

Are Expert Systems "More Intelligent" Than Laboratory Doctors?

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Expert systems, which use rules based on biomedical knowledge, can validate particular laboratory results more efficiently than most individual laboratory doctors (LDs) (1,2). Expert systems can, therefore, enable LDs to spend more time on duties that require human intelligence and enable physicians to rapidly obtain their patients' laboratory results (1-3). Since August 1996, more than 50% of our hematology and biochemistry results have been validated by an expert system (VALAB, EREMS, Toulouse, France), those expertise rules originated from a university-hospital team of LDs (including doctors of pharmacy, medical doctors, and PhDs specialized in hematology or biochemistry) (1). Currently, the VALAB system is also being used in over 100 laboratories throughout Europe.

The Friedewald formula is:

$$\text{LDLc} = \text{TC} - \text{HDLc} - \text{TG}/5$$

where LDLc = LDL cholesterol, TC = total cholesterol, HDLc = HDL cholesterol, TG = triglycerides (all these parameters being expressed in g/L).

For reasons unknown to us, our laboratory computer (LMX, Bayer, Grenoble, France), which we purchased at the end of 1995, understood this formula as follows: $\text{LDLc} = \text{CT} - \text{HDLc}/5 - \text{TG}/5$ and during more than 2 years (until April 1998), this LMX defect remained unnoticed by the three LDs who in turn validated all our laboratory results, in accordance with the current French laws (2). Therefore, during more than 2 years, more than 4,000 LDLc results were falsely increased (by more than 30% in some cases). It is likely that some patients received some inappropriate treatments aimed at decreasing their blood cholesterol, although such patients do not seem to have been systematically searched for (in our opinion, this reluctance might

be a consequence of a possible "feudal system" phenomenon in certain French medical institutions (3)).

Two main motives enable the VALAB expert system to refuse the validation of a particular laboratory result: (a) in case of a "correlation" defect between the result and one or several other laboratory results and/or between the result and the patient's clinical situation; (b) in case of an "anteriority" defect, in which the current and previous laboratory results and/or patient's clinical situations are taken into account. A few months after our laboratory had purchased the VALAB system (in August 1996), one of the conceivers of the VALAB system (E. Rogari, MD) (1) kindly warned us that VALAB refused to validate too many LDLc results, as compared with the numbers of TC, TG, or HDLc results that were refused by VALAB during the same period of time (16.36% vs. 4.35%; 16.36% vs. 5.27%; 16.36% vs. 5.35%) (Table 1). This enabled us to search for and eventually find, a little bit late, however, the LMX defect. Today, as indicated in Table 1, more than 1 year after the LMX defect has been corrected, the percentage of LDLc results re-

TABLE 1
 Percentages of Validation Refusals During Two Periods of Time

	Periods (number of expertised results)	Percentages of Validation Refusals (motives)	
		Correlation	Anteriority
TC	P ₁ (13,080)	4.35	2.75
	P ₂ (9,419)	3.05	2.95
TG	P ₁ (13,240)	5.27	5.67
	P ₂ (9,536)	3.94	5.94
HDLc	P ₁ (3,755)	5.35	3.62
	P ₂ (2,712)	4.90	3.95
LDLc	P ₁ (3,754)	16.36	2.34
	P ₂ (2,711)	5.46	3.87

TC = total cholesterol; TG = triglycerides; HDLc = HDL cholesterol; LDLc = LDL cholesterol; P₁ = first period (8/5/96-4/19/98); P₂ = second period (4/20/98-6/12/99).

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fused by VALAB is much more similar to the corresponding percentages of TC, TG, and HDLc results. In addition, if we compare the pairs of "anteriority" percentages obtained during the two different periods of time in Table 1, the figures are quite similar in the case of TC (2.75% vs. 2.95%), TG (5.67% vs. 5.94%), and HDLc (3.62% vs. 3.95%) but not in the case of LDLc (2.34% vs. 3.87%).

This recent experience brings us to conclude that: (a) expert systems may help improve the organization within a laboratory, which is particularly worth stressing in the current context of French hospitals' accreditation (2); (b) our expert system likely en-

abled some patients to avoid being additionally treated inappropriately.

References

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