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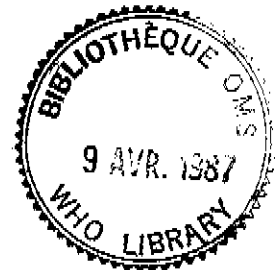
CONSULTATION ON RULES AND DEFINITIONS IN
DEATH CERTIFICATION IN RELATION TO ICD-10

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THE WHO PRINCIPLES FOR REGISTERING CAUSES OF DEATH:
SUGGESTIONS FOR IMPROVEMENT

by

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WHO is preparing the Tenth Revision of the International Classification of Diseases (ICD-10). The new classification is scheduled to go into effect in the different countries in 1993.¹ As a part of this work WHO is reviewing the international rules and recommendations for vital statistics registration of causes of death. These rules and recommendations are published in the current revision of the ICD (ICD-9, pp. 699-737).² Suggestions for their revision in ICD-10 have been made.³

Since the selection of the principal cause of death, i.e. the underlying cause of death, is ultimately determined by these rules, changing them may lead to trend effects in future cause-of-death statistics. Such changes may affect the contents of the register on which these statistics are based, a principal source of information for epidemiological and health research. On the other hand, the shortcomings of the present WHO rules and recommendations are such that a revision is essential to the improvement of the quality of the official cause-of-death statistics.⁴⁻⁹

The aim of this paper is to elucidate some theoretical and practical problems in the application of the WHO rules and recommendations, and to make suggestions for the improvement of these principles. These suggestions are a result of a working party set up by the Nordic Medico-Statistical Committee (NOMESCO) and are intended to be submitted to WHO.

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THE PRESENT REGISTRATION PROCEDURE

The International Form of Medical Certificate of Cause of Death

The present rules for registration of causes of deaths have evolved from the rules of ICD-6 that were adopted by WHO in 1948. In connection with ICD-6 WHO also introduced the present International Form of Medical Certificate of Cause of Death (Figure 1) and the manual International Certification of Cause of Death, Instructions for Physicians on Use of International Form of Medical Certificate of Cause of Death. The latest revision of these instructions was published in 1979.¹⁰

In Part I of the certificate the principal course of events leading to death should be stated by "one condition per line", with the most recent conditions, the direct cause, at the top (line a) and the underlying cause on the lowest used line (e.g. line c). However, it is sufficient to record only one condition in Part I, if the condition mentioned on line (a) "is the underlying cause"¹⁰ or if the statement on this line "describes completely the train of events".²

In Part II the contributory conditions should be recorded, i.e. "all other diseases or conditions believed to have unfavourably influenced the course of the morbid process and thus contributed to the fatal outcome but which were not related to the disease or condition directly causing death."¹⁰

In this context, the concept 'causes of death' is defined as "all those diseases, morbid conditions or injuries which either resulted in or contributed to death and the circumstances of the accident or violence which produced any such injuries."²

'The underlying cause of death' is defined as "(a) the disease or injury which initiated the train of events leading directly to death, or (b) the circumstances of the accident or violence which produced the fatal injury".²

Rules for the Coders' Registration of the Underlying Cause of Death

The basic idea in the registration is of course that the condition stated alone on the lowest used line in Part I, i.e. the condition stated by the certifier as the underlying cause of death, should be registered as the underlying cause in the statistics.

This principle, formulated in the General rule, should not be discarded unless "the certifier has entered more than one condition on the lowest used line of Part I or has entered there a single condition and it is highly improbable that this condition could have given rise to all the conditions entered above it."² In such cases, when the General rule cannot be applied, "clarification of the certificate should be sought from the certifier whenever this is possible."² Thus, it is only when such amplification cannot be obtained, or does not provide sufficient information as to what was the underlying cause of death, that any of the other three Selection rules should be applied.

