

Chapter 3 System Overview

The aim of this thesis has been to explore ways to improve learning through reflecting in a learning-environment that enables medical students or postgraduate medical practitioners to undertake a series of simulated consultations involving the diagnosis and management of chronic illness.

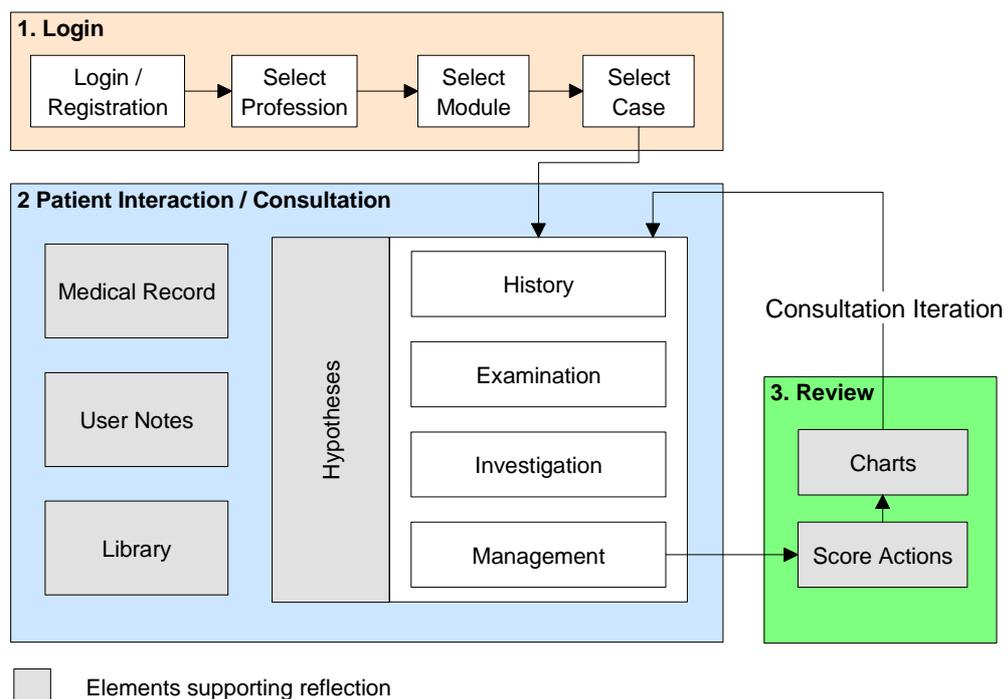


Figure 3: System overview with three functional units.

From a user's perspective, the system can be considered from three functional units, as shown in Figure 3.

1. General housekeeping functions such as logging in a user and selecting a case.
2. Enabling the user to undertake a virtual encounter with the patient.
3. Enabling the user to review their activity and progress, as well as compare their activity to other users.

This chapter is primarily an overview of the system from the point of view of the user. While it is presented as a typical user interaction with a series of screen shots, it also describes in Section 3.2.3 and Section 3.3, those elements that have been included to support reflection. These elements are shown in grey in Figure 3. The design decisions that were made with respect to the user levels are also described (Section 3.1.1).

The chapter has been structured to match the functional units listed above. The first section describes how a user is able to login to the application and select an appropriate case. The second section describes how the user is able to interact with the patient, as well as the tools available to the user to assist them with this interaction. Finally, the last section describes the user interface that has been developed to enable users to reflect on their actions and compare their activity with others.

3.1 Login and Case Selection

The user is initially presented with a screen from which they can login to the application (Figure 4). If the user has not used the application previously, they have an opportunity to register as a new user (Figure 5).

Simprac Application Login - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address <http://localhost:8080/simprac/servlet/simprac>

Login to the Case Simulator

Please enter your login ID and Password.

Login ID:

Password:

If you have not used "Simprac" previously you should [register](#) as a new user.

Help! | [forgot my user name or password](#)

[Help](#)

Local intranet

Figure 4: The user must login to the application.

Simprac Registration Form - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address <http://localhost:8080/simprac/servlet/simprac/template/SimpracRegistrationForm.vm>

Register with Case Simulation Programme

Title:

Surname: *

Given Name: *

E-mail address: *

Your **User ID** can be anything you like that is easy to remember.

User ID: *

Select a password: *

Confirm password:

* Items marked with an asterix are required

Done Local intranet

Figure 5: If this is the first time that the user has used the application then they must first register with the application.

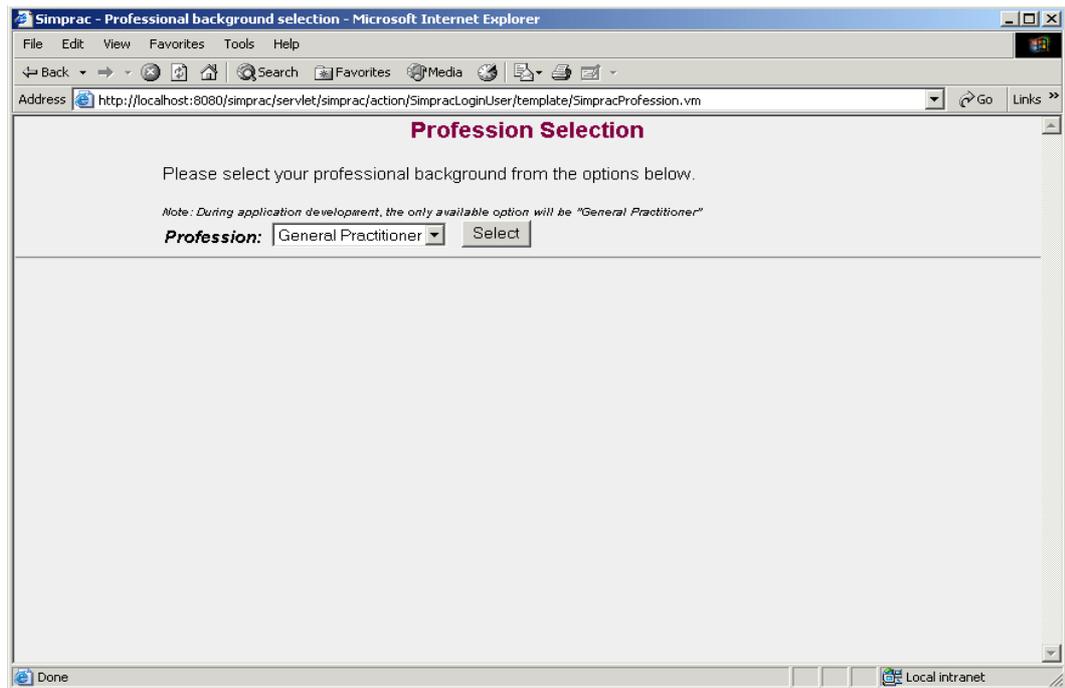


Figure 6: Having registered with the application and logged onto the system, the user must then select their professional background.

3.1.1 Learner Groups

Having registered or logged in, the user is asked to select their professional background (Figure 6). The options currently available for selecting a user's professional background are Medical Student, General Practitioner, or Expert, although it is possible to have any number of professional backgrounds encoded. These three groups were chosen during the development of the software because the initial goal was to provide continuing medical education for medical practitioners, especially general practitioners, on the diagnosis and management of chronic illnesses. Due to the need for evaluation, and the perceived applicability of this method of instruction to medical student education, the scope was broadened from just general practitioners. Furthermore, the "Expert" group was required to enable at least one expert to use the software for any given case so that other users could compare their activity to this individual. Additional specialists may register as an expert but only one is used to compare with other users. The selection of this one expert is currently hard-coded within the database for each

case. It was also hypothesized that Medical Students, General Practitioners, and Specialists in the management of hyperlipidaemia, would have different approaches to the case, which would be reflected in their diagnostic and management choices. Therefore, as part of this exploratory investigation, these three groups were chosen.

The users' selection of their peer group determines the group comparisons available to the user during the consultation review. As is discussed in more detail later, a user is only able to compare their activity against the average for their peer group, or a single expert.

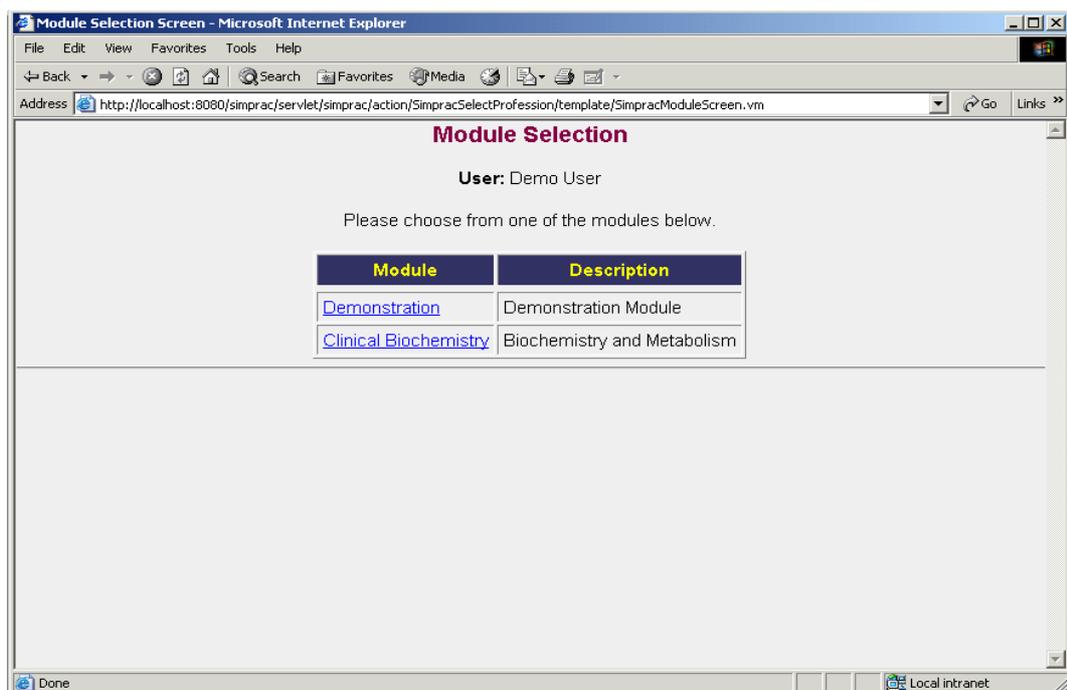


Figure 7: The user can choose from different knowledge domains. There are currently two modules. The first is a demonstration module used to help familiarize users with the interface. The second is the Clinical Biochemistry module that includes the case used during the user evaluations.

