. Such vague expressions also occur in combinations in the same category, for example, '*Other and unspecified superficial injuries of throat*'. Table 3 shows the apparent frequency of vague expressions in Chapter XIX of all three ICD-10 versions, especially the words *other* and *unspecified*.

Table 2
The frequency of vague expressions in Chapter XIX of the different versions of ICD-10

The frequency of vague expressions in Chapter XIX in numbers	Original English version of ICD-10 (1276 categories) vs. CM (13035 categories)	German Modification (1862 categories)	Hungarian version (1276 categories)
open wound	276 (CM: 317)	132	92
superficial injury	140 (CM: 131)	65	61
unspecified / NOS	1612/ 727 = 2339 (CM: 4817/ 635 = 5452)	460/ 208 = 668	718
multiple	234 (CM: 225)	101	83
other	4014 (CM: 2895)	404	522

3.3. Locations of injuries in the categories of ICD-10 and in the other two national versions

As for the locations of injuries, ICD-10 categories include the parts of limbs, the types of tissues affected, and indicate whether an injury is unilateral or bilateral. Section S is designated to code injuries related to single body regions. Section T covers injuries to multiple or unspecified body regions. However, there are no codes for whether an injury affects the left or right side,

in case it is unilateral. It is possible to code multiple body regions if more than one body region is affected by an injury at the same time. On the other hand, in such a case, as many as 4 regions are cited within one code, without the possibility of further specification, e.g. T04.4.: *Crushing injuries involving multiple regions of upper limb(s) with lower limb(s)*. According to the WHO instructions, in those cases '*the word **with** in the title indicates involvement of both sites, and the word **and** indicates involvement of either or both sites*' (ICD 10-2017: XIX-1). The ICD-10 Classification also contains references to certain blood vessels, nerves, and ligaments.

3.4. Synonymy in the national versions and terminological congruence between the original English version and the national versions pertaining to types of injuries

Terminological analysis was performed to examine how consistently the original English version was translated into German and Hungarian. The original English version contains 126 different terms referring to types of injuries. Synonymy could be found in numerous cases in the national versions. In the original English version, there was only 1 synonym (in case of puncture and puncture wound). In the German version (German Modification), synonymy was detected in 5 cases, while in the Hungarian version it was found in 15 cases with as many as 6 synonyms detected for both *laceration* and *crushing injury*.

In case of synonymy, the different expressions used in the national versions were compared with respect to the classification of terminological equivalence. Table 3 summarizes the synonymous terms detected in the national versions, as well as the different degrees of terminological equivalence between the concepts of the English version and those in the German and Hungarian versions in the case of terminological incongruence. In the German version 2 expressions, and in the Hungarian version 11 expressions were found as only partially equivalent with the English terms. Non-equivalence was also revealed in the Hungarian translation of 4 terms. As a partially equivalent translation of *crushing injury* the expression összezúzódás ('*smash*') occurs in 6 cases (although only in headings without individual codes) and its non-equivalent Hungarian translation *zúzódás* ('*bruise*') occurs in 7 diagnosis categories in Chapter XIX of the Hungarian version.

3.5. Frequency of ICD-10 codes to diagnose injuries in authentic reports

Corpora of authentic medical reports on injuries examined in previous studies were re-investigated to establish how frequently categories taken from the ICD classification were used as diagnoses of injuries. ICD categories were used as diagnoses (without giving the alphanumeric codes) in 23% of 725 diagnoses in a large-scale Hungarian corpus consisting of 339 medical reports cited in forensic files (Fogarasi, 2012). The use of categories usually did not follow WHO instructions on precise coding, i.e. they used a single code even when multiple codes would have been required.