After the underlying cause of death has been selected according to the appropriate Selection rule(s), this choice may be further modified by the Modification rules. The purpose of these rules is "to improve the usefulness and precision of mortality tabulations."² There are also other rules governing the registration of the underlying cause of death, such as the Notes for use in underlying cause mortality coding, some of which may be viewed as mere applications of the Selection and Modification rules. These rules have been analysed in a previous study.⁴ We will here concentrate only on the thirteen main rules, which read as follows (ICD-9, pp. 703-712).²

(i) Selection Rules

General rule. Select the condition on the lowest used line of Part I unless it is highly improbable that this condition could have given rise to all the conditions entered above it.

Rule 1. If there is a reported sequence terminating in the condition first entered on the certificate, select the underlying cause of this sequence. If there is more than one such sequence, select the underlying cause of the first mentioned sequence.

Rule 2. If there is no reported sequence terminating in the condition first entered on the certificate, select this first mentioned condition.

Rule 3. If the condition selected by the General rule or Rules 1 or 2 can be considered a direct sequel of another reported condition, whether in Part I or Part II, select this primary condition. If there are two or more such primary conditions, select the first mentioned of these.

Certain conditions that are common post-operative complications (pneumonia (any type), haemorrhage, thrombophlebitis, embolism, thrombosis, infarction) can be considered as direct sequels to an operation unless it is stated to have occurred 4 or more weeks before death.

(ii) Modification Rules

Rule 4. Senility. Where the selected underlying cause is classifiable to 797 (Senility) and a condition classifiable elsewhere than to 780-799 is reported on the certificate, re-select the underlying cause as if the senility had not been reported, except to take account of the senility if it modifies the coding.

Rule 5. Ill-defined conditions. Where the selected underlying cause is classifiable to 780-796, 798-799 (the ill-defined conditions) and a condition classifiable elsewhere than to 780-799 is reported on the certificate, re-select the underlying cause as if the ill-defined condition had not been reported, except to take account of the ill-defined condition if it modifies the coding.

Rule 6. Trivial conditions. Where the selected underlying cause is a trivial condition unlikely to cause death, proceed as follows:

(a) if the death was the result of an adverse reaction to treatment of the trivial condition, select the adverse reaction.

(b) if the trivial condition is not reported as the cause of a more serious complication, and a more serious unrelated condition is reported on the certificate, re-select the underlying cause as if the trivial condition has not been reported.

Rule 7. Linkage. Where selected underlying cause is linked by a provision in the classification in the Notes for use in primary mortality coding on pages 713-721 with one or more of the other conditions on the certificate, code the combination.

Where the linkage provision is only for the combination of one condition specified as due to another, code the combination only when the correct causal relationship is stated or can be inferred from application of the selection rules.

Where a conflict in linkages occurs, link with the condition that would have been selected if the underlying cause initially selected had not been reported. Apply any further linkage that is applicable.

Rule 8. Specificity. Where the selected underlying cause describes a condition in general terms and a term which provides more precise information about the site or nature of this condition is reported on the certificate, prefer the more informative term. This rule will often apply when the general term can be regarded as an adjective qualifying the more precise term.

Rule 9. Early and late stages of disease. Where the selected underlying cause is an early stage of a disease and a more advanced stage of the same disease is reported on the certificate, code to the more advanced stage. This rule does not apply to a "chronic" form reported as due to an "acute" form unless the Classification gives special instructions to that effect.

Rule 10. Late effects. Where the selected underlying cause is an early form of a condition for which the Classification provides a separate late effects category and there is evidence that death occurred from residual effects of this condition rather than in its active phase, code to the appropriate late effects category.

The following late effects categories, including those in the Supplementary E code, have been provided: 137, 138, 139, 268.1, 326, 438, 905-909, E929, E959, E977, E989, and E999. (Sec III Late effects, page 723).

Rule 11. Old pneumonia, influenza and maternal conditions. Where the selected underlying cause is pneumonia or influenza (480-487) and there is evidence that the date of onset was 1 year or more prior to death or a resultant chronic condition is reported, reselect the underlying cause as if the pneumonia or influenza had not been reported. Where the selected underlying cause is a maternal cause (630-678) and there is evidence that death occurred more than 42 days after termination of pregnancy or a resultant chronic condition is reported, reselect the underlying cause as if the maternal cause had not been reported. Take into account the pneumonia, influenza or maternal condition if it modifies the coding.

