THE EFFECTS OF ALCOHOL USAGE ON CANCER PATIENTS

RECEIVING RADIATION TREATMENTS

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ABSTRACT

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The purpose of this research is to investigate the effects alcohol has on the radiotherapy patient's treatment. Of particular interest are the effects on the cell, the psychosocial status of the cancer patient, effects on body systems and side effects, and patient outcomes. Research was done using oncology studies, journals, and textbooks that were peer reviewed and reliable. Research showed that alcohol can make tumors biologically aggressive and radioresistant, worsen patient outcomes and survival, worsen some patient's side effects from radiotherapy, and cause or worsen clinical depression. These effects mean the cancer health care team must be involved with the patient who continues to consume alcohol against physician orders, displays signs of alcohol dependence, and may be at risk for problem drinking.

CHAPTER ONE

KNOWING THE PROBLEM

The purpose of this work is to provide the health care team, particularly the radiation therapist and radiation therapy student, with a sense of guidance when addressing alcohol problems with the dependent patient. These patients can be difficult to confront because of their embarrassment or denial of their problem. Because of this, the radiation therapist should use caution and understanding with these patients.

Consumption of alcohol dates back to ancient times and has been used as a means of socializing in many cultures around the world. However, problems that arise with drinking alcohol have also been present throughout history. Public drunkenness and dependence have been just as prevalent as the consumption of alcohol itself.

Alcohol is a depressant that is often used recreationally but is sometimes used as a means of self-medicating for pain or coping with medical or emotional problems. This can very easily turn into a dangerous situation that ends in alcohol dependence and more health problems.

Alcohol is known to be a carcinogen in the development of many cancers and can contribute to health problems later on in life. These problems can be compounded for cancer patients currently undergoing treatment that continue to consume alcohol. Alcohol consumption patterns are particularly important to identify in the cancer population

because these patients are at a higher risk of developing drinking problems. Head and neck cancer patients are twice as likely to have drinking problems and 41-54% of this particular patient population continues to drink alcohol after learning of their diagnosis (Duffy, Ronis, Valenstein, Fowler, Lambert, Bishop & Terrell, 2007). The radiation therapist should be aware of these at-risk patients and be able to anticipate problems and provide the patient with solutions and resources.

It can be very difficult for the cancer health care team to detect patients who are at-risk of developing alcohol dependence or who are continuing to consume alcohol through their radiotherapy treatments due to patient embarrassment or the patient's unwillingness to come forward about their drinking patterns. Radiation therapists must work closely with radiation oncologists to determine which patients are at-risk of alcohol dependence or are already considered alcohol-dependent. Sometimes, the oncologists can gather this kind of information at initial consultations or from the patient's medical charts if the problems have been documented in the past. Oftentimes, the radiation oncologist does this through a series of questions or questionnaires. However, this is not always the best way to get the patient to open up and begin talking.

A German study found that general hospital physicians who used alcohol questionnaires, a common physician practice, among their patients for alcohol dependence detection had low detection rates of just 37% for patients who were exhibiting alcohol problems (Rumpf, Bohlmann, Hill, Hapke, & John, 2001). Of these patients detected, only 13.9% were referred to any addiction services (Rumpf et al, 2001). The National Institute on Alcohol Abuse and Alcoholism in June 2004 reported that, "Of

the ~16 million Americans who met the diagnostic criteria for abuse or dependence, only ~1.5 million seek and receive treatment." This means the overwhelming majority of problem drinkers have either never been diagnosed with alcohol dependence or have never received treatment for their alcoholism.

CHAPTER TWO

CELLULAR BIOLOGY

There are several ways that alcohol can affect the radiation therapy patient's treatments. Each part of this work will address alcohol effects on different aspects of the treatments. This section will discuss how alcohol affects the cellular biology of the radiation therapy patient undergoing radiotherapy treatments.

One of the biggest problems that can arise with alcohol interference on the cancer cell undergoing radiation therapy is possible cellular mutations that may occur. Several studies have shown that alcohol is linked to p53 gene mutations (Karp, 2001). The p53 gene is the most important gene that controls cancer cell growth and death. This gene, if healthy, stops any normal cell from progressing into a malignant cell by forcing the cell into apoptosis, or scheduled cell death (Karp, 2001). If the p53 gene has a mutation, it is less able to stop malignant cells from forming and progressing. Cancer cells that have this gene mutation will be resistant to apoptosis and may become more resistant to cancer radiotherapy treatments due to the imbalance between malignant cell apoptosis and cell survival (Karp, 2001). Cancer cells that have increases in p53 gene mutations become more biologically aggressive, and therefore, have an inherited resistance to radiotherapy.

