Public Health Evaluation of Indoor Air Quality, Self-Reported Illnesses, and Tumors Corona del Sol High School, Tempe, Arizona

May 19, 2008

1.0 Overview

The Superintendent of Tempe Union High School District (TUHSD), Mr. Steve Adolph, contacted the Arizona Cancer Registry (ACR) on March 4, 2008. Mr. Adolph asked for assistance in addressing a health concern. He explained that there is a perceived excess of brain tumors among students and staff at Corona del Sol with approximately eight (8) to twelve (12) brain tumors noted in the last few years. The concerns about tumors arose in conjunction with concerns about air quality.

The air quality concerns include stagnant air, excess carbon dioxide (CO_2), wet and moldy carpets around drinking fountains, and other ventilation system problems. These air quality concerns were evaluated by industrial hygienists under contract with the school district and the report is currently available on the TUHSD website.[1]

The ADHS agreed to review cancer case reports and basic information about the affected individuals. This included an analysis of inquiry forms that staff or parents could complete and return to the ACR. The ACR reviewed the returned inquiry forms to verify whether the reported tumors are benign or malignant, and analyzed various other aspects such as patient's age, gender, and type of cancer.

The ADHS also agreed to review the indoor air quality data, make additional recommendations to improve air quality, and to determine whether the indoor air quality problems identified in the report may be responsible for adverse health effects.

2.0 Health Assessment of Reported Conditions

2.1 Background

In response to the school's request for an assessment of the tumors, the ACR offered to review case reports, and requested that the school send us basic information about the affected individuals. To expedite the process, the ACR e-mailed an inquiry form (Attachment 1) to the school that the teachers or parents could complete and return to the ACR. The ACR agreed to review these returned inquiry forms to verify whether the reported tumors are benign or malignant, and to analyze various other aspects such as patient's age, gender, and type of cancer.

Of note, the school subsequently offered the inquiry form to a broader audience than the cases of initial concern. The school made the inquiry form widely available on their website to persons wishing to submit a report to the ACR. In addition, there have been public meetings sponsored by the school at which parents and staff attended and raised health concerns. The situation at the school has been well publicized in both the broadcast and print media.

2.2 Arizona Cancer Registry

The ACR is a program of the Arizona Department of Health Services (ADHS). The ACR is a population-based cancer registry for the State of Arizona that began in 1980 as a voluntary

[1] TUHSD Website: https://www.tuhsd.k12.az.us/view.php?page=5&tuhsdgroup=1

hospital-reporting program. The statute[2] was amended and mandated the reporting of cancer cases. The statute directs ADHS to operate a statewide cancer registry to monitor patterns of disease, identify high-risk groups, and provide data for use by researchers. The state statute does not provide specific authority or resources for the registry to conduct cancer investigations or conduct cancer research. Through administrative rule[3] the ACR specifies how hospitals, clinics, and physicians report to the ACR the approximate twenty-four thousand (24,000) new cases diagnosed in Arizona every year.

By law, most cancers (i.e. malignant tumors) diagnosed in Arizona since 1992 are reported to the ACR. However, the rules that specify the reportability of tumors exclude most benign tumors. Brain and central nervous system tumors are the only benign tumors that are reportable to the registry because of their potential for causing significant health effects. There are two primary categories of primary brain tumors; non-cancerous (benign) and malignant (invasive). Benign tumors harm the brain tissue mainly by causing pressure within the cranial space. Malignant tumors may invade and destroy surrounding brain tissue.

Complete data is available on all new cancer cases diagnosed among Arizona residents since 1995 through 2004 and includes information on age, race, ethnicity, residence at diagnosis, gender, and specific types of cancer. The ACR adheres to national guidelines for operation of central cancer registries including how cases are defined and coded. The ACR also participates in the Centers for Disease Control and Prevention National Program of Cancer Registries.

2.3 Methods

Response forms submitted to the school or directly to ADHS by April 15, 2008 are available for analysis. The ACR received one hundred forty-three (143) responses to the inquiry report form given to the school district. The responders describe a wide variety of illnesses ranging from colds and allergies to cancer. Illnesses with no relationship to cancer or tumors account for seventy-one (71) case reports. The other seventy-two (72) cases were reviewed in detail to identify those that meet the criteria for inclusion into the ACR database.