In the large-scale German corpus of 106 medical reports cited in forensic files, 8 ICD categories could be found as diagnoses (all in the subcorpus of Mainz), giving the codes too. On the other hand, a German corpus of 51 medical reports contained no ICD categories. As the latter corpus consisted of authentic photocopies of findings instead of citations of reports in

Table 3
Different degrees of terminological equivalence between the English version and the German (G) and Hungarian (H) versions in cases of inconsistent translations

Terms of injuries in the English version of ICD-10	Number of terms designating the same concept in the national versions	Total equivalence	Intersection	Inclusion	Non-equivalence
abrasion	German: 2 Hungarian: 2	G: Abrasio G: Schürfwunde (abrasion wound) H: horzsolódás (being abraded) H: horzsolás (abrasion)			
amputation	German: 1 Hungarian: 2	G: Amputation H: csonkolás H: amputatio			
animal bite	German: 1 Hungarian: 2 (separated by a komma)	H: állati eredetű harapás H: (állati eredetű) marás G: Tierbiss			
avulsion	German: 1 Hungarian: 3	G: Abriss (tear off) H: kiszakadás (tear out) H: kiszakítás (being torn out) H: leszakadás (being torn off)			
'black eye'	German: 1 Hungarian: 1	G: blaues Auge (blue eye) H: monokli			H: 'fekete szem' (black eye)
contusion	German: 2 Hungarian: 1	G: Kontusion H: zúzódás (bruise)		G: Prellung (bouncing off) H: sérülés (injury)	
crushing injury	German: 1 Hungarian: 5	H: összenyomatás (being crushed) H: összenyomatásos sérülés (crush injury) H: kompressziós sérülés (compression injury) G: Zerquetschung	H: összezúzódás (both crushing and bruising)		H: zúzódás (bruise) H: zúzódásos sérülés (bruised injury)
current	German: 1 Hungarian: 1			G: akut H: heveny (acute)	
cut	German: 1 Hungarian: 3	H: metszett seb (incised wound in both clinical and forensic terminology) G: Schnittwunde (incised wound)	H: átmetszés (cutting through)	H: vágás (cut in general language, chop in forensic medicine)	H: vágott seb (chop wound)

deprivation	German: 1 Hungarian: 2	G: Mangel H: nélkülözés H: deprivatio			
dislocation	German: 1 Hungarian: 3	H: luxatio H: ficam H: fog kimozdulás (luxation of tooth) G: Luxation			H: dislocatio
infection	German: 1 Hungarian: 2	G: Infektion H: fertőzés H: infectio			
intracranial injury	German: 2 Hungarian: 1	G: Schädel-Hirn-Trauma G: intrakranielle Verletzung H: koponyaűri sérülés			
laceration	German: 2 Hungarian: 6	H: szakított sérülés (disrupted injury) H: szakításos sérülés (disruption injury) H: laceráció G: Riss (rupture) G: Zerreißung (disruption)		H: szakadás (being disrupted) H: felszakadás (being disrupted upwards) H: szakítás (disruption)	
open wound	German: 1 Hungarian: 2	G: offene Wunde H: nyílt seb		H: sérülés (injury)	
penetrating	German: 1 Hungarian: 2	H: áthatoló (penetrating through) H: behatoló (penetrating into) G: penetrierend			
puncture	German: 0 Hungarian: 2	H: szúrás (puncture)		H: szúrt seb (stab wound)	
puncture wound	German: 1 Hungarian: 1	H: szúrt seb (stab wound) G: Stichwunde (stab wound)			
rupture	German: 1 Hungarian: 3	G: Ruptur H: repedés (rupture) H: szakadás (tear) H: ruptura			
sprain	German: 1 Hungarian: 2	H: rándulás H: distorsio G: Verstauchung			
tear	German: 2 Hungarian: 2	G: Riss (rupture, tear) G: Zerreißung (disruption)	H: nyúzódás (decollement)	H: sérülés (injury)	
traumatic	German: 1 Hungarian: 2	H: traumás H: baleset következtében (caused by accident) G: traumatisch			

forensic files, it was possible to establish that only ICD-codes (without ICD categories) were added at a later date, after detailed diagnoses had been formulated by primary treating doctors. In the large-scale Austrian corpus of 101 medical findings cited in forensic files, no ICD categories could be detected, except for some diagnoses which occur in ICD-10, but are also used as individually formulated ones (e.g. *Nasenbeinbruch*, cf. S02.2. *fracture of nasal bones*). However, in a smaller Austrian corpus of 37 original reports, which were not forensic citations, 21% of the diagnoses represented ICD categories (giving the codes).