Rule 12. Errors and accidents in medical care. Where the selected underlying cause was subject to medical care and the reported sequence in Part I indicates explicitly that the death was the result of an error or accident occurring during medical care (conditions classifiable to categories E850-E858, E870-E876), regard the sequence of events leading to death as starting at the point at which the error or accident occurred. This does not apply to attempts at resuscitation.

Concerning the registration and statistics of deaths in the perinatal period the International Conference for the Ninth Revision of the ICD recommended that, where practicable, the causes of death should be derived from a special certificate (instead of the normal death certificate presented in Figure 1). The main disease or condition in fetus or infant and the main maternal disease or condition affecting fetus or infant are, in this type of certificate, presented separately without stating any aetiological relationship between them. ²

COMMENTS AND SUGGESTIONS FOR IMPROVEMENTS

For some time, it has been questioned whether the traditional way of registering and tabulating causes of death, by attributing death to a principal cause, is adequate to current needs.¹¹⁻¹³ This way of reporting causes of death may perhaps be appropriate when death is caused by acute conditions, such as serious injuries, infectious and communicable diseases, but it creates difficulties in a society where a majority of the deaths occur in old age, where death is often caused by chronic diseases and a combination of concurrent conditions.

The traditional registration procedure, sanctioned by WHO, has been criticized from the point of view of both the certifiers and the users of the cause-of-death data. It has been claimed that on the present certificate form, physicians cannot always do justice to their judgement on the relative significance of, and the relations between, the different causes.^{11,13,14} Further, if only the underlying cause is accounted for in the statistics, valuable information about complications and contributory conditions will be lost to the users of the data.¹¹

At least three different problems are involved here, the first has to do with the amount of diagnostic information to be registered (i.e. how many causes should be registered for each death?), the second concerns the selection of causes (i.e. which causes should be registered?), and the third concerns the causal classification (e.g. the present division into the underlying cause, complications, and contributory conditions).^{5,15}

In several countries, annual national mortality statistics are tabulated in the form of multiple cause-of-death data, e.g. in Sweden from 1965.¹⁶ This makes it possible to make full use of the diagnostic information provided on the death certificates. Information on the underlying cause, complications and contributory conditions can be accounted for in separate tables.

The difficulties for the physician of singling out a principal course of events and identifying a single underlying cause of death, especially when death occurs in old age, have led to the suggestion that the present causal classification should be abandoned and that conditions should be tabulated without any relative order of precedence or division whatsoever.¹³ This would, however, make the statistics less useful,¹¹ and would not take us any further in dealing with the fundamental problem of selection: deciding what cases are relevant for registration. It would be more fruitful to try to develop a new classification of causes, e.g. that would, if necessary, allow for more than one underlying cause being registered for each death.

Basically, the difficulties with the present registration procedure are not only of practical and empirical nature. They have to do not only with reserving enough space for concurrent conditions and complex combinations of causes, but with correcting defects, such as those pointed out by Comstock, et al.¹⁷ (physicians lack of adequate training in the purpose and process of death certification; incomplete and preliminary established medical information being tabulated; failing to query inadequate certificates; deficiencies in the publication of the statistics). The shortcomings of the present registration procedure are also of theoretical nature. They concern such fundamental things as uncertainties in the WHO formulation of the purpose of registering causes of death, and uncertainties in the definitions of basic concepts. Some of these uncertainties will be dealt with and suggestions for improvements will be made.

The Purpose of Cause-of-Death Statistics

WHO motivates the definition of 'the underlying cause of death' by stating: "From the standpoint of prevention of deaths, it is important to cut the chain of events or institute the cure at some point. The most effective public health objective is to prevent the precipitating cause from operating".² However, the possibilities to manipulate and thereby reduce or eliminate the risk of untimely death, does not seem to be a criterion of selection used in practice. This criterion is not emphasized in the Instructions for physicians or in the ICD-rules. Instead, the degree to which the conditions have contributed to death is a central criterion. For example, the priority given to "a more serious" condition in Rule 6, and in some of the Notes, and the preference of "a more advanced stage" in Rule 9. This criterion of severity is relevant to the purpose of prediction rather than prevention.⁸

It is not difficult to find examples of cases when the elimination of a serious condition would not eliminate or even reduce the risk of untimely death. For example, there are cases of overdetermination, i.e. when two conditions are simultaneously present in one individual, both in themselves sufficient for causing death. There are also cases when the treatment of one serious condition would introduce another, perhaps even a more serious condition.