The criteria for inclusion are an Arizona resident classified with: 1) an invasive or *in situ* cancer; or 2) a benign tumor of the brain or central nervous system. The review of the seventy-two (72) reports resulted in thirty-eight (38) reports classified as reportable cancer cases. The ACR wants to ensure that the cases noted among Corona del Sol are recorded in the ACR database to ensure complete reporting and verification of cases for the purpose of this report.

The identification of reportable cancer cases (n=38) included a review and verification in the ACR database. The ACR staff reviewed hospital discharge data to look for cases not found in the ACR database to further confirm the information provided on the inquiry report forms. The inquiry report forms ask where the person was diagnosed. The ACR was able to use the hospital discharge data to verify the information. When a facility treating the case was identified through the hospital discharge data only, the cancer registrar for that facility was contacted and asked to review the medical record. If the case met the criteria for case ascertainment a case report was

[2] ARS § 36-133: http://www.azleg.state.az.us/ars/36/00133.htm
[3] Arizona Administrative Code: http://www.azsos.gov/aar/2006/3/final.pdf

completed and returned to the ACR. The case was reviewed and quality controlled by the ACR staff and entered into the ACR database. There are four (4) inquiry report forms that were not verified through the ACR database or the hospital discharge data but listed a physician on the inquiry report form. Physicians identified on the inquiry report forms were contacted and asked to complete a cancer case report form within two days. The ACR received two (2) of the four (4) cases. Two (2) people with two primary cancers are counted as four (4) cases. The thirty-eight (38) reportable cases are classified by site and histology (benign-uncertain vs. *in situ*-malignant).

2.4 Findings

The ACR received one hundred forty-three (143) responses to the inquiry report form sent to TUHSD for identification of cancer cases at Corona del Sol High School. The ACR found that seventy-one (71) inquiry report forms are of illnesses not related to cancer (See Table 1) and seventy-two (72) inquiry report forms appear to be cancer related and needed further review (See Table 2).

Statewide, the ACR recorded 7,148 benign and invasive brain and CNS tumors between 1995 and 2004 for Arizona residents. The number of brain tumors has risen from 555 in 1995 to 987 in 2004. For ACR analysis purposes, primary brain and CNS tumors include the brain, central nervous system, and brain membranes (meninges).

Although not requested, seventy-one respondents submitted annotated forms with conditions not related to tumors. These 71 persons self-reported a variety of symptoms including headache (43 reports), fatigue (23), sinus infection (14), asthma (12), and various other conditions (60 reports). A person may have had more than one condition. Table 1 summarizes these findings.

The inquiry report forms returned to the ACR identified seventy-two (72) tumors or cancers. The majority of these cases were diagnosed between 2004 and 2008. The earliest diagnosis year is 1988 and the latest diagnosis year is 2008. There are forty (40) female and thirty-two (32) male cases reported and most cases (n=43) are reported among young adults fifteen to twenty-nine (15-29) years of age. The majority of the cases are students or former students (n=49). See Graphs 1-4. Smoking status was also assessed. The majority of respondents do not smoke (n=53), few are former smokers (n=8), one is a current smoker, and ten (10) did not specify their smoking status.

As shown on Table 2, the ACR review of the seventy-two (72) inquiry forms that mentioned tumors found that thirty-eight (38) cases fit the criteria as a reportable case, twenty-nine (29) cases do not meet the criteria for reporting and five (5) cases cannot be classified as to their reportable status because not enough information was given on the inquiry report form. Table 3 shows the subset of cases that the registry would consider reportable cases. For the remainder of the analysis we refer to the seventy-two (72) reports shown in Table 2.

The ACR received relatively fewer case reports for all other tumor sites such as breast (n=4), colorectal (n=3), and lung (n=1). Since the primary concern among this community is brain tumors and brain cancers the ACR focuses this report on the findings for benign brain and malignant brain cancers of the seventy-two (72) inquiry report forms with a mention of cancer or tumors, which includes two (2) reports from out of state residents.