4. Discussion

4.1. Structural congruence

As presented in 3.1., the structure of the Hungarian version is identical with that of the general English version of ICD-10. In most cases, the German Modification allows more specific coding of locations than the original English version, using an additional digit in the code numbers in Chapter XIX. Chapter XX in the German Modification summarizes the possible external causes of morbidity and mortality, categorized in more generalized groups than the original version. The ICD-10-CM allows the most detailed coding as it contains thousands of sub-subcategories.

4.2. Suitability of ICD categories to establish explicit diagnoses of injuries

4.2.1. Occurrence of vague expressions

As demonstrated in 3.2., there are numerous occurrences of vague expressions in the categories of the original English version (even in the Clinical Modifications of the USA) and in the national language versions. However, when translating the ICD from English to national versions, there seems to be a tendency of omitting vague expressions or further simplifying them. In the following paragraphs, the most frequent vague expressions found in clinical documentation will be discussed, such as *open wound*, *superficial injury*, *unspecified injury*, *multiple injuries,* and *other*.

These vague expressions make diagnoses inaccurate, because their meanings cannot be defined precisely. For example, ***open wound*** is described as '*a wound that disrupts the integrity of the skin*' (Mosby, 2016). The term *wound* can be understood as '*a physical injury to the body consisting of a laceration or breaking of the skin or mucous membrane often with damage to underlying tissue or an opening made in the skin or a membrane of the body incidental to a surgical operation or procedure*' (Merriam-Webster, 1995, location 70524). As this medical expression is included in Chapter XIX, which deals with injuries, it is obvious that its first meaning has to be taken into account. However, open wounds can be caused in different ways, resulting in different types of open wounds (e.g. incised wound, chop wound, lacerated wound, shot wound, bite wound etc.). Therefore, at the beginning of Chapter XIX, the following interpretation of the expression '*open wound*' is given: it includes animal bite,

cut, laceration. and puncture wound (the latter also without further specification and with a (penetrating) foreign body involved) (ICD-10, XIX-2). It is also interesting that *chop wounds* and *shot wounds* are not mentioned at all, and the generally used expression *cut* is used instead of the professional term *incision* or *incised wound*.

Although the Clinical Modification (ICD-10-CM) developed for clinical practice in the USA contains a more elaborate system of categories than the commonly used version of ICD-10, even this version fails to differentiate between the types of open wounds in detail. In the ICD-10-CM the most frequently used expression is *open wound*, and in several cases, in combination with the expression *unspecified*. Nevertheless, there are categories of open wounds that can be coded separately, marked by specific terms: e.g. bites (even insect bites, open bites), lacerations and puncture wounds. However, it is also remarkable that *cuts* are not mentioned in the Clinical Modification at all.

