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Risky Business

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<u>Risky Business</u>

"A Serious Game in HIV Risk Assessment"

An Interactive Qualifying Project Report

submitted to the Faculty of

WORCESTER POLYTECHNIC INSTITUTE

in partial fulfillment of the requirements for the

Degree of Bachelor of Science

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Abstract

This IQP studied the efficacy of educational games for risk assessment in comparison to normal classroom materials. The team created a game prototype for New York sponsor *Cicatelli Associates* that would teach proper interviewing techniques for client risk assessment. After testing and researching, the team found that the game consistently improved user comprehension of the subject matter. Feedback from users indicated that the game was a much more enjoyable experience than using standard classroom materials.

Authorship

Mike Johnson created all art assets and contributed the introduction and results sections.

Mike Wall programmed the game and contributed the procedure section.

Addison Jones-Mulaire imported the script into the game, wrote code to handle the script and contributed the background, conclusion and recommendations sections.

Table of Contents

Section 1: Introduction

Risky Business is an IQP designed with the goal of creating a prototype of a game that helps teach a person how to perform a risk assessment for an individual at risk for HIV or AIDS. The project is broken up into two major parts: the designing of the game, and the testing it for viability. As an IQP the focus of the project is the testing, and in this case our testing focused on the game as a tool to teach unskilled people how to perform a risk assessment versus helping improve someone who already knows how. HIV risk assessment is the process of interviewing a patient in order to determine whether (and to what extent) they are at risk of contracting HIV and other sexually transmitted diseases. This is done to allow the interviewer to recommend ways of reducing risk that are tailored to the patient's lifestyle and preferences. To do this, the interviewer will ask questions about varying topics, including the patient's sexual activity and methods of contraception. Risk assessments are important because they provide personalized advice to patients who might not ordinarily know how to avoid contracting harmful diseases.

The current training methods for clinical staff are often insufficient. It is not altogether uncommon for an individual to still be uncomfortable interviewing clients even after undergoing training, due to shortcomings in modern training techniques. These methods of training could be

improved through more practice for the trainees, but most methods require at least one trained professional to practice with a trainee individually. This requires an enormous amount of manpower to train even a small group of new clinical staff in risk assessment.

A solution for this is to create a method of training that requires no teacher; a system that allows trainees to practice on their own to feel more comfortable with performing risk assessments on real patients. *Cicatelli* and the IQP team came to the conclusion that proper approach to using this solution was to create a game that simulates a risk assessment, giving trainees the opportunity to practice without needing a professional to train with. The goal is for the game to teach the player about the appropriate things to say to the patient, as well as what signs to look for in the body language of the patient to provide clues as to the patent's well-being. If a game can fulfill the role of the teacher, or at least supplement it, then training clinical staff would become far more efficient and effective.

Cicatelli Associates is a New York company dedicated to providing training for healthcare professionals and social services employees. These training sessions are intended to help improve the quality of care delivered to those in need. Their website homepage states:

"We have a strong track record in managing federal grants and cooperative agreements, managing large, complex national projects, building organizational capacity, developing curricula and supportive materials, planning and conducting national trainings and training of trainers, effectively using distance learning technologies to enhance learning, building organizational capacity and enhancing infrastructure, and helping agencies implement performance management systems that use data for rapid and ongoing improvement."

CA came to WPI looking for a game development team to create a game prototype, as the company was interested in what a teaching tool constructed as a game could offer. The IQP team was assembled with the goal of assisting *CA* in the design and development of such a game. *CA*

was able to offer the IQP team educational expertise and knowledge of the subject matter. The IQP was then able to translate this information into a game prototype.

Games are potentially great tools, due to their ability to retain our attention while stimulating our interest in the game's subject matter. They can be tailored for many purposes, from training various skills to learning a vast array of subjects. Any game that has a goal other than providing entertainment to its players can be considered a tool, whether it is a simple simulator, an educational game, or even a form of advertisement. A game that is an effective tool will ideally capture the player's attention and perform whatever task it was designed for without the player ever having to be explicitly aware of its goal.

We were addressing the task of creating a tool for clinical training. In our case, we needed to create a game designed to allow clinical staff to practice risk assessment skills. As a secondary goal, the game should be able to teach these skills as well. To do this, we needed to make a game that would simulate a risk assessment interview with an actual person with reasonable accuracy, while also providing the teachings required to perform such an interview. In addition, the game had to work on a wide array of different computer systems.

We opted to build a risk assessment interview simulator with a sample client. *Cicatelli Associates* and the IQP team discussed the merits of different platforms. While a push was made for the game to playable on smart phones and other portable devices, it was more crucial that the game run on a widely owned platform, as a significant portion of the smartphone market consists of Apple products that could not run the chosen game engine: Adobe's Flash Player. Because of

these limitations, we advised *CA* that the game should be designed with the capability to run through a web page. The goal was to improve the effectiveness of interviewers who are trying to learn to detect at-risk individuals for HIV. Our target audience for the project is clinical staff who are training their interviewing skills for HIV risk assessments, while the intent of the project was to create a program that would be used by clinical staff as a training simulator to improve their interviewing skills in the real world.

To evaluate the effectiveness of our game, we ran a user study that tested participants' change in performance in a quiz on proper interviewing skills. Each participant took a quiz on the subject to determine their preexisting knowledge on risk assessment techniques. Then, they either read some educational material or they played our game and read the material. We compared how much their scores improved after using their respective learning tools.

An additional goal was to test it on both individuals unassociated with interviewing people at risk and testing on individuals who are associated with interviewing people at risk. This goal is to use the resulting data to determine if this game contained useful material for teaching people who were not already familiar with how to interview people, and if it would be helpful as a supplementary piece to actual training for people who are already appropriately trained in how to do these interviews.

Section 2: Background

The object of this project was to provide a serious game prototype that simulated an HIV risk assessment. Risk assessment in a clinical environment involves both uncovering risks and

risky behavior, and then explaining to the client what sorts of options they have to reduce these risks. The "primary goal in administering a comprehensive risk assessment is to provide clients with insight into their HIV/ STI risk behaviors and to help clients personalize their risk for HIV infection/transmission."[1] The following dialogue is an example of a risk assessment. Melissa, 25 years old, and has come to a clinic to learn more about birth control and safe sexual practices. The provider is conducting the assessment. Melissa is the client.

Provider: *Melissa, the part of your medical history that I'm going to go over now is about*

sexual behavior and drug use. I ask these questions of every client, because these

things have a big impact on people's health.

Melissa: *Okay.*

Provider: *I know you came in today to get a method of birth control. What's going on*

in your life right now, sexually speaking?

Melissa: *[responds rapidly] I have a boyfriend - he's a great guy. We've been together*

a year and-a-half. And we do have sex. Not a lot, I mean not as much as he

wants [laughs] but we do. But, you know, that's why I'm here - for birth control.

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[1] Amie Ginnetti, Mindy Domb, Jorge Sanchez – *HIV Risk Assessment Users' Manual*, developed for Project SPHERE (Statewide Partnership for HIV Education in Recovery Environments)

Provider: *So what have you been doing to keep from getting pregnant?*

Melissa: *Well, he pulls out before he comes, and, I guess I've been lucky...[her voice trails*

off]

Provider: *It sounds like not getting pregnant is very important to you. You and your boyfriend*

have been using one of the most difficult methods around - withdrawal.

Lots of people use it, and they're surprised to learn that it's not very effective.

Melissa: *Yeah, I know.*

Provider: *The good news is that there are much, much more effective methods that are so*

much easier than withdrawal.

Melissa: *Yeah. My boyfriend really wants me to get the pill.*

Provider: *How do you feel about taking the pill?*

Melissa: *Well, I'm sure not ready for a baby!*

Provider: *When pills are taken correctly, they are very effective at preventing*

pregnancy.

But - and you probably know this - the pill doesn't protect against sexually

transmitted infections. What are you doing to prevent getting STIs, like HIV,

the virus that causes AIDS?

Melissa: *[shaking her head "no"] I don't really think that's an issue for me.*

Provider: *You know, I think it's hard for any of us to imagine that these diseases could*

have anything to do with us. At the same time, I've seen so many young women

learn the hard way about these diseases.

Melissa: *[nodding] You're right about that. Actually I got something once. Calmidia,*

I think it was called, but I got treated for that. That was a couple of years ago.

Provider: *Yes, chlamydia is one of the most common STIs. And luckily, it can be treated.*

I bet that was unnerving for you.

Melissa: *[nods vigorously] You're right about that. I couldn't believe it. I was so*

embarrassed! I ended up breaking it off with that guy.

Provider: *And even though it was embarrassing, you took care of it. And you know from*

that experience that a person can get an infection when they don't expect it

at all. Here's a tough question to think about: how does it feel to trust your

boyfriend with your health, and maybe even your life?

Melissa: *I never really thought of it that way. I know we're supposed to use condoms, but guys just won't use those things. Besides, we're only having sex with each other!*[2]

This small bit of conversation contains many of the important aspects of risk assessment, such as the provider's reactions, the environment the assessment is being taken in, the language used during the interview, and the use of open ended questions

2.1: Uncovering Risk Factors

The goal of any risk assessment of any kind is to uncover risk factors. Risk factors are behaviors, environments, substances, or people that pose a threat to the client's health or well being. An assessment may not be as simple as asking a client what he or she thinks the problem is. An in depth interview can help reveal risks that may not be obvious or even known the client. These interviews are the key. If not conducted properly, the client may not reveal much, and even close up entirely if they are offended or otherwise put off. If a barrier exists between the client and the provider, the interview will not be as complete as it could be. The important point to remember during risk assessment is that it is not meant for the provider to discover these risks, but primarily for the client to identify risks. The key potential barriers are the client's motives, the provider's reactions, the environment for the assessment, the language used during the interview, and the use of open ended questions.

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[2] Garrity, Joan Mogul – *Asking the Hard Questions: A Reproductive Health Provider's Guide to Client-Centered HIV Risk Assessment*   44 Famsworth Street, Boston MA April 2002.

Client Motives: The client coming in for the assessment may or may not want to be subject to an examination.[3] It is good that the client is willing to come in, but if something causes discomfort or threatens safety, the client may end up leaving the clinic. As typical of many risk assessments, *Risky Business* provides no information to the player on the person they are about to interview, except for their name and age.

Provider Reactions: Providers should not judge the client nor show negative reaction to any response.[4] Even if a client says something totally shocking, the provider must remain composed and support the client. The provider's values and judgments may differ, but any feelings of unease not be conveyed to the client. This will allow the provider to be better able to respond to a client in a way that encourages open conversation. This particular aspect of risk assessment is not a part of the current prototype, but it remains a crucial part of the process, and possible future games should account for player reactions.

Environment: Environment is another potential factor to a successful risk assessment. The interview should be conducted in a private space with a professional feel, such as a doctor's or psychiatrist's office. The more organized and professional the provider and workspace appear, the more the client will trust that the provider genuinely cares about the client's well being and is serious about the assessment. *Risky Business* features a simple room, with a chair for the client to sit in, and no other clutter, typical of many medical offices.

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[3] Garrity
[4] Garrity

Communication: Verbal and non-verbal communication are a large part of risk assessment, since is spoken can be just as important as what is not spoken. As in the provider reactions even a non-negative comment can send a different message to a client because of the tone. It is equally important for the provider to recognize non-verbal signals from the client, such as crossing of the arms or legs, gestures meant to close off outside contact or protect one's self.

The words used in conversation can also have an impact on the success of the assessment. If the language used is too casual, the client may feel unsafe and think that the environment around them is not professional. If the language used is too technical, the client may feel distanced and confused. The language and tone must be friendly, open, and simple enough to understand, but retain a professional feel.[5] *Risky Business* features client reactions, ranging from open and happy, to distressed, to angry. The player can observe these reactions as well as the language in the response from the client. The player cannot influence the client through his or her non-verbal expressions, but can choose tone of voice and the phrases used to interview the client.

Open Ended Questions: Open ended questions allow the person being asked to answer and then expand upon that answer. Examples of open ended questions are "What" or "How" questions rather than "Do you...." questions. The provider should not ask yes or no questions, since these force the client to answer one way or another (known as close ended questions). If the client is asked close ended questions, he or she feels trapped and only able to affirm or deny. The interview may feel like an exam, with the client anxious to answer correctly instead of truthfully. However, if the client can explain and expand on responses, the flow of conversation becomes smoother, and the client will feel more comfortable and talkative. The dialogue in *Risky Business*

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[5] Garrity

features questions of both styles. This is so the player can realize which style of questions leads to better results and learn to ask that way, and see the difference between that and when they phrase questions poorly. People are hesitant to talk about sensitive information, and getting them to tell the provider through their own will is better than trying to force them to answer.

In the interview example at the beginning of Section 2 between the provider and the client, Melissa, the provider exemplifies all the necessary qualities to conduct a successful assessment. The client is nervous at first, but gradually warms to the provider's language, style, and lack of judgment or accusation. Notice the provider never asks a yes or no question, or asks "Why". While the body language is not shown, it's easy to picture Melissa as starting nervous and closed, and ending being friendly and open. Again, it is important to remember these assessments are not meant to pry into a client's private life, but for the client to realize risk factors and for the provider to help the client deal with those risks.

Traditional classroom materials are effective at teaching and ensuring retention of useful information. Lectures, diagrams and text all are proven methods of displaying information. However, each can only connect to one of the senses at a time, while there are three kinds of learners: visual, auditory, and kinesthetic or tactile.[6]

Visual learners learn by seeing, by examining text or other printed materials, auditory learners learn best from lectures and talks, and tactile learners retain information best by doing what is being taught. For example, consider the task of installing a dishwasher. The visual learner will read up on the subject, and look at diagrams and instructions. The auditory learner will have someone explain to them the steps, and then proceed to do the installation themselves.

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[6] Ray, Graner Sheri – Tutorials: Learning To Play, October 6th, 2010, Gamasutra.com

The tactile learner will have someone show them how to install the machine, participate in the process, and afterwards have a much better knowledge of the steps.[7]

While most traditional materials provide benefit to one type of learner or another, games can provide benefit to all three styles of learning. By providing accurate visuals, well timed sound cues, and thorough interactivity, a game can meet the needs of all three learning types. In *Risky Business*, both the visual and kinetic needs are met. The player can see the client, read the replies, and see the reaction after posing a question. The player can choose both questions and the tone for the question. A kinetic learner will be able to influence the conversation and see the effects. Currently, there is no audio component to *Risky Business*. Full dialogue would have taken a large amount of time and effort, both in recording and implementing. Due to time limitations implementing everything we considered more important, it was decided to forego recorded dialogue. Future work could include sound effects indicating whether a choice was correct or incorrect, or even voice acting so players can hear the client's response as well as read it.

Section 3: Design and Development

We had several discussions between our team and Cicatelli Associates, Inc. to come up with a viable scope for the game that would not be too large or too small. There was talk about the number of characters the player would be able to interview in the game, the length of the conversation, and even the number of choices the player would have per dialogue option. After

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[7] Walter L. Leite, Marilla Svinicki, Yuying Shi - *Attempted Validation of the Scores of the VARK: Learning Styles Inventory With Multitrait -Multimethod Confirmatory Factor Analysis Models*, August 31st 2009, published originally in *Educational and Psychological Measurement,* 2010

all the discussion, both sides agreed on a goal for the game that we felt gave a good enough

impression of the overall game to be a viable prototype. The goal for our game was to have a

complete playthrough with one character. This playthrough would consist of transitioning

through a full conversation with several exchanges with the client as well as response animations

from the mock client. The game was given 2D graphics that had a pseudo-3D look to them, with

animations for seven different responses for the client. The game was designed to allow the

player to interact with the game by choosing a question and the tone with which the question is

asked, and then clicking the ask button.