A total of eight (8) inquiry report forms identified benign brain tumors and include two cases diagnosed from students who resided outside Arizona when diagnosed with a brain tumor. These cases were diagnosed between 1990 through 2007 with the majority of cases diagnosed after 2004. There are five (5) female cases and three (3) male cases. The benign brain tumors were diagnosed among fifteen to fifty-nine (15-59) year olds. The majority of the cases are current or former students (n=5). See Graphs 5-8. The histologies (cell type) of the reported benign brains tumors include hemangioblastoma (n=2), meningioma (n=3), ganglioma (n=1), neurilemmoma (n=1), and pituitary prolactinoma (n=1). The majority of respondents do not smoke (n=7) and one is a former smoker.

A total of five (5) case reports identified malignant brain tumors. These cases were diagnosed between 1999 through 2008 with the majority of cases diagnosed in 2006 and later. There are three (3) female cases and two (2) male cases. The malignant brain tumors were diagnosed among young adults between the ages of fifteen to twenty-nine (15-29) years of age. All the cases are current or former students (n=5). See Graphs 9-12. The histologies (cell type) of the malignant brain include astrocytoma (n=1), glioblastoma (n=1), glioma (n=1), neuroblastoma (n=1), and pilocytic astrocytoma (n=1). All of the respondents do not smoke (n=5).

2.5 Rate Assessment

A cancer rate was not calculated for this analysis because the ACR determined a rate calculation is not appropriate given the method of data collection, a non-quantifiable, indeterminate population at risk, and a lack of a geographic area of analysis.

2.6 Review Panel

A review panel met on May, 6, 2008 to discuss the findings of this health assessment. The following people were in attendance: Dr. Douglas Campos Outcalt (University of Arizona College of Medicine, Phoenix Campus), Dr. Stephen Coons (Barrow's Neurological Institute), Dr. Timothy Flood (ADHS, Medical Director, Public Health Statistics), Jennifer Botsford (ADHS, Office of Environmental Health), Mary Wolf-Francis (Corona del Sol, Parent Coalition), Ken Komatsu (ADHS, State Epidemiologist), Christopher Newton (ADHS, Cancer Epidemiologist), Richard Porter (ADHS, Bureau Chief, Public Health Statistics), Veronica M. Vensor (ADHS, Cancer Data Section Manager), Georgia Yee (ADHS, Office Chief, Office of Health Registries), Don Herrington (ADHS, Bureau of Epidemiology and Disease Control), Will Humble (ADHS, Assistant Director, Public Health Preparedness), Susan Edwards (Corona del Sol, Principal), Michael Murphy (ADHS, Communications Director), and Janey Pearl (ADHS, Public Information Officer). The data findings were presented to the panel for review and discussion. See Flowchart 1.

Dr. Coons provided information on the brain cancers. The panel learned that the histologies (cell types) for the benign tumors reported to the ACR are unrelated and should be considered different diseases. He noted that four of the five malignant brain histologies are considered as arising from one (glial) cell lineage. For the reasons described above, the panel did not feel that calculation of rates of either benign or malignant brain tumors was indicated. Radiation is the

only known risk factor for benign brain tumors, but as stated earlier the most common form of radiation exposure occurs when radiation was given for treatment of leukemia.

Dr. Douglas Campos Outcalt identified the limitations to this assessment. The panel agreed that the method used to collect cases was biased. It was less likely that earlier students had the opportunity to return the inquiry report form therefore the potential of missed cases exists. Consequently, the findings do show a lack of cases for diagnosis years prior to 2004.

Ms. Susan Edwards, Principal at Corona del Sol, informed the review panel that the school was constructed approximately 32 years ago, and currently has an enrollment of approximately 2,750 students and 200 staff. Ms. Edwards communicated that the safety of her students and staff is of primary importance.

Ms. Mary Wolf-Francis, Corona del Sol Parent Coalition, expressed concerns of high CO_2 and mold found in the school. The Parent Coalition would like to see a full environmental assessment of the school building.

Ms. Jennifer Botsford, ADHS Office of Environmental Health, provided a summary of the findings from the environmental study conducted by the Health Effects Group.

Ms. Veronica M. Vensor and Mr. Christopher Newton, Arizona Cancer Registry, provided a summary of the data findings.