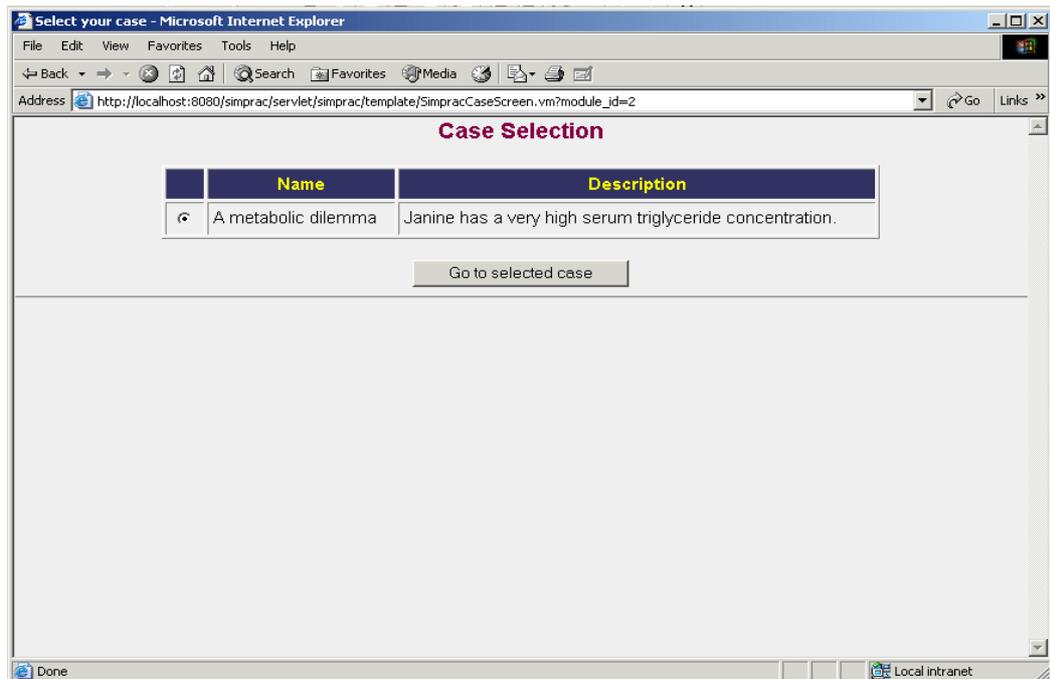


Figure 8: The design of SIMPRAC allows several modules with several cases within each module. The current system has only one case available within the Clinical Biochemistry module.

3.1.2 Modules and Cases

Once the user has selected their professional background, they can then select the module of interest, and the specific case they wish to undertake. A module represents a group of cases covering a limited domain. These modules can be narrowly or broadly defined. Given the limited number of cases, arbitrary, and rather broad categories were chosen. As shown in Figure 7 on page 43, two modules have been defined. The first is the demonstration module containing a case that is used to familiarize users with the software. The second is the “Clinical Biochemistry” module that contains a single case concerning the diagnosis and management of hyperlipidaemia. This module name is defined by the author and is unrestricted, it could have just as easily have been titled, “Diagnosis and Management of Lipid Disorders” if all the cases were limited to this field of medical practice.

The case involves a 29 year old female, who referred herself for management of hypertriglyceridaemia. The patient has a known history of the rare disorder, Type 1B Glycogen Storage Disease (GSD) characterised by short stature, characteristic “doll like” appearance, fasting hypoglycaemia, neutropenia, hypertriglyceridaemia, hyperuricaemia, and hepatomegaly with abnormal liver function tests. This disorder is caused by a defect in the hepatic microsomal glucose 6-phosphate transport system, and sufferers are not able to convert glucose 6-phosphate to glucose in the liver. At presentation, the hypertriglyceridaemia is at such a level that it places the patient at risk of developing pancreatitis. On the other hand, administration of an effective triglyceride lowering agent such as Gemfibrozil is contra-indicated in the presence of liver disease. Type 1B Glycogen Storage Disease is optimally managed by maintaining the fasting blood glucose level with the regular administration of cornstarch. With the exception of neutropenia, most of the metabolic derangements can be corrected by maintaining the blood glucose (Chen and Burchell, 1995). Unfortunately, most patients have difficulty maintaining this therapeutic regimen because uncooked cornstarch is not very palatable.

The first case was chosen because:

- It was a within the domain of the author’s medical experience.
- It is an uncommon condition, which most users would not have seen in their previous clinical practice. Therefore, it would be unlikely that any single user would have an advantage over any other user, making results comparable.
- This case is typical of the complex issues facing the clinician, where one must balance the risks of treatment with the expected benefit. Moreover, these risks and benefits vary over time, and with respect to different individual’s response to treatment.

It was hoped that users would:

1. Identify that the patient had massive hypertriglyceridaemia, and to a lesser extent, hypercholesterolaemia, secondary to Type 1B GSD by asking about the patient's presenting problem, asking about the patient's past medical history, and requesting triglyceride and cholesterol measurements.
2. Exclude other secondary causes of hyperlipidaemia, including excessive ethanol use, renal failure, liver disease, obesity, and diabetes. This could be achieved by asking about the patient's past medical history, and ethanol intake, as well as by measuring the patient's height and weight, and requesting relevant pathology, including electrolytes, creatinine, and liver-function tests.
3. Consider cardiovascular risk factors such as smoking and hypertension by asking about tobacco use, as well as, past medical history, including current medications.
4. Consider primary causes of hypertriglyceridaemia, as might be suggested by a family history of disease.
5. Manage the GSD with strategies to maintain blood glucose. Especially the use of low glycaemia index supplements such as uncooked cornstarch.
6. Consider the patients diet from the point of view of GSD and hypertriglyceridaemia
7. Institute lifestyle changes such as regular exercise.
8. Commence treatment with an appropriate lipid-lowering agent, with the preferred agent belonging to the fibrate therapeutic class.
9. Recognize the side-effects of the therapeutic agents, and monitor the patient accordingly.

3.2 Patient Interaction

The patient interaction element can be divided into two major sub-components: a diagnostic component, and a management component. These were implemented with the goal of providing an environment that would be sufficiently close to a standard medical consultation, such that it could be used as an “authentic” learning activity. The goal was not to make a perfect simulation, but one that would be close enough to enable the lessons learnt using the simulator to have a strong likelihood of being abstracted and transferred to actual medical practice.

3.2.1 Diagnostic elements

The virtual patient interaction begins with a short vignette, as shown in Figure 9, which introduces the problem to the user. Users then have the opportunity to ask questions and take a history from the patient, perform a physical examination, order investigations and review results, and to choose a variety of management options. Consistent with real-world clinical practice, history taking, physical examination, and the ordering of investigations can be undertaken in any sequence.

To help users reflect on their diagnostic hypotheses, users are presented with a screen that asks them to state or update their hypotheses. This screen is displayed when the user chooses to perform a physical examination, request investigations, or select management options for the first time in each consultation.

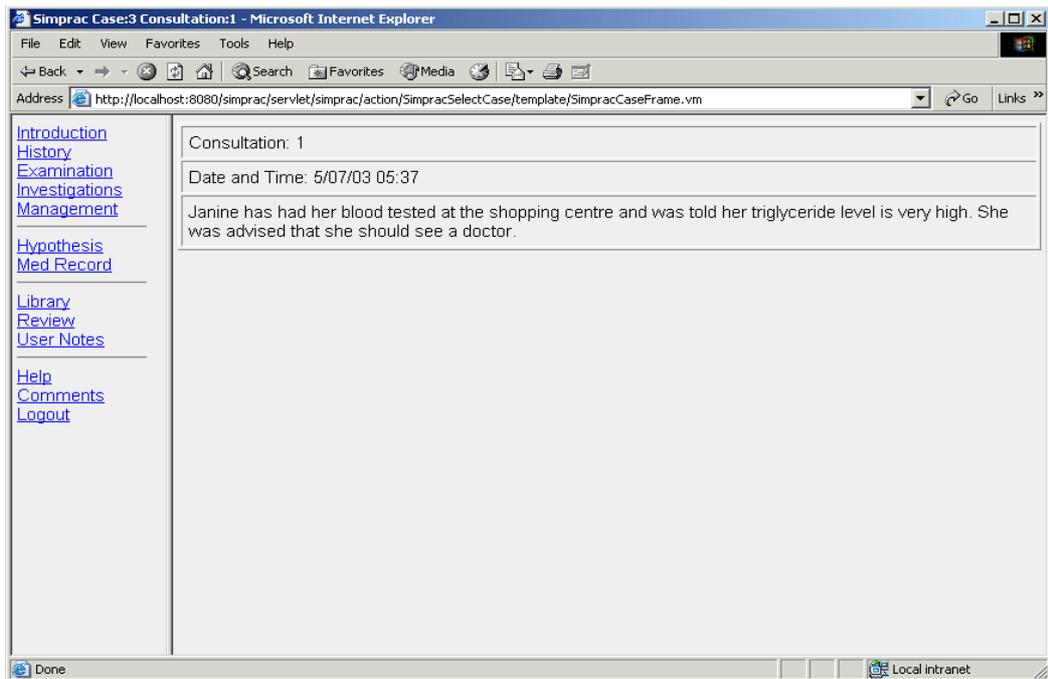


Figure 9: At the beginning of the case the user is given a short introduction to the patient, as a primer to further interaction. The navigation frame on the left also provides access to a number of support functions including the user's hypotheses regarding the patient, the medical record, library resources, and user notes. The review function is only available at the end of the first consultation.

History

Given the large number of possible questions a patient can be asked, and the large number of variations in which these questions can be phrased, the history-taking element was challenging to implement. Rather than allowing free-form questions and using natural language processing, a restricted set of allowable questions have been maintained in a database. These questions have been further categorized according to an arbitrary schema, thought to be reasonable based both on the past medical experience of the author, and categories used by various sources such as textbooks on clinical practice (Robinson and Robertson, 1999, Macleod, 1983). Example question categories include the history of the presenting complaint, past medical history, lifestyle and social questions, and so on. The patient's history can be taken either by asking short questions with keywords, or by selecting from a list of questions by category (Figure 10). When asking questions using free text, a list of possible matching questions is displayed

(Figure 11). If the system is not able to find a sufficiently close match, then the user is asked to rephrase the question. The response to the question is obtained by clicking on the desired question, which is presented as a hypertext link (Figure 13).

