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EXPERIMENTAL INTRODUCTION OF SOFTWARE IN THE FORENSIC PROBATION EXPERTISE METHODOLOGY FOR THE PERIOD OF CONCEPTION IN CHILDREN REGARDING FATHERHOOD CONFIRMATION

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ABSTRACT
This study has as a target the experimental introduction of a software methodology in forensic expertise of the period concerning conception of children in the paternity research. The following standard methods had been used in this research: the methodology of forensic expertise to design limited range of conception period for minors in research paternity, the establishment of possible period of conception, the calculation of the probability to conceive at a time of coexistence already indicated, the calculation of the probability to conceive before or during the start of cohabitation, the calculation of the probability to conceive after the start of cohabitation developed by the National Institute of Forensic Medicine ,,Mina Minovici" Bucharest. For the data and calculation formulas entry in the program the parameters we used were the data from tables on intrauterine growth, obtained by processing mathematical tables and curves of Lubchenco for rapid determination of the statistical average duration of pregnancy and its limits. The main advantage is speed in obtaining results and removing human error factor in the process of calculation, by replacing it with software. The software was developed in .NET, creating a simple interface through which can be calculated easily, using a mathematical algorithm, to determine the probability for possible period of conception of minors in paternity research
Keywords: forensic expertise, the probability of calculus of conception, experimental software

BACKGROUND:

Under Article 61 of the Family Code, which defines the legal time of conception as the time period of 300-180 calendar days preceding the birth of the child considered from day to day (121 days). (Codul Familiei,1999)

During the forensic expertise we must calculate the legal time of conception. By law a child can be born later than 300 days or until 180 from conception. This statement underpins forensic expertise, which then can calculate the probability of date determination based on some well studied parameters (Alexandrescu Gh.,1999, Alexandrescu Gh. 2000).

The information used in the expertise is: the medical chart of the pregnant woman with the time she was taken into evidence including the course of gestation, copies of the clinical observation sheet of the mother and infant, a chart documenting development of the child from 0 to 1 year after birth with weight curve evolution, statements from the parties regarding the sexual cohabitation period and, in special circumstances, the case file (Ancar V.,1997).

The methodology of forensic expertise used to study the limited period of minors' conception in researching its paternity shall contain all information required to draw up forensic expertise as set out below:

Clinical data, laboratory and testimonial data necessary in the expertise regarding the date of the conception: the date of birth and the sex of the infant, major fetal anthropometric indices (waist, weight, cranial perimeter), the maturity of the infant, placental weight, clinical diagnosis of gestational age, obstetric historical data (date of last menstrual period, first fetal movements), history of any pregnant pathological information, laboratory investigations (fetal age estimation based on shaft femoral length and biparietal diameter fixed fetal ultrasound), the evolution curve of infants weight in neonatal period, date or period of sexual cohabitation as presented in the court statements. Maternal-fetal medical data interpretation requires: statistical tables and curves on intrauterine growth of fetuses containing the main anthropometric indices (waist, weight, cranial perimeter), obtained by various authors of clinical statistical material, tables of estimated (theoretically) intrauterine growth of conception product, drawn on the basis of anthropological research, tables on the scores of infants (morpho-functional and neurological) maturity, pathological bias curve of intrauterine growth, curves and tables regarding the average weight gain in premature babies depending on their weight at the moment of birth and during the neonatal period, the curve of the normal evolution of the biparietal diameter (DBP) and estimating

the gestational age by assessing the length of the femoral shaft of the featus via an ultrasound, tables and formulas for the calculation of conception probability (previously used in research methodology of an extended period of conception) (Alexandrescu Gh.,1999, Alexandrescu Gh., 2000, Ancar V., 1997, Belis V., 1995, Dermengiu D., 1999, Dragomirescu V. T., 1999, Moraru I.,1967).

The objective was the creation of software that can calculate the probability of conception based on classic parameters: size of the child, date of birth, sex and the presumed date of conception.

