Figure 1. It shows designed questions algorithm

For instance, a child with infection in upper respiratory system is considered to be monitored everyday up to 10 days by IMPROS. The information about general conditions (including consciousness, appetite, nausea, vomiting, temperature and heart rate) is classified under general condition question package. The information about respiratory condition (such as respiratory rate, coughs, mucus) is classified under respiration package. Regarding this patient, we choose questions about body temperature from general package and we choose respiratory rate, coughing and mucus from respiration package. Child's mother or his other caregiver calls the system based on predefined schedule and enters measured values in respective manner. (Figure 1 shows designed

questions algorithm and Figure 2 depicts pattern of question package design). In fact it is the duty of medical staff to define packages, questions group and design administrative sequence of packages under the supervision of related physician.

2.3. Reports

A part of IMPROS is allocated to reports. After that the patient enters data, the system automatically draws results of disease treatment to medical staff in the form of diagrams and tables. Reports can be extracted under three categories:

Management reports: Parameters such as system usage (the way in which system is used), both successful and unsuccessful calls, order and sequence of patients' calls and values about control of diseases for each patient are extracted in the form of management reports. Reports about which social and educational levels, genders, living places (city or village) and disease types use the system frequently are also included in managing reports. Such reports are results of collective data and the patient's name is not mentioned for privacy reasons.

Another kind of reports is about the performance of software itself. The percentages of errors occurred during login process, incorrect responses, moving to next question without giving a correct response to previous one, number of repeated questions after 10 seconds of waiting for response and the number of alerts played by system is among this kind of reports. These reports help to improve and further develop the system.

Other reports are about disease progress and its treatment. By selecting patient name, the sequence of reports about his
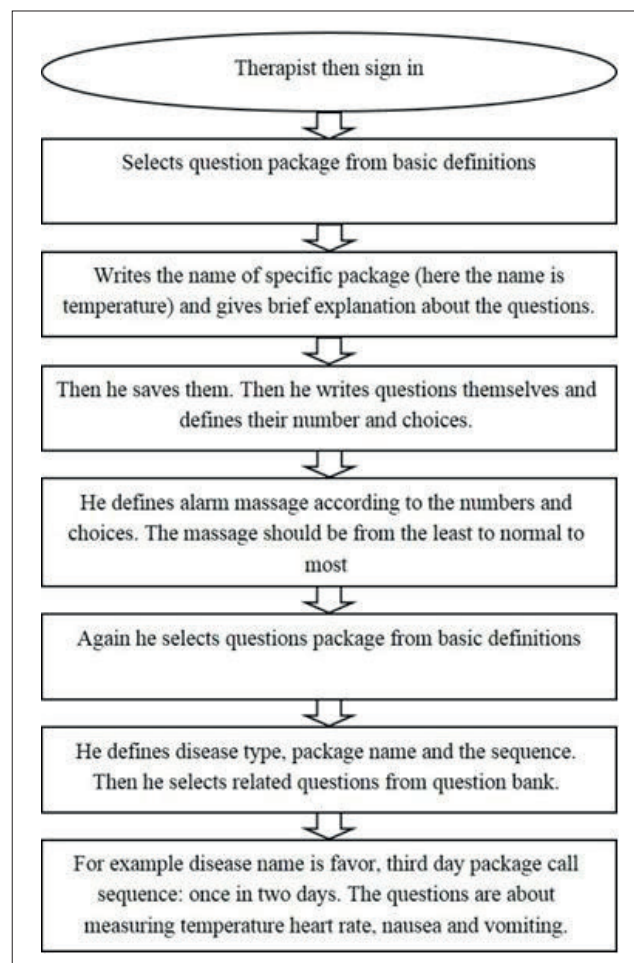