Flash was chosen for game development because of its ease of use and due to the ease

with which the artist can develop the artwork. Flash is primarily for use with 2D art, and includes

a nice set of tools for art-based development. Flash also has a well structured programming

language, Actionscript, which is relatively easy to learn and use. We learned the basics from

doing tutorials.[8] Flash is also well supported online which helps with achieving necessary

functionality.

The content of the in-game dialogue consists of a series of written question and answers

sets provided by Cicatelli Associates Inc., all organized into a single large tree structure. The tree

is structured such that there are three questions and stances. Each potential result has its own

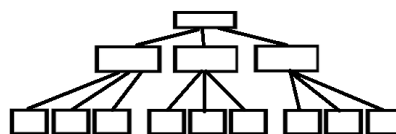scene with its own set of questions, hence, a branching structure.

Figure 1: A dialogue tree example

[8] Adobe. "Getting Started With Actionscript." Adobe Flash Platform. Available from
http://help.adobe.com/en_US/as3/learn/WS5b3ccc516d4fbf351e63e3d118a9b8cf79-8000.html. Internet;
accessed 22 April 2011.

There are approximately five sets of questions and answers on the shortest branch and seven on the longest branch, meaning there are over 10,000 nodes in the dialogue tree. Questions and responses are all contained in a series of external .xml files, broken up by section. Early sections contain an entire level of the tree, but as the player gets further into the tree, the number of options forces each .xml file to contain only a section of the level of the tree. An XML file is a file type that is designed to be easy to read by a computer.

```xml
- <set>
    <chain>Q1S3-Q2S1</chain>
    <response>He's a great guy. We've been together six months. We've been using the pull out method.</response>
    <Picture>Relaxed</Picture>
  </set>
- <set>
    <chain>Q1S3-Q2S2</chain>
    <response>He and I have been together six months.</response>
    <Picture>Uncertain</Picture>
  </set>
- <set>
    <chain>Q1S3-Q2S3</chain>
    <response>It's good.</response>
    <Picture>Nervous</Picture>
  </set>
- <set>
    <chain>Q1S3-Q3S1</chain>
    <response>Not really. He pulls out before he comes.</response>
    <Picture>Uncertain</Picture>
  </set>
- <set>
    <chain>Q1S3-Q3S2</chain>
    <response>Not really.</response>
    <Picture>Uncomfortable</Picture>
  </set>
- <set>
    <chain>Q1S3-Q3S3</chain>
    <response>No.</response>
    <Picture>Defensive</Picture>
  </set>
```

Figure 2: Sample XML from Risky Business

It is special in that it features a standard of formatting that most programming languages can interact with specifically, meaning it is easier for programs to interact with a .xml document than a generic loaded document. The game originally used a generic URL loader, which can be used to load any sort of generic external data[9], but we discovered that Flash has better built in support for the XML file type so we switched to that for convenience[10].

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[9] Adobe. "flash.net.URLLoader." ActionScript® 3.0 Reference for the Adobe® Flash® Platform. Available from http://help.adobe.com/en_US/FlashPlatform/reference/actionscript/3/flash/net/URLLoader.html. Internet; accessed 22 April 2011.
[10] Adobe. "com.adobe.icomm.assetplacement.controller.XMLDataLoader." ActionScript® 3.0 Reference for the Adobe® Flash® Platform. Available from http://help.adobe.com/en_US/FlashPlatform/reference/actionscript/3/com/adobe/icomm/assetplacement/controller/XMLDataLoader.html. Internet; accessed 22 April 2011.

We broke down the script into pieces because there are so many options that keeping all the dialogue choices in one file causes lag times exceeding fifteen seconds per scene, which causes a timeout error in Flash because it held up too long trying to load. To get around this, we developed a system for breaking down the original .xml file into many smaller .xml files and reading the correct set of dialogue from an individual file at any point. This system assigns a name to each scene, or set of questions and responses. Picking a question and stance sets the part of the chain that determines what file has the next scene for that response. Each subsequent scene creates a new piece of the chain, and these full chains determine the scene and loaded .xml file.
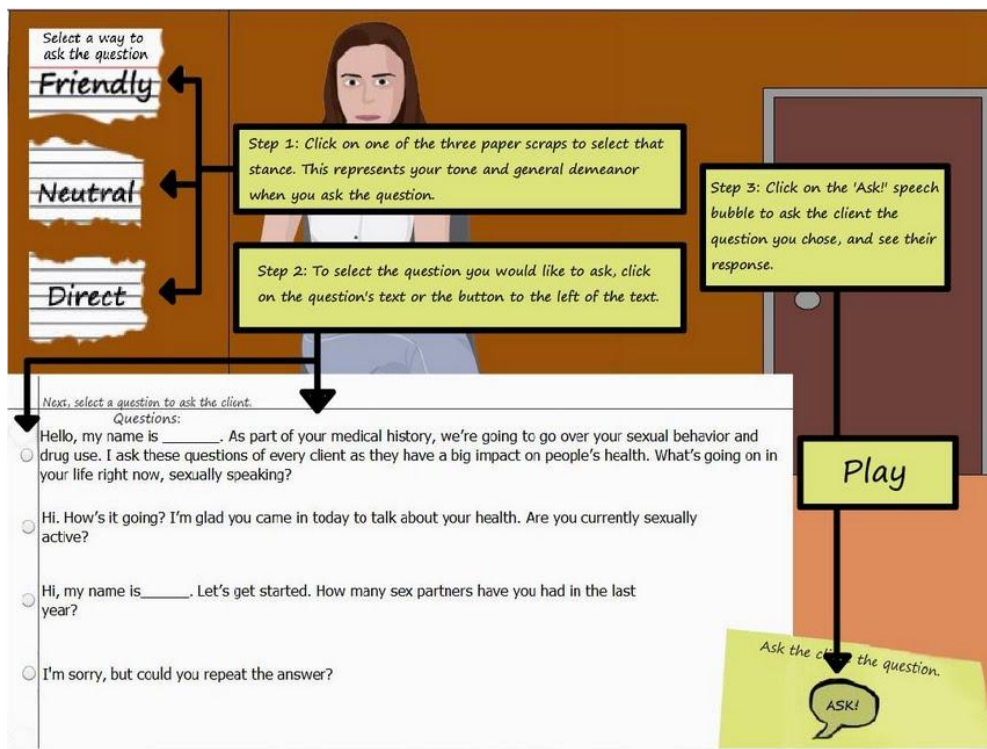
Figure 1: A screenshot of the help screen

Gameplay is handled entirely by mouse interaction. For each question, the player must select a stance and a question, then choose to ask the question. A stance is the tone by which the player chooses to deliver the question, with options of friendly, direct, and

indirect. Friendly is a kindhearted tone, which is helpful for getting the patient to trust the player more. Direct is for being blunt, which will get the player an answer but may put off the patient some. Indirect is less likely to get the player the information, but probably will not make the patient angry. There is also an option to ask the patient to repeat their last response.

After corresponding with Cicatelli, a decision was made to use a two dimensional art style. Cicatelli wanted the game to be useable on a wide range of systems, which precluded the use of realistic three dimensional graphics due to the harsher hardware requirements to run them. Two dimensional graphics not only required less powerful computers to run them; they also would be more feasible to create in the timeframe of the project.

The setting is a room, and the client is an attractive 22 year old Caucasian girl with long brown hair wearing business casual attire. The patient sits in a chair in the room with a neutral expression at first. Since a large part of the interview process is about gauging physical cues from a patient, it was decided that the example patient be given animations for the various ways in which she might react to the questions asked. In order to give the player feedback on how the client felt about the questions being asked, these animations had to be detailed enough to convey a convincing and believable emotional response. Such detail was necessary in order to make the game realistic enough for Cicatelli to use as a training tool. The seven animations are shown below. Figure 2 is angry, Figure 3 is bored, Figure 4 is defensive, Figure 5 is guilty, Figure 6 is nervous, Figure 7 is relaxed, and Figure 8 is uncomfortable, though only six were actually used in the finished game, with the guilty animation being left out because of the script only

supporting six different animations.
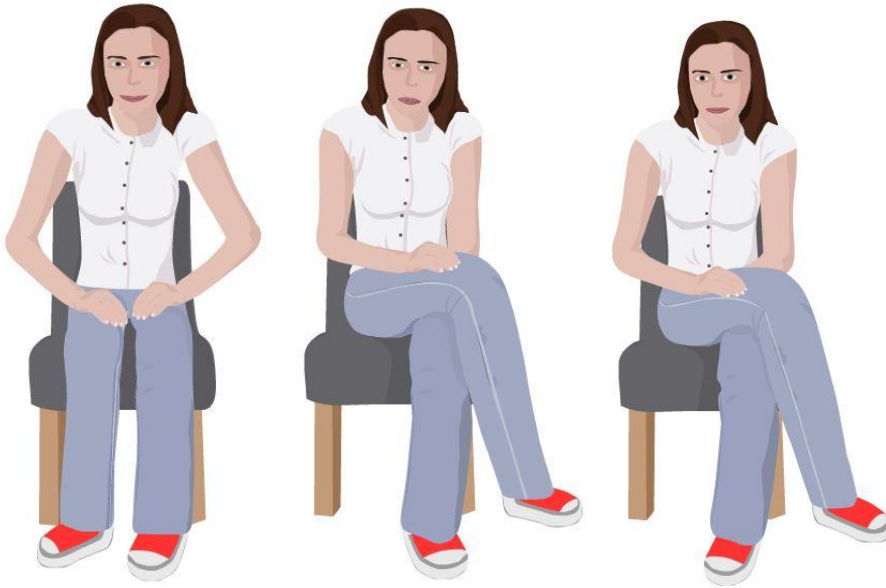
Figure 2: Angry　　　Figure 3: Bored　　　Figure 4: Defensive　　　Figure 5: Nervous

Figure 6: Relaxed　　Figure 7: Uncomfortable　Figure 8: Neutral

Section 4: Evaluation

Testing the viability of the game as a teaching tool was done using the results of two surveys. . These surveys were made by us using the information we were provided by Cicatelli Associates Inc. and were also checked by someone from that company. They were designed to test the player's knowledge about HIV risk assessment. One survey tested the player before and after reading information about performing an HIV interview. The other survey tested the player before and after reading the same piece of information as well as playing the game. The results of these surveys were useful in helping determine how much of an impact the game had on the learning procedure. A copy of each of these surveys is located in the Appendix.

The user study uses a survey that contains a few questions pertaining to performing risk assessments. It has a question about how familiar the survey taker is with risk assessment, asks two questions to gauge the subject's preexisting knowledge, and about how comfortable the user is performing a risk assessment. The follow-up survey also asks them how much the subject

thinks the reading or reading and game helped them with learning how to perform a risk assessment. The intent was to gauge if giving the users material about performing a risk assessment would help the user to become comfortable or more knowledgeable about performing a risk assessment on a potential client.

To do the surveys, which we called the Reading Survey and the Reading and Game Survey, we emailed out a request to the WPI student mailing list for people to do the surveys, which also contain the link to the surveys, which were accessible via the Internet. The surveys were open for a period of 4 days. The game was also accessible via the Internet during this time, with the Reading and Game Survey containing a link to it.

There were 38 responses to the Reading survey, although only 27 actually finished, and there were 202 responses to the Reading and Game survey, although only 86 actually finished. The unfinished surveys were removed from the analysis. The number of finished Reading surveys was not a large enough sample to be statistically significant. At least 32 responses were necessary to give meaningful results. We used surveymonkey.com to set up the surveys, and it reported finished and unfinished surveys by whether or not the subject submitted answers for all the questions.

The main demographic for our survey is college students, 18-21. We used other students at WPI by sending out the surveys through the school email system. Given our test demographic, none of the participants had any actual experience in performing HIV risk assessments and most of them had no relevant knowledge in the area. We took this into consideration when analyzing the result, both in base knowledge and in improvement after one of survey options.

Section 5: Analysis

The first question is about how comfortable the user is with performing a risk assessment. Figures 3 and 7 are based around the Reading Survey, with Figure 3 prior to the Reading Survey while Figure 7 is after the reading in the survey. The X-axis indicates the number of people who have picked a particular response, while the Y-axis represents the number between 1 and 5 that people have picked.
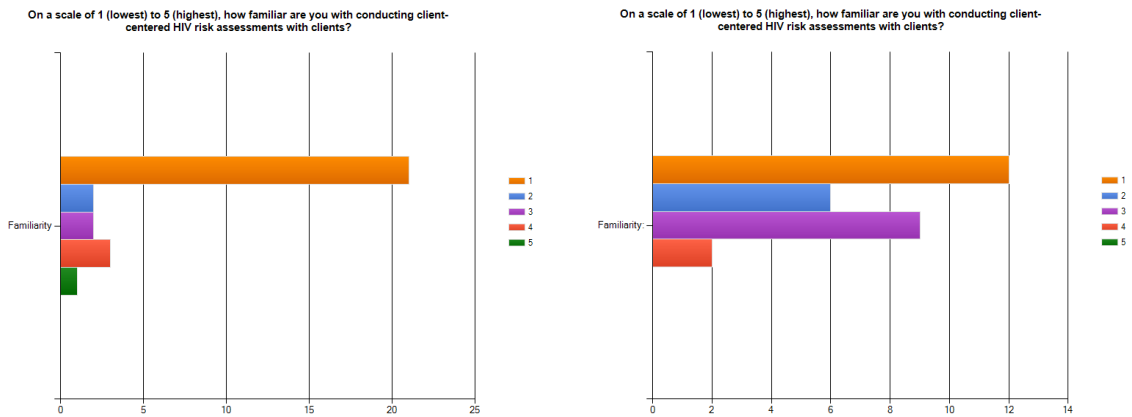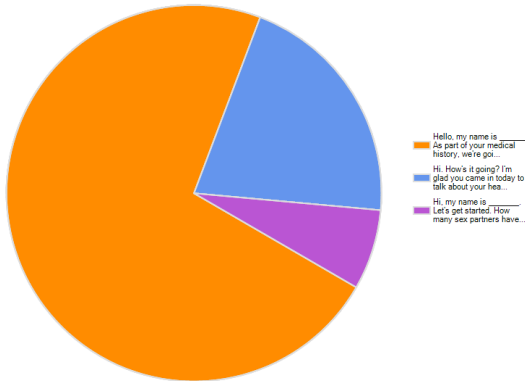

Figures 3-7: Graphs showing the results of the first question before and after the reading in the Reading Survey

While the number of people who are not comfortable with performing a risk assessment after the reading is still high after, there is a large increase in the number of people who were at least moderately comfortable. This means players at least feel more familiar with performing a risk assessment than they were prior to the reading.