MATERIAL AND METHODS

We used as standard methods, the methodology of forensic expertise regarding a limited period of conception of a minor in the research of paternity, the establishment of a possible period of conception, the calculation of the probability of conception at the indicated time of cohabitation, the calculation of the probability of conception before or during the start of cohabitation, the calculation of the probability of conception after the start of cohabitation, all of these developed by the „Mina Minovici" National Institute of Forensic Medicine, Bucharest. For the input of data and the formulas into the program itself, we used parameters that existing in tables on intrauterine growth, obtained by processing mathematical tables and the curves of Lubchenco for rapid determination of the statistical average duration of pregnancy and its limits. So we studied: the methodology of forensic expertise of a limited period of child conception in paternity research, practical methods of cases analysis, determination of degrees of content probability, use of statistical tables on fetal anthropometric indices and addition of formulas to calculate mathematical concept of probability taking into consideration the parameters mentioned above. Three possibilities may arise: 1. Cohabitation period is all contained within the possible period of conception, and in this case we will conclude that the minor could be conceived during the cohabitation of the parties. 2. Cohabitation period partly coincides with the period of possible conception. 3. Cohabitation period does not coincide with the possible period of conception. We need to mention that the main objective is to remove human error from the process of calculation, by replacing the human factor with software.

Implementation was difficult because there are a lot of adjustment factors and more specific cases cannot be subjected to the full calculation formulas. However we will try to progress, and to integrate more elements as it is known that a complex computer system increases the accuracy of simulating a real case.

In order to determine the conception probability we used tables with statistical analysis created by Wichmann and Freudenberg. These tables contain statistical data for population distribution taking into consideration two main characteristic parameters: the average (m) and the standard deviation or medium square deviation (sigma).

Standard deviation is represented by dividing the individual values to the average. The obtained values have a close probability of certitude of 99,74%. For even closer values we used three tables. (Alexandrescu Gh.,1999, Alexandrescu Gh., 2000, Ancar V., 1997, Belis V., 1995).

Table 1 contains the medium pregnancy period post conception corresponding to fetal length between 45-55 cm, a correction coefficient for sex and the maximum deviation from average. The correction coefficient for sex is 2 days for length of 45-48 cm and of 1 day for 49–55 cm. This coefficient will be deduced from the medium period of pregnancy for masculine sex and will be added for those of feminine sex (Belis V., 1995).

Table 2 contains the medium period of pregnancy post conception in rounded numbers, the correction coefficient for sex and the standard deviation for fetal length between 45–55 cm.

Table 3 contains in the first column the coefficients obtained by dividing the standard deviation (sigma) coefficients of several deviations in the maximum deviation (delta). In the second column we have the percentage frequency versus the maximum frequency of pregnancy. In the 3rd and 4th columns we have the percentage probability for deviations in less or more to the average (Belis V., 1995).

This software program is using all three tables, with the help of a matrix equations witch substitutes variables according to their value, automatically modifying the correction coefficient. The calculation mechanism is standard and determines the conception probabilities using tables with anthropometric information. The software also takes into account the Gauss curve for even more accurate result (Belis V., 1995).

In this software we used the top four standard methods, as follows:

1. Setting possible period of conception: in which the average duration of development in length, at birth, is known. These are listed in Table 1. The period of conception is written in columns 2 and 3 and is corrected with minus for male fetuses and plus for female. Finally we add and minimum and the maximum deviations in column 4, resulting the possible limits of pregnancy. After that, we retroactively calculate the calendar from the date of birth.
2. The calculation of the probability on a specified date: using Table 2 and 3. The calculated interval between cohabitation and birth date is deducted from the number obtained by the medium average duration of pregnancy in column 2, corrected by the factor in column 3 of Table 2. The difference is divided by the corresponding standard deviation of column 4,

the coefficient obtained is compared with the first column of Table 3. Within table 3 we pay close attention to column 2, the frequency of births for the sought after duration of pregnancy. If the uncorrected coefficient exceeds 3,1 the indicated date cannot be the date of conception.