2.7 Discussion

This analysis responds to the concerns expressed by staff, parents, and students at Corona del Sol High School on the perceived excess of brain tumors. These concerns arose in conjunction with concerns over air quality in the school. The ACR agreed to do an assessment of the cancers, specifically brain. Given this information, the ACR expected to receive most, if not all, case reports for brain tumors or cancers and fewer than expected reports on other cancers. The ACR response is limited in this assessment to the cases submitted by the Corona del Sol community and verified in the existing registry system. Incidence rates of cancer were not calculated, therefore comparisons of rates are unavailable. Nonetheless, although the Corona del Sol case counts are relatively small in this assessment, we can compare the proportional distribution of the Corona del Sol gliomas to the proportion reported nationally by the Central Brain Tumor Registry of the United States (CBTRUS).[4] The CBTRUS reports that gliomas comprise 36% of all tumors, and 81% of malignant tumors. These proportions are similar to those reported from Corona del Sol: 4 gliomas among the 13 (30.7%) brain tumor cases and 4 gliomas among the 5 (80%) malignant cases.

Few risk factors associated with brain cancer are known,[5] and most cases in the U.S. have no link to these factors. One recognized, environmental risk factor for brain cancer is exposure to

[4] In their latest draft report, the CBTRUS analyses 73,583 tumors diagnosed between 2000 and 2004 from 19 participating state registries. The Arizona Cancer Registry is one of the contributing states. In this paragraph we utilize the case definitions of CBTRUS.

[5] Preston-Martin S, Munir R, and Chakrabarti I. Chapter 62: "Nervous System." pp. 1173-1195. in Shottenfeld D and Fraumeni JF: *Cancer Epidemiology and Prevention*, 3rd ed., 2006. Oxford Press.

ionizing radiation. The most common example of radiation induced brain cancer occurs among a small proportion of patients who received radiation treatment to the brain as part of their treatment for leukemia. Other, less recognized, environmental factors with weaker statistical evidence are exposure in occupational settings to pesticides, vinyl chloride, and petroleum products. Some studies have shown an increased risk of brain cancers and other studies have not. Studies in animals have associated brain cancer with a number of substances, including lead.[6] Recent human studies did not find an association with increased risk of brain cancer for exposure to aspartame (sugar substitute), electromagnetic fields from cell phones, or high-tension wires. Most researchers agree that convincing evidence is not there. Persons with impaired immune systems are at an increased risk of developing lymphomas of the brain or spinal cord. Also, rare cases of brain cancer run in families. Some of these families have well known disorders such as neurofibromatosis type 2, tuberous sclerosis, and von Hippel-Lindau syndrome. General information about the causes of cancer can be found on the website of the National Cancer Institute.[7]

Clinicians and epidemiologists from the infectious disease unit of ADHS reviewed the 71 non tumor reports, summarized on Table 1. They were unable to conclude a common infectious etiology for the reported symptoms. Some reports of asthma symptoms may be indicative of cases not under optimal clinical control.

There were several limitations for this assessment. There was a biased ascertainment of tumor cases. There may be additional cases not currently known to the ACR; it is very likely that students attending the school in its early years did not have the opportunity to complete and return the inquiry report form. The number of cancers reported per diagnosis year is small, especially cancers diagnosed in earlier years. The small number of cases per year may result in highly variable and statistically unstable rates of cancers. This contributed to the ACR's decision to not calculate a rate. Additionally, other exposures outside the school cannot be assessed. The low proportion of current smokers (only one of 53 respondents) is significantly different than the state's smoking rate of 18.2%, implying that the characteristics of respondents may be different from that of the general population. Additional factors, such as genetic predisposition, could not be assessed.

2.8 Summary

The review panel and the ACR conclude that a pattern of disease could not be identified, and that the tumor and cancer findings are not indicative of a link to environmental factors.

3.0 Environmental Health Evaluation

3.1 Purpose & Background

The current of Superintendent of Corona del Sol High School in Tempe, AZ contacted the Arizona Department of Health Services (ADHS) and expressed concern about the results of recent indoor air studies conducted by Health Effects Group (HEG), Inc. at the school. The

[6] http://ntp.niehs.nih.gov/files/11thROC_factsheet_1-31-05.pdf
[7] http://www.cancer.gov/cancertopics/prevention-genetics-causes

studies suggested that the air exchange and indoor air quality at the school was substandard. In addition, some students and staff have complained that they sometimes experience adverse health effects when they are at the school.

