Computerized Underwriting in Nippon Life Insurance

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Nippon Life has been a leader in the use of mechanical underwriting systems including the introduction of computer underwriting by the Expert System. The following is an outline of the computer underwriting system used in Nippon Life.

I. The Environment of Life Insurance Risk Selection in Japan

Life insurance is widely spread among the Japanese, partly due to the large female agent sales system. The total life insurance in force of 24 private life insurers in 1986 was 5,970 billion dollars, and the per capita in force business was $49,100, which far exceeds the average of $27,800 in the U.S.

Under such circumstances, our risk selection department is burdened by an extreme quantity of applications. The following characterizes the risk selection business:

1. New business is extensive and much of it requires a medical examination. (1,980,000 were medically examined out of 2,920,000 new applicants of Nippon Life in 1988.)

2. Applications peak at the end of the month, because sales performance is measured monthly. In two campaign months every year the number of applications triple those of a usual month. (37,000 applications may be seen on a peak day of a campaign month.)

3. Division of labor is practiced for efficiency in the selection process; this involves checking of application forms, medical risk selection and moral hazard selection, which are operated independently.

The following is an outline of computerization of underwriting including medical underwriting. Under the above-mentioned circumstances, systems development would naturally focus on efficiency in underwriting.

II. Introduction of Computer Underwriting of Numerical Items

Medical underwriting was traditionally administered manually on data from medical reports and past medical information in the home office (abnormal data entered at past applications, hospitalization certificates on claims for hospital stays, etc.) for numerical items including build, blood pressure, pulse rate and urine findings. However, manual underwriting of numerical items required too many hands-on people and caused the overlooking of many abnormal numbers. Computer underwriting of numerical items was introduced in June, 1986 to improve this.

It is best if input of numerical items is done by the underwriter at the time of medical underwriting. However, professional keypunchers input data on medical reports before underwriting, because underwriters are usually unfamiliar with typewriting in Japanese and it is much more efficient and faster by keypunchers. Findings on declaration and medical reports are entered item by item to be keyed in with numerical items (height, weight, girth of chest, girth of abdomen, blood pressure, pulse rate, urine sugar, urine protein, etc.).

Programming for the underwriting of numerical items was facilitated by using an underwriting evaluation table for numerical measurement. The underwriting system could then be easily established if the numerical input from the medical report was feasible.

Effects of Computer Underwriting of Numerical Items:

- Large reduction in the number of errors caused by overlooking incomplete declarations and medical report items as well as abnormal measurements.

- Applications with neither abnormalities of declaration and medical report items, nor lacking past medical information could then be medically underwritten by numerical items only, therefore fully computerizing underwriting. 58% of our medically underwritten applications are automatically underwritten in this way.

- Speed-up was achieved in processing new business through computerization.

III. Introduction of An Expert System for Underwriting

42% of applications are still handled manually, 5% of which are moral hazard underwriting, 32% are medical underwriting by lay underwriters, and 5% are underwritten by medical doctors.

Computerization of medical underwriting by lay underwriters was thought to be feasible by the use of a new computer system called Artificial Intelligence. Development of this Expert System started in October, 1986 for this purpose. Following is its outline:

1. Period of Development
   October 1986 to March 1988

2. Purpose of Development
   i. Accurate, uniform and fair underwriting with the help of computers.
   ii. Training of underwriters in short periods of time and

improvement in underwriting techniques.

iii. At the end of the month and in campaign months, personnel in other departments with basic underwriting knowledge may underwrite medically with the support of the computer. Thus, business peaks will be eased.

iv. Expert System shows the result of underwriting automatically without input by keypunchers. Thus, the processing of new business may be faster.

3. Outline of the System

i. Machine Composition

Vax-8350 x 1 (operation system-host computer)
NEC 9801VM x 8 (operation system-terminal computer)
XEROX 1121 x 1 (development system computer)

ii. Input Method

Dialogic: Selection of numbers corresponding to names and degrees of disease on display, without spelling words by keyboard

iii. Language and Development Tool

LISP, COBOL

KEE (knowledge engineering environment)

4. Systems Structure

i. Applications not automatically underwritten within the new business host system will be transferred at night from the host system for the data in question.

ii. On the following day, additional underwriting information (other than numerical) will be inputted to a terminal by dialogic inputting for automatic evaluation. The result of evaluation will be transferred back to the host system as coding data of the medical report.

iii. New business which cannot be underwritten by the Expert System will be manually underwritten for input by coding sheet.