Figures 12 and 16 are the same question, but before the Reading and Game survey, and after the reading and playing the game. The X-axis indicates the number of people who have picked a particular response, while the Y-axis represents the number between 1 and 5 that people have picked.
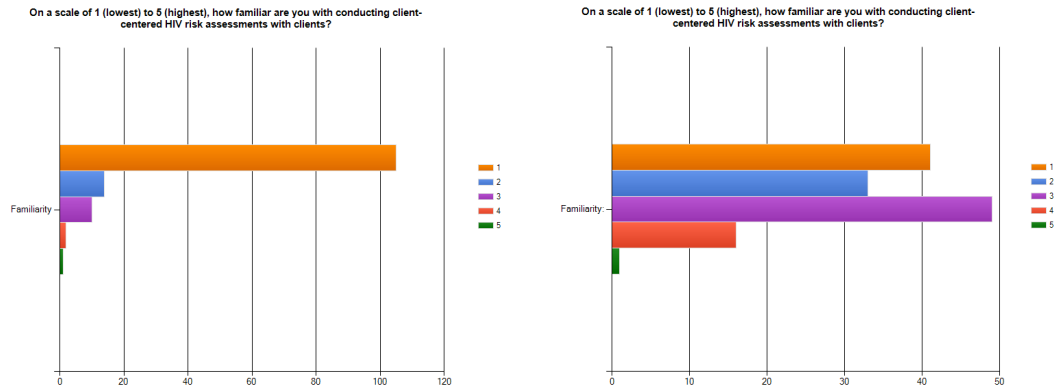
Figures 12-16: Graphs showing the results of the first question before and after the reading in the Reading and Game Survey

These charts show that the increase in the number of people who are at some level comfortable with performing assessments has jumped dramatically. The results are more distinct in this survey, since people who are mildly comfortable, a 3, is worth a much larger amount of the overall results. Even more importantly, the subjects who picked being comfortable with it, a 4, had a large and definite increase. In regards to this question between both surveys, it would seem that at in the subject's eyes, the reading and game survey definitely helped them become more familiar with performing a risk assessment than just doing the reading.

In a comparison between the Reading Survey results and the Reading and Game Survey results for after the survey is completed, the Reading and Game Survey comes out ahead. A larger percentage of the subjects who took the Reading and Game survey became more familiar and to a greater degree than those subjects who only did the reading.

The second question is essentially a knowledge test, since it asks a question to which the answer is in the reading. This is done to see how many players get the right answer before and after the reading. Figure 4 is the results of this question before the reading, while Figure 8 is after the reading. Each color in the pie chart represents a different answer, as shown in the key.
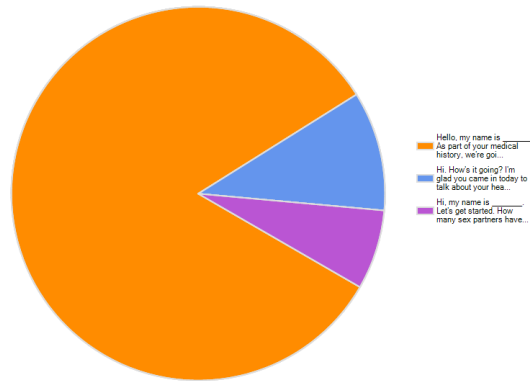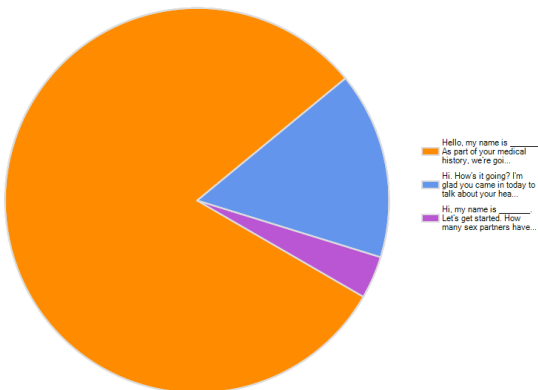
Figures 4-8: Graphs showing the results of the second question before and after the reading in the Reading Survey

The orange slice of the pie chart represents the correct answer. As the chart shows, the number of people who got the answer correct increased by a noticeable amount between both questions. The amount of people who got the correct answer increased from 70.8% to over 79.2%.

The next two figures, 13 and 17, represent the answer to this same question for the Reading and Game Survey. Figure 13 represents the results before the doing the reading and playing the game while Figure 17 represents the results from after doing the reading and playing the game.

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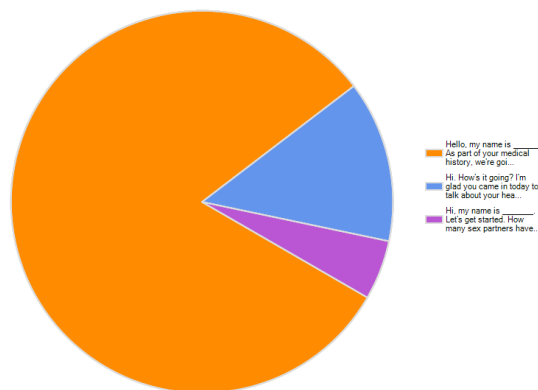
Figures 13-17: Graphs showing the results of the second question before and after the reading and game

On this set of answers, most people picked the correct answer the first time. However, the number of correct answers does decrease mildly. The number of subjects who got the correct answer before the game was 79.1%, while the number for after the game was 78.8%. This represents a small decrease in the number of people who got the correct answer. This could represent someone learning an incorrect method of asking from the game, which would be a mark against the reading and game being more effective than the reading alone.

In a comparison between the Reading Survey results and the Reading and Game Survey results for after the survey is completed, the Reading Survey subjects were the overall better group. The Reading and Game Survey group actually decreased the number of subjects with the correct answer, and the Reading Survey group had the higher percentage of correct answers, with 79.2% versus 78.8% for the Reading and Game Survey.

The next question is another test question of the survey taker's knowledge of the correct way to ask a particular risk assessment question. This question tests their knowledge about the proper way to ask about birth control, and this question was definitely harder, as you will see from the number of incorrect answers that were picked the first time. Figure 5 represents the results before the Reading Survey, while Figure 9 represents after the Reading Survey.

The correct answer on this question is represented by the orange pie slice. Before the reading, most people asked to most straight up wrong way possible, by being far too forward and direct, which would put the interviewee in an awkward position. After the reading, the most wrong answer has dropped to being the smallest portion of the chart, and the correct answer is a larger amount, though the most people picked the in-between way to ask, which is not particularly bad but could be better.

The Reading and Game Survey version of this question ended up similar based on results. Figure 14 represents before the Reading and Game Survey, while Figure 18 is after.
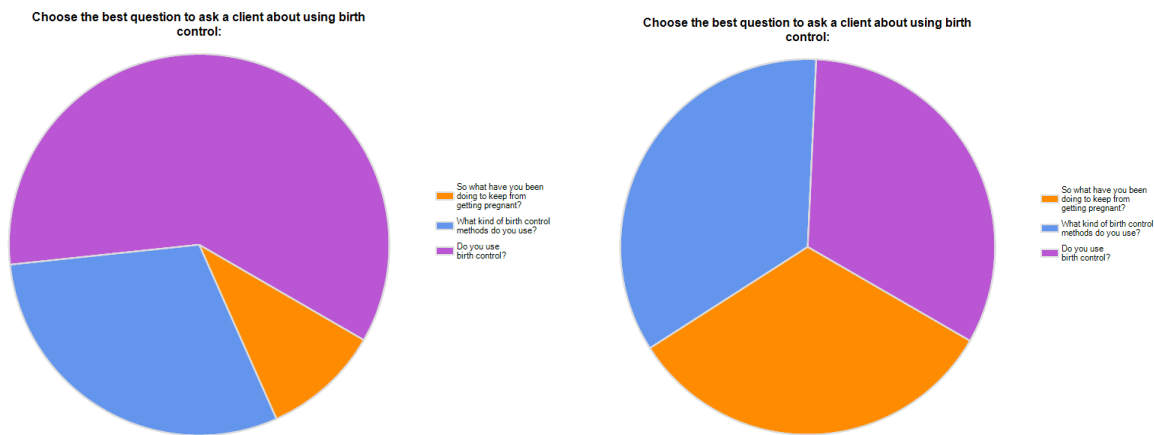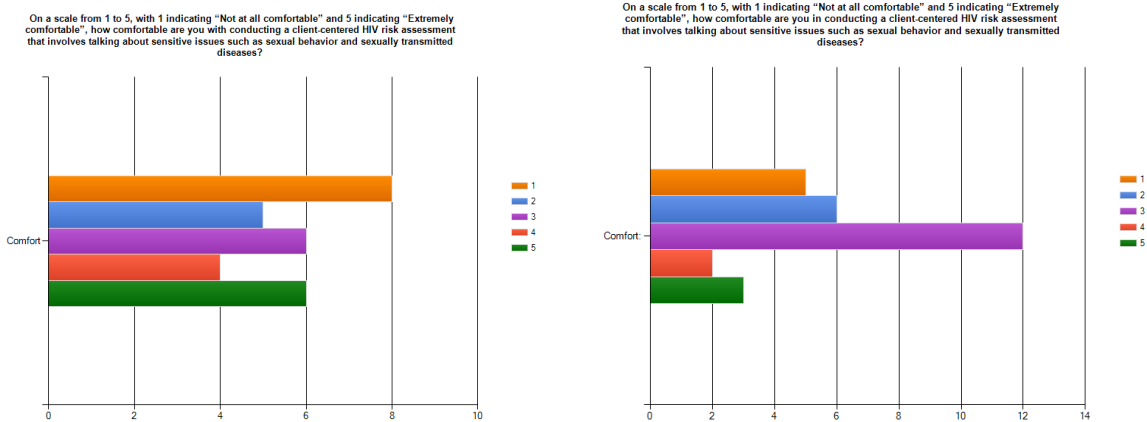

Figures 14-18: Graphs showing the results of the third question before and after the reading in the Reading and Game Survey

Before the Reading and Game survey, most people again picked the completely incorrect answer, while the correct answer was largely the smallest overall selection. Only 10.3% of people picked the correct answer, with 57% picking the wrong answer. After the survey, the answers evened out so that each answer was worth about 1/3rd of the overall results. 34.5% of subjects picked the correct answer, while 28.6% of subjects still chose the incorrect answer. In

this regard, the game certainly helped people gain the knowledge to not pick a bad answer.

In a comparison between the Reading Survey results and the Reading and Game Survey results for after the survey is completed, The Reading and Game Survey subjects had a much larger improvement as well as the larger amount of overall correct answers. The Reading Surveys subjects ended with 33.3% of subjects choosing the correct answer, and the Reading and Game Survey had 34.5% of subjects choosing the correct answer. Also important to note is that the larger percentage of Reading and Game Survey got the question wrong after playing the game and doing the reading, 28.6%, versus the 16.7% wrong on the Reading Survey.

Question 4 is about how comfortable the subject would feel about performing an actual risk assessment, which would include talking about uncomfortable things, such as sexually transmitted diseases. Figure 6 is before the Reading Survey, while Figure 10 is after the reading. The X-axis represents the number of people who chose a particular answer, while the Y-axis represents the number between 1 and 5 that represents how comfortable the user is.


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Figures 6-10: Graphs showing the results of the fourth question before and after the reading in the Reading Survey

The before Reading survey shows a fairly even spread results between the values, but the subject being very uncomfortable is the highest, with 8 people at that level. After the reading,

the numbers changed significantly, with mildly comfortable being the highest representative

value with 12 of the total 28 subjects. The reading certainly resulted in more being comfortable

with performing a risk assessment, though it may have also helped some people realize that they

would not be comfortable performing a risk assessment.

Figures 15 and 19 represent the results of the previous question based on the Reading and

Game survey. Figure 15 is before the Reading and Game survey while Figure 19 is after the

reading and game. The X-axis indicates the number of people who have picked a particular

response, while the Y-axis represents the number between 1 and 5 that people have picked.
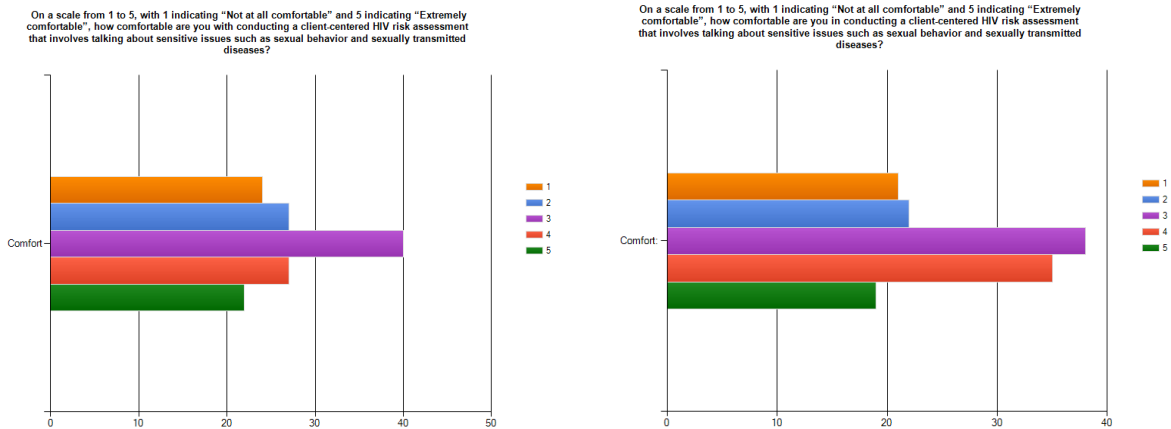
Figures 15-16: Graphs showing the results of the first question before and after the reading in the Reading and Game Survey

Before the Reading and Game survey, most of the people felt mildly comfortable with

performing an assessment, with 22 people who considered themselves mildly comfortable, and

the other numbers being about even. After the Reading and Game, even more people considered

themselves mildly comfortable, with 25 people now considering themselves a 3, and noticeably,

the amount of people who felt comfortable and extremely comfortable increased dramatically,

with 23 subjects considering themselves a 4. The information to draw from this is that the game

helped people feel more comfortable than just the reading did alone.

In a comparison between the Reading Survey results and the Reading and Game Survey results for after the survey is completed, the subjects who participated in the Reading and Game Survey had a larger general improvement. After the Reading Survey, the largest portion of the subjects felt only mildly comfortable, with other levels being low all around. After the Reading and Game Surveys, the largest portion of participants felt mildly comfortable, but other categories, especially comfortable, a 4, had increased to a close level. The overall improvements in the Reading and Game Survey are larger and more noticeable on the Reading and Game Survey.

The last question, which was only asked on each follow-up survey, was how helpful and informative the user considered the Reading Survey or the Reading and Game to be. Figure 11 is after the Reading survey while Figure 20 is after the Reading and Game Survey.
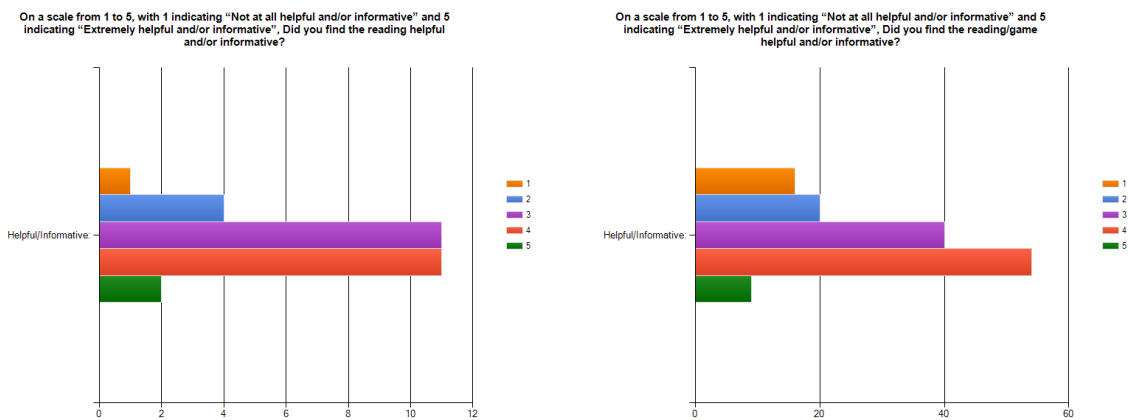
Figures 11-20: Graphs showing the results of the fifth question after the Reading Survey and after the Reading and Game Survey

Most people considered the reading to be between mildly helpful and actually helpful, with some outliers on each side. The people who took the Reading and Game survey considered the game to be helpful, with less people considering it to be mildly helpful. This means more people considered the game and reading together to be the better result, and considered it to be

more helpful and informative. In that sense then, even if the user would not have actually learned more, which it still seems like the average person did, it accomplished the more important goal of doing a better job of making the user more comfortable with performing actual risk assessments.