3. The Calculation of the probability of conception before or during the start of cohabitation: the interval between the start of cohabitation and child birth date is calculated. We reduce the medium average length of corrected pregnancy. Deviation obtained is divided by the standard error and the coefficient obtained is compared with column 1 of Table 3. If the deviation is in addition we will read the percentage of probability in column 4, if less then we will read the percentage in column 3. If the deviation is in addition to the average and coefficient obtained by using Table 2 is greater, that the period of cohabitation is higher than the minimum period for the development of pregnancy. In conclusion the task took place during cohabitation
4. The calculation of conception probability before or during the start of cohabitation: the interval between the start of cohabitation and child birth date is calculated. We reduced the medium average length of corrected pregnancy. Deviation obtained is divided by the standard error and the coefficient obtained is compared with column 1 of Table 3. If the deviation is in addition we will read the percentage of probability of column 4, if less then we will read the percentage in column 3. If the deviation is higher than the average and coefficient obtained by using Table B is greater, that the period of cohabitation is higher than the minimum period for the development of pregnancy. In conclusion the conception took place during cohabitation.

Table 1

Length at birth (cm)	The average duration of pregnancy(days)	Correction factor for gender	Maximum Deviation
45	248	2	60
46	252	2	56
47	257	2	51
48	261	2	45
49	264	1	42
50	266	1	40
51	268	1	38
52	270	1	37
53	271	1	37
54	273	1	37
55	274	1	37

Table 2

Length at birth (cm)	The average duration of pregnancy(days	Correction factor for gender	Maximum Deviation
45	247.8	2	19.3
46	252.1	2	17.9
47	256.8	2	16.2
48	260.9	2	14.5
49	263.9	1	13.5
50	266.1	1	12.8
51	268.1	1	12.2
52	269.8	1	11.9
53	271.5	1	11.8
54	272.8	1	11.8
55	273.8	1	11.9

Table 3

Coefficient delta / sigma	Frequency (%)	Probability Percentage	
		Deviation in less	Deviation in plus
0	100	50	50
0.1	99.5	46	54
0.2	98.0	42.1	57.9
0.3	95.6	38.2	61.8
0.4	92.3	34.5	65.5
0.5	88.2	30.8	69.1
0.6	83.5	27.4	72.6
0.7	78.3	24.2	75.8
0.8	72.6	21.2	78.8
0.9	66.7	18.4	81.6
1	60.6	15.9	84.1
1.1	54.6	13.6	86.4
1.2	48.7	11.5	88.5
1.3	43.0	9.7	90.3
1.4	37.5	8.1	91.9
1.5	32.5	6.7	93.3
1.6	27.8	5.5	94.5
1.7	23.6	4.5	95.5
1.8	19.8	3.6	96.4
1.9	16.4	2.9	97.1
2	13.5	2.3	97.7
2.1	11.0	1.8	98.2
2.2	8.9	1.4	98.6
2.3	7.1	1.1	98.9
2.4	5.6	0.8	99.1
2.5	4.4	0.6	99.4
2.6	3.4	0.5	99.5
2.7	2.6	0.4	99.6
2.8	2.0	0.3	99.7
2.9	1.5	0.2	99.8
3	1.1	0.13	99.87
3.1	0.8	0.1	99.9

The information from the tables are provided by Belis V., Tratat de Medicina Legala (sub red.), vol. II, Ed. Medicala, Bucuresti, 1995.

For the implementation it was used .NET which is a software platform (Framework) from Microsoft Company, to develop applications. The most important features of this platform are:

- Programmers have provided a number of high-level programming languages to choose from
- There can be developed a large variety of applications, from desktop software applications up to mobile devices, web services and applications or Windows services, from isolated software to remote and distributed systems of enormous size.
- The execution environment is strictly controlled by an execution engine, which offers some facilities to raise the quality of the applications

(automatic memory management and security are the first two that stand out).