In the instructions of the general English version of ICD-10, the category of ***superficial injury*** is referred to as a generic term for abrasions, blisters (nonthermal), contusions including bruise and haematoma, injuries from superficial foreign body (splinter) without major open wounds and insect bites (nonvenomous) (ICD-10, XIX-2). Thus, these injuries cannot be coded separately, but merely as superficial injury, except for *contusion,* which, in some cases, has individual codes. Some of the concepts belonging to the terms listed above represent the relation of superiority or subordination, or the terms are synonyms. *Contusion* can be regarded as a synonym of bruise described as '*an injury transmitted through unbroken skin to underlying tissue causing rupture of small blood vessels and escape of blood into the tissue with resulting discoloration*' (cf. Merriam-Webster, 1995, location 24429). The mechanism of a bruise is defined as follows: '*bruises are [caused by] greater blunt force, when the injury involves the quick compression of tissues resulting in the injury and rupture of smaller blood vessels in the loose connective tissue under the skin, in the muscle tissue, perhaps in organs* [...]. *Above the bleeding the skin is intact, and the injured part of tissue shows through the skin in a brownish-reddish colour*' (Buris 1996: 81). As a result of the rupture of blood vessels, discolorations of the skin can develop, which are called *haematomas*. (Hematoma is referred to as '*a mass of usually clotted blood that forms in a tissue, organ, or body space as a result of a broken blood vessel*', (cf. Merriam-Webster, 1995, location 35185). Based on the above, *haematomas* are manifestations of *bruises* (*contusions*) such as *oedemas* (*swellings*), which occur in case the blunt force is not great enough to break blood vessels, or post-traumatic *redness of the skin* (Sótonyi, 2011). Nevertheless, in the instructions, the term *contusion* includes both bruise and haematoma, suggesting that the term *contusion* is used as a superior term of *bruise* too.

In the ICD-10-CM, the category of superficial injury also occurs very frequently (cf. Table 3). However, in the Clinical Modification, all types of *superficial injury* can be coded separately, while they do not have individual codes in the general English version of ICD-10. Abrasions, contusions, nonthermal blisters, superficial foreign bodies, nonvenomous insect bites, and even external constrictions can be assigned individual codes, categorized into groups of body regions. The term *contusion* seems to be used as a generic term for bruise and haematoma in the ICD-10-CM. For example, under code S00.33, the diagnosis category *Contusion of nose* includes both *Bruise of nose* and *Haematoma of nose* not specified by individual codes. This classification suggests that the term *bruise* comprises the cases of contusion where no haematomas develop.

The vague expressions ***unspecified***, ***multiple*** and ***other*** occur very frequently in the categories of types of injuries and body regions. In conceptual systems, usually more and more specific characteristics are added to the main concepts to narrow their extension, i.e. to make their subject field more specific. As a result, terms describing more specific subordinate concepts consist of more words than the term designating the main concept (Arntz, Picht, & Meyer, 2004). For example, the characteristics *displaced* or *non-displaced* can be added to the concept of fracture, each narrowing the extension of the original concept. However, in case of ICD-10, the exact opposite occurs: the additional vague expressions listed above seem to fulfil the function of widening the extensions of the concepts described in the diagnosis categories. Widening the extensions (i.e. denotations, scopes) of concepts might serve statistical comparability. In statistical data processing, each individual diagnosis case has to be assigned to a category, and it is almost impossible to offer a code for each existing phenomenon. However, through these expressions, the diagnoses turn out much less specific. Single-coding in numerous cases lacks explicit meaning, e.g. diagnosis code S00.8 *Superficial injury of other parts of head* or diagnosis code S31.8 *Open wound of other and unspecified parts of abdomen*, both cited from the general English version of ICD-10. As diagnosis categories containing such vague expressions cannot be associated with concepts via definitions, these categories cannot be regarded as terms according to terminology theory.