The following graphs compare the results of subjects reading the written material to those of the subjects who both read the material and played the game. First is a comparison of familiarity with risk assessments.
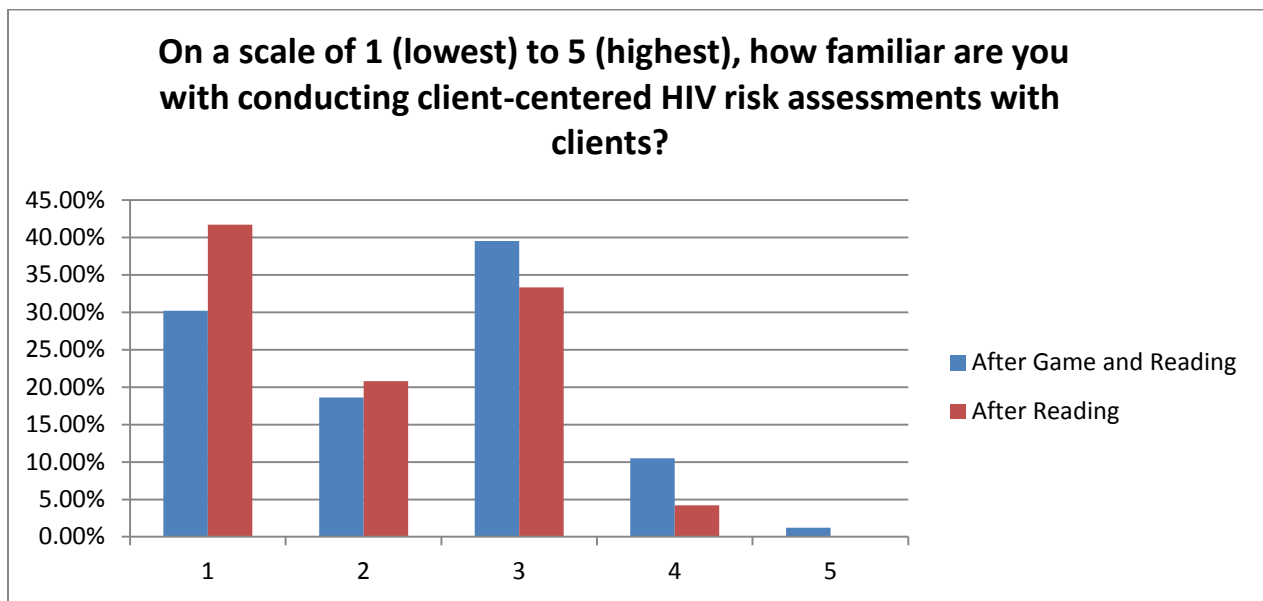
Figure 21: Graphs showing a comparison of survey responses between subjects who read and subjects who read and played the game

As can be seen in Figure 21, subjects reported much higher familiarity with the process after both the reading and the game. There was a slight improvement in choosing the correct phrasing for an interview question.
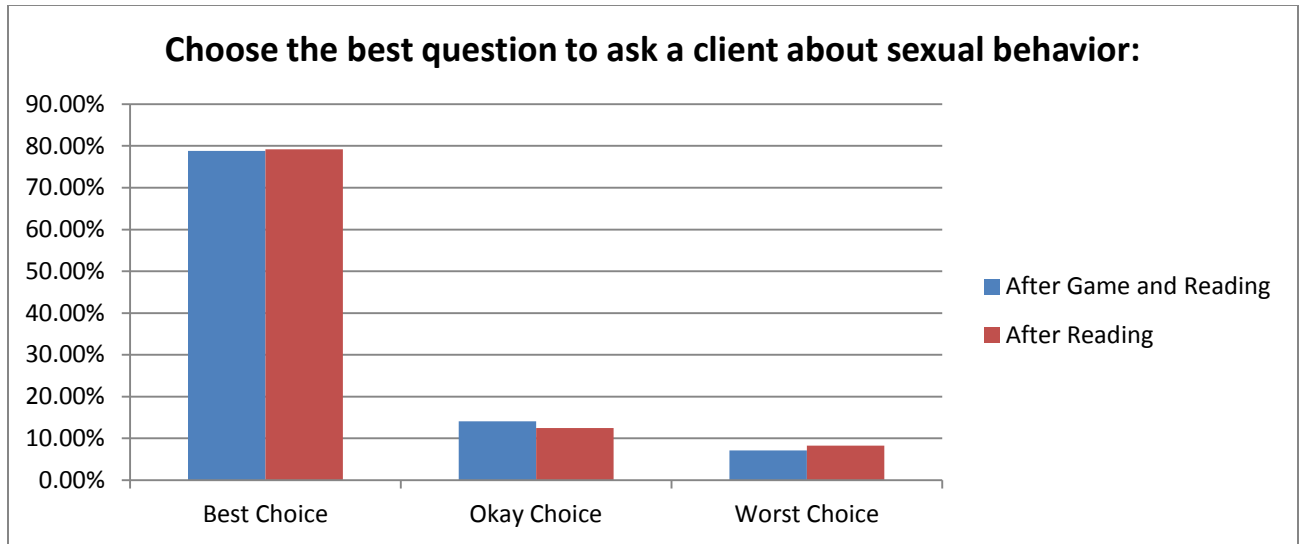
Figure 22: Graphs showing a comparison of questions to ask a client between subjects who read and subjects who read and played the game

Figure 22 shows that the results for choosing the best question were nearly identical, both around 78%. Subjects who played the game did choose the "okay choice" more often than the designated "worst choice".
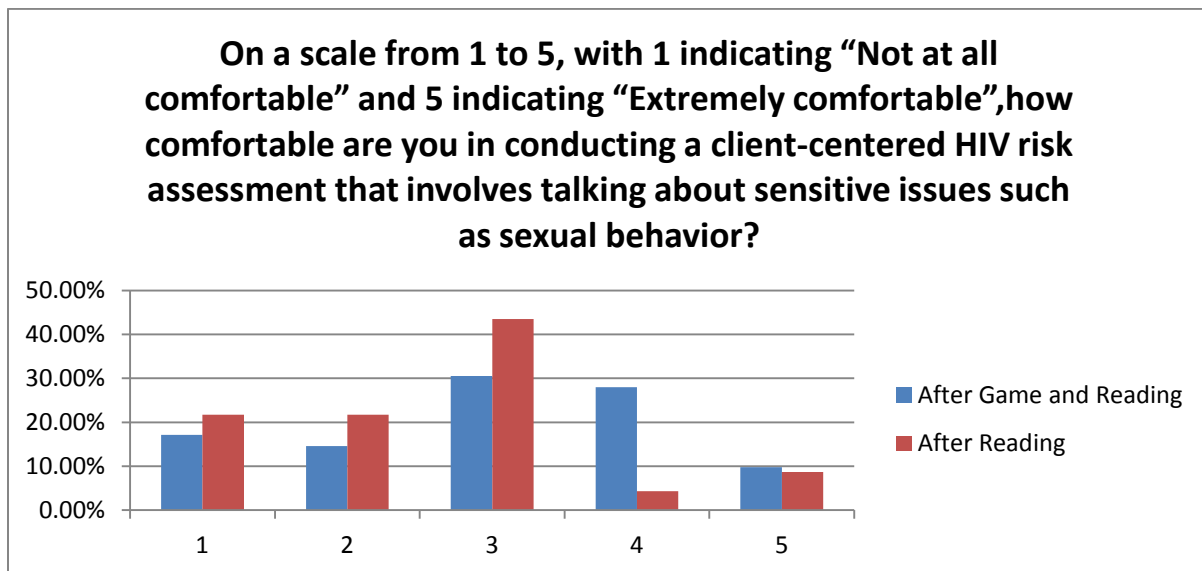

Figure 23: Graphs showing a comparison of comfort level between subjects who read and subjects who read and played the game

According to Figure 23, subjects who did the reading and played the game reported a higher comfort overall than those who did the reading alone. This suggests that the game does immerse users in the subject such that they become more comfortable thinking about it. All the graphs from this section can be viewed in larger form in the Appendix.

Section 5: Recommendations

Two dimensional graphics were useful for the sake of performance optimization, but they were inadequate for portraying realistic and accurate emotional responses to interview questions. We recommend three dimensional graphics to more effectively show the client's emotional response to the player. Additionally, while simplifying the responses to seven different animations was necessary for the scope of the project, a more robust and in-depth animation system would have been more optimal for the project goals.

We also recommend a different structure of survey. The Reading and Game survey had over 200 participants, but less than half of those finished the entire survey. This could be attributed to the length and complexity of the survey. The survey combined with the testing materials took testers around 20 minutes to complete. There were also many questions on the survey, many more than most subjects are used to. Many might not have been willing to finish after doing the reading and game, or the instructions were not visible enough.

More testing is also recommended. The Reading survey had fewer than 40 participants, and not all of those finished the survey either. In this test, subjects were given a choice of which survey to take. Clearly there was more interest in the game. Further tests should be conducted

blind, so participants do not know what they are being surveyed for, and so that there will equal data both for the game and for the conventional method.

The team chose to use Flash for the sake of making the import of art assets simple. However, Flash had problems elsewhere, including some errors that could not be debugged as well as a large amount of lag when importing the script that had been split into .xml files. For example, there was a problem after the first question was asked where the text for the next scene would not load. Neither programmer could explain the bug, and had to force the game to load the text using a single function dedicated for that purpose. When the .xml files started to exceed 300 kilobytes, the text in each scene loaded significantly slower. Flash can load text from external files, but not at the size and depth required for *Risky Business*.

Section 6: Conclusions

Most classroom materials at hand today can only access one of the three learning types: visual, audio, or kinetic. A serious game however, does not have the boundaries of a textbook or a lecture, allowing a broader range of interaction with the material. *Risky Business* is a prototype serious game the models part of an HIV risk assessment. This prototype was tested to see if it helped subjects retain details about risk assessment beyond the information retained from only reading a text. The results indicate that, overall, the game in conjunction with the reading was more effective at teaching than the reading alone. Subjects comfort and knowledge of HIV based risk assessment increased more when they played the game and read the information than from reading the information alone. The multiple choice questions also showed similar improvement, reading and game subjects choosing the more correct answers over the wrong one. Many also stated that the game and reading was more helpful overall than the reading alone.

These lead us to conclude that serious games can be used to benefit training in areas beyond just typing or simple math; they can be used in focused and specialized tasks to allow people to learn in a different, and for some people better, manner. These games would not have widespread appeal, due to the narrow focus each one would have by necessity, but then it could be made with a very strong focus in design goals, making it better suited to the specific task it has to teach a focused group of people.

In summary, *Risky Business*, a serious game, when used together with a straightforward reading, helped students retained more information from playing the game than students that did reading alone. The study also demonstrated that there is much greater interest in games than reading text, as the survey involving the game was taken more than 200 times, while the reading received fewer than 40 subjects. This data was not intentionally collected, but does show that the current generation of students and young people entering the work force are intrigued by games.

The prototype game *Risky Business* helped students learn more about HIV risk assessment than they could have from a reading according to the results of the tests. There was also greater interest in playing a game than reading text. Future work would include comparing the results of reinforcing the same information given in a lecture, written assignment, or exam with *Risky Business*.

Bibliography

Crawford, Chris – *Chris Crawford on Interactive Storytelling*, New Riders Games, October 16,

2004

Garrity, Joan Mogul – *Asking the Hard Questions: A Reproductive Health Provider's Guide to

Client-Centered HIV Risk Assessment*, Boston, 2002.

Amie Ginnetti, Mindy Domb, Jorge Sanchez – *HIV Risk Assessment Users' Manual*, developed

for Project SPHERE (Statewide Partnership for HIV Education in Recovery Environments),

Accessed April 4, 2012< http://www.mass.gov/eohhs/docs/dph/substance-abuse/model-case/adult-

admission-forms-sphere-manual.pdf>

Glassner, Andrew – *Interactive Storytelling: Techniques for 21st Century Fiction*, A K Peters,

Ltd., Natick, 2004

Ray, Graner Sheri – *Tutorials: Learning To Play*, October 6th, 2010, Gamasutra.com, Accessed

April 4, 2012 <http://www.gamasutra.com/view/feature/134531/tutorials_learning_to_play.php>

Walter L. Leite, Marilla Svinicki, Yuying Shi - *Attempted Validation of the Scores of the VARK:*

Learning Styles Inventory With Multitrait -Multimethod Confirmatory Factor Analysis Modesl,

August 31st 2009, published originally in *Educational and Psychological Measurement* 2010

Adobe- "Getting Started With Actionscript." Adobe Flash Platform. Available from

http://help.adobe.com/en_US/as3/learn/WS5b3ccc516d4fbf351e63e3d118a9b8cf79-8000.html.

Internet; accessed 22 April 2011.

Adobe. "flash.net.URLLoader." ActionScript® 3.0 Reference for the Adobe® Flash® Platform.

Available from

http://help.adobe.com/en_US/FlashPlatform/reference/actionscript/3/flash/net/URLLoader.html.

Internet; accessed 22 April 2011.

Adobe. "com.adobe.icomm.assetplacement.controller.XMLDataLoader." ActionScript® 3.0

Reference for the Adobe® Flash® Platform. Available from

http://help.adobe.com/en_US/FlashPlatform/reference/actionscript/3/com/adobe/icomm/assetplac

ement/controller/XMLDataLoader.html. Internet; accessed 22 April 2011.

