**Scholars Journal of Applied Medical Sciences (SJAMS)** **ISSN 2320-6691 (O)**
**Sch. J. App. Med. Sci., 2013; 1(4):265-268** **ISSN 2347-954X (P)**

(An International Publisher for Academic and Scientific Resources)
www.saspublishers.com DOI: 10.36347/sjams.2013.v01i04.011

## Review Article

# An Introduction To Computer Aided Health Science Research

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**Abstract:** Computer aided health science research refers to the application of computers in conducting health science research. This could be mere use MS office such as MS Word for preparing a report or MS Excel for quantitative data analysis to higher applications such SAS, SPSS etc. Gone are the days when research used to happen manually with the use of human intellect only. There has been a paradigm shift in research approach and most of the research activities happening during these days are a combination of manual and computer aided approach. A number of softwares are available for this purpose both for bio-clinical research and public health research. These softwares are useful both in qualitative and quantitative research. Computer aided health research helps in many different ways such as data entry, analysis, and interpretation. Computer aided health research should not be confused with computer aided health care as the latter refers to computer assisted health care delivery. There are many advantages of the softwares used in health science research but the disadvantages cannot be neglected. In this paper an attempt has been made to give an introductory idea about computer aided health science research in the form several of softwares used in HSR.
**Keywords**: Computer, Health Science, Research, Software

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## INTRODUCTION:

With the growing pace of time and invasion of computers in to every field the domain of health science research has also fallen prey to use of computer programmes or software. Health services research (HSR) is a highly interdisciplinary field that employs a variety of quantitative and qualitative methods. While many statistical software applications are available to health services researchers, there is no accepted norm in the profession regarding which software product to use for HSR studies [1]. In one way the quantitative research is more of statistics oriented domain that requires software which work on various statistical methods both descriptive and inferential on the other hand the qualitative research is more of a socio-anthropological domain that uses software which are different than the quantitative one in many different ways. Simply saying qualitative software can provide tools to help analyze qualitative data not the analysis in the sense what SPSS, SAS can do, say multiple regression. Sometimes many investigators think that once the data are put in the software would read it and some decision may come up but this is not the case as the software cannot substitute learning and doing data analysis process. Precisely speaking the researcher has to know what and how of data analysis i.e. the theory of data analysis before putting it in to a software package. Again many HSR investigators, particularly junior investigators new to the field, are often uncertain about which software programs to adopt. Attempts have been made by some authorities to evaluate the relative merits and limitations of the various software programs [2].

However, the choice of a particular software package for a particular HSR study generally will be dependent on the study's specific computational needs, the investigators' skills and experience, and their judgment about the suitability of a particular software application for a specific analysis [1]. With this background this paper serves as a beginners guide and introduces briefly about the computer aided health science research. This is rightly called as a beginner's guide as the subject is very vast and each of the computer programming is a big document in itself which narrates the operational guideline of the same and the same cannot be reproduced here.

## BRIEF HISOTORY OF USE OF COMPUTER IN HEALTH SCIENCE RESEARCH

The historical aspects of health science research aided by computer application can broadly be discussed in two different segments. One segment deals with quantitative health science research which is more of a statistics oriented subject and the second segment deals with qualitative research which is a social science intensive domain. For most of the long history of medicine, greater emphasis has been placed upon clinical explanations reasoned through basic science than upon those supported by numerical (statistical and epidemiological) evidence. Many methods currently described as medical statistics are classical epidemiological techniques. Classical patho-physiological reasoning is deeply ingrained into medical culture, and it gives rise to small-scale, statistically invalid clinical experimentation. This situation is not necessarily damaging to medical knowledge; on the contrary, innovations of large-scale