4.2.2. Possible locations of injuries in ICD categories

To ensure exact forensic interpretability, it is essential that medical documentation includes precise information on the numbers and locations of injuries (Schneider, Fogarasi, & Riepert, 2014), because not only the severity of each particular injury is taken into consideration, but also the overall picture of the bodily harm. This means that inflicting numerous slighter injuries can be classified as grievous bodily harm (Fogarasi & Schneider, 2015). Therefore, it is important that each injury described in detail is listed among the diagnoses too. On the other hand, exact locations recorded in the diagnoses help forensic experts to assign each diagnosed injury to its detailed description so that forensic experts can reconstruct the underlying mechanism of each injury correctly. For example, certain injury localisations are typical for self-imposed injuries, while other localisations are indicative for injuries inflicted by others. Also, for the assessment of the direction from which injuries might have been inflicted, forensic experts seek to obtain exact information on the location of the injury, especially if more than one person is suspected of committing a crime (Fogarasi, Schneider & Bajnóczky, 2014). However, ICD-10 classification does not contain explicit information on site of the injury, except for indicating whether an injury is uni- or bilateral. Only the Clinical Modification of ICD-10 allows the separate coding of right- and left-side injuries. However, it also offers the possibility to choose a code without providing information on the location of the injury. The instructions given to the German Modification require recording the additional mark G (gesichert = proved) for diagnoses which have already been proved. Furthermore, they at least recommend the use of another mark (R for right side, L for left side and B for both sides) for the affected side (cf. Schneider, 2017, based on DIDM, 2014). Multiple coding is recommended by all national versions of ICD-10 to specify both the types and the locations of injuries, but in cases of complex, multiple injuries it would require a lot of time, considerable

care and professional knowledge, so it could only be performed by trained staff. Therefore, in practice, only single codes are recorded without using additional marks (Schneider, 2017).

4.2.3. Different classifications of injuries in the clinical and the forensic medical approach

A previous study (Fogarasi, 2012) showed limited forensic interpretability of medical documentation in case of soft tissue injuries due to information deficiency and terminological problems. From a terminological point of view, differences in classification were revealed between the classification of injuries in the forensic medical and clinical discourses in both Hungarian and German.

In Hungary, especially the differences between terms depicting contusion and types of wounds can lead to misunderstandings between clinicians and forensic experts. In accident surgery the terms *zúzott seb* and *zúzott sérülés* (meaning 'contused wound' and 'contused injury') are used to describe *lacerated wounds*, while in forensic medicine the term *repesztett seb* ('ruptured wound') is applied. In the classification of forensic medicine, the term 'zúzott seb' does not exist; however, 'zúzódás', created from the same root word, means contusion. Consequently, if clinicians use the term *zúzott sérülés*, forensic experts might understand it as contusion, which is a closed injury without disruption of the continuity of the skin, instead of an open one (Fogarasi, 2012). Until recently, incised and chop wounds were classified in the literature of accident surgery as only one category (*metszett és vágott seb*, 'incised and chop wound') from a therapeutical point of view (Fogarasi, 2010). On the other hand, the forensic medical approach makes a clear distinction between these types: the incised and the chop wound. In the case of an incised wound, a bladed instrument penetrates the tissues moving parallel to its blade. In the case of a chop wound, the instrument moves perpendicularly to its blade, and with great kinetic energy because of the great weight of the object, e.g. an axe (cf. Sótonyi, 2011). Because of these differences in classification, in 30% of the injuries caused by sharp objects, the terms relating to incised and chop wounds were used interchangeably in Hungarian findings (Fogarasi, 2012).

Examining the English version of ICD-10 and its clinical modification, ICD-10-CM, it appears that neither of the two classification systems allows for the coding of chop wounds and shot wounds. However, the Clinical Modification includes separate codes for blast injuries and more detailed specified lesions, e.g. lesions of the nervous system. The latter also allows the separate coding of injuries affecting the female or male urogenital region. In the general version of ICD-10, *cut* is mentioned as a subordinate category of *open wound*, although this word, borrowed from the general language, is less terminologised than the usual medical term *incision*. The ICD-10-CM only allows the coding of unspecified open wounds in the case of incised injuries. This categorisation suggests that both the general English version of ICD-10 and ICD-10-CM were developed following only clinical aspects rather than including the forensic approach. The terminological analysis of ICD categories suggests that the differences in classification of soft tissue injuries found between the clinical and forensic medical approaches in Hungary and Germany appear to exist in the English terminology as well.

In the general English version, different types of fractures (e.g. comminuted, depressed, spiral, etc.) cannot be coded separately. Coding only determines whether a fracture is open

or closed. Neither can codes be used to specify different types of dislocations, strains, sprains, and types of injuries to the nervous system, to blood vessels, to muscles and tendons, as well as to internal organs. However, especially in the case of soft tissue injuries, it would be essential for diagnoses to use the most precise terms for types of injuries in order to enhance a complete reconstruction at a later date of the underlying mechanisms and the severity of injuries.