5. Underwriting Processing System

a) Impairment Groups for Underwriting
   1. Abnormalities of build
   2. Glycosuria
   3. Diabetes Mellitus
   4. Abnormalities of blood pressure
   5. Abnormalities of pulse
   6. Proteinuria
   7. Injury
   8. Tumor
   9. Tuberculosis
   10. Neuralgia
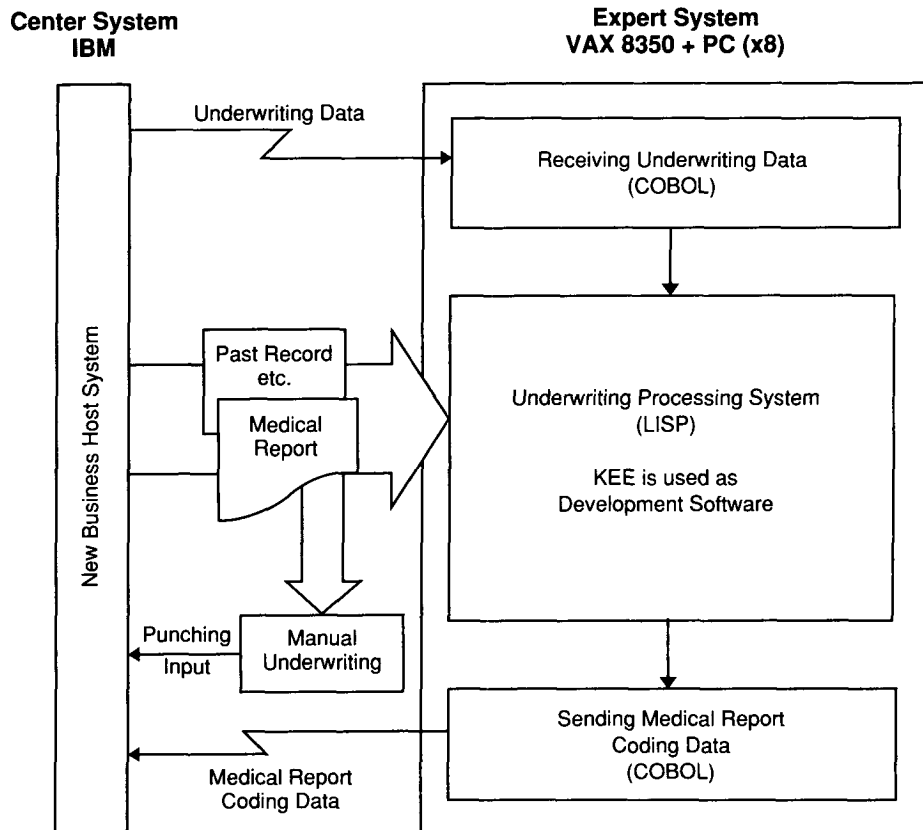
11. Bronchial asthma
12. Gastric and duodenal ulcer
13. Indigestion
14. Disease of gallbladder
15. Liver disease
16. Pregnancy and delivery
17. Eye disease
18. Ear disease
19. Skin disease
20. Bone and muscle disease
21. Appendicitis
22. Common cold
24. Sinusitis
25. Disease of digestive system

One quarter of Nippon Life's rating or underwriting manual was transplanted to the knowledge base of the underwriting processing system. This one quarter, however, represented 90% of the medical underwriting, because they included the most common block of different impairments.

b) Knowledge Base System

The rating manual was transformed into a tree structure to be transplanted to the knowledge as illustrated.

At every branching of the tree, the underwriter will input the state of an applicant in a dialogic manner to see the next display and to reach the final underwriting evaluation.

It was possible to have an inference function in the underwriting process of the Expert System. However, judgment on the state of an application is made by the underwriter in the dialogic process to maximize the processing speed.

IV. Effects and Problems

1. Effects

   • 200,000 cases, or one third of the medical underwriting by lay underwriters, were handled by Expert System per year.

• Underwriting process was shortened by one day.

• The system was effective for the education of inexperienced underwriters. Utilization of personnel from other departments was also possible during peak period.

• Changes of the knowledge base caused by revised underwriting criteria are made easily by use of Expert System Development Tools (KEE).

2. Problems

   • Simpler underwriting cases are more efficiently processed. Complicated ones, however, require more display turnings, and thus take more than 5 minutes per case.

   • Judgments are made by underwriters with the assistance of dialogical supply of underwriting knowledge; however, basic medical education is indispensable.

   • As the rating manual is directly translated into knowledge base, display may often indicate "consult with the underwriting doctor," making the input operation in vain.

   • Expert System is effective for simpler underwriting. But underwriters have mastered the knowledge to underwrite such cases even faster than the Expert System. Therefore, Expert System is good for education but not quite so good for practical underwriting processing.

V. Tasks

1. We will have to develop the Expert System into a comprehensive system so that it may handle moral hazard underwriting as well as medical underwriting.

2. Manual underwriting process cannot be fully replaced by the Expert System. Therefore, the scope of underwriting by the Expert System has to be specified and a special knowledge base should be constructed.

3. Inference function will have to be installed to the Expert System so that it will take part in making judgments in underwriting.

Image Illustration