clinical benefit have been attributed to such experiments. For these reasons, computer support of numerical reasoning in medical research presents challenges that are different from those in more clearly hypothetico-deductive fields. In other words, medicine has a distinctive epistemology. Software written to support numerical reasoning in medical research should therefore be differently presented to software that is written for general statistical use [3]. The widespread use of general statistical software in medical research presents two potentially damaging misconceptions. First is the specious acceptance that a large software package is broad enough to support general numerical reasoning in medical research. Second is the use of statistical software as a substitute for consultation with a statistician. When the involvement of a statistician is replaced by inappropriate use of computer software, statistical theory is distanced from observation, and scientific opportunity is lost. Just as medical research is fuelled by clinical observation, advances in statistical science are often born of a marriage of theory and observation. A classical example of an avid observer formulating statistical theory is Francis Galton's conceptual contribution to the development of multiple regressions [4]. Similarly for several years qualitative researchers were happy with their pan, pencil and note sheets. The scenario took a turn after mid of 1980s when some of them started using word processors for typing work and very few of them started experimenting with database programmes for storing and accessing the texts. In 1980 a couple of programmes began to appear for qualitative data analysis and the early programmes like QUALOG, the first version of The Ethnograph and NUD*IST reflected the state of computing at that time [5]. After this several programmes were lunched in to the market and some of them sustained in the market and few obsolete owing to lack of users.

**FUNCTIONS OF COMPUTER PROGRAMMES:**

**Table 1: Functions facilitated by quantitative software programmes**

| Sl No | Function | Interpretation |
|---|---|---|
| 1 | **Data management** | Collection, compilation, tabulation (frequency distribution), graphical presentation of data |
| 2 | **Descriptive statistics** | Measures of central tendency (Mean, Median, Mode) and Measures of dispersion (Range, Quartile Range, Mean Deviation, Standard Deviation, Coefficient of Variance, Variance) |
| 3 | **Inferential Statistics** | Helps in tests of significance by using various test both parametric tests (“Z” test, “t” test, and ANOVA) and non parametric test (The Sign Test, Wilcoxon’s Signed Rank Test, Mann Whitney Test, Kruskal-Wallis H Test, and Friedman Test). |
| 4 | **Analysis** | Correlation and regression, Multiple regression, Logistic regression etc |
| 5 | **Others** | Life table, Survival analysis |

**Table 2: Functions facilitated by qualitative software programmes [6]**

| Sl. No | Function | Interpretation |
|---|---|---|
| 1 | **Making notes** | Taking notes at the field setting |
| 2 | **Writing up** | Transcribing the field notes |
| 3 | **Editing** | Correction, revision, extension of the field notes |
| 4 | **Coding** | Attaching key words/ tags to texts, graphics, audio or video for further retrieval |
| 5 | **Storage** | Organizing the text in a database |
| 6 | **Search and Retrieval** | Locating specific segments and availing them for inspection |
| 7 | **Data Linking** | Forming categories, clusters and networks of information |
| 8 | **Memoing** | Writing reflective commentaries on some aspects of data, theory or method as a basis for further and deeper analysis |
| 9 | **Content analysis** | Counting frequencies, sequences or locations of words and phrases |
| 10 | **Data display** | Placing selected or reduced data in a condensed, organized format such as a matrix or network for inspection |
| 11 | **Conclusion drawing and verification** | Helping in the interpretation of displayed data and the testing or confirmation of the finding |
| 12 | **Theory building** | Developing systematic, conceptually coherent explanations of findings; testing of hypotheses |
| 13 | **Graphic mapping** | Creating diagrams or graphs that delineate findings or theories |
| 14 | **Report writing** | Writing reports both interim and final |

(*Adopted from- Qualitative Data Analysis: An Expanded Source Book) [6]

## COMPUTER PROGRAMMES/SOFTWARE USED FOR HSR

The following few lines delineates about various software packages available for both quantitative and qualitative data analysis.

### Software for Quantitative HSR

### SAS (Statistical Analysis System)

SAS took its birth as a statistical analysis package in the late 1960s. It was designed and developed as a project in the Dept. of Experimental Statistics at North Carolina State University. This project turned to be SAS institute in 1976. Since its origin it has evolved in to an integrated system of data analysis and exploitation. It contains those capabilities those are normally available with data analysis packages. These capabilities include functionalities to support Analysis of Variance (ANOVA), regression, categorical data analysis, multivariate analysis, survival analysis, psychometric analysis, cluster analysis, and non parametric analysis. One of the greatest advantages of SAS is its consistent up gradation with each release in order to reflect the latest and greatest algorithmic developments in the statistical arena. SAS has become one of the biggest players in the statistical software arena. It has done great job in marketing itself as a data mining company. It has a huge client base including numerous companies, academic institutions, government agencies and it will continue as an active statistical software firm in the foreseeable future [7].