Appendix: Survey Results

Reading Survey Results: Before Reading

Figure 3:

On a scale of 1 (lowest) to 5 (highest), how familiar are you with conducting client-centered HIV risk assessments with clients?
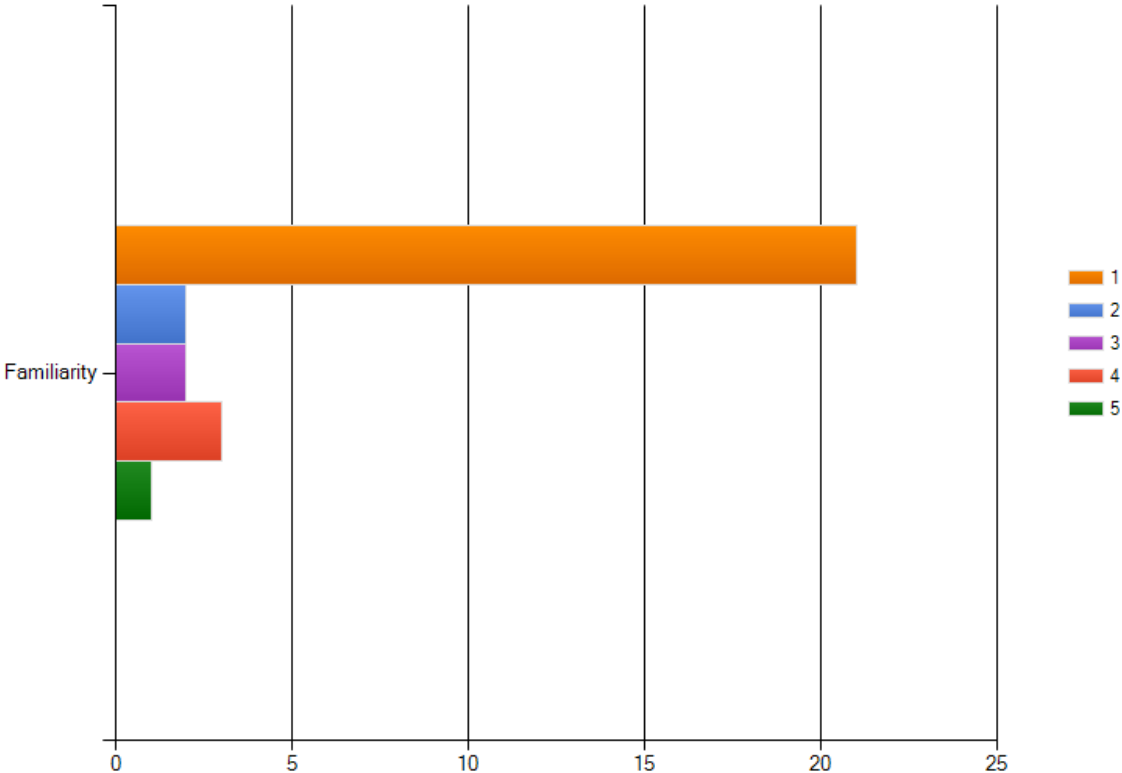
Figure 4:

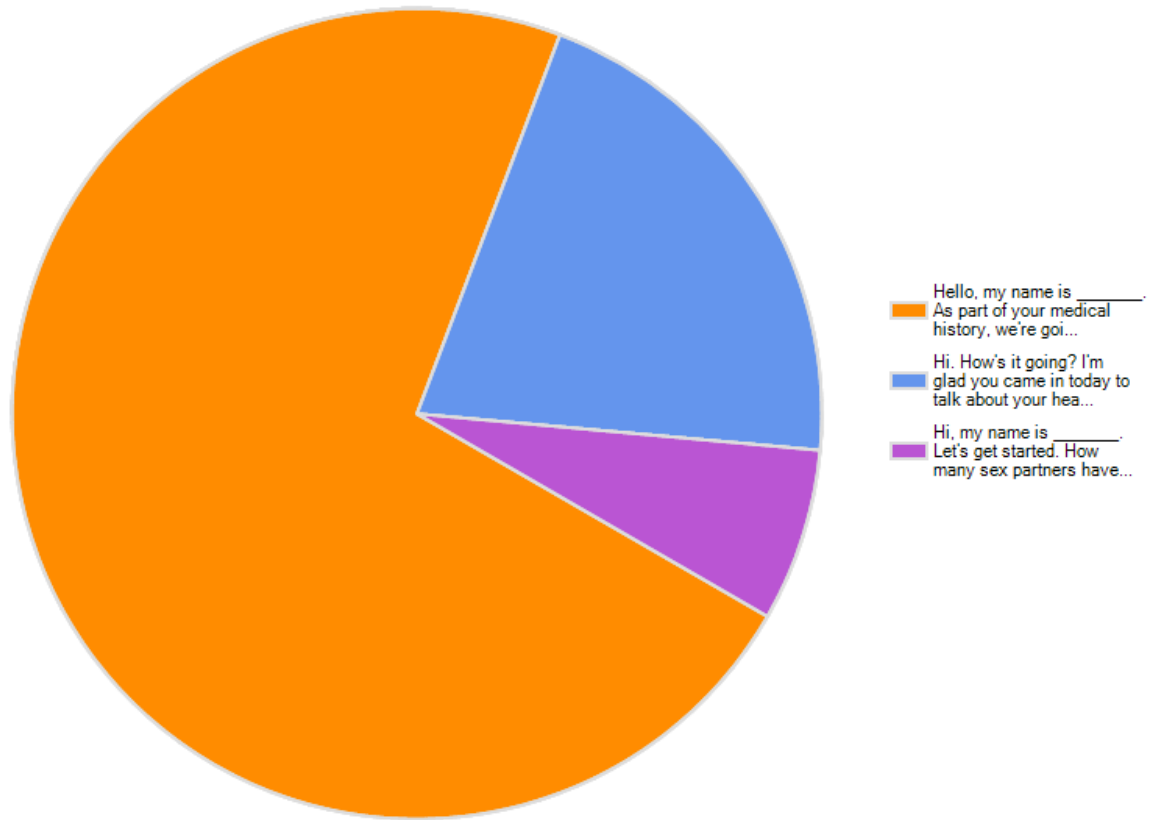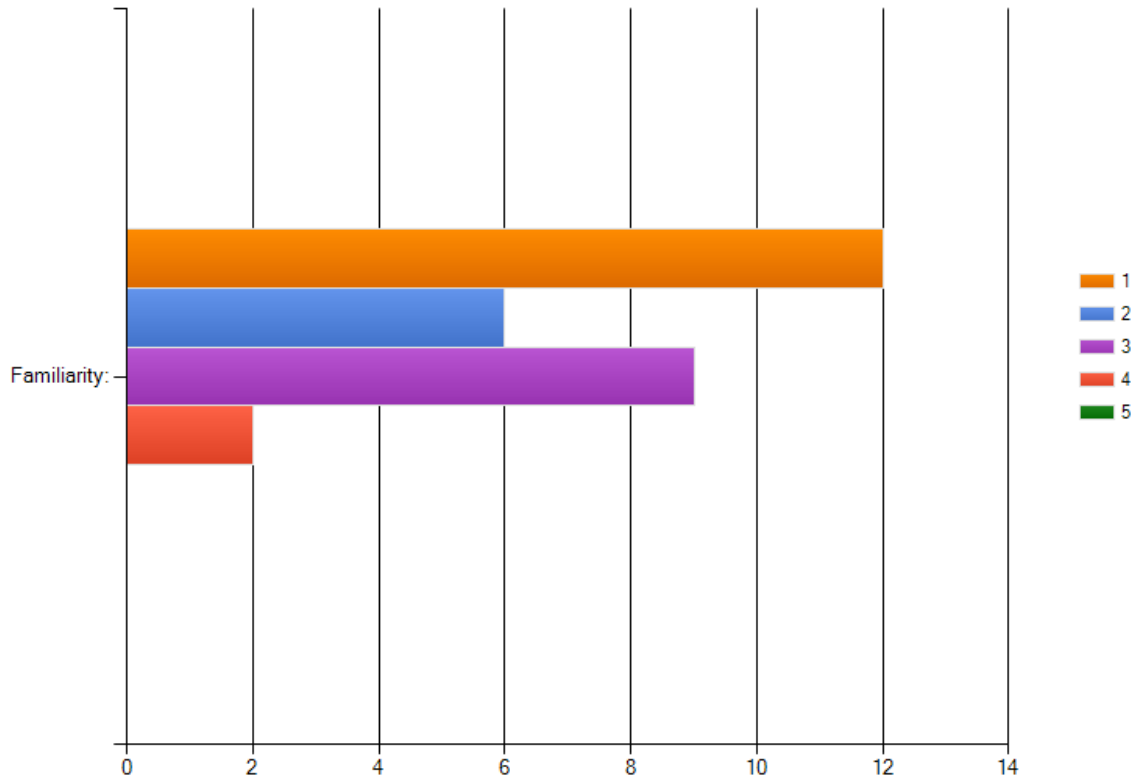**Choose the best question to ask a client about sexual behavior:**
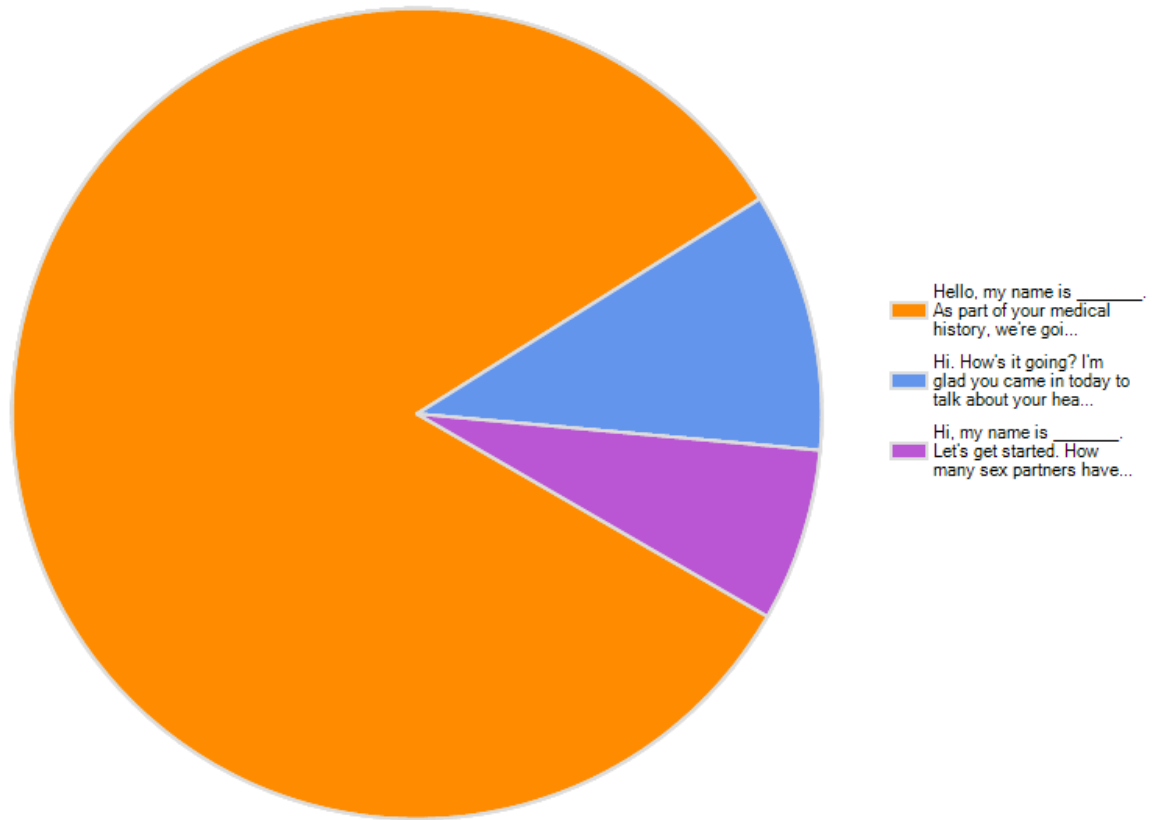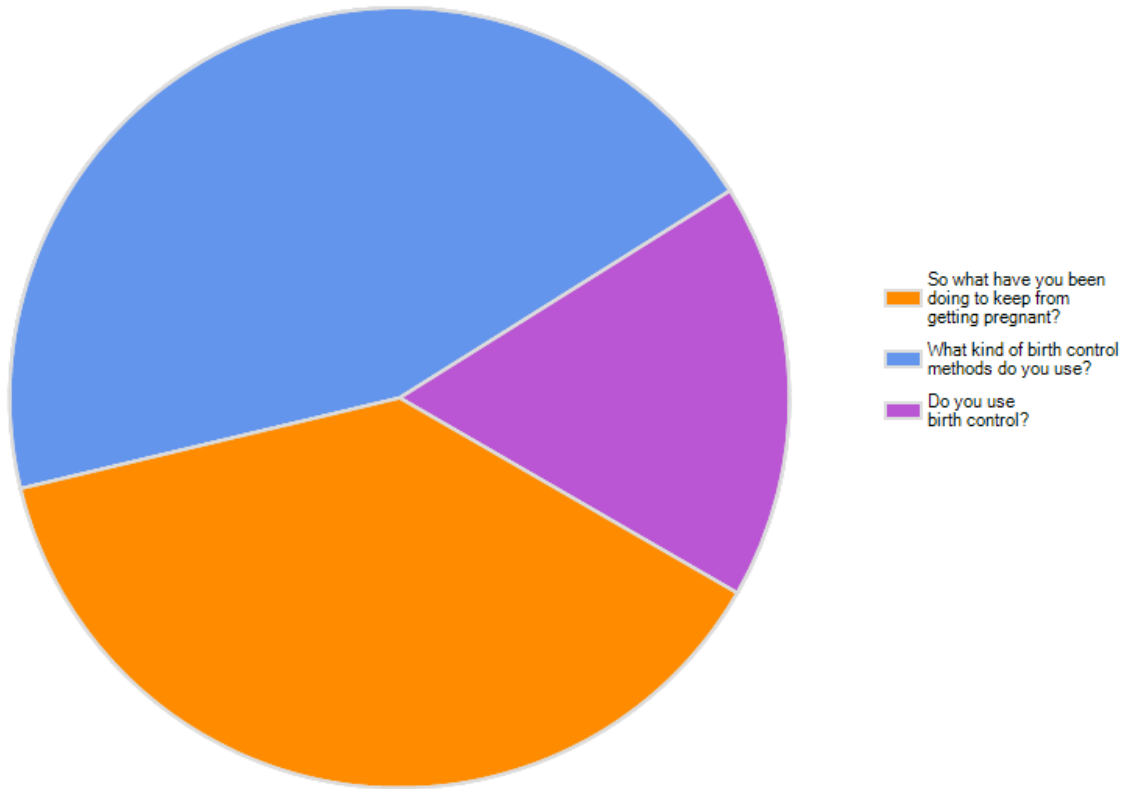

Hello, my name is _____.
As part of your medical
history, we're goi...

Hi. How's it going? I'm
glad you came in today to
talk about your hea...

Hi, my name is _____.
Let's get started. How
many sex partners have...

Figure 5:

Choose the best question to ask a client about using birth control:
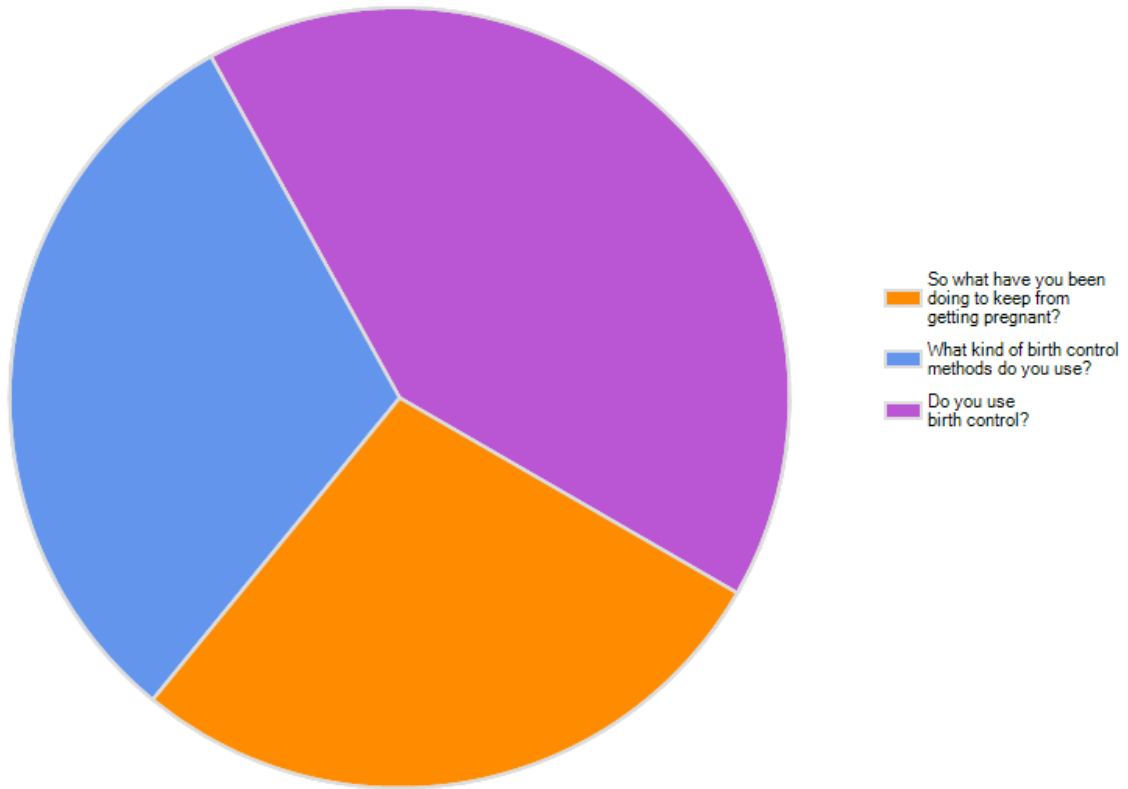
So what have you been doing to keep from getting pregnant?