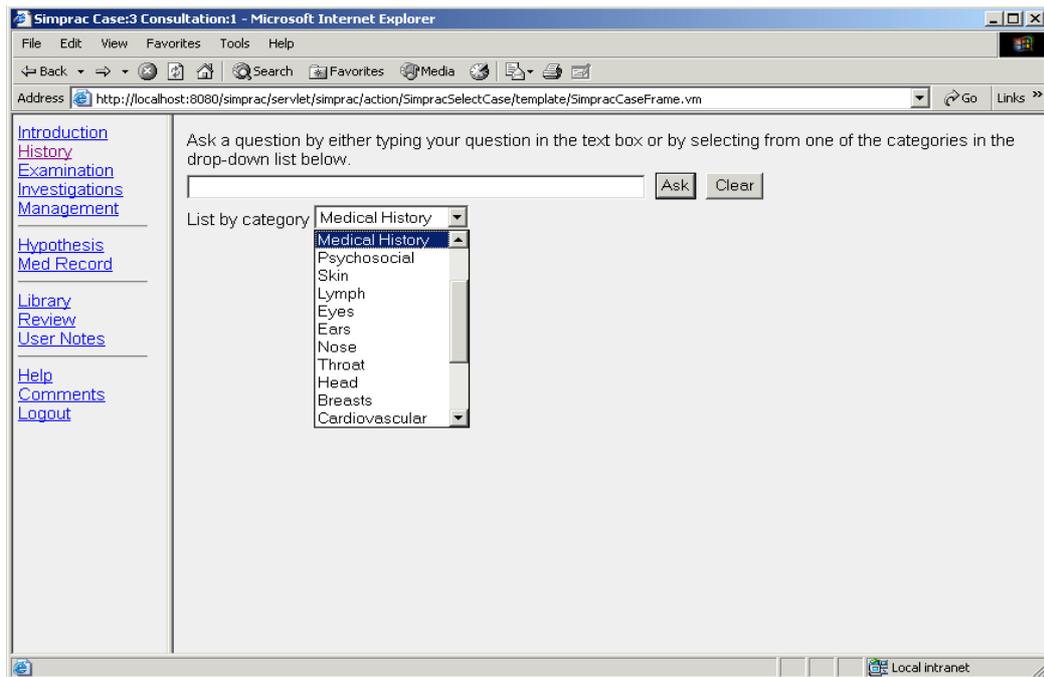


Figure 10: Questions can be asked by either entering free text or keywords at the top of the screen or selecting from one of the question categories provided within the drop down list box.

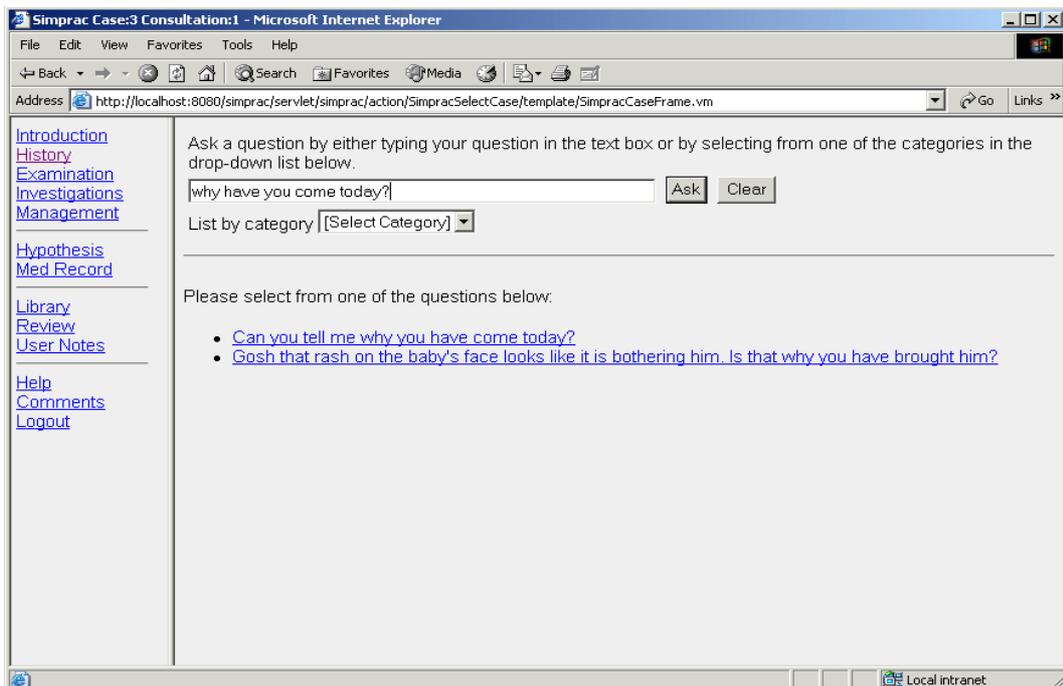


Figure 11: If a question is entered as free text, a series of matching questions from the database is provided. In this instance the user has asked the open-ended question, “why have you come today?” The search engine has found two matching questions from the question database and has listed these as hypertext links below the search field and question category drop-down box. To ask the question the user must then click on the desired hypertext link. If the user clicks on, “Can you tell me why you have come today?” they will be shown the response seen in Figure 13.

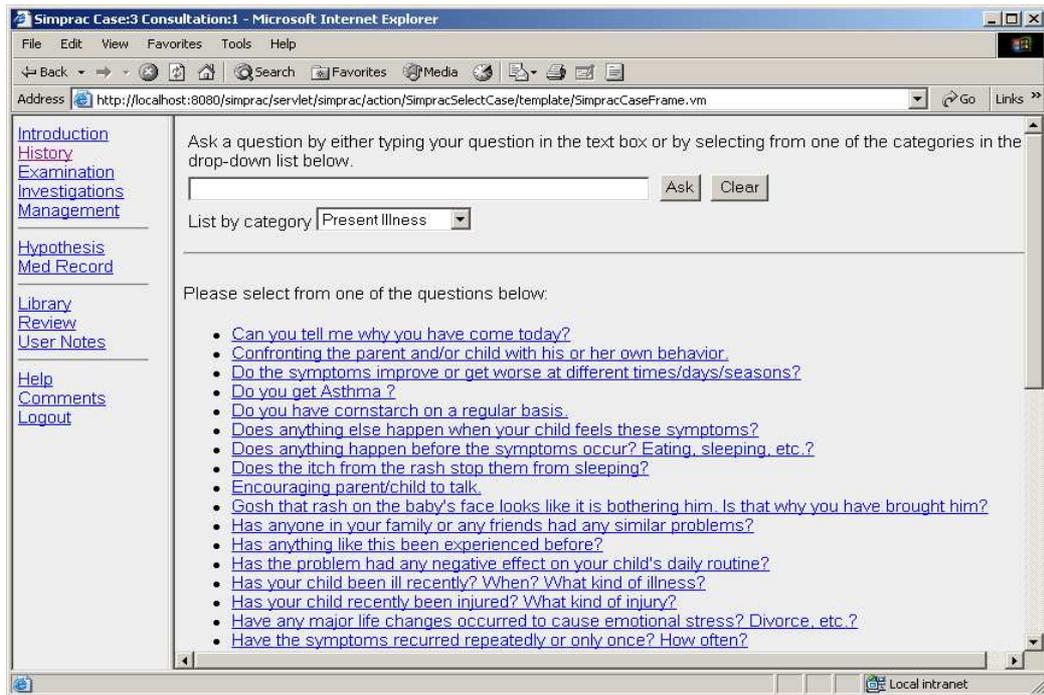


Figure 12: In addition to using the free text mode of questioning, questions can also be asked by selecting from a category. In this example, the user has selected the “Present Illness” category, and has been shown all the questions under this category. Again the user may click on the link, “Can you tell me why you have come today?” to be shown the response in Figure 13.

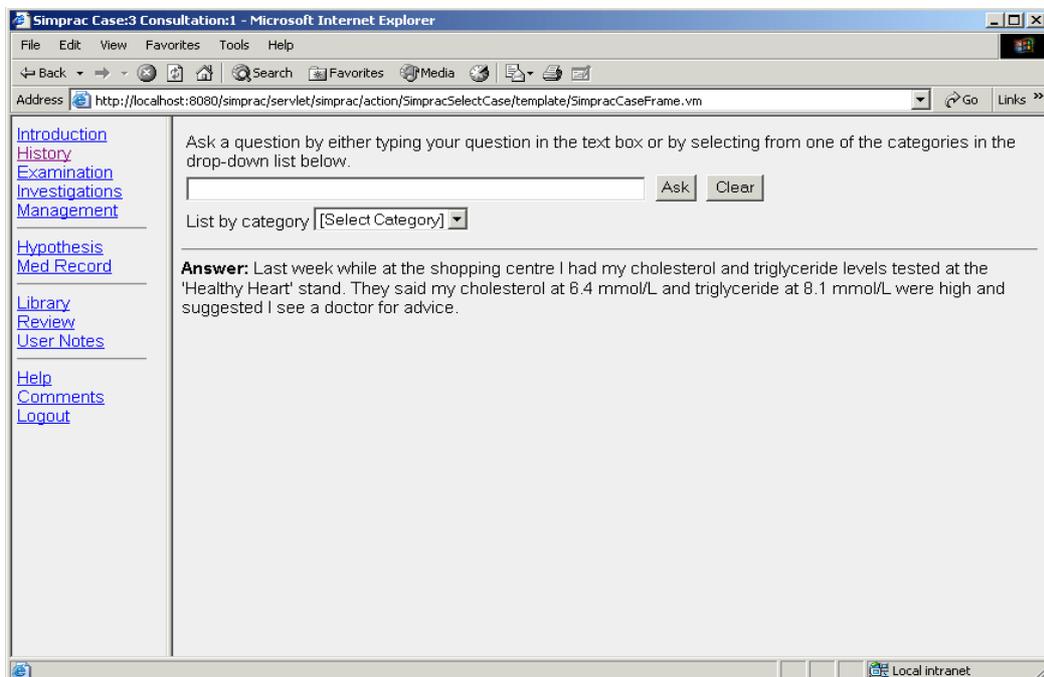


Figure 13: The user has clicked on the hypertext link representing the question, “Can you tell me why you have come today?” To which the patient has responded, “Last week while at the shopping centre ...”

