Medical Informatics Europe '96
J. Brender et al. (Eds.)
IOS Press, 1996

A New Version of the Programme ALGO for Clinical Algorithms

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Abstract. A clinical algorithm is a step by step procedure with a finite series of instructions which, when followed, result in the solution of a clinical problem. We have developed the software ALGO for generating and using clinical algorithms. ALGO is an object oriented programme written in Borland Pascal 7.0 for Windows. The programme has a presentation tool and a writing tool. In the presentation tool you can browse through an algorithm, look at annotations, and save the pathway of a patient together with the patient characteristics. The writing tools enables you to create a new algorithm in a comfortable and standardised way. After input of text, the boxes and corresponding arrows are generated automatically and presented on the screen. The user can change the graphic design or rearrange the boxes, this is supported by automatic calculation of the distance between graphic elements. ALGO determines also the complexity score CASA of an algorithm and makes CAPA (Clinical Algorithm Patient Abstraction) scoring easy. There is a choice of printing out an algorithm either on one page or on several pages. An extensive help function is available.

1. Introduction

This is a description of the newest version (rel. 3.1) of our computer programme ALGO for generating and using clinical algorithms. A former version has already been presented [4].

A clinical algorithm is a step-by-step procedure with a finite series of instructions which, when followed, result in the solution of a clinical problem. The Arabic word 'algorithm' originates from the name of the Persian mathematician and astronomer Al-Khwarizimi, who lived from ca. 780 - 850 AD.

The instructions in a clinical algorithm contain conditional (if/then) logical statements and are usually represented graphically. There is a standard nomenclature for clinical algorithm maps, these symbols and their meaning are illustrated in fig.1.

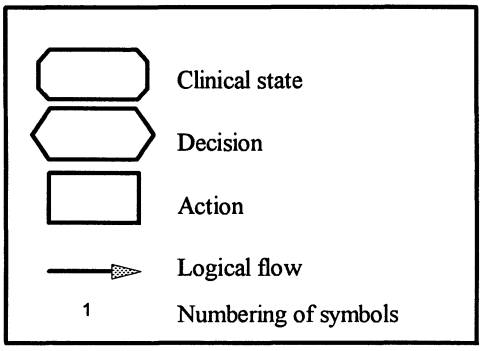

Fig. 1: Standardized terminology of clinical algorithms according to the recommendation of the Society of Medical Decision Making [5]

2. Use of Clinical Algorithms

The main reasons for the use of a clinical algorithm are a great variation in the management of a clinical problem or a clinical outcome which is not reached but should obviously be reached. Clinical algorithms are applied mainly for teaching, quality assurance, cost containment, and standardization. Standardization is important in every day patient care as well as in the design of clinical trials.

3. Aim

The computer programme ALGO is developed to facilitate the evaluation and routine use of clinical algorithms and to have a flexible tool for generating new clinical algorithms. The purpose of ALGO is to provide a consistent user interface under Windows which allows comfortable browsing through an algorithm, to support the use of algorithms in clinical routine, to generate and modify the structure of clinical algorithms, and to evaluate the complexity score CASA (Clinical Algorithm Structural Analysis).

4. Object-Oriented Programming

The programme ALGO is written in the object-oriented language Borland Pascal 7.0 for Windows and runs on IBM-compatible PCs. The comparison of object-oriented programming with procedure-oriented programming shows two fundamentally different paradigms. In procedure-oriented programming languages, data and procedures tend to be seperated; a programme consists of getting data into data-structures and then calling a series of routines to compute on that data, modifying the data structures and their contents as appropriate. An object-oriented programme consists of objects (logically related procedures *and* data) that exchange messages with each other and is characterized by encapsulation, inheritance, and polymorphy. *Encapsulation* means that the combination of data fields with procedures and functions, which are used to process such a field, generates a new type of data: an object. Each successor object *inherits* the entire code and informations of its predecessors. *Polymorphy* means that a function has a unique code which is used throughout the object hierarchy. Each

object implements the function in a way necessary for this object. The execution of the programme is the exchange of messages among all the objects constituting the programme. This approach enhances the modularity and flexibility.

5. Description of the Programme

Since the programming is object-oriented the presentation is action-driven by mouse click, key stroke, etc. The programme ALGO consists of a presentation and a writing tool, text and format of an algorithm can be exchanged between the two modes. The writing tool enables the user to create a new algorithm (fig. 2).