Among the languages provided by Microsoft they included C # (pronounced "see sharp ", a language developed along with the platform. NET and located somewhere between Java and C + + like syntax, but with some significant innovations), Visual Basic.NET.

The application was made using the language C # respecting the programming rules the most important of them being MVC. Model-View-Controller (MVC) is an architectural model used in software engineering.

Successfully implemented this model insulates business logic from user interface considerations, resulting in an application where it is easier to change the visual or lower levels of business rules without affecting other levels.

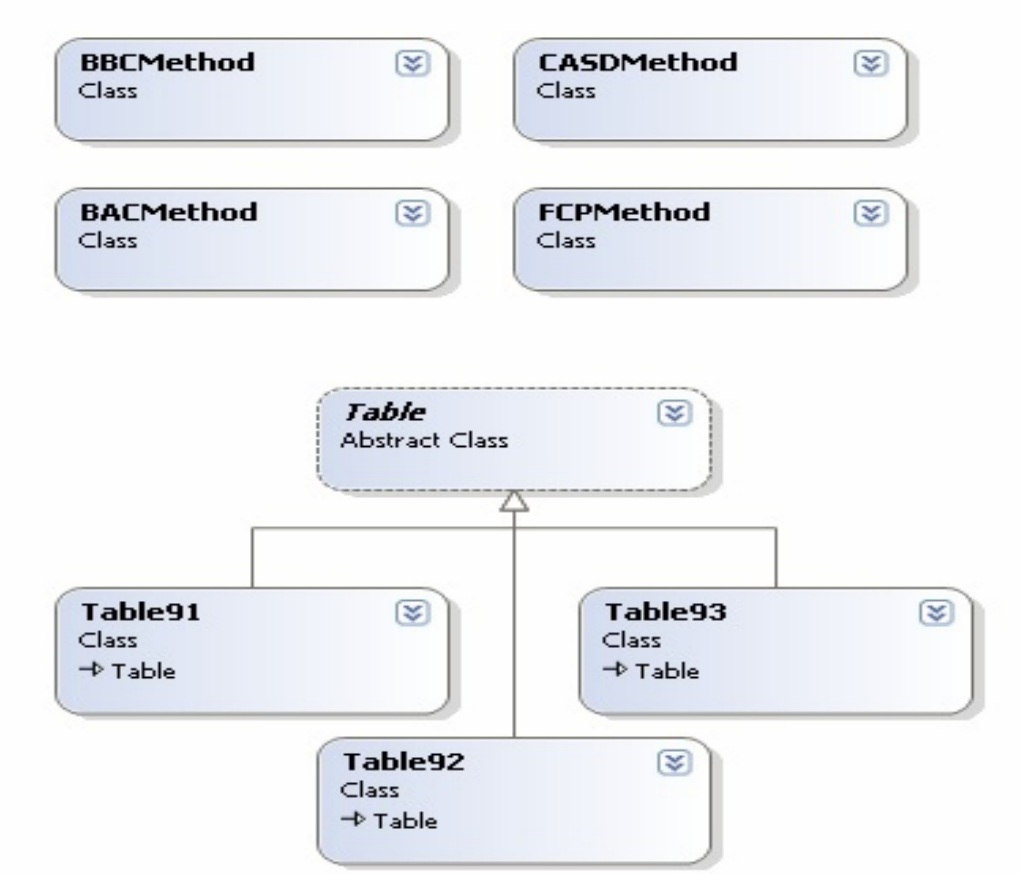

Figure No. 1. Application algorithm

According to this model our application can be divided into two parts:

- The data model that includes statistical tables and methods for solving the proposed problems.
- User interface that provides an interactive environment for communication with data model behind the application, the graphic interface of the application was built in accordance with current standards, using technology. Net Forms such as MDI (Multiple Document Interface) on the left side of the interface is a menu bar where appropriate windows from where can be launched various methods.