4.3. Terminological consistency in the national translations of the original English ICD-10

4.3.1. Partial equivalence

When comparing the national translations with the original English version of ICD-10, several synonymous terms were detected in the national translations of Chapter XIX (especially in the Hungarian one), reflecting the same concepts expressed by the same terms in the original English version. Although a new, revised edition of the Hungarian ICD-10 was published (Egészségügyi Stratégiai Kutatóintézet, 2009), in which some of the mistranslations listed below have been corrected, this new version has not yet been enforced and is therefore not in use. Detailed terminological analysis was performed to examine whether all synonymous terms listed in the national versions can be regarded as equivalents of the source language terms. Based on the different degrees of equivalence, each synonym or close-synonym was classified in Table 4. In most cases, total equivalence was found between the English term and several different Hungarian synonyms, e.g. in the case of *avulsion*, *laceration,* or *rupture*. Selectional restrictions seem to influence the choice of target language equivalents in the case of explicitly defined terms, since 'in all languages there are restrictions in respect of which words can appear together. [...] Selectional restrictions are those which in a given language can be naturally deduced from the propositional meaning of words.' (Sanchez, 2009: 81). In the case of *avulsion* for instance*,* all Hungarian terms can be regarded as total equivalents, but the selection of the specific verbal aspects (tearing out, being torn out or tearing off) comprised in the different nominalized forms depends on which anatomical term they are combined with (cf. Table 4).

In the German Modification, the term *Prellung* can be considered as a partial equivalent of the English term *contusion*, because *Prellung* is a word borrowed from colloquial language and can be defined as 'an injury caused by great collision or hit causing haematoma' (Duden, 2003: 1380). This expression primarily describes the process of 'bouncing from or off something', from a semantic point of view (cf. Fogarasi, 2012: 49). In contrast to *Prellung*, both medical German terms *Quetschung* or *Kontusion* have the same definition and classification as the English term *contusion*, as described in 4.2.1. Therefore, only the latter two can be considered as total equivalents of *contusion*. In cases of partial equivalents, the national versions often contained less precise and less specific information on the injuries (cf. Table 4).

4.3.2. Non-equivalence

In the Hungarian version in use (Népjóléti Minisztérium, 1995), 4 cases of non-equivalence were detected. One of them should not cause any difficulties in practice because it only occurs as an additional term under code S00.10, i.e. under the heading *Contusion of eyelid and periocular area - Black eye* (*A szemhéj és szemkörüli terület zúzódása - Fekete szem*), and only in the first printed version of the Hungarian ICD-10 (Népjóléti Minisztérium, 1995). The word-for-word translation of the English term *black eye* in the Hungarian target language can only refer to black eye colour (meaning the pigmentation of the iris) rather than to a periorbital haematoma, the meaning the original term conveys. An appropriate Hungarian equivalent is *monokli,* which can be found in certain copies of the 1995 translation of ICD-10. In the other 3 cases, non-equivalence can lead to confusion and misunderstanding. Firstly, the English term *dislocation* was translated into Hungarian in all cases using the two words *ficam* and *dislocatio* as synonyms (luxation, dislocatio), with the latter meaning fracture displacement in Hungarian surgery (Gaál, 2012) defined as 'a traumatic bone break in which two ends of a fractured bone are separated and out of their normal positions' (Mosby, 2016: 549), while *dislocation* in English means a kind of joint injury entailing 'displacement of one or more bones at a joint, called also luxation' (Merriam-Webster, 1995, location 27712). In the Hungarian terminology, the total equivalents of *dislocation* are only *luxatio* and the Hungarian term *ficam*, having the same definition as the original English term. Thus, the non-equivalent translation of *dislocation* with the corresponding Latin form *dislocatio* erroneously suggests a severe bone fracture instead of a joint injury.