Examination

The examination screen was heavily influenced by the design of other case simulations, especially the product known as DxR (Myers et al., 2001). To examine the patient, the user needs to select an appropriate view of the body, with the default being the full body view. They are then able to select one of the examination tools by clicking on the tool's icon. As illustrated in Figure 14, the palpation tool has been selected. This is

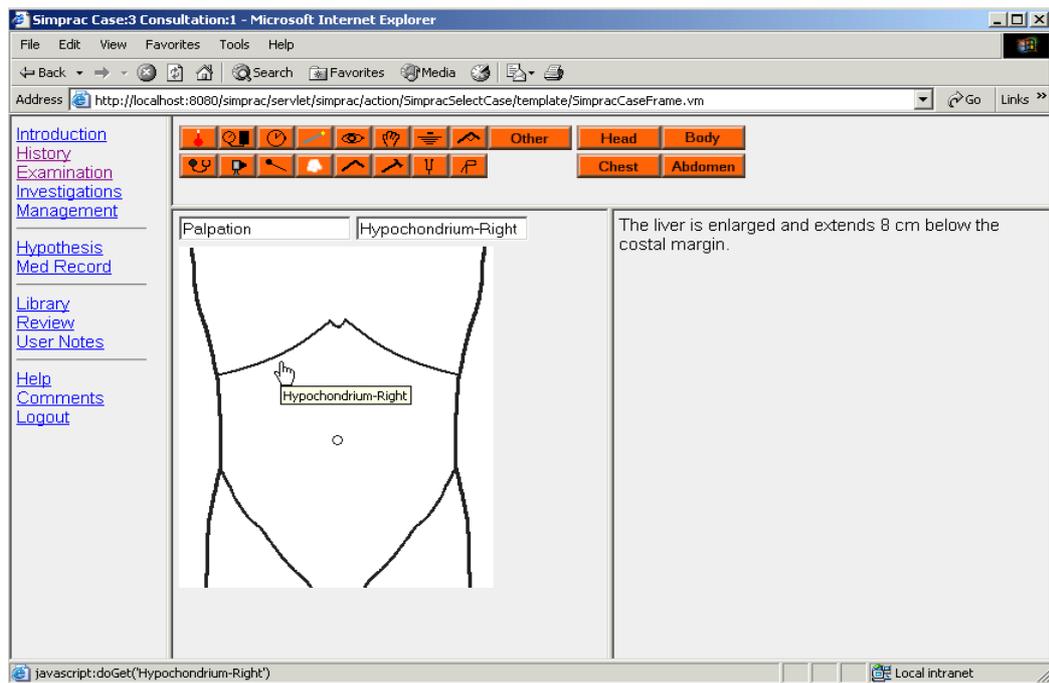


Figure 14: Palpation of the liver in the right hypochondrium has revealed that the liver is enlarged and extends 8cm below the costal margin. Placing the mouse over a tool button displays a text description of that button.

represented by the hand on the sixth button from the left in the top row. By clicking over the desired part of the body, in this case the right hypochondrium, the findings are displayed in the frame to the right. If an inappropriate selection is made, for example, using the sphygmomanometer on the head, where it is normally used for measuring blood pressure by being applied to the upper arm, the application reports that no information is available. Clinical information that does not apply to a single part of the body, for example the height and weight, can be obtained by selecting from a list that is displayed after clicking the “other” examinations button (Figure 16).

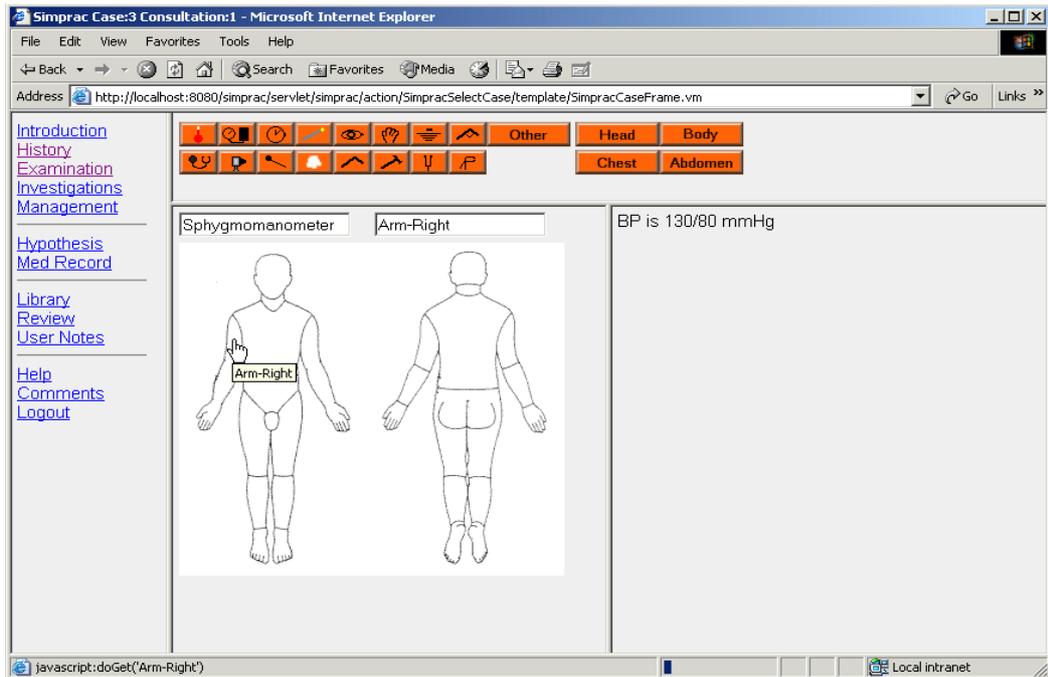


Figure 15: Measurement of blood pressure using the sphygmomanometer tool.

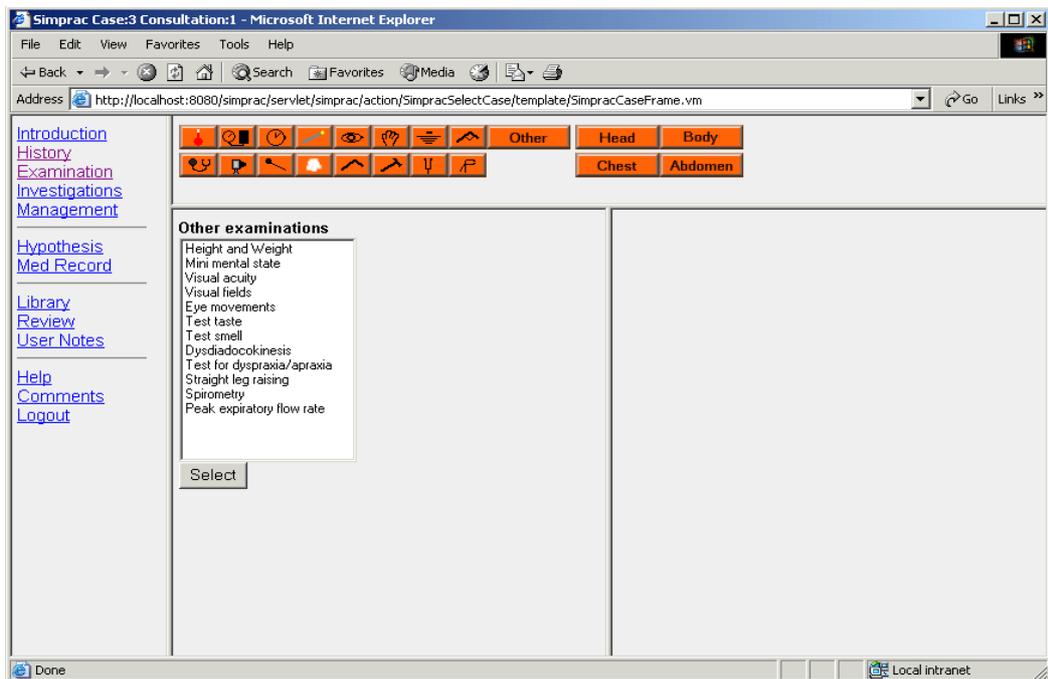


Figure 16: More general examinations, not involving a specific part of the body.

Investigations

Mimicking the clinical situation, a full range of laboratory and other investigations are available to the user. These investigations have been grouped into collections commonly found in clinical practice. Clicking on a group displays a list of investigations under that

particular category. For example, if “Haematology” is clicked, then a list of haematology investigations, such as full blood count and simple coagulation studies is displayed to the user. Very few test panels such as FBC (full blood count), EUC (electrolytes, urea, and creatinine), and LFT (liver function tests) have been allowed. Those that have been used are consistent with those allowed under the Australian Medical Benefits Schedule guidelines (Health Insurance Commission, 2003). As an alternative to selecting from the preconfigured lists, the user may enter the first few letters of the test name to search for a test from the entire database of tests. Tests beginning with the matching sequence of text are then displayed in a list (Figure 17).

When the user selects the investigations from the list, they are then shown a screen with the investigations grouped as either having results available for review, or not available for review (Figure 18). Only those investigations such as electrolytes and creatinine, which are widely and rapidly available, are immediately available for review. All others, that in clinical practice usually require more time to be completed, will not have their results visible until the next consultation. If the results are available for review, then they can be viewed by clicking on the corresponding test name (Figure 19).

The decision not to have all results available at the time of request, was a compromise between having all results available, and having no results available. In actual clinical practice, a medical practitioner will not have the results of investigations available at the first consultation, and will need to make management decisions on incomplete investigations. Often, that decision will be to do nothing until the results are available. At subsequent consultations, a practitioner may give the patient a request form for follow up investigations to be undertaken a day or two before the patient returns for

their next consultation. In this way, the results are available to the clinician at the time of the consultation. From a learning perspective, it was felt that it was not necessary to try to model the full complexity of the clinical situation. Instead, the approach described above was taken.

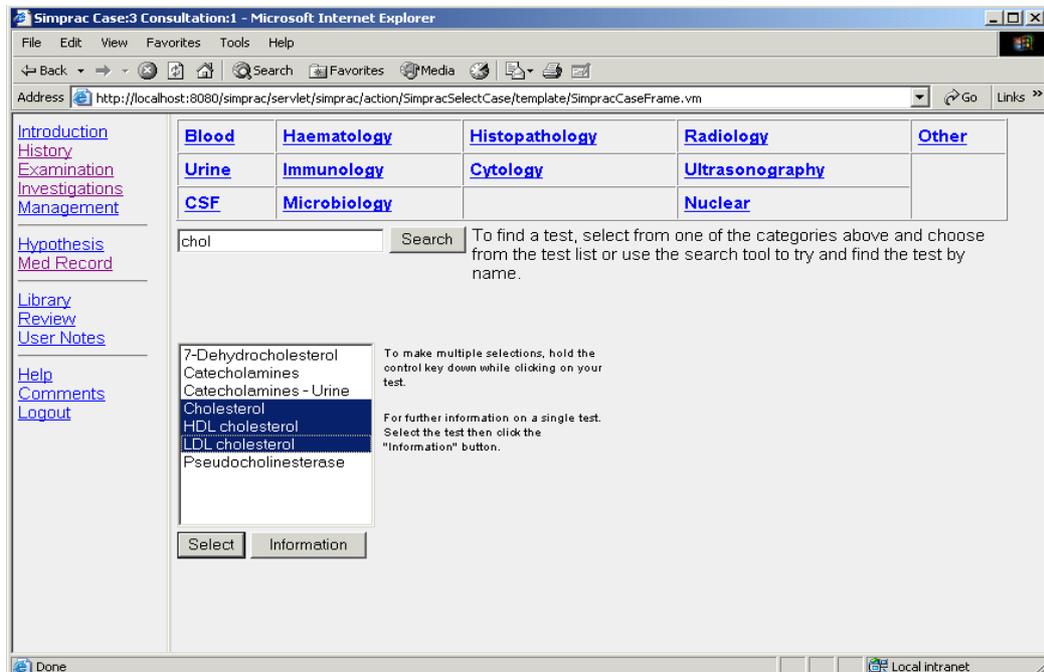


Figure 17: Requesting investigations. In this screen the user has search for tests containing the sequence of letters, "chol". From the displayed list they have then selected three tests that will be requested once they click on the select button.