Figure 2. It depicts pattern of question package design

treatment in a determined period of time can be extracted automatically. Reports are presented in the form of diagrams and medical staff can see normal and abnormal points in the form of highlighted spots. Regarding the kind of variables, reports are presented in terms of tables for qualitative variables and diagrams (for instance pie, bar and line chart) for both qualitative and quantitative variables (Figure 3 shows instances of diagram).
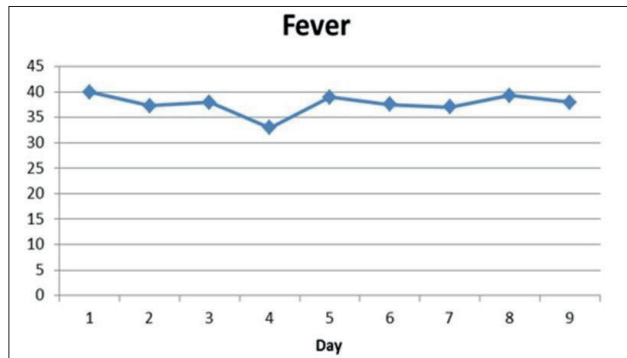

Figure 3. It shows instances of diagram

3. RESULTS

Capabilities and characteristics of system are as follows:

A) Hardware capabilities

From the beginning, IMPROS is designed in a way that it is capable of being administered on common computers. It needs no complicated hardware. It uses cheap and simple modems which are available in the market. It supports several modems that are installed on one computer. It also makes possible to have several calls at the same time.

B) Software

IMPROS makes it possible to design questions in a way that they have an administratively logical order (it means that there is a logic behind their sequence of administration). It also makes possible to have appropriate responses based on input data which altogether form software intelligence. One of the main advantages of the system is its high speed in obtaining users responses. Here the average time period for a patient to response all questions is about 10 minutes in each call.

C) System use

Even low literacy people (those who can only read and write) can interact with the system in easy way.

D) Extensive range of diseases

IMPROS is designed to promote homecare with the direct supervision of medical staff. Thus this system can monitor an extensive range of diseases such as chronic diseases (diseases that need long term treatment especially among elders and children), cancers (for instance breast and blood cancers), cardiovascular diseases, nutritional treatments, diabetes, medical cares during pregnancy, neonatal care (for instance reminder for vaccination, controlling fever and seizure) logical use of medicines, psychological diseases and in general diseases with average severity.

E) A user friendly software

IMPROS is designed in a way that makes it possible for users and medical staff to learn its functionality in a short period of time. To have user friendly software was a high priority regarding the design of this system. It can be even

learned when the patients are waiting in care centers just by means of software modeling , face to face education and training booklets. Designing questions and integrating them in the form of questions packages and the way by which the patients would be followed up and monitored can be taught to medical staffs within few hours.

F) Costs

By application of this system, great bulk of direct and indirect costs of medical care can be reduced. Direct costs such as visit payments, consulting, transportation and hospitalization costs and indirect costs like leaving job, time, energy, etc. can be saved. Even a single medical staff can manage several patients at the same time thus it can reduce cost of services and increase efficiency.

G) Staffs (human resource)

Based on the number of patients, one or more nurses are enough to care and follow up them in time periods. A technical operator is also needed to guarantee the appropriate functionality of system, backing up of data and also maintaining and repairing the system. Therefore according to the structure of the system, if medical staff is familiar with computer and software maintenance, all of the above mentioned duties (medical and technical) can be handled by one individual.

H) Information security

IMPROS has two levels of security for users and medical staff: If the patient calls by phone number which is not registered, the system immediately asks him to enter his ID and password. If another person finds patient's login ID and password when calls the system, IVR doesn't give any information about patient's therapeutic and personal information. It only asks designed questions from questions packages which was supposed to fill in be original patient.

There is a defined level of accessibility for each medical staff. Everyone by his own unique ID and password can see his patient's profiles. However they cannot transfer, extract or print patients' information from the software. Data are exclusively depicted in the form of diagrams and tables. Software is totally off-line and cannot be accessed from the web.

4. CONCLUSION

Today, digital phone lines are available in almost cities and villages. Most of the people need no prerequisite knowledge to work with phone. IMPROS can be easily applied in wide range of medical centers. Medical staffs, therefore, will have more time to evaluate and control the diseases and will have more accurate interventions in real time periods. IMPROS actually prepares a ground for patient's active participation in his treatment. It also improves mutual interaction between patient and medical staffs and ultimately improves the quality of health services.

Abbreviations

IVR: Interactive voice response, IMPROS: Intelligent multilingual patient reported outcome system, ID: Identification

CONFLICTS OF INTEREST: NONE DECLARED.

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