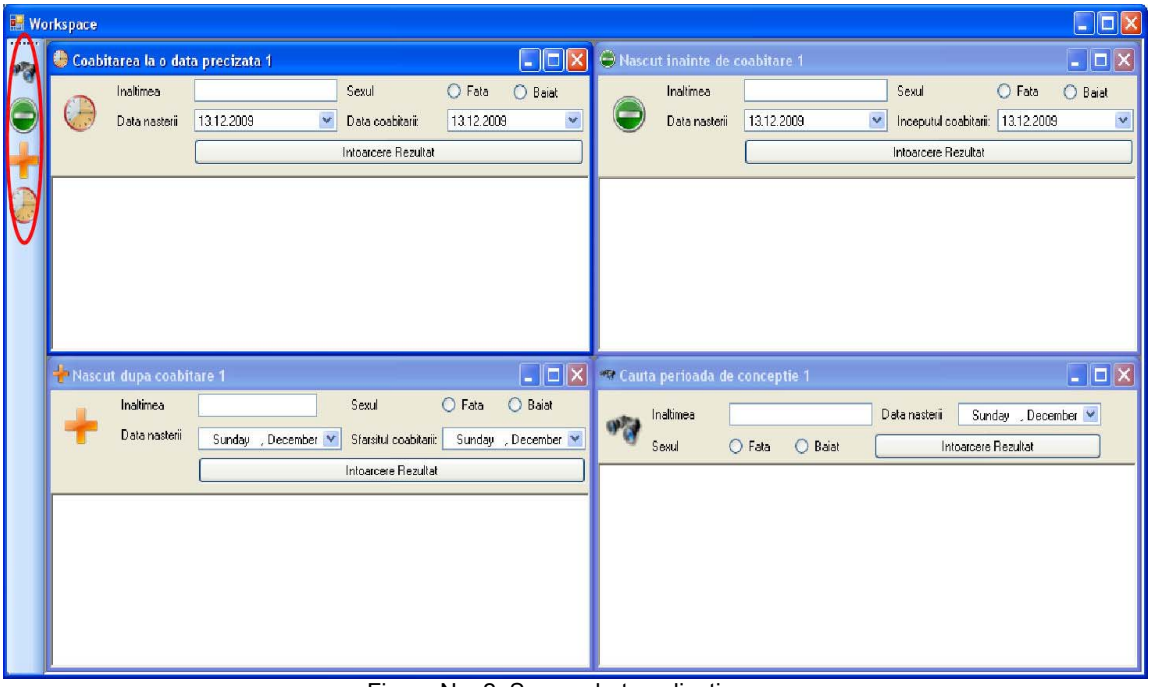

Figure No. 2. Screenshot application

For verification we used several applications such as male child, born on 15.01., birth length 50 cm. They say that was developed on 01.04., the previous year. Pregnancy should be of 289 days. The difference from the average is 266.1-1 = 265.1 and obtain a deviation of 289-265.1 = 23.9. It is divided by the standard deviation resulting in 23.9 : 12.8 = 1.867. Last decimal place is rounded achieving 1.9. In Table 3 we find at coefficient 1.9 a frequency of 16.4%. In the example above, if it were claimed as a date of cohabitation on the 01.03. from the previous year then 01.03. - 15.01. = 320, the deviation would be 320-265.1 = 54.9 and 54.9:12.8 = 4.28. the coefficient being greater than 3.1, excludes the conception on the affirmed date.

The program was developed so that data entry is simple. For now the program only works in view mode / computer, printing and creating other methods of calculation will be realized as a future project.

CONCLUSIONS

By introducing a software program for paternity research, this forensic expertise becomes faster.

The data base can be correlated easier and the result is precise.

The utilization of this software program in the forensic expertise have not the great precision of the DNA method, but it can be the first step of the methodology of forensic expertise, regarding the period of children conception in research affiliation, in the paternity research.

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