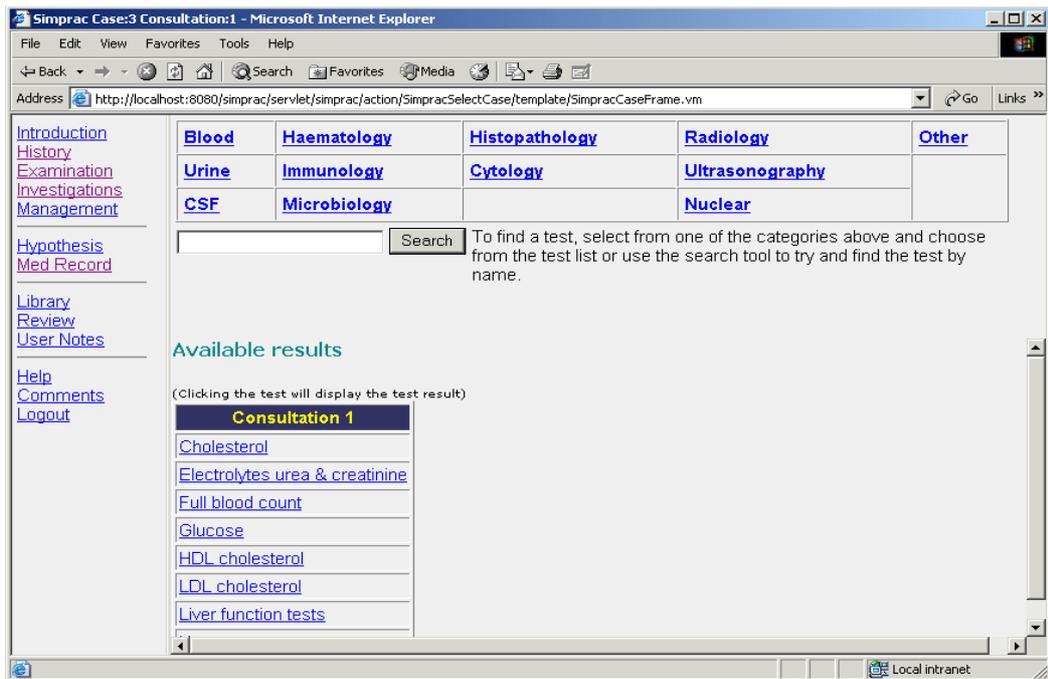


Figure 18: As tests are selected they are added to one of two lists, those tests for which results are currently available, and those tests for which results will not be available until the next consultation. In this example, all the tests are available and they have been listed in alphabetical order.

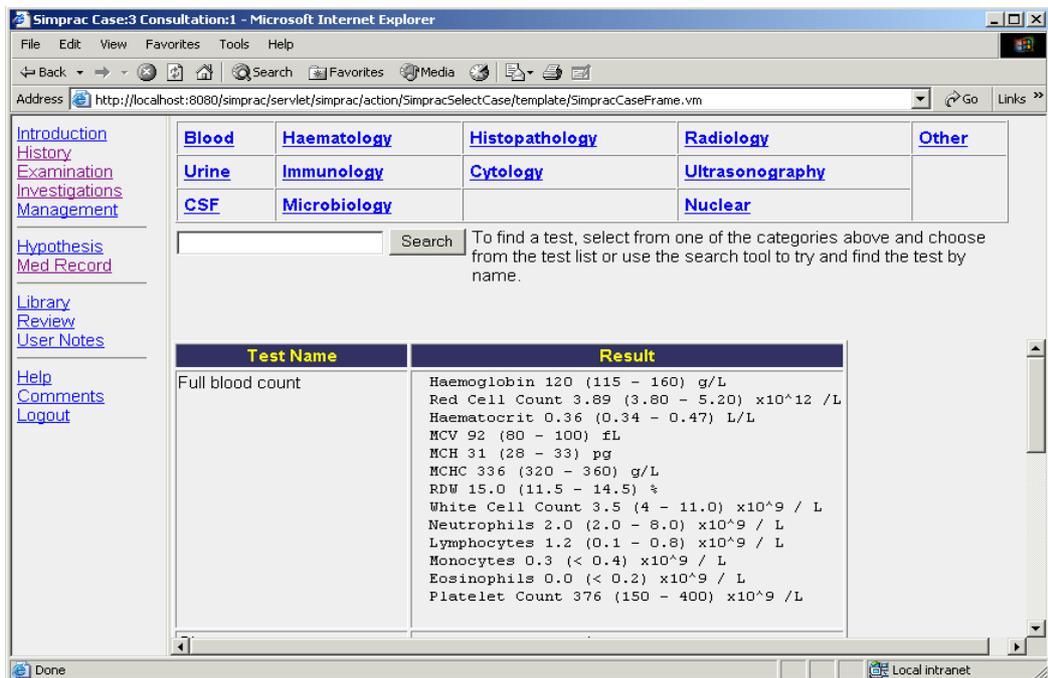


Figure 19: The results of the requested investigations are available by clicking on the relevant item from the list of available results. When a test is chosen (refer to previous Figure), all the test results, for that consultation, are displayed in a two column table. The left column contains the test or test-group names, while the right column contains the result for each test.

3.2.2 Management elements

One of the features of SIMPRAC is its focus on patient management that may vary over a number of consultations, based on the patient's response to the management strategies chosen by the user. This section provides a description of the management interface, as well as showing how different strategies can lead to different patient outcomes. In order to illustrate the management issues, this section also provides a more detailed description of the medical case.

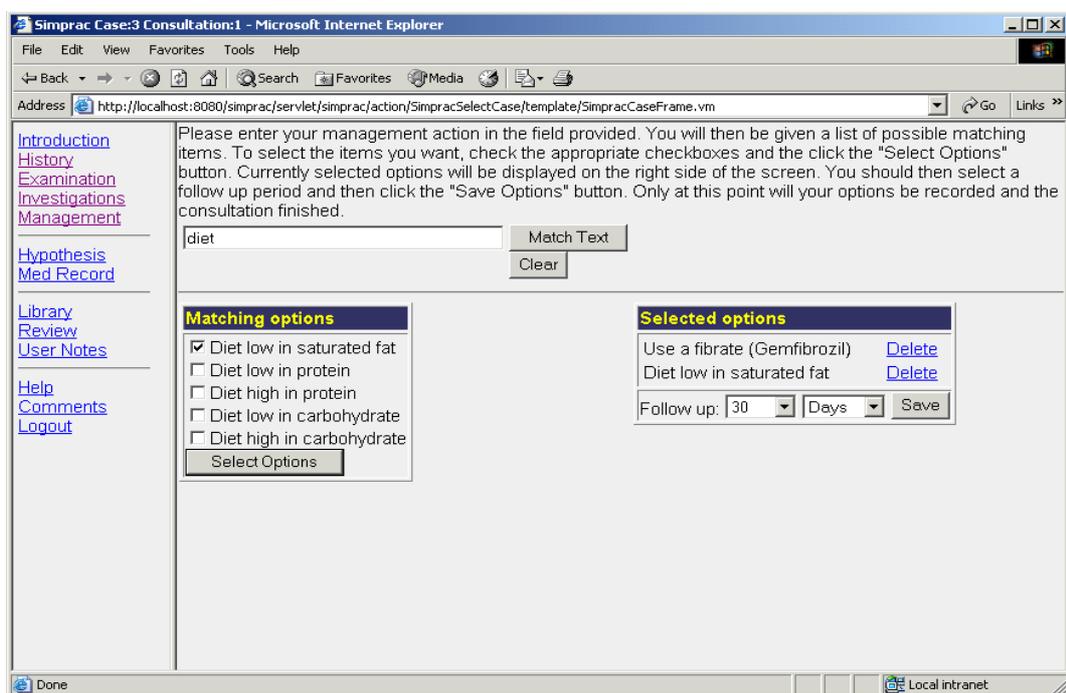


Figure 20: Management options screen where options have been matched against the search term, “diet”. The user has already chosen to use a fibrate, and a diet low in saturated fat. This user has also decided to see the patient again in thirty days.

Once the user believes they have obtained sufficient information, they may then choose the appropriate management for the patient (Figure 20). In a manner similar to the process of history taking, the user enters keywords matching the desired management activity. Matching options are displayed in a list and can be selected by the user. Once the user is happy with their list of proposed management activities, they then choose a

follow-up period and save the information, thereby concluding the consultation. The list of management options selected by the user is maintained across consultations, and to stop some management activity, it must be deleted from the list of selected options. The follow-up period does not influence the outcome in any way but was originally included so that a virtual time line could be maintained. Following the initial evaluations this approach was no longer maintained, as it made case construction very difficult. Having a time line, added another variable that increased the combinatorial complexity, but it was felt that this did not enhance learning in the context of chronic illness. Such an approach might be worth considering when looking at acute medical emergencies, where time dependence is critical. However, this was outside the scope of the current project.

In order to model multiple patient outcomes, each patient state is dependent on two variables. One variable is the consultation. That is the number of times the patient has been seen. The other is a variable denoted by the term “stream”. This concept is illustrated graphically in Figure 21. Other than the first consultation, where only one stream is defined, there may be one or more parallel streams representing the different outcomes for the patient in each consultation.

The outcome for the patient in the following consultation is determined by the management options selected in the previous consultation. Any significant events affecting the patient are given to the user in the vignette for the following consultation. For example, in the biochemistry case used during the evaluation of SIMPRAC, if the user has not prescribed an effective lipid-lowering agent such as Gemfibrozil, or an HMG CoA Reductase Inhibitor at the end of consultation one, at the beginning of the

second consultation they are simply informed that the patient has returned for review. This is represented by the state having stream 1 at consultation 2 in Figure 21. If the lipids are re-checked during this second consultation, the user will not see any significant changes in the results from the first consultation. If the user still does not instigate the use of an effective agent at the end of the second consultation, then at the beginning of the third consultation, the user is informed that the patient has suffered an episode of pancreatitis (stream 5 at consultation 3 in Figure 21). They are also informed that pancreatitis can be a complication of hypertriglyceridaemia, which is present in this patient secondary to her underlying metabolic disorder. Alternatively, if the patient has been prescribed Gemfibrozil in the first, second, and third consultation, then at the beginning of the fourth consultation, the user will receive a letter from the patient's Immunologist informing them that the patient suffered pancytopenia as an idiosyncratic side-effect of the drug (stream 6 at consultation 4). Pancytopenia is a reduction in the number of red cells, white cells, and platelets in the blood.