### SPSS (Statistical Package for Social Sciences)

The SPSS software package was developed in the late 1960s by SPSS chairman of the board Norman H. Nie, C Hadlai (Tex) Hul, and Del Brent three of which were Stanford University Graduates at that time. Nie and his colleagues founded SPSS in 1968. SPSS incorporated in 1975. It established its headquarter in Chicago Illinois, where it currently resides. SPSS became publicly traded in August 1993. It has several versions which came from time to time and the current version is SPSS 16.0. SPSS 16.0 is a comprehensive system for analyzing data. SPSS can take data from almost any type of file and use them to generate tabulated reports, charts and plots of distributions and trends, descriptive statistics, and complex statistical analyses [8].

### Epi Info

Epi Info is a public domain statistical software used for epidemiological data analysis. It was developed by Center for Disease Control and Prevention, Atlanta, Georgia, USA and is freely available both at CDC and WHO web portal. The first version was released in 1985 and the latest Windos Vista version was released in Aug. 13, 2008. The program allows for electronic survey creation, data entry, and analysis. Within the analysis module, analytic routines include t-tests, ANOVA, nonparametric statistics, cross tabulations and stratification with estimates of odds ratios, risk ratios, and risk differences, logistic regression (conditional and unconditional), survival analysis (Kaplan Meier and Cox proportional hazard), and analysis of complex survey data [9].

### Epi Data

This quantitative data analysis package was developed by EpiData Association, Denmark in 1999. This software is being used by many organizations including WHO for large data analysis pertaining to the field of biostatistics, epidemiology, public health and medicine. EpiData has two parts:

- EpiData Entry: used for data entry
- EpiData Analysis: performs basic statistical analysis, graphs, and comprehensive data management, such as recoding data, label values and variables, and basic statistics [10].

### STATA

STATA is a general purpose software package developed by StataCorp. in 1985. It is being used by many business and academic institutions around the world for research purposes in the domains of economics, sociology, political science, biomedicine and epidemiology. STATA's capabilities include data management, statistical analysis, graphics, simulations, and custom programming [11].

### Software for Qualitative HSR

### Atlas.ti

Atlas.ti is a software package used commonly, but not exclusively, for qualitative data analysis. This package helps the researcher in uncovering and analyzing complex phenomenon hidden in unstructured data. A prototype of this was developed by Thomas Muhr at Technical University at Berlin in the context of the project ATLAS (1989-1992) and the first commercial version was released in 1993. Atlas.ti mainly adopts grounded theory, content analysis and knowledge elicitation as its main methodology. The package provides tools that help researcher code and annotate findings in primary data material (text, image, audio, video and geo data), to weigh and evaluate their importance and visualize complex relation between them [12].

### Anthropac

ANTHROPAC is a menu-driven DOS program for collecting and analyzing data on cultural domains. The program helps collect and analyze structured qualitative and quantitative data including freelists, pilesorts, triads, paired comparisons, and ratings. The programme capabilities of Anthropac include collection and analysis of proximity data, attitude scaling, consensus analysis, data transformation and data management**.**

**NVivo**

It is a qualitative software package developed by QSR International. It is being used in different organizations including academic, health and government in the field of social sciences such as anthropology, sociology, psychology. It accommodates a wide range of research methods such as network and organizational analysis, action or evidence-based research, discourse analysis, grounded theory, conversation analysis, ethnography, literature reviews, phenomenology, mixed method research and framework methodology [10].

## CONCLUSION

In this paper an effort has been made to delineate the common statistical packages used in quantitative and qualitative health science research. It does not describe the operational guidelines of any of the software packages used in health science research as the same goes beyond the scope of this article. It is true that computers have an immense impact in every walk of life so also the health science research but the same cannot yield everything without the intervention of the human brain. Choosing a particular software package for a particular type of data analysis whether quantitative or qualitative depends on the requirement of the investigator and it may happen so that all the software cannot be used for every health science research and there are specific packages for specific purposes. Hence the use of a computer programme or software rightly depends on the type of research, specific requirement such as procedures or methods, skill of the investigator to operate, affordability, capacity to handle data.

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