The ADHS agreed to review the indoor air quality data, make additional recommendations to improve air quality, and to determine whether the indoor air quality problems identified in the report may be responsible for adverse health effects.

3.2 Methods

The ADHS examined the analytical results found by HEG and the health effect survey reports that were submitted to the Department to determine whether the indoor air quality problems identified in the report may be responsible for adverse health effects.

The ADHS reviewed the U.S. Environmental Protection Agency's Tools for Schools program recommendations to identify potential action items for the school to take that could improve indoor air quality.

3.3 Data Sources

This Assessment uses data collected by the Health Effects Group (HEG) during initial assessments of Corona del Sol High School on September 15, 21, and 25, 2006, and February 12 and 26, and March 14, 2007. In addition, the report uses information collected from the health effects survey reports submitted to the Department by students and staff.

Assessments conducted by HEG included: a visual inspection of classrooms and common areas within the school, the collection of microbial air samples in selected classrooms and common areas, monitoring general indoor air quality parameters in selected classrooms and common areas, the collection and analysis of swab and dust samples for microbial agents at selected carpeted locations, a review of general chemical use at the school, the collection of indoor air samples to look for viable and non-viable fungal spores, and the collection and analysis of 2 outdoor air samples for comparison purposes.

Indoor air quality parameters were measured with a TSI Incorporated Indoor Air Quality Meter Model 8762. Indoor air quality parameters measured are listed in Table 1. The contractor sampled for microbials in the following methods: air sampling, swab sampling, and Carpet dust sampling. The microbials that were identified are listed in Table 1.

No environmental samples (i.e., air, water or soil samples) were collected for chemical analysis. However, the contractor did discuss the use of chemicals with the school. The contractor reviewed the MSDS sheets that were stored on site and visually inspected the chemicals stored or used at the school. The list of chemicals is in Table 1.

Table 1 Sampling/Investigation	
Indoor Air Quality Parameters	Carbon Dioxide (CO2) Carbon Monoxide (CO) Humidity Temperature
Identified Microbials	
Air Sampling	*Mold:* *Acremonium, Alternaria, Ascospores, Aspergillus flavus, Aspergillus niger, Aspergillus sydowii, Aspergillus ustus, Aspergillus versicolor, Aspergillus* – other, *Basidiospores, Bipolaris/Dreschlera* group, *Chaetomium, Cladosporium, Culvularia, Epicoccum,* Non-sporulating fungi, Other Brown, *Paecilomyces, Penicillium, Phoma/coelomycetes, Rhizopus, Smuts & Myxomycetes, Torula,* and *Ulocladium*
Swab sampling	*Mold:* *Acremonium, Aspergillus niger, Aspergillus ustus, Aspergillus versicolor, Exophiala, Fusarium, Penicillium,* and yeasts *Bacteria:* Broad spectrum bacteria, gram negative coliform, gram negative non-fermentative, and gram positive
Carpet dust sampling	*Mold:* *Alternaria, Aspergillus caespitosus, Aspergillus flavus, Aspergillus fumigatus, Aspergillus niger, Aspergillus ochraceus, Aspergillus sydowii, Aspergillus terreus, Aspergillus ustus, Aureobasidium, Bipolaris/Dreschlera, Choanephora, Chrysonilia, Cladosporium, Epicoccum, Fusarium, Humicola, Peniscillium, Phoma/coelomycetes, Rhizopus, Ulocladium*, and yeasts
Chemicals	MSDS sheets found for: ethanolamine, glycol ethers, quaternary ammonium compounds, and hydrocarbon-based solvents Chemicals found on site by contractor: Tetrachloroethylene, formalin

3.4 Results

3.4.1 Indoor Air Quality Results

Carbon Dioxide

Carbon Dioxide (CO_2) is a naturally present in the atmosphere at levels of approximately 350 parts per million or ppm (0.035%). Higher outdoor CO_2 concentrations can be found near vehicle traffic area, industry and sources of combustion. People exhale CO_2 – the average adult's breath contains about 35,000 to 50,000 ppm of CO_2. Hence, CO_2 buildup is used as an indicator of poorly ventilated areas characterized by inadequate fresh air or inadequate air supply in buildings.