What kind of birth control methods do you use?

Do you use birth control?

On a scale from 1 to 5, with 1 indicating "Not at all comfortable" and 5 indicating "Extremely comfortable", how comfortable are you with conducting a client-centered HIV risk assessment that involves talking about sensitive issues such as sexual behavior and sexually transmitted diseases?
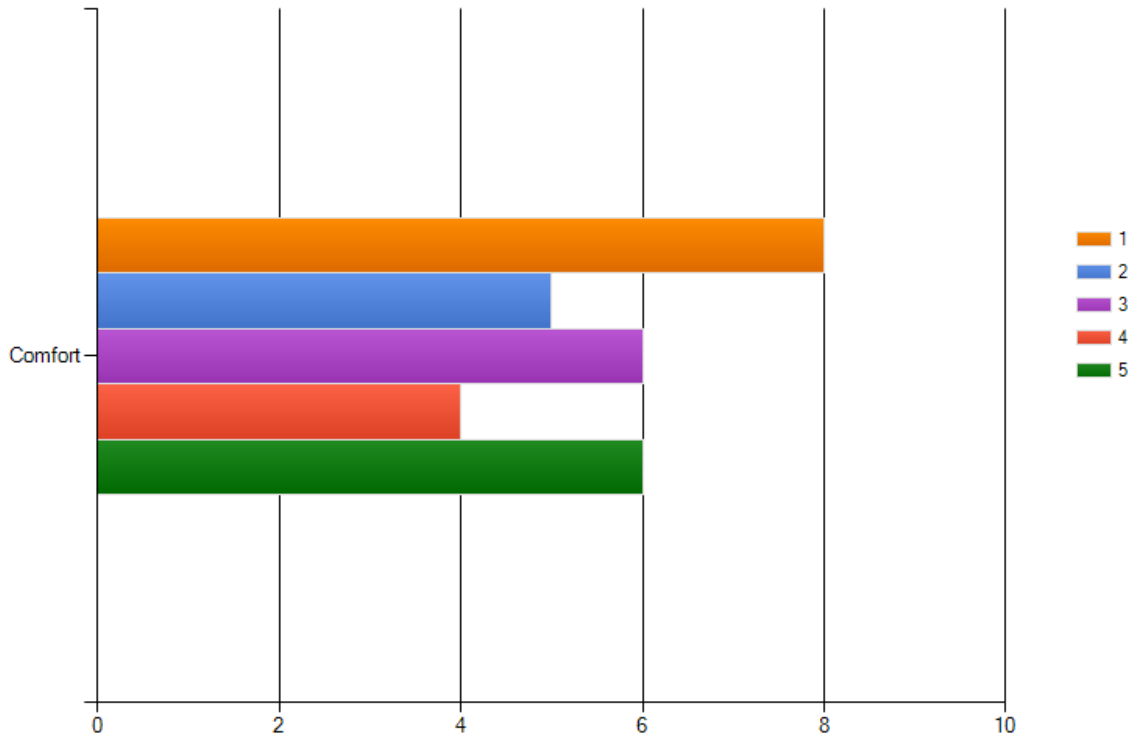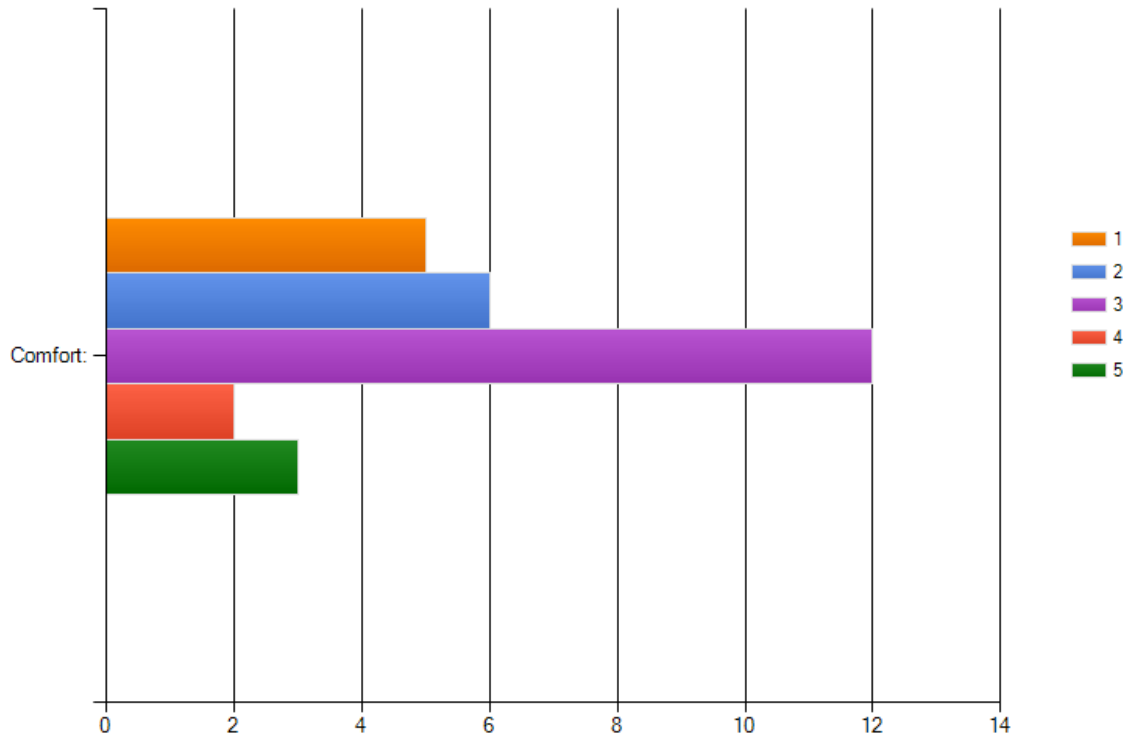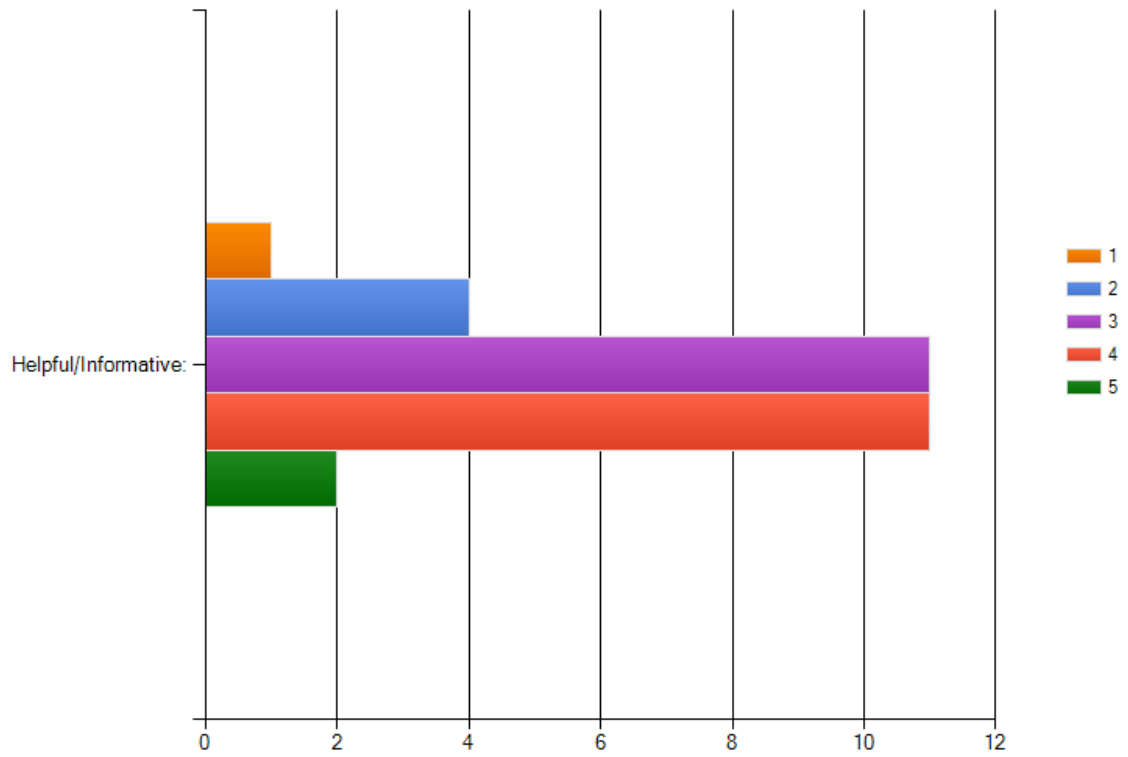

Reading Survey Results: After Reading

Figure 7:

On a scale of 1 (lowest) to 5 (highest), how familiar are you with conducting client-centered HIV risk assessments with clients?

Figure 8:

Choose the best question to ask a client about sexual behavior:

Legend:
- Hello, my name is _____. As part of your medical history, we're goi...
- Hi. How's it going? I'm glad you came in today to talk about your hea...
- Hi, my name is _____. Let's get started. How many sex partners have...

Choose the best question to ask a client about using birth control:

So what have you been doing to keep from getting pregnant?

What kind of birth control methods do you use?

Do you use birth control?

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Figure 10:

On a scale from 1 to 5, with 1 indicating "Not at all comfortable" and 5 indicating "Extremely comfortable", how comfortable are you in conducting a client-centered HIV risk assessment that involves talking about sensitive issues such as sexual behavior and sexually transmitted diseases?

Figure 11:

On a scale from 1 to 5, with 1 indicating "Not at all helpful and/or informative" and 5 indicating "Extremely helpful and/or informative", Did you find the reading helpful and/or informative?

Reading and Game Survey Result: Before Reading and Game

Figure 12:

On a scale of 1 (lowest) to 5 (highest), how familiar are you with conducting client-centered HIV risk assessments with clients?
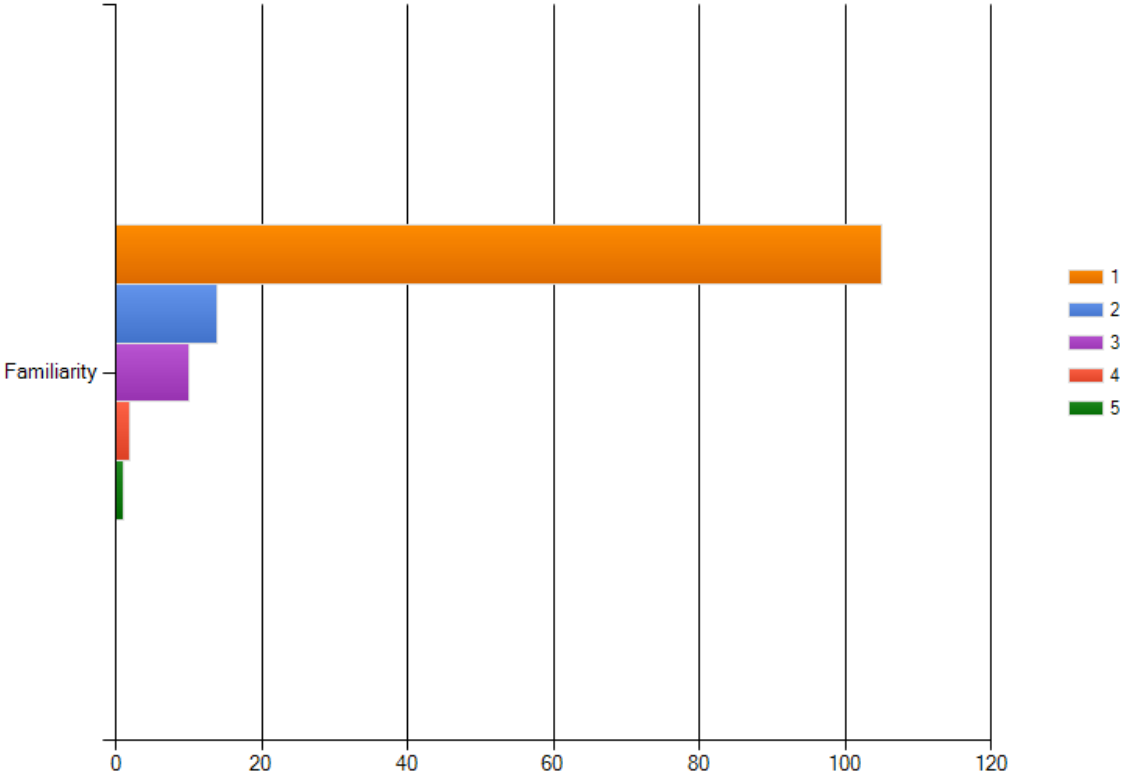
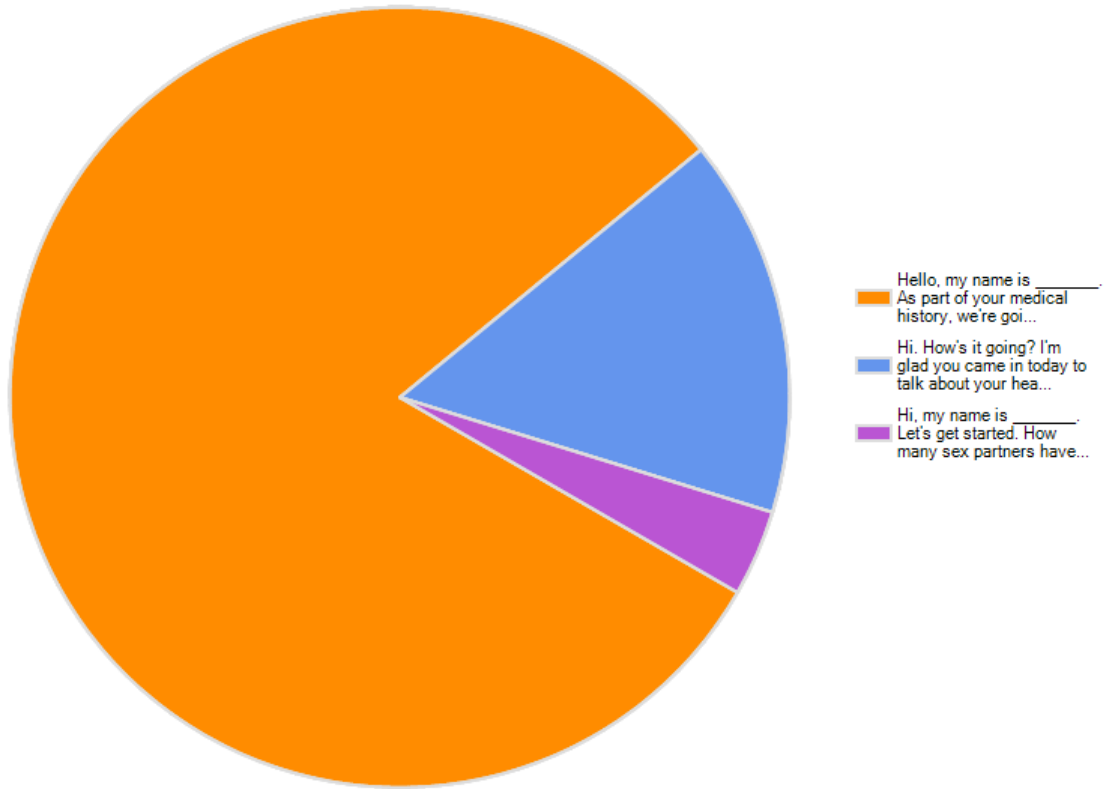**Choose the best question to ask a client about sexual behavior:**

Legend:
- Hello, my name is _____. As part of your medical history, we're goi...
- Hi. How's it going? I'm glad you came in today to talk about your hea...
- Hi, my name is _____. Let's get started. How many sex partners have...