The resistance malignant cells may inherit from alcohol intake is demonstrated in a study done in an oncology department in Italy where red wine intake was tested to see if it decreased skin toxicity in female breast patients (Morganti, Digesu,

Panunzi, De Gaetano, Macchia, Deodato, Cece & Cirocco, 2009). The study proved that red wine contained components, polyphenols in particular, which would decrease skin toxicity if consumed in moderate amounts (one glass per day). However, the question raised here is if alcohol also gives its radioprotectant qualities to tumor cells, possibly compromising the goal of treatment in order to reduce the skin side effects of radiotherapy (Morganti et al., 2009). According to Morganti et al., the components in red wine, "…decreased, by 20% the gamma radiation-induced deoxyribonucleic acid (DNA) damage at 1 and 2 h after consumption." DNA of malignant cells is the primary target of radiotherapy and, if alcohol is decreasing the damage done here, then the goal of radiotherapy is being severely compromised. Although it has radioprotectant qualities that may benefit some radiosensitive tissue that are non-malignant, such as the skin and heart during breast treatments, the overall goal of treatment may be compromised due to the diseased tissue also taking advantage of alcohol's radioprotectant effects, possibly being the reason for disease recurrence (Morganti et al., 2009).

CHAPTER THREE

PSYCHOLOGICAL IMPACT

This section will discuss the psychosocial status of patients who are consumes alcohol while undergoing radiotherapy treatments.

With a cancer diagnosis comes many emotional and self-image problems the patient must face. Oftentimes, depression, even if temporary, is very common for the patient. Alcohol can worsen depression symptoms, and possibly even interfere with depression medication the patient may be prescribed.

Alcohol is known to be a depressant, and, if consumed over a long period of time, can contribute to clinical depression, a problem many cancer patients already battle. This is the most important influence alcohol has on the patient's psyche. The University of Michigan published an article that highlights the effects of problem drinking on head and neck cancer patients in terms of depression and lifestyle factors. This article states that, "16% of head and neck cancer patients screened positive for problem drinking, as compared with 8.5% of the general population." (Duffy et al., 2007). The article goes on to describe that many head and neck cancer patients increase their alcohol intake after learning of their diagnosis, possible as a means of self-medication for pain and coping with the many emotional tolls a cancer diagnosis can have. This depression is not only

limited to head and neck cancer patients but can be applied to all cancer patients, regardless of diagnosis.

When discussing depression and alcohol consumption patterns, it is important to note that these affect the quality of life for these patients. A Michigan University and Veterans' Affairs study states that, "Adequate treatment of depression increases social functioning, patient productivity, and quality of life. Quality of life and its assessment have become increasingly important…particularly in the field of oncology where quality of life is sometimes as important to a patient as quantity of life." (Duffy, Terrell, Marcia, Ronis, Copeland, & Connors, 2002). This study surveyed a sample of 81 head and neck patients and their alcohol consumption patterns, among other things. The study found that the largest percentage of patients currently consumed alcohol after their cancer diagnosis (Duffy et al., 2002). Coincidentally, almost half of patients scored a high score on a scale measuring levels of depression. These results can be seen in table 1.

A similar study done in Munich, Germany proved that socio-demographic factors can accurately predict the quality of life after radiotherapy for head and neck patients, with an emphasis on alcohol intake. The study attempted to determine how to best predict quality of life for head and neck cancer patient using several factors, categorically, medical factors (such as stage, surgical procedures, diagnosis, etc.) and socio-demographic factors (such as ethanol abuse, children, employment, education level, etc.) (Sehlen, Helmuth, Lenk, Schymura, Herschbach, Aydemir, & Duhmke, 2002). The study found that, "With only five socio-demographic variables…especially ethanol abuse, we succeeded…in prediction of low QOL by 80%." (Sehlen et al., 2002). The quality of life

for cancer patients is of significant importance. Alcoholic intake, especially for patients where alcohol is a risk factor for their particular cancer, can decrease quality of life, which may cause the patient to increase their alcohol consumption in order to deal with their pain and suffering, potentially causing a vicious cycle. It is important for cancer patients to spend what remains of their life, whether a short or long period of time, with the best quality of life possible.