The possible states for the first case are shown in Figure 21. The case author's preferred path is shown by following the thick line. If this path is followed, the user does suffer an adverse event due to an idiosyncratic drug reaction. As a result of the complexity and poor compliance of this patient, it is not possible for the patient to be cured and their biochemical parameters normalised.

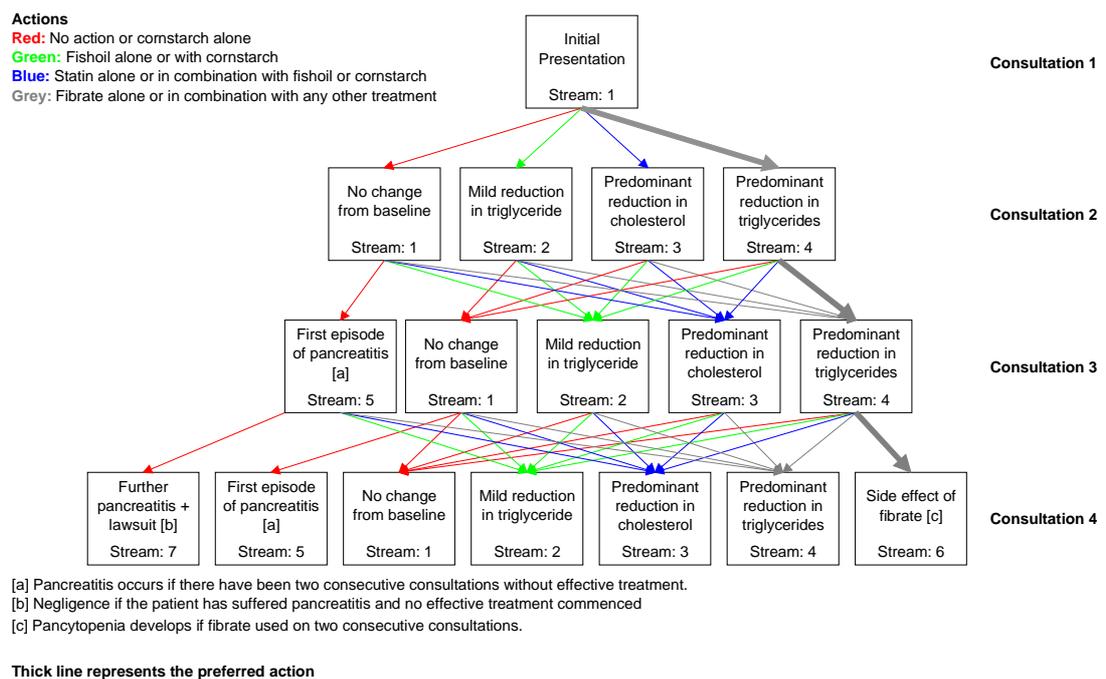


Figure 21: State transitions through the first case that has four consultations. Each box represents one particular state for the patient in each consultation. The transition from one state to another is determined by the management actions selected by the user. The bold lines represent the transitions expected by the case designer. The order of the streams in this diagram is dictated by their relationship to the streams in the preceding consultation.

3.2.3 User Support

During the patient interaction a number of elements are available to users to support them while they use the application. Each of these will be described in turn.

Hypothesis

As alluded to previously, when moving to the examination, investigation or management screens for the first time in a consultation, users are asked to update their diagnostic hypotheses (Figure 22). Hypotheses can be added by entering the relevant information and then clicking the add button. Alternatively, they can click on “Save” which will save their hypotheses and direct them to the screen for the currently selected stage of the consultation (physical examination, investigations, or management selection). Access to the hypothesis screen is available at anytime though the hyperlink in the left navigation-frame and hypotheses can be edited or deleted as required. Users are encouraged to enter the hypothesis itself, the likelihood with which they believe the statement is true, and the reason for holding the hypothesis. Nevertheless, only the statement of the hypothesis is compulsory when adding a new hypothesis. For the

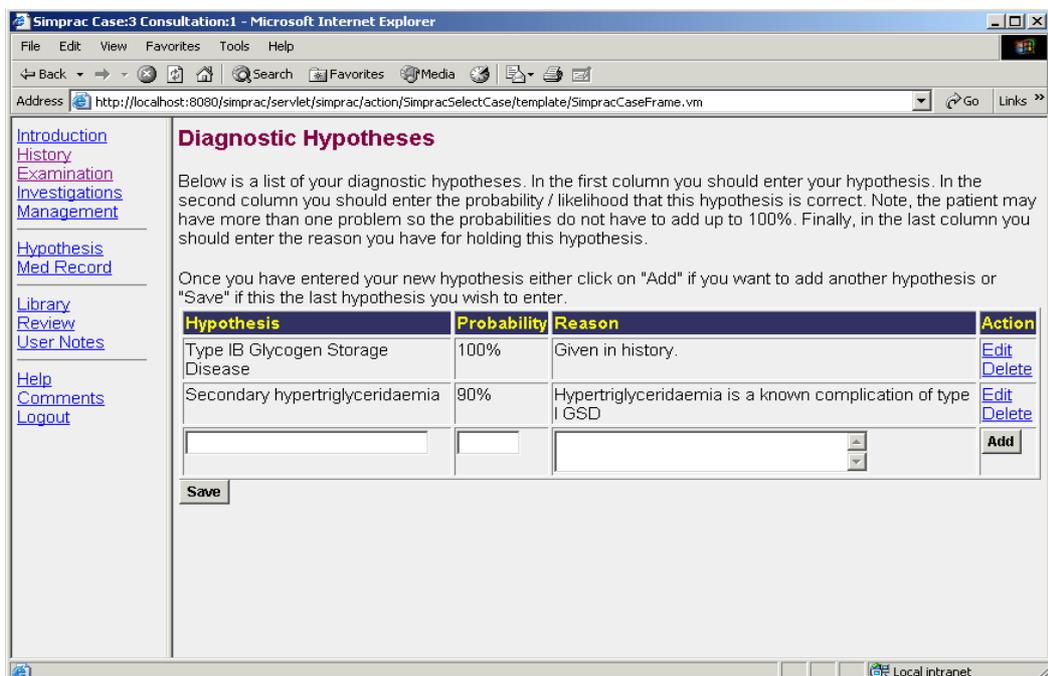


Figure 22: The hypothesis screen. In this example the user has listed two hypotheses. The first is that the patient has Type 1B Glycogen Storage Disease, and this is thought to be 100% true based on the history from the patient. The second hypothesis is that the patient has hypertriglyceridaemia secondary to their Glycogen Storage Disease.

purposes of the software evaluation, it was not compulsory for the user to enter a

probability or enter their reasons for their hypotheses, because early evaluations suggested that some users become frustrated when forced to enter this information.

The Hypothesis Screen was included early in the design of this application, as a means for learners to reflect on their current knowledge and guide further assessment of the patient. Its use is consistent with the hypothetico-deductive approach to medical problem-solving taught to medical students, and included in our model of the consultative process (see Figure 1).

Medical Record

The medical record component comes in two parts, and is included, primarily, as an aid to memory. The first part is a free-text area named Medical Notes, which enables the user to record their history and examination findings, much like a standard paper-based medical record. This was implemented as a simple text area that does not allow any text formatting or highlighting (Figure 23). The second part is a screen from which the results of investigations can be viewed. In this way the medical record tool can be used to re-orient a user to their previous line of thought when recommencing a case. For example, if the user does not want to complete the case in a single sitting, they can record their findings in the medical record, and review it at their next visit, before continuing with the case.

This component was included to encourage the learner to record the medical history of the patient. In addition to being part of normal practice during a consultation, documentation of the history makes explicit what the doctor or learner knows about the patient. Reflection on the information contained in the record, is a useful way of integrating that information, and directing further enquiry.

User Notes

The user notes component was included as a text-based scratchpad onto which the user could record additional information and observations if they choose to do so. This component is accessible via a hyperlink from the main screen, or via a button on the Medical Notes popup screen. It was envisaged that a user might use this to record any learning objectives that may have arisen from undertaking the case. While such a device

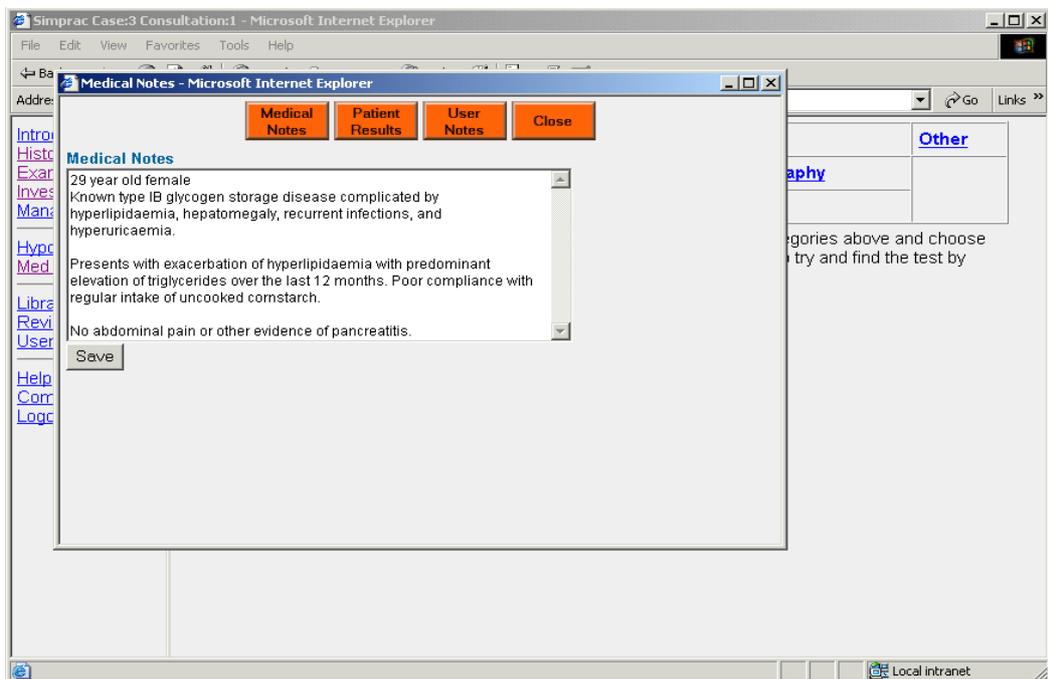


Figure 23: The medical record component is available as a separate window, and enables the user to record their observations about the patient.

is not necessarily found as a specific artefact in normal clinical practice, it was hoped, that when used with the medical record component, it would encourage reflection on the part of the learner. For example, having taken a history and learning that the patient had Type 1B Glycogen Storage Disease, this fact would ordinarily be entered in the medical record. Reflection on this information might then trigger the learner to consider such things as: the natural history of the disease, the complications associated with the disease, the mode of inheritance and risk to the patient's offspring, how the disease might be managed, as well as the psychological impact on the patient of having a

chronic illness of this nature. These reflections could all be recorded in the user notes for later research and learning.