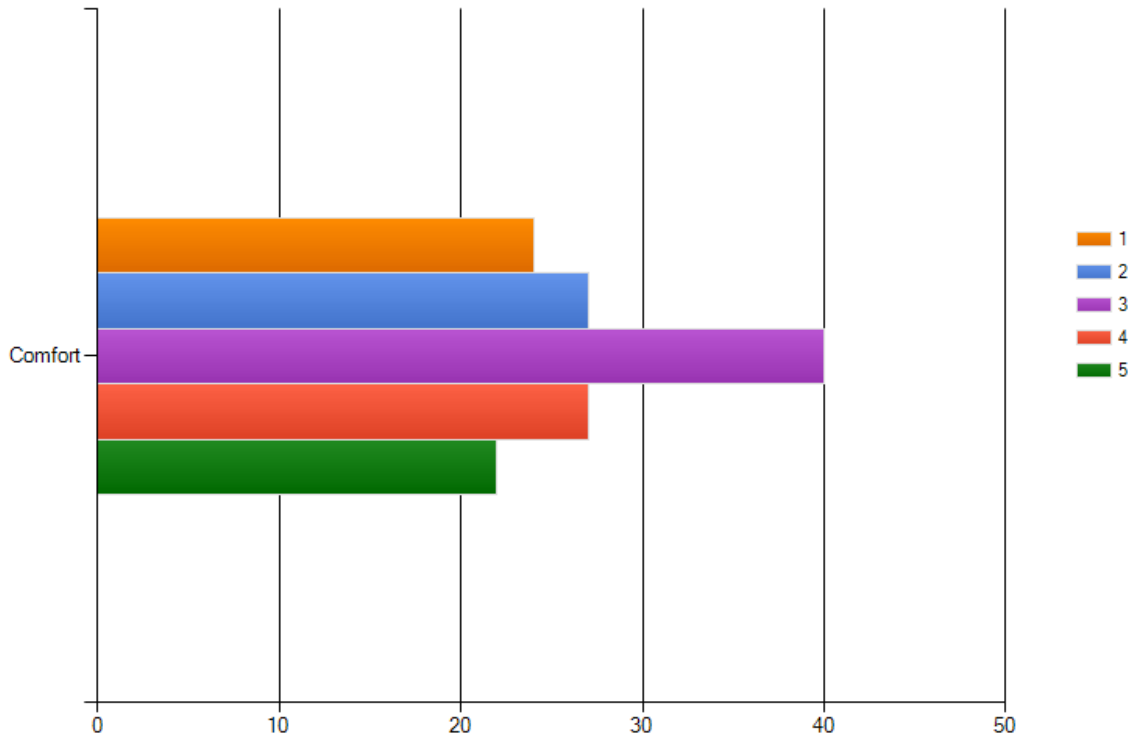Choose the best question to ask a client about using birth control:
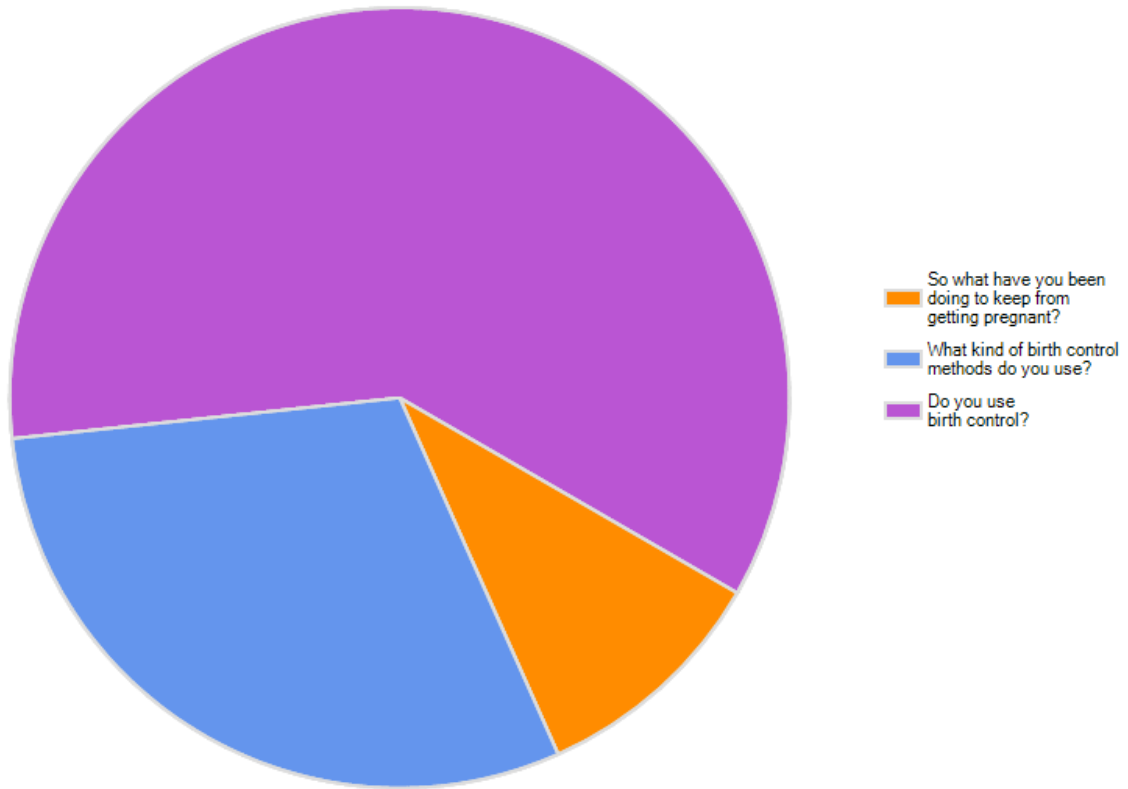
Figure 15:

On a scale from 1 to 5, with 1 indicating "Not at all comfortable" and 5 indicating "Extremely comfortable", how comfortable are you with conducting a client-centered HIV risk assessment that involves talking about sensitive issues such as sexual behavior and sexually transmitted diseases?

Reading and Game Results: After Reading and Game

Figure 16:

On a scale of 1 (lowest) to 5 (highest), how familiar are you with conducting client-centered HIV risk assessments with clients?
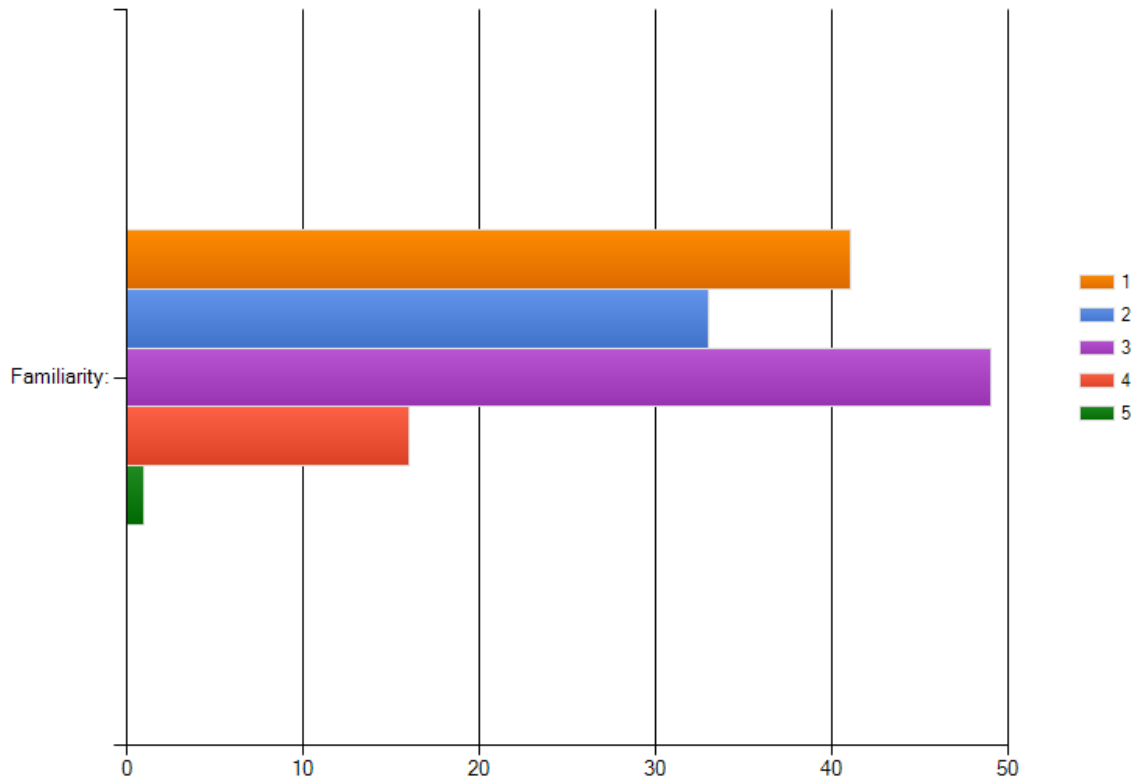
Figure 17:

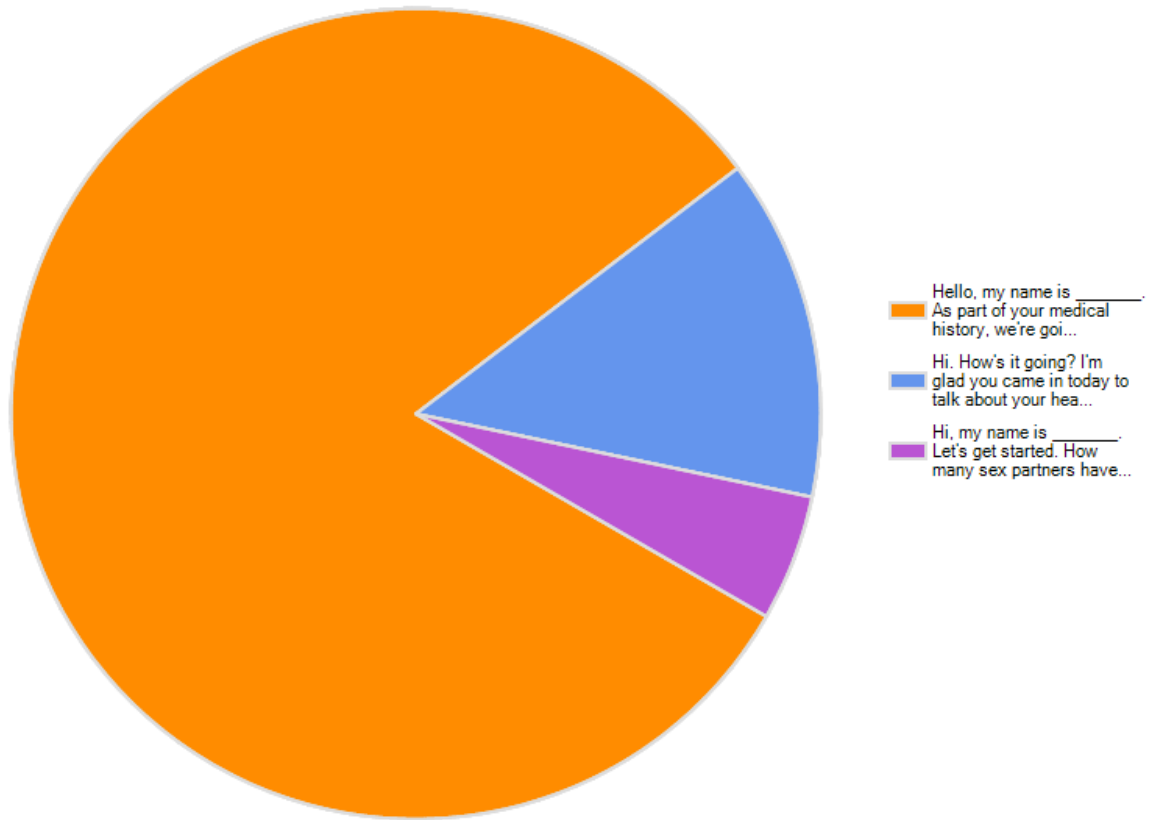**Choose the best question to ask a client about sexual behavior:**

Hello, my name is _____. As part of your medical history, we're goi...

Hi. How's it going? I'm glad you came in today to talk about your hea...

Hi, my name is _____. Let's get started. How many sex partners have...

Choose the best question to ask a client about using birth control:

So what have you been
doing to keep from
getting pregnant?