Since preventive measures need not always be a medical concern and whereas the identification of serious conditions is a natural part of diagnostics, it may seem justifiable to include the latter and exclude the former task in the purpose of death certification. In order for the underlying causes to serve a preventive purpose, they need not themselves be manipulable. It is sufficient that they provide appropriate points of departures for preventive studies.

Suggestion: the following reformulation of the purposes of the concept 'the underlying cause of death' would be better adjusted to the selection principles used in practice: "For the purpose of identifying risk-factors for untimely death, the underlying cause of death has been defined as ...".

The Basic Concepts

(i) Causes of death. It is emphasized in the ICD that the definition of 'causes of death' does not include symptoms and modes of dying. 'Modes of dying' is not explicitly defined, but the following examples are given in the ICD and in different revisions of the Instructions: anoxia, asphyxia, asthenia, collapse, exhaustion, heart failure, respiratory failure, and syncope.^{2,10,18} With the exception of heart failure (428.9), these conditions are classifiable within the categories for general symptoms (780.2, 780.7) and ill-defined conditions (799.0, 799.1). Since the definition is intended to exclude these conditions, this fact should be clearly indicated in the definition, which it is not in the present formulation.

Suggestion: If we understand "symptoms" to mean the conditions classifiable within the categories 780-789, and if we exclude "morbid conditions" (which seems redundant, when "diseases" is used), and if we change "circumstances" to "external causes of injuries and poisoning" (which seems to be the meaning intended), the following reformulation of the definition of 'causes of death' could be made: "all those diseases, injuries and external causes of injuries and poisoning which either resulted in or contributed to death; excluding symptoms (780-789) and ill-defined conditions (799.0, 799.1)".

(ii) The underlying cause of death. The definition of 'the underlying cause of death' does not take into account cases in which more than one course of events has been identified and the choice lies between two or more initiating conditions.^{4,9} Preferably, the definition should include the criteria used in the ICD when choosing between initiating conditions, e.g. 'seriousness'. At the very least, the definite articles should be modified.

Suggestion: A reformulation in accordance with these observations and which also conforms to the suggestions for the general concept 'causes of death', would be the following: "(a) the main disease or injury which initiated the principal train of events leading directly to death, or (b) the main external cause of an injury or poisoning, which resulted in death".

(iii) Contributory conditions. The exclusion of conditions "related to the disease or condition directly causing death" from the concept 'contributory conditions' can be interpreted in at least two ways: (a) a contributory condition may not be a part of the principal course of events, or (b) a contributory condition may not, independently of the principal course of events, be a cause of the direct cause at the end of the principal course of events.⁸

The first interpretation can, in its turn, be understood in two ways: (a₁) a contributory condition may not be a cause that has already been mentioned in Part I of the certificate (as a cause of the direct cause), and (a₂) a contributory condition may not be a cause that, together with a cause in the principal course of events, constitutes a sufficient condition for the direct cause at the end of the principal course of events.

Furthermore, the WHO definition of 'contributory conditions' does not make clear whether it excludes only conditions directly causing the direct cause, or if it also excludes conditions indirectly causing the direct cause by influencing an intermediate cause in the principal course of events.⁸

It is difficult to see why conditions not mentioned in Part I of the certificate, but which are causing the same direct cause as those stated in Part I, may never be mentioned on the certificate. For example, in interpretation (b) this would exclude all concurrent conditions and parallel chains of events converging towards the same direct cause as the principal course of events. It seems that the definition would gain from the deletion of the last part.