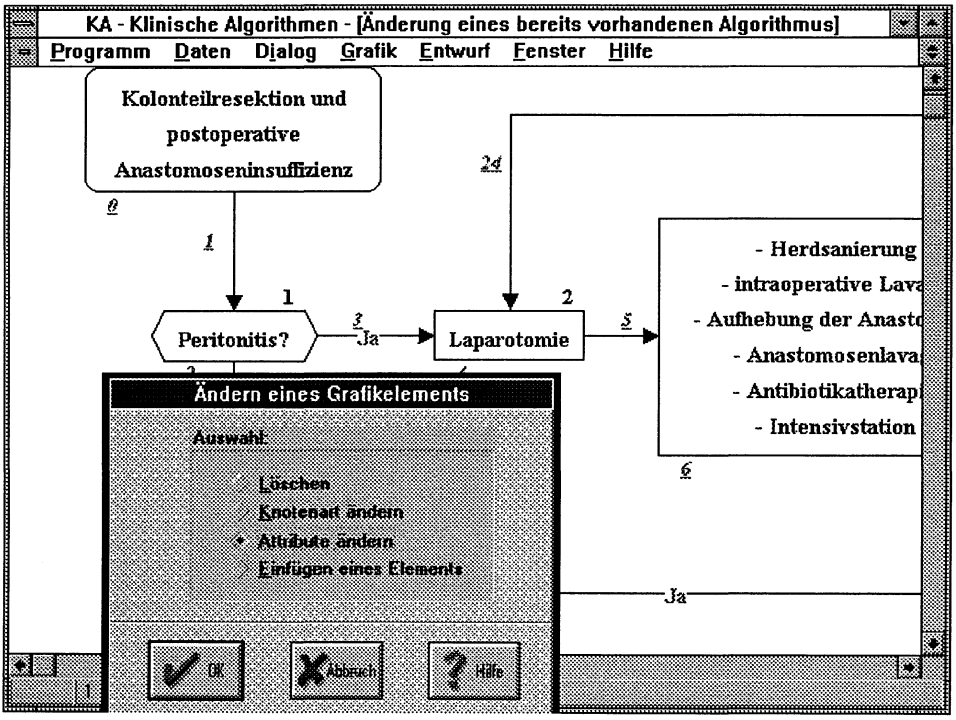

Fig. 2: Screen from writing tool

Into prespecified boxes questions and possible subsequent actions are inserted. All algorithms are structured in such a way that the labels of the arrows are only yes or no. After a clinical algorithm is stored, the complexity-score CASA (Clinical Algorithm Structural Analysis) [3] is computed automatically and it is possible to start a dialogue. Browsing through the algorithm by answering yes-no questions with mouse clicks and arriving at action boxes, solves the clinical problem of a single patient. The boxes and arrows of the chosen pathway are high-lighted. The sequence of the numbers in the pathway is stored for its unique identification together with the

patient characteristics and the pathways for calculation of the CAPA (Clinical Algorithm Patient Abstraction)-score. Loops are generated after specification of start and reentry point automatically. Changes in an algorithm like deletion or insertion of boxes are performed if the according box numbers are selected, the user has not to care about the coordinates of the elements of the clinical algorithm. The graphic display of the algorithms is rearranged by the programme and the new coordinates are stored with their symbols. Plausibility checks are implemented. The graphical representation and the data of findings and actions can be printed or exported to other data bases and statistical software. There is an extensive help facility for all features of the programme. A double mouse click in a selected box displays annotations which usually accompany every step in an algorithm. This is a help function for clarifying the underlying clinical problem and supporting the presented flow chart.

6. Computer-Physician Interface

Limitations of printed algorithms listed in [1] can be overcome by computer implementation. The computer programme ALGO allows easy handling of complex algorithms with many boxes, supports algorithm generation during a consensus meeting by quick rewriting of a flow chart after changes, and provides comfortable access to annotations. The minimum prerequisites for running ALGO on an IBM compatible personal computer are: 80386 processor; 4 MB RAM memory; VGA; hard disk and floppy disk; mouse; and Windows 3.1.

7. Conclusions

It is known that clinical algorithms teach medical decision making more effectively than prose and that they are a powerful instrument for standardization of diagnostic and therapeutic management [2]. The computer programme ALGO is a very flexible tool for generating new clinical algorithms, supporting consensus development and evaluation. In routine use, the algorithm on the PC is available at the time of the patient's visit, decisions for a clinical problem are standardized and the findings and actions for a single patient are documented automatically.

Note

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