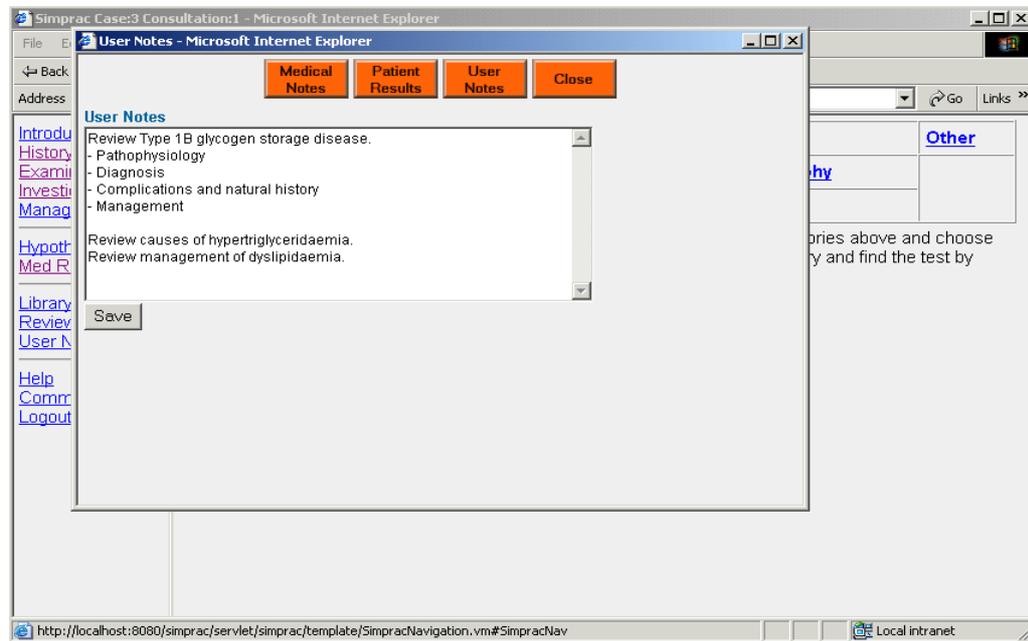


Figure 24: The user notes screen has been included as a scratch pad to enable the user to record their ideas or items to follow up. In this example, the user is unfamiliar with the major problems affecting the patient and has recorded a number of items that need to be reviewed.

Library and Information Resources

The library component enables the case author to provide links to a variety of learning resources. It currently links to PubMed and the University of Sydney Library. It was envisaged that this component would exist as a portal to generic learning resources, as well as case-specific information that was updated on a regular basis. For the current main case, there are no links.

3.3 Review

The third main part of the interaction involves those elements designed to encourage reflection and enable users to review their activity. At the end of each consultation, each user is helped to begin the reflective process by being shown a page that lists all their questions, examinations, investigations, and management selections for that

consultation. For each item, the user is required to classify each of their actions as one of: critical, relevant, or not relevant to the diagnosis and management of the patient in light of their current knowledge (Figure 25). This component forces users to review and reconsider their actions. The classification levels and the reason for choosing these levels are discussed in more detail in Section 4.2.2 on page 75.

The screenshot shows a window titled "Simprac Review" with a green header containing instructions: "Before reviewing your actions you need to categorise the actions you selected as being critical, relevant, or not relevant to the diagnosis or management of the patient. Once you have categorised your actions click the button labelled next at the bottom of the screen to proceed to the next page." Below this are four sections, each with a blue header and a list of actions with radio buttons for classification:

Section	Action	Critical	Relevant	Not Relevant
History	Other past medical history including psychiatric or surgery	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Can you tell me why you have come today?	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Examination	Palpation --> Hypochondrium-Right	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Sphygmomanometer --> Arm-Right	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Investigation	HDL cholesterol	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
	Glucose	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
	LDL cholesterol	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
	Triglycerides	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
	Full blood count	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
	Lipid electrophoresis	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
	Liver function tests	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
	Electrolytes urea & creatinine	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
	Cholesterol	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
	Management	Diet low in saturated fat	<input type="radio"/>	<input checked="" type="radio"/>
Six hourly cornstarch to maintain blood glucose		<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>

At the bottom of the window, there is a "Next" button and two tabs: "My Actions" and "Graphs".

Figure 25: At the completion of the consultation, the user must classify their actions and selections as being critical, relevant, or not relevant to the diagnosis or management of the patient, based on their current knowledge.

Only after completing the scoring process, the user is shown a second screen that enables them to compare their activity to the:

- average activity for their peer group (Figure 29), or
- specific activity of a single expert in this field (Figure 26).

The information is presented as a chart displaying the number of critical, relevant, or not relevant items selected by the user, for each diagnostic and management stage, within

each consultation. This same information can be viewed as either a column chart (Figure 26), pie chart (Figure 27) or line chart (Figure 28), according to user preference. The inclusion of multiple forms of presentation was done to evaluate which form was favoured by users.

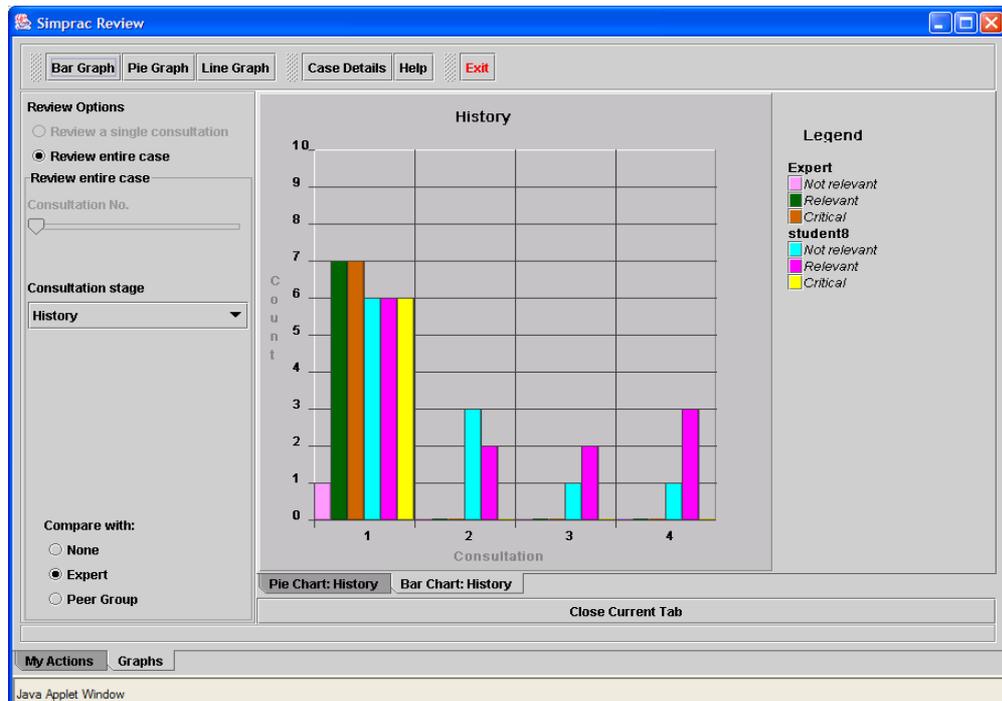


Figure 26: The graphical review screen presents the user with an overview of the proportion of critical, relevant, or not relevant actions they selected during the consultation. In this example, the user with username, “student8” (see legend at upper right) has compared themselves with the case “Expert” for the “History” stage of the consultation. The comparison group is selected by using the radio-buttons at the bottom left of the screen, while the stage of the consultation is chosen using the drop-down box at the middle left of the screen. Student8 has selected six critical (yellow), six relevant (purple) and six irrelevant (cyan) questions in the first consultation. In contrast the “Expert” asked seven critical (brown), seven relevant (green) and one irrelevant question (pink). In subsequent consultations, student8 and the expert have been in different streams, so comparable data are not available for the expert.

For the first case, the author was also the “Expert” who attempted the case, and provided the activity record against which other users could compare. It should be noted that this need not be the case. When authoring a case, the author must classify each history, examination, investigation, and management element for each patient state. In

contrast, the “Expert” interacts with the virtual patient, as would any other user. Subsequent users can then compare their own activity to the record of the “Expert”. Separating the author classification from the “Experts” activity has at least two benefits. First, it overcomes the start up problem, by providing comparative data for the first user. Second, it enables the element classification to be revised. Such revision may take place in the light of expert consensus, or even after actual use by learners.

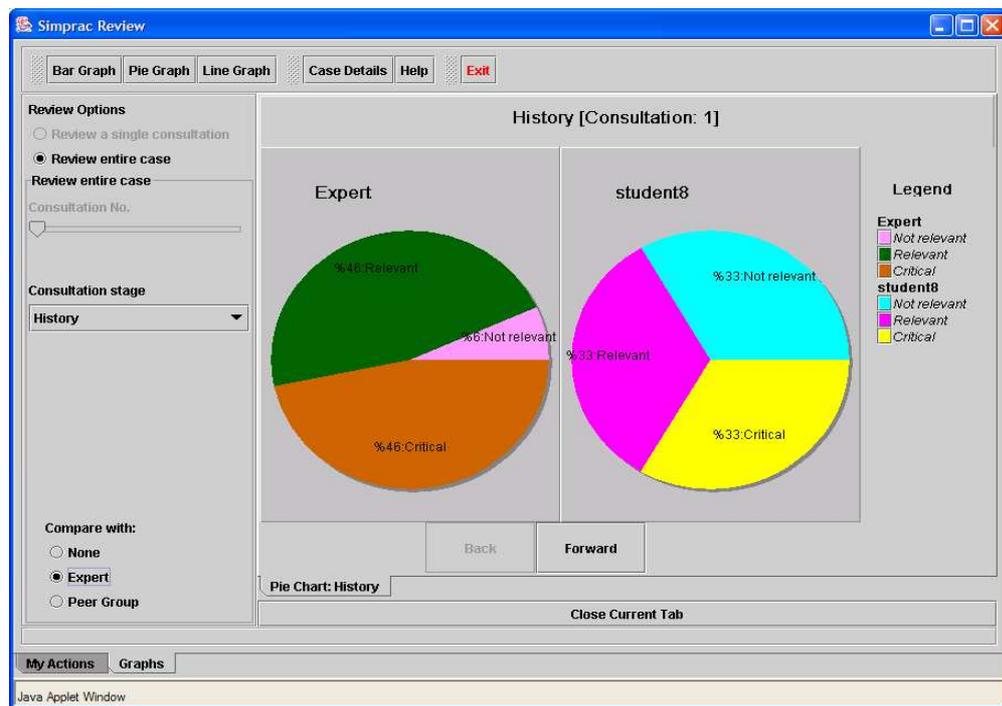


Figure 27: The user’s activity data can also be viewed as a pie chart. In this example, student8 has compared themselves to the expert in the first consultation. The student has chosen relatively more questions that were regarded by the case author as being not relevant. The user can display pie charts for each of the consultations by clicking on the forward and back buttons below the charts.