The radiation therapist must keep in constant communication with the patient and the patient's caregivers to check for warning signs of worsening depression that may be due to the patient's continued alcohol consumption. If the patient has a clinical depression diagnosis, alcohol consumption should cease altogether.

Table 1

Alcohol use and Depression of Head and Neck Cancer Patients	n	Percentage
Alcohol Use Patterns (N=76)		
Never drank alcohol	5	7%
Quit over 1 year ago	34	45%
Quit within 1 year	2	3%
Quit within 6 months	3	4%
Quit within last month	1	1%
Currently drinking alcohol	31	
Frequency of alcohol intake of persons who drank within last year (N=34)		
Monthly or less	4	12%
2-4 times/month	9	26%
2-3 times/week	11	32%
4 or more times/week	10	29%
Number of drinks on typical day when drinking (N=36)		
1-2 drinks	14	39%
3-4 drinks	12	33%
5-6 drinks	7	19%
7-9 drinks	0	0%
10 or more drinks	3	8%
Alcohol Use Disorder Score (N=77)		
0-7	63	82%
8 or higher	14	18%
Depression Score (N=77)		
0-4	43	56%
4 or higher	34	44%

Table 1. Smoking, Alcohol use and depression of head and neck cancer patients from "Effect of smoking, alcohol, and depression on the quality of life of head and neck cancer patients." (Duffy et al., 2002)

CHAPTER FOUR

IMPACT ON BODY SYSTEMS

This section will discuss how alcohol affects the side effects that are common to radiotherapy treatments and how alcohol affects different body organs. This is important for the radiation therapist to be aware of because patient care is knowing what is going on with the patient in a grand scheme way of thinking, not just what body part is being treated with radiation therapy.

Alcohol can affect organs differently depending on whether the consumption patterns mimic acute or chronic alcohol consumption. Chronic alcohol consumption is defined as alcohol intake of more than 60g/day for males and more than 40 g/day for females that lasts at least 3 months (Bhardwaj, 2012). Acute alcohol intake is defined as short-term consumption of higher concentrations of alcohol or pure ethanols (Bhardwaj, 2012). Alcohol damage to organs may also depend on the type of alcohol consumed. Alcohol is generally divided into three categories depending on the alcoholic content. These categories are beers (4% alcoholic content), wines (10% alcoholic content), and liquors (40% alcoholic content) (Bhardwaj, 2012). Depending on the organ in question, one alcohol type may inflict more damage on the organ than another type of alcohol.

<u>Esophagus</u>

The gastrointestinal (GI) system is comprised of the esophagus, stomach, and the small and large intestines. This entire organ system absorbs alcohol through the mucosal lining that is present throughout the entire system (Bhardwaj, 2012). Because the GI tract is where foods and liquids immediately go after leaving the oral cavity, this system absorbs alcohol and digests it in the highest concentrations compared to other body organs and systems (Bhardwaj, 2012).

According to Bhardwaj, alcohol consumption affects the esophagus differently depending on whether the patterns are chronic or acute alcohol consumption. Acute alcohol intake decreases the pressure of the lower esophageal sphincter and decreases peristaltic movement of the esophagus that may be attributed to disturbances to the autonomous nervous system (Bhardwaj, 2012). This can lead to esophageal blockages and choking. Chronic alcohol consumption has the opposite effects than acute intake. Chronic intake promotes peristaltic movement, sometimes creating double-peaked contractions and increases the pressure of the esophageal sphincter (Bhardwaj, 2012). No matter the type of alcohol involved, alcohol causes gastrointestinal reflux (GERD), mucosal damage, and tearing of the distal esophagus due to vomiting (Bhardwaj, 2012). These effects can be damaging to the patient because any damage to the esophagus could inhibit the patient from eating. If this were to occur, the patient could lose weight, which would affect the radiation treatment planning.

The effects of alcohol on the esophagus are important to keep in mind when treating any cancer where the chest area will be irradiated. These cancers include esophageal cancer, lung cancer, Hodgkin's lymphoma, and others.

Stomach

The effects of alcohol on the stomach depend on both the amount and type of alcohol consumed (Bhardwaj, 2012). Low amounts of alcohol stimulate stomach acid secretion, whereas high amounts of alcohol show no effect or inhibit stomach acid secretion (Bhardwaj, 2012). Both of these situations would create digestion issues for the patient because an imbalance of gastric juices would be present. Drinking alcohols produced by fermentation, such as beer and wine, increases the production of gastric juices, similar to the effect of drinking low amounts of alcohol (Bhardwaj, 2012). Alcohol produced by distillation, such as whiskey and other liquors, do not affect the output of gastric juices (Bhardwaj, 2012).