Secondly, as a subordinate term of *open wound*, the term *cut* is listed 11 times in Chapter XIX of the original English version, once in plural, although none of these can be coded individually. In the Hungarian version, *cut* is translated in 5 cases as átmetszés (cutting through over its full length or width), in 3 cases as *vágás* (cut) and in 1 case as *metszés* (incision). In 2 cases (T01.90) *vágott, metszett sebek* (chop wounds and incised wounds) or *metszés, vágás* (incision, chop) were translated as one category, although only as a subordinate term of the generic category open wound, without individual codes. Although the English expression *cut* is not a professional term, the professional Hungarian translation is *metszett seb* (incised wound) or *metszés* (incision), while átmetszés could only be a partial equivalent. However, *vágott seb* (chop wound) is an absolute non-equivalent of *cut*. During the evolution of the Hungarian language, the meaning of the word *vágni*, the most commonly used translation of the expression *to cut*, has changed. Historically, *vágni* was the sole equivalent of *to chop*. However, in time its meaning extended to *to incise* as well, and by now, *vágni* is more commonly used to describe wounds caused by sharp objects rather than injuries caused by heavy *and sharp* ones. Unfortunately, in forensic medicine, the general language expression *vágás* (meaning *cut* in contemporary Hungarian language) implies *vágott sérülés* (chop injury), which falls into a much more serious criminal legal category (Schneider, Patonai, Gergely & Fogarasi, 2018). This example proves that the Hungarian translation is less consistent than the German one, as the former employs everyday, non-professional expressions on a large scale.

Thirdly, as the most problematic case of non-equivalence, the mistranslation of crushing injury (47 occurrences in the English version) was *zúzódás* (bruise, occurring 7 times) and *zúzódásos sérülés* (bruised injury, mentioned in 1 case) in Hungarian. *Crushing injury* (compression) is defined as 'an injury that occurs because of pressure from a heavy object onto a body

part. A crushing injury may also result from squeezing a body part between two objects. Depending on their severity, crush injuries can be further complicated by bleeding, bruising, broken bones, open wounds, poor circulation or breakdown muscle' (A.D.A.M. Encyclopedia), whereas *bruise* only means an injury affecting soft tissues exclusively, resulting from blunt force trauma (cf. in 4.2.3.). The appropriate equivalents of crushing injury in Hungarian are összenyomatás (crush), összenyomatásos sérülés (crushing injury) or *kompressziós sérülés* (compressed injury in Latin). The confusion with the Hungarian equivalent of *bruise* might be due to the fact that these terms (össze*zúz* and *zúz*) have identical verb stems. *Zúz*ódás (bruise) derives from the verb *zúzni,* referring to bruising explicitly in medical terminology. However, in general usage, both *zúzni* and összezúzni refer to squeezing or crushing as well besides bruising. In case the translator is not conscious of the border between professional terminology and general language, they can easily overlook this difference, causing misunderstandings fraught with multiple consequences discussed in 4.2.3. Although the same kind of similarity exists in German between *quetschen* (to bruise) and *zerquetschen* (to crush, to squeeze), the German Modification translated the term *crushing injury* consistently, using exclusively its total equivalent *Zerquetschung* (crushing).