In this instance, having the author and “Expert” as the one person was done for pragmatic reasons, and while it increased the correlation between the “Expert’s” activity and number of critical and relevant items, it enabled evaluation to begin as early as possible without having to wait for another domain expert to undertake the case before other users. The author has had specialist training in the management of

hyperlipidaemia and has previously managed a patient with Type 1B Glycogen Storage Disease.

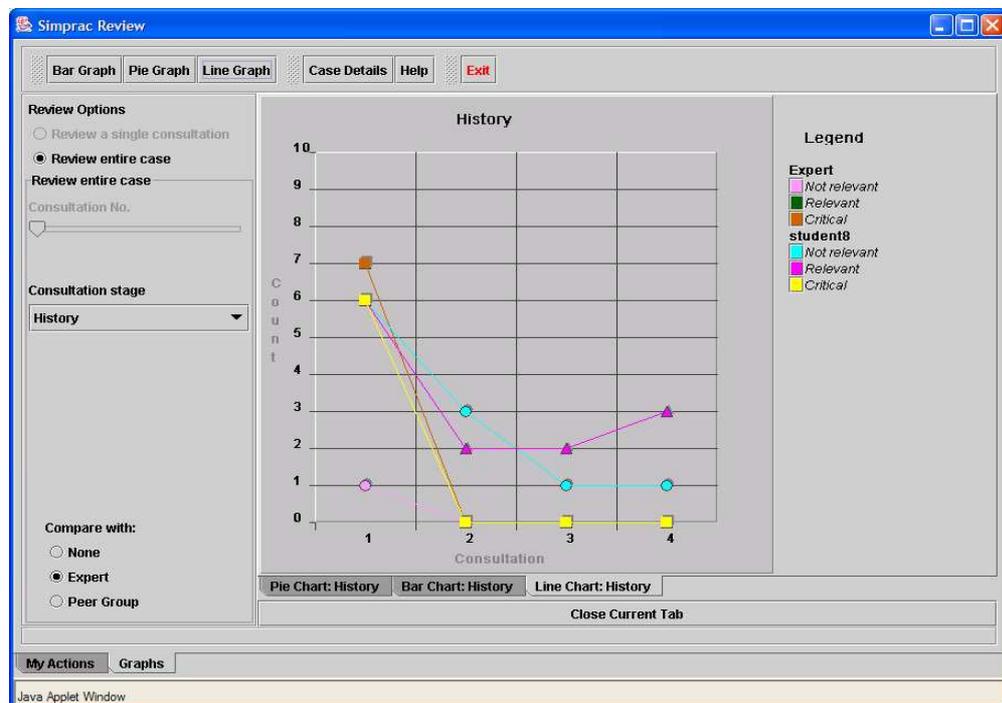


Figure 28: In addition to bar and pie charts, the user can also view their activity as a line chart. This is the same data as in the bar chart above.

By right clicking a column within a particular consultation and stage of the column chart, the user is able to retrieve specific textual information related to that consultation and stage combination. As illustrated in Figure 30, if the user right-clicks on the first consultation concerning the history questions, they are able to display a table that includes:

1. critical questions asked by the user,
2. critical questions not asked by the user,
3. relevant questions asked by the user,
4. relevant questions not asked by the user, and
5. questions asked by the user, that the case authors regarded as not relevant.

This facility was included based on specific feedback from users, indicating that the provision of this information was essential for appropriate review (See Chapter 5).

Once they have reviewed their activity, the user is able to move to the next consultation for the case (Figure 31). This cycle of patient interaction and consultation review is continued for a predetermined number of consultations for each case (see Figure 3 on page 39).

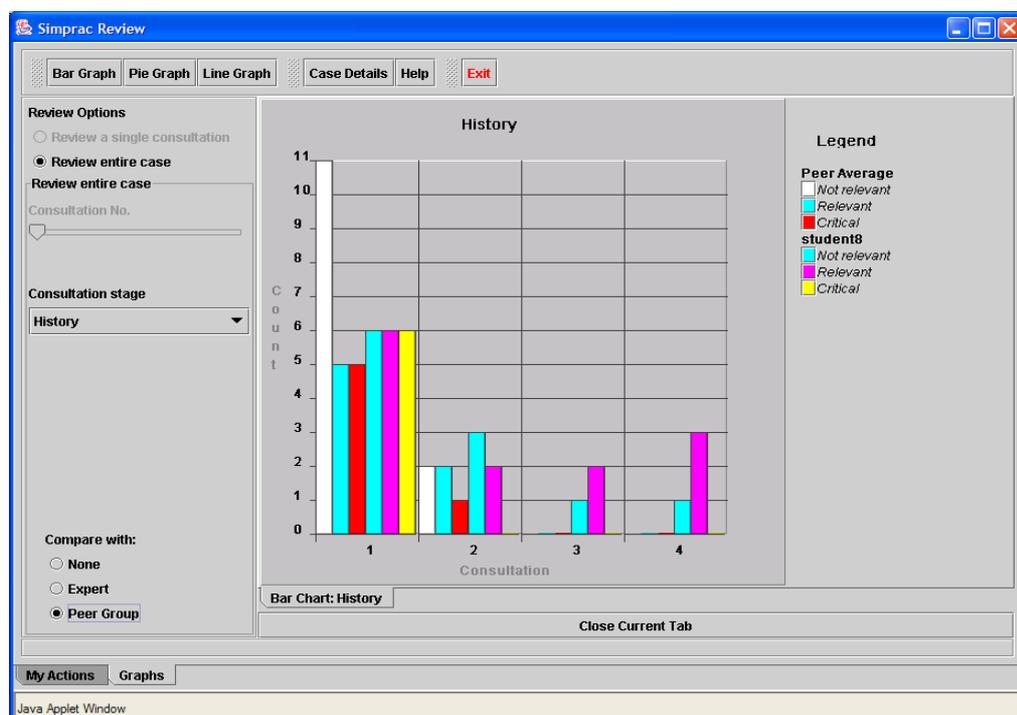


Figure 29: In addition to comparing their activity to an expert, the user can also compare themselves with the average for their peer group by choosing the appropriately labelled radio-button at the bottom left of the screen. In this particular case, again reading from the right in consultation one (starting with the yellow column), student8 has selected six critical, six relevant and six irrelevant questions while on average, their peer group (medical students) have asked, five critical, five relevant, and eleven irrelevant questions during the first consultation. For this comparison to occur, this user had to indicate they were in the medical student peer group when they logged in (see Figure 6 on page 42).

Critical Options:	
Chosen	Not Chosen
Can you please describe your diet.	When did you first notice the problem? When did it start?
Can you tell me why you have come today?	Are there any other health professionals involved the management of the current problem?
Alcohol use?	Has anything like this been experienced before?
Other past medical history including psychiatric or surgery	
Do you have cornstarch on a regular basis.	
Has anyone in your family or any friends had any similar problems?	
Relevant Options:	
Chosen	Not Chosen
Do you take regular exercise?	Do you have any allergies?
How old are you	Is there any family history of illness?

Java Applet Window

Figure 30: Details of the questions that were asked are available by right clicking over the column chart for the consultation of interest. In this case, the user asked six questions that the author thought were critical questions. However, there were also three questions that the author thought were critical questions, but student8 did not ask.

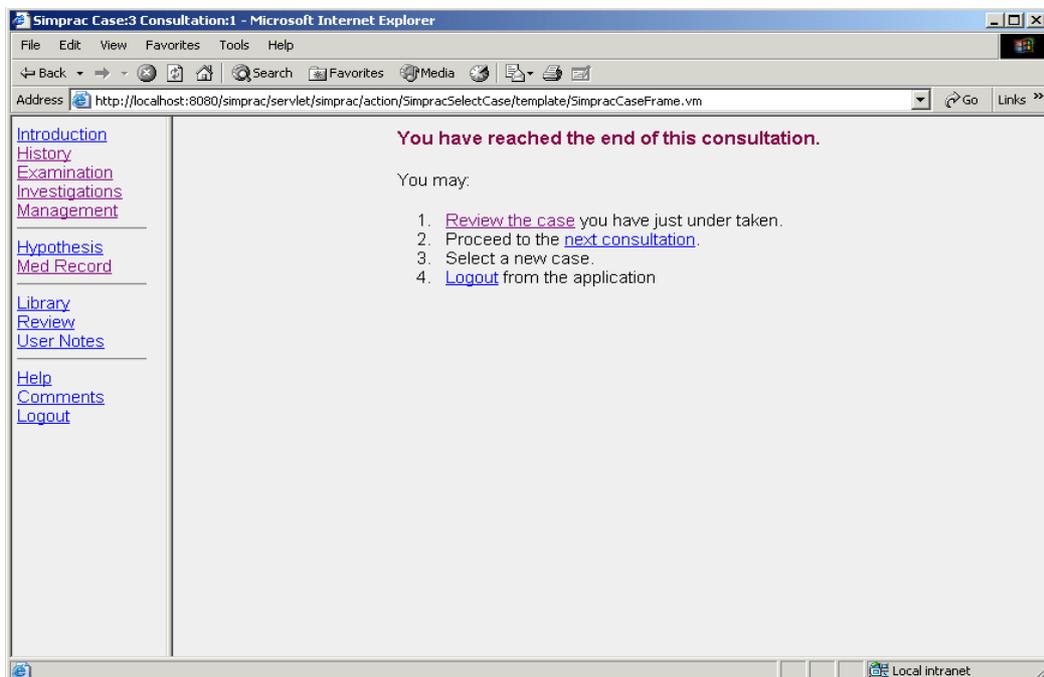


Figure 31: After they have completed the consultation the user may return to the review screen, proceed to the next consultation or logout and return to the case at a later time. At the time of writing it was not possible for the user to start a new case without first logging out.