The effects alcohol has on the stomach should be considered for cancers where the abdomen is irradiated. Some of these cancers include stomach cancer, esophageal cancer, non-Hodgkin's, cancers where the WART technique is utilized such ovarian cancer, and others.

Intestines

The intestines are comprised of the small intestines and the large intestines. According to Bhardwaj, alcohol appears to have the biggest impact on the duodenum and ileum in the small intestines. Some studies have shown that alcohol reaches the highest concentration in the duodenum and jejunum 45 minutes after consumption, although 75% of alcohol is absorbed in the stomach (Bhardwaj, 2012). This leaves 10-25% of alcohol absorption occurring in the duodenum. This is a relatively high concentration and can inflict a lot of damage.

One of the most important issues that can arise from alcohol intake is the decrease in nutrient absorption that occurs throughout the small intestines (Bhardwaj 2012). With acute alcohol consumption, nutrient absorption can return to a normal state within 24 hours after the alcohol has left the system (Bhardwaj, 2012). This is very important for cancer patients because maintaining weight and nutritional status is very important for radiation treatment planning and patient healing. According to Bhardwaj, "Many hospitalized alcoholic patients have fat, vitamin B_{12}, or xylose malabsorption, and in one study, as many as 93% had at least one abnormal parameter of absorption." Other nutrients that are at risk of malabsorption include protein, folic acid, vitamin B_6, vitamin C, selenium, and zinc. Iron is at risk of increased absorption (Bhardwaj, 2012).

The effects alcohol has on the intestines should be considered when the abdomen is irradiated. This includes cancers such as Hodgkin's lymphoma, stomach cancer,

colorectal cancer, cancers where WART would be utilized such as ovarian cancer, and others.

Liver

The majority of effects to the liver from alcohol will occur with chronic alcohol consumption. The liver is equipped to handle acute alcohol consumption because part of the liver's function is to break down alcohol. Chronic alcohol consumption can overwhelm the liver. Some of the most common liver effects from chronic alcohol consumption include a fatty liver that is reversible with the abstinence of alcohol, alcoholic hepatitis, and cirrhosis (Bhardwaj, 2012). The hepatitis is generally coupled with jaundice, liver failure, abdominal distress, and fever (Bhardwaj, 2012). According to Bhardwaj, this usually only occurs with clinical alcoholic tendencies that have been present for at least 5 years. These conditions can lead to inadequate nutritional intake (particularly protein), maldigestion, malabsorption, and a defective metabolism (Bhardwaj, 2012).

The effects of alcohol on the liver should be considered for irradiation to the liver and for the patient who demonstrates clinical alcoholic tendencies.

Immune System

Alcohol exposure, both acute and chronic, inhibits and slows the immune system. In particular, this includes the tumor surveillance system and infection response

(Bhardwaj, 2012). This is because alcohol inhibits white blood cell (WBCs) from being able to respond to injury and infection (Bhardwaj, 2012). This is very important for all cancer patients due to the compromised immune system that cancer patients tend to have.

Side Effects

Alcohol can affect the side effects and symptoms of radiotherapy treatments the cancer patient is experiencing during radiation treatments. For example, the breast cancer skin toxicity study mentioned before found that female breast patients with a moderate intake of red wine experienced less skin reaction than breast patients who were not consuming red wine concurrently during radiotherapy (Morganti et al., 2009). This may seem to be a good thing; however, breast cancer is one of the few cancers where the whole organ being treated with external beam radiotherapy is considered diseased. So in this case, the entire affected breast, rather than only part of the breast, would be treated as being diseased.. Alcohol can also decrease the function of the body's immune system by decreasing T-cell activity, making already highly susceptible patients even more susceptible to illness and infection while they are undergoing radiotherapy treatments (Swanson, Sedghi, Farhadi, & Keshavarzian, 2009).

For pelvic and abdominal cancer patients, an Inflammatory Bowel Disease study showed that alcohol can cause leaky intestines, diarrhea due to high sugar content in alcohol, intestinal permeability, and disruption in gastrointestinal system function

(Swanson et al., 2009). All of these side effects are already of concern for pelvic and

abdominal cancer patients and should not be worsened by the consumption of alcohol.

CHAPTER FIVE

PATIENT OUTCOMES

This section will discuss how alcohol affects cancer patient outcomes of radiotherapy treatments to include disease progression, local recurrence, tumor control, and survival rates.