What kind of birth control
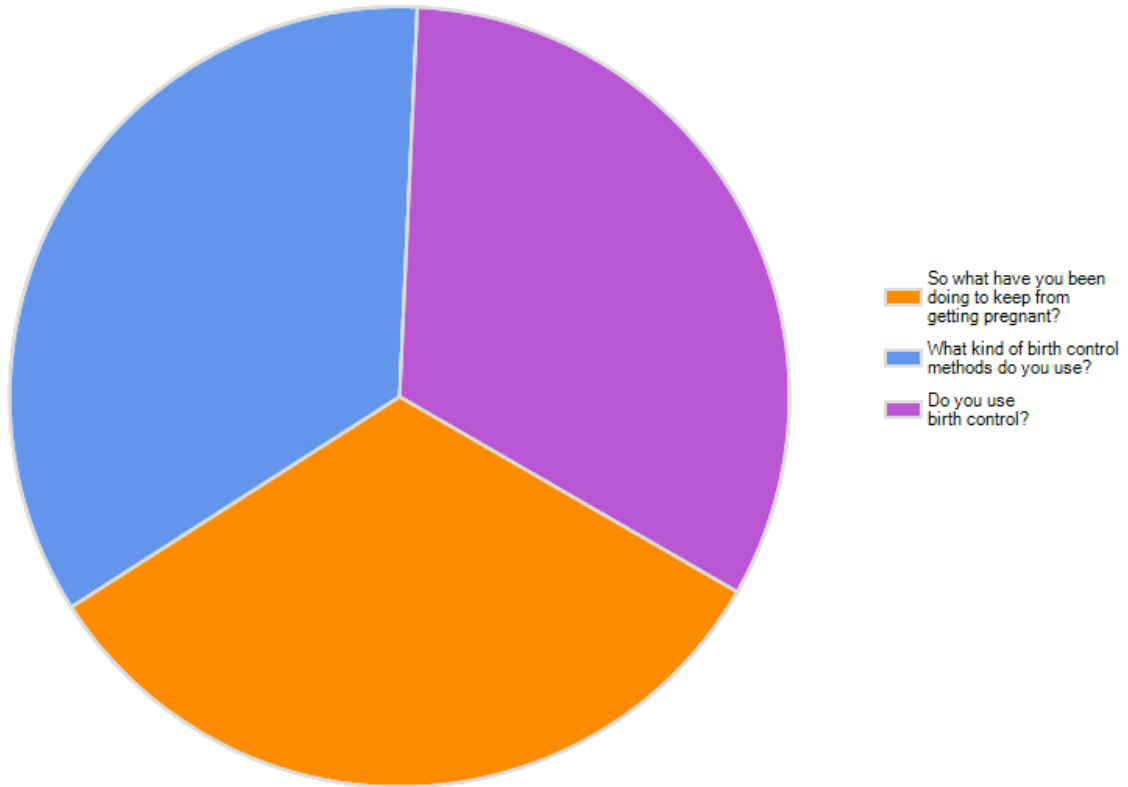methods do you use?

Do you use
birth control?

Figure 19:

On a scale from 1 to 5, with 1 indicating "Not at all comfortable" and 5 indicating "Extremely comfortable", how comfortable are you in conducting a client-centered HIV risk assessment that involves talking about sensitive issues such as sexual behavior and sexually transmitted diseases?
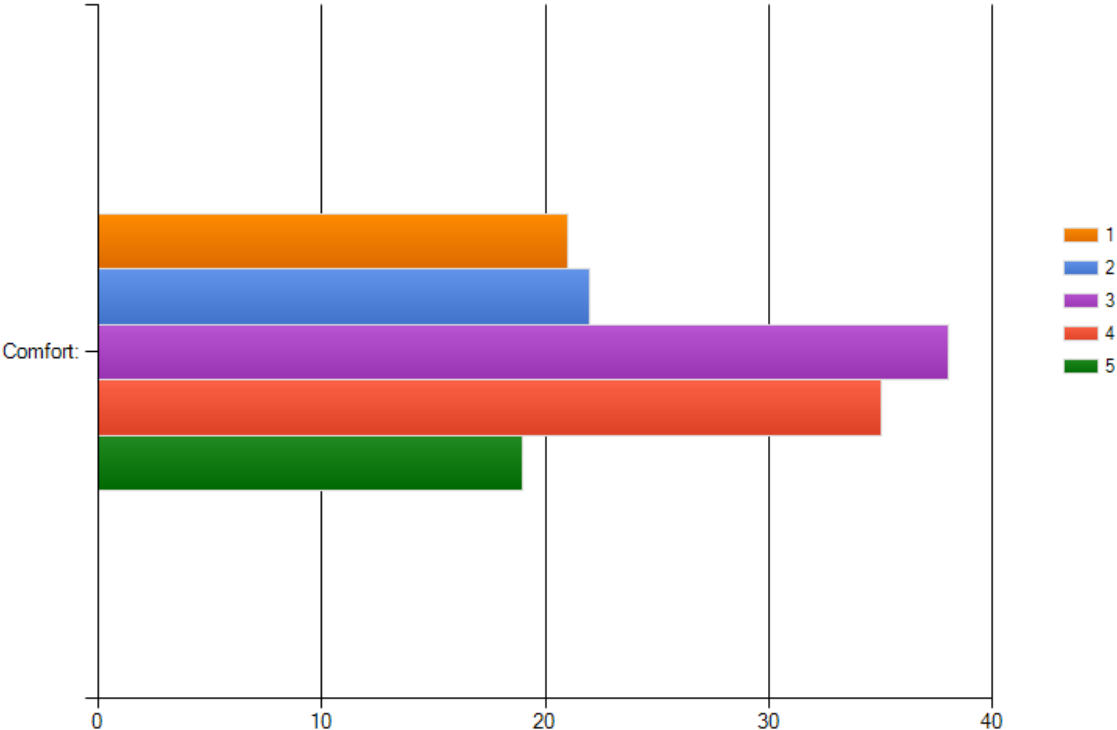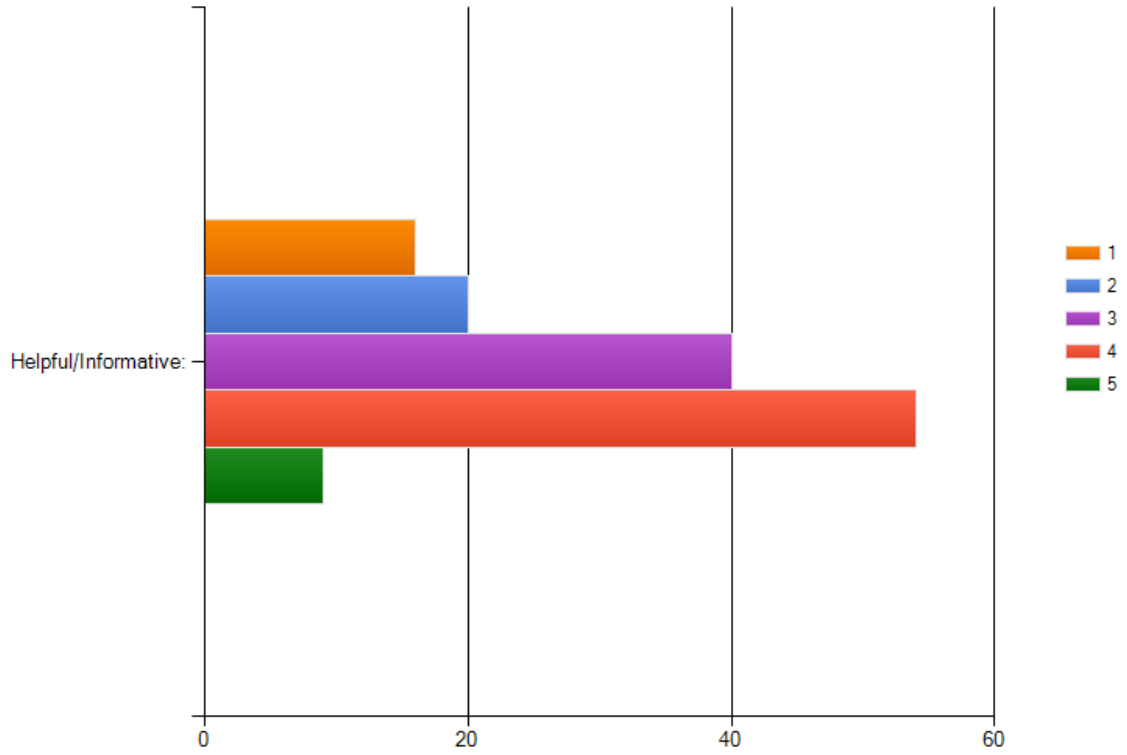
On a scale from 1 to 5, with 1 indicating "Not at all helpful and/or informative" and 5 indicating "Extremely helpful and/or informative", Did you find the reading/game helpful and/or informative?

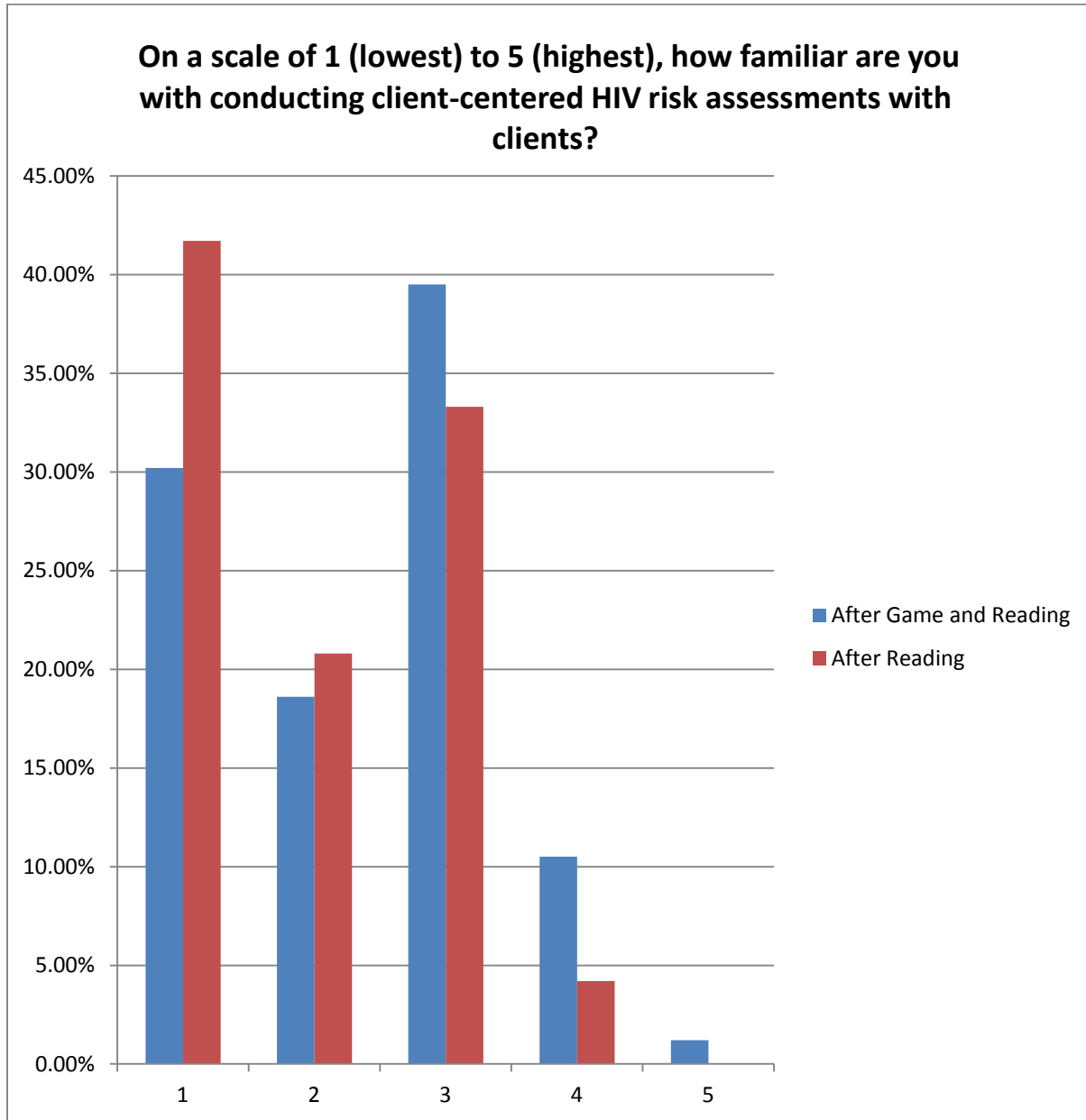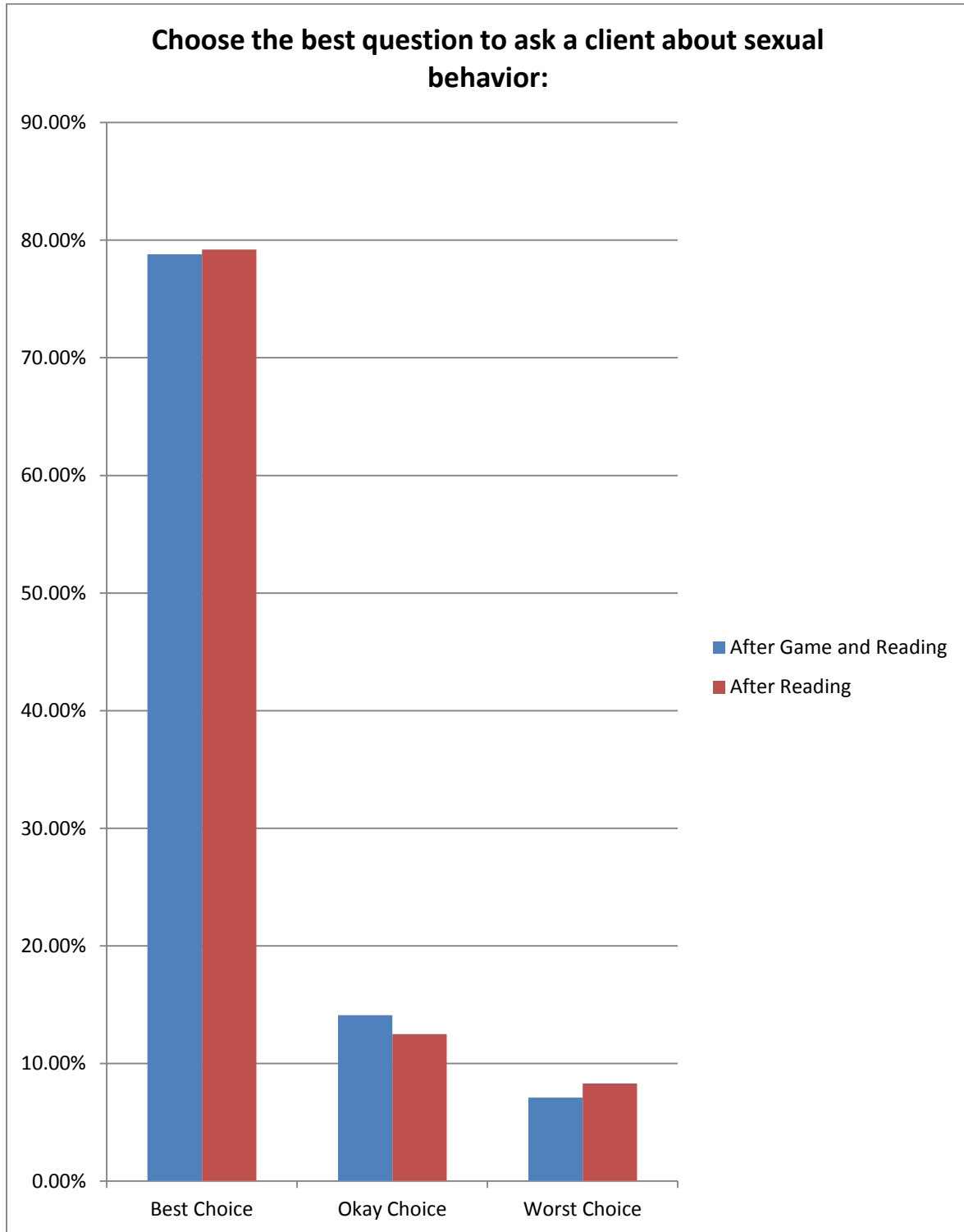## Comparison of Reading to Game and Reading

Figure 21:

On a scale of 1 (lowest) to 5 (highest), how familiar are you with conducting client-centered HIV risk assessments with clients?

Choose the best question to ask a client about sexual behavior:

Figure 23:

On a scale from 1 to 5, with 1 indicating "Not at all comfortable" and 5 indicating "Extremely comfortable",how comfortable are you in conducting a client-centered HIV risk assessment that involves talking about sensitive issues such as sexual behavior an

- ■ After Game and Reading
- ■ After Reading