Suggestion: A practical reformulation and curtailment of the definition, which aims at satisfying the interests of both the certifiers and the users of multiple cause-of-death data, would be the following: "all other diseases or conditions believed to have unfavourably influenced the principal course of events and thus contributed to the fatal outcome".

The Rules

The ICD-rules have, basically, three different functions: semantic rules which consider the diagnoses, how precise (Rule 5), inclusive (Rule 7) and specific (Rule 8) they are, and not the properties of the causes themselves (Rule 4, could be viewed as an extension of Rule 5); causal rules which consider the causal characteristics of the conditions (General rule, and Rules 1,3,6,9-12); and in part purely conventional rules which partly concern neither the semantic qualities of the diagnoses, nor the causal characteristics of the conditions, but merely give directives to facilitate the work of the coders (Rules 1-3).⁴

A few comments will be made in the following upon the suggestions for revision of these rules prepared for ICD-10 by a working party in connection with WHO.³

The suggestions made about the Selection rules are: that the General rule should be re-phrased in a positive instead of the present negative manner; that the purely conventional second sentences of Rules 1 and 3 (these being respectively - giving preference to the underlying cause of the first mentioned sequence, and to the first mentioned of two primary conditions) should be deleted; and that the expression "can be considered a direct sequel" in Rule 3 should be replaced by a stronger requirement: "is obviously a direct consequence of".

The General rule then reads: "Where more than one condition is entered on the certificate, select the condition entered alone in the lowest used line of Part I if it could have given rise to all the conditions entered above it".³ The condition in this rule could, with advantage, be further strengthened by adding "only" before "if".

The intention to eliminate the arbitrariness of Rules 1 and 3 is deserving, but this purpose is hardly served by only deleting these sentences. In order to eliminate the arbitrariness, some other criterion ought to take their place. Otherwise these rules will give no guidance at all when more than one sequence or primary condition is mentioned on the certificate. Since 'seriousness' is a central criterion in the ICD, a better solution would be to substitute "more serious" for "first mentioned" in Rules 1 and 3. This amendment could well be extended to Rule 2 as well.

Regarding the Modification rules, no suggestions for Rules 4,5,7-10,12 are made in the report. However, it should be noted about Rule 5 that if symptoms (780-789) and modes of dying (ill-defined conditions 799.0, 799.1) are, as we have observed earlier, by definition not causes of death, then these codes should be deleted from Rule 5. Regarding Rule 6, deletion of section (b) is suggested: since that section was considered "rarely applied", and "there seemed no justification for preferring a completely unrelated condition". It is further suggested that the rule should be extended to include also untoward complications. The new formulation reads: "Where the selected underlying cause was a trivial condition, i.e. one which would not lead to death on its own, and death was the result of an adverse reaction to or untoward complication of its treatment, select the adverse reaction or untoward complication".³

Rule 11 is suggested to be deleted: "The possibility of miscoding old cases of pneumonia and influenza was considered to be minimal, and old cases of maternal conditions would be dealt with by rule 10..."³

CONCLUSIONS

The present death certificate form, with its call for a principal course of events and a single underlying cause of death should be retained.

The purpose of selecting the underlying cause of death ought to be adjusted to the selection criteria actually employed in the ICD: to identify important risk-factors for untimely death.

The definitions of basic concepts, 'causes of death', 'the underlying cause of death' and 'contributory conditions', as well as the formulation of Rules 1-3, ought to be improved, taking into account the presence of concurrent causes and complex combinations of conditions.

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INTERNATIONAL FORM OF MEDICAL CERTIFICATE OF CAUSE OF DEATH

CAUSE OF DEATH		Approximate interval between onset and death
I		
<i>Disease or condition directly leading to death</i> *	(a) due to (or as a consequence of)
<i>Antecedent causes</i>	(b) due to (or as a consequence of)
Morbid conditions, if any, giving rise to the above cause, stating the underlying condition last		(c)
II		
<i>Other significant conditions</i> contributing to the death, but not related to the disease or condition causing it
<small>* This does not mean the mode of dying, e.g., heart failure, asphyxia, etc. It means the disease, injury, or complication which caused death.</small>		

FIGURE 1 (Reproduced from ICD-9)²

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