Because alcohol can impact p53 gene mutations, it stands to reason that alcohol intake during radiotherapy also affects treatment outcomes and disease progression. In a study done by the Department of Veterans' Affairs, "progression was defined according to the National Cancer Institute standards as a 20% increase in the size of targeted, measurable lesions or the development of any new lesions." (Paull, Updyke, Baumann, Chin, Little, & Adebonojo, 2005). This study found that alcohol abuse was correlated to worse outcomes in patients diagnosed with non-small cell lung cancer in terms of overall survival rates and number of months without disease progression. These results are shown in Figures 1 and 2. The broken line in each diagram represents alcohol abusing patients and the solid line represents patients who are not alcohol abusing. Figure 1 shows median survival time in terms of months and Figure 2 shows patient median disease progression time in terms of months. Overall, alcohol-abusing patients had less median survival time and worse disease progression compared to patients who were not alcohol-abusing.
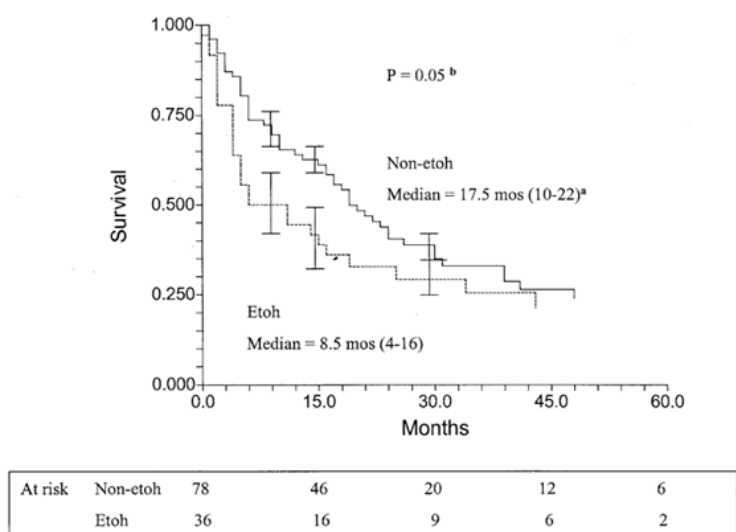
Figure 1. Overall survival of 36 alcohol-abusing patients and 78 non-abusing patients with non-small-cell lung cancer. (Paull et al., 2005)
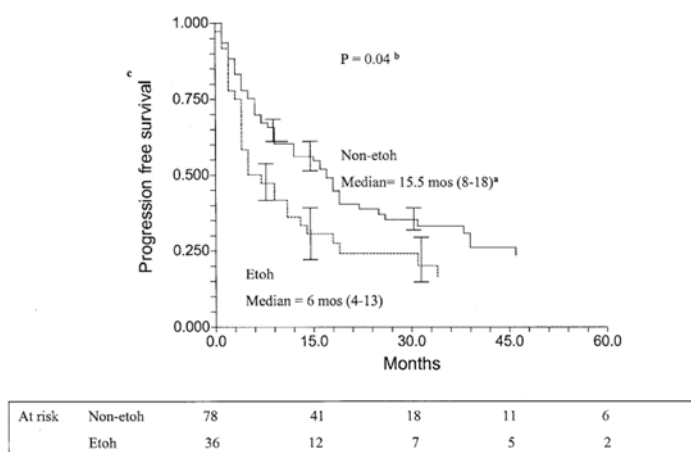

Figure 2. Progression-free survival of 36 alcohol-abusing and 78 non-abusing patients with non-small-cell lung cancer. (Paull et al., 2005)

A clinical study done in a Quebec cancer clinic also demonstrated poorer survival rates and local tumor control with the development of secondary cancers for head and neck cancer patients who continued to drink after learning of their diagnosis (Fortin, Wang, & Vigneault, 2009). There was a 7% better chance of local control and 14% better chance of 5 year survival for patients who had never drank versus patients who were actively drinking (Fortin et al., 2009). For diseases where alcohol is a major risk factor, such as both head and neck and lung cancers, mortality rates and secondary cancer incidence increase and local control decreases with active alcohol consumption (Fortin et al., 2009).