4.4. Consequences of non-equivalent national translation in practice

When reanalysing the corpus of Hungarian medical reports on soft tissue injuries, we established that 23% of them had diagnoses adapted from ICD-10 (Népjóléti Minisztérium, 1995) without featuring the codes, and 12 reports (7%) contained the diagnosis *koponya zúzódása* ('contusion of skull'), which is under code S.0710 in the Hungarian ICD-10. However, this expression has no substantiated meaning because, according to the exact definition, *contusion* means bruising of the skin and the connective tissue under the skin (i.e. only injury of the soft tissue and on no account an injury of bones). Comparing the Hungarian version with the English one, it turned out that the original diagnosis category is *crushing injury of skull*, meaning compression of the bones of the skull. Based on the descriptions of the injuries diagnosed as *contusions of skull*, it was clear that physicians actually meant to refer to *contusion of head*. This was also confirmed by the additional Latin diagnosis in 3 cases. This terminological problem seems to come down to two factors. Firstly, doctors simply do not have an alternative category to diagnose *contusion of head*, apart from *superficial injury of head*, which leaves their diagnosis inherently vague. Secondly, the diagnosis *contusion of skull* has become widely established in Hungarian medical findings, adapted from a mistranslated ICD diagnosis, as this injury and this code both occur very frequently, so its category name sounds familiar and correct to physicians.

Whenever medical documentation contains the diagnosis *contusion of skull* without a detailed description, the forensic reconstruction remains uncertain about whether a bone is involved or not. Considering the mobility of patients, this has further consequences: in case of injuries inflicted to foreigners, insurance companies match the Hungarian ICD category *contusion of skull* with its national translation based on the standardized code system, which is, internationally, *crushing injury of skull*. The insurance company will probably deny payment and question the expertise of the Hungarian physician. Even from a forensic point of view, *a crushing injury* implies a much more severe injury than a bruise.

If incised and chop wounds are regarded as the same injury category (e.g. in the most widespread Hungarian translation of ICD-10 both belong to the generic expression open wound), it can lead to confusion in practice, unless a detailed description of the injuries by the primary treating physician makes a clear distinction possible. Only unambiguous diagnoses can help the investigation authorities establish the crime category with absolute certainty, on the basis of which the criminal procedure is initiated (Fogarasi, Schneider & Bajnóczky, 2014).

4.5. Differences between the clinical, forensic, criminal, and statistical approaches to ICD-categories of injuries

Clinicians are mostly concerned with the appearance of injuries to assess the best treatment: that is, the body region affected and the nature of injury (e.g. open wounds require a different hygienic treatment than closed wounds). Therefore, ICD categories suit their approach. However, vague ICD diagnoses might leave patients puzzled as to what exactly they mean, which has civil legal consequences. Forensic experts are interested in the underlying mechanisms of injuries and the weapon involved to differentiate between blunt force, sharp force, etc. Overly general diagnoses are useless for them in the reconstruction of injuries. In the criminal procedure, the prosecutor is interested in the manner of committing a crime and the consequences of the crime on the victim, to differentiate between slight bodily harm, grievous bodily harm, dangerous bodily harm, etc. However, collective terms adapted from ICD categories do not help prosecutors determine the appropriate crime category either, because they often fail to reveal even the exact types of injuries. Only in healthcare statistics does ICD-10 classification serve as a flawless tool for statistical data acquisition.

5. Conclusion

The results of this study have several implications for the use of medical terminology. In clinical practice, physicians should provide unequivocal information through recording individually formulated diagnoses rather than mere ICD categories. The translation mistakes, which can be identified even in the latest Hungarian version, should be revised, and new codes, missing from the current version of ICD-10, should be introduced. Clinicians and medical students should be made aware of the terminological differences between different medical fields in Hungary, e.g. accident surgery and forensic medicine, and the influence of everyday language use on professional terminology. The present study confirmed the practical importance of individually formulated diagnoses, as the linguistic reliability of the Hungarian version of standardized classification systems is questionable at times, for example, in the case of the inconsistent Hungarian translation of ICD-10. Additionally, the ICD-10 categories discussed in this paper are based on clinical aspects, while, in case of injuries, diagnoses should respect criminal legal considerations as well. Therefore, overgeneralisation should be avoided when writing diagnoses, and the use of exact terms is of vital importance. Medical terminology courses should include topics on formulating individual diagnoses (containing types and locations of injuries) in the most accurate way possible. Medical students should also be made aware that standardized classifications mainly serve statistical purposes, and individually formed diagnoses are therefore more reliable in forensic assessment.

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