CHAPTER SIX

IMPLICATIONS FOR PRACTICE

It is extremely important for the cancer health care team to be hands on with patients that are consuming alcohol while undergoing their radiotherapy treatments. The radiation therapist, who is the most critical patient advocate, must monitor the patient more frequently than other personnel because of the daily face-to-face interaction. Provided are questions that may help the radiation therapist confront the patient who is exhibiting signs of alcohol consumption and national resources the therapist can refer the patient to.

When encouraging the patient to open up about their drinking habits, the radiation therapist must be cautious and understanding, so as not to embarrass or offend the patient. When bringing up the issue, it may be best to ask questions that will slowly bring the topic up organically. Some questions that may do this should involve the patient's diet and fluid intake. Here are a few questions that may help the patient open up about the topic:

- "It is important for you to be taking in lots of clear liquids during your treatments. What kinds of things have you been drinking at home?"
- "Some things you should avoid include coffee, black tea, and alcohol. Have you been drinking any of these things?"

- "What did you eat and drink for dinner last night?" The radiation therapist

  could also ask the same question about breakfast, lunch, and snacks.

If the radiation therapist suspects the patient may be drinking alcohol, then it is

the responsibility of the radiation therapist to inform the radiation oncologist. Ultimately,

the responsibility of talking to the patient about discontinuing drinking falls on the

shoulder of the radiation oncologist. It is important for the radiation oncologist to discuss

with the patient their drinking habits and encourage the patient to stop drinking or

decrease the amount of alcohol they are drinking. This discussion cannot simply be done

through questionnaires, but must be face-to-face, meaningful, and thorough. The patient

needs to completely comprehend the effects alcohol has on their treatments and what is

expected of them in regards to their drinking behavior after they start their treatments.

There are national resources the radiation therapist can refer the patient to if they

wish to receive help with their drinking habits. These resources are available to any

patient who wishes to use them and can oftentimes refer the patient to more local

resources for their convenience. Some of these resources include:

- Alcoholics Anonymous (AA) with phone number (212) 870-3400

- SMART Recovery with phone number (440) 951-5357

- National Institute on Alcohol Abuse and Alcoholism with website address

  www.niaaa.nih.gov

All information given to the patient should be in print and easy to read so the

patient can refer back to it at any time. A fifth or sixth-grade reading level is usually

recommended for patient educational handouts. In Appendix 1 is a basic example of a

patient handout relating to alcohol consumption during radiation therapy treatments.

CHAPTER SEVEN

CONCLUSION

This research was done utilizing medical databases available through the Texas State University-San Marcos Alkek library system and oncology textbooks. The majority of the information obtained was gained through oncology journals and studies using the databases. All articles were checked to ensure they were peer-reviewed and reliable. The textbooks used are widely distributed and reliable.

There were both strengths and weaknesses to the research that went into this project. The amount of available resources that were written and published within the last 10 years directly related to alcohol in oncology was very limited. However, the research that was used was very specific and relevant to the topic at hand. Many of the studies done, although done well and unbiased, had small sample sizes due to study criteria that excluded many patients and may have skewed some of the results.

Overall, it is important for radiation therapists and radiation therapy students providing cancer care treatment to the patient to be involved and well-informed on the drinking patterns and behaviors of the patient, if the patient decides to come forward about their drinking habits. It is also very important for the patient to be well-informed on the effects and consequences alcohol can have on their treatments.

Radiation therapists must be understanding, compassionate and uplifting during radiotherapy treatments and aid those patients who are problem drinkers and continue to consume alcohol against physician orders. The most important things for cancer care health care personnel are to provide patients with the best quality treatments possible.

APPENDIX A: Patient Education

Alcohol During your Radiation Treatments

During your radiation treatments, it is important to talk to your doctor about drinking alcohol. Preferably, you should stop drinking alcohol during radiation. You should be aware of how alcohol could affect your radiation treatments.

Side Effects

Alcohol could make some of the side affects you experience during radiation treatments worse. These will be different for each person and may depend on your treatment area. Some of the side effects alcohol can have on you include:

- Decreasing your immune system
- Interfering with your digestive system
- Impairing your memory
- Dehydration
- Increasing your chance of developing depression
- Decreasing the effects of radiation on your tumor
- Liver damage

Getting Help

If you think you will need help with the decision to quit drinking, you can talk to your doctor or with another member of your cancer care team. Below are some resources for you if you would like help with your decision to quit drinking alcohol.

Alcoholics Anonymous (AA)	Phone: (212) 870-3400
SMART Recovery	Phone: (440) 951-5357
National Institute on Alcohol Abuse and Alcoholism	Website: www.niaaa.nih.gov

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