The current occupational safety standard is 5,000 ppm for healthy adults for an 8-hour work day within a 40-hour workweek. While levels below 5,000 ppm are considered to pose no serious health impacts, experience indicates that individuals in schools and offices with CO_2 concentrations greater than 1,000 ppm tend to report drowsiness, lethargy, and a general sense of stale air. According to the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE), classrooms should maintain CO_2 concentrations below 1,000 ppm in order to maximize comfort. Maintaining less than 1,000 ppm of CO_2, usually requires that 15 cubic feet per minute (CFM) of outside air per person be introduced through the ventilation system.

The average CO_2 concentrations found at Corona del Sol were between 1,140 ppm and 1,960 ppm in the morning and in the afternoon, respectively. Nearly all samples exceeded ASHRAE's recommendation of 1,000 ppm. These results suggest that improving classroom ventilation would improve student and staff comfort.

Carbon Monoxide

Carbon monoxide (CO) is a potentially deadly gas. It is colorless, odorless, tasteless and non-irritating. CO, produced by the combustion of petroleum, is commonly present in ambient air at low levels. The most common sources of indoor carbon monoxide are motor vehicle emissions and stationary sources, such as furnaces and water and space heaters.

The adverse health effects associated with CO vary with its concentration and duration of exposure. Clinical symptoms range from subtle cardiovascular, respiratory, and neurobehavioral effects at low concentrations (10 ppm) to unconsciousness and death after prolonged exposures or after acute exposure to high concentration of CO (> 500ppm). The World Health Organization (WHO) recommends that indoor air levels for CO to be kept below an average of 9 ppm for any 8-hour period and below 35 ppm for any 1-hour period.

The measured CO concentrations ranged from 1.6 to 2.3 ppm with an average of 2.1 ppm at the sampling locations. Levels of CO measured during the investigation are below WHO's recommendation, and CO does not appear to represent a health threat at the school.

3.4.2 Microbial Analytical Results

Water leaks and humidity provide the moisture needed for microbial growth. Molds can be found almost anywhere; they can grow on virtually any substance, providing moisture is present. There are molds that can grow on wood, paper, carpet, and foods. There is no practical way to eliminate all mold and mold spores in the indoor environment; the way to control indoor mold growth is to control moisture.

Inhalation of mold spores can cause the following acute (short term) health effects: allergic reactions, asthma, and other respiratory complaints. Some people are sensitive to molds. For these people, exposure to molds can cause symptoms such as nasal stuffiness, eye irritation, wheezing, or skin irritation. Some people, such as those with serious allergies to molds, may have more severe reactions. Severe reactions may occur among workers exposed to large amounts of molds in occupational settings, such as farmers working around moldy hay. Severe reactions may include fever and shortness of breath.

A number of different mold species in varying concentrations have been identified in samples collected by HEG. In general, the species and concentrations of mold and mold spores that were found indoors at the school were similar to the species and concentrations found outdoors. However, because of the limited number of samples that were collected outdoors it is difficult to draw conclusions regarding whether there are still sources of gross mold contamination at the school.

There is a wide range of susceptibility to allergic reactions to molds, and some students and staff may be exposed to levels of mold and mold spores that could potentially result in allergic responses among students and staff. However, there are currently insufficient data to conclude whether or not any symptoms that persons may be experiencing are a result of exposure to indoor mold sources at the school.

4.0 Conclusions

The indoor carbon dioxide levels found at Corona del Sol High School were higher than the recommended maximum of 1,000 parts per million. These results suggest that the carbon dioxide that accumulates during the school day could be causing drowsiness, lethargy, and a sense of "stale air" among students and staff. There is currently insufficient information to conclude whether or not the symptoms that people have been experiencing are due to indoor mold.

Exposures or potential exposures did not fit recognized risk factors for brain tumors. The Review Panel was unable to establish a link between brain tumors and environmental factors at Corona del Sol High School.

5.0 Recommendations

- Adjust or modify the ventilation system to ensure that carbon dioxide concentrations are maintained below 1,000 parts per million to reduce drowsiness, lethargy, and a sense of "stale air" among students and staff. Consider using mobile carbon dioxide monitors in classrooms and offices to ensure that CO_2 levels are maintained below 1000 ppm.

- Because mold and mold spores can cause allergic responses and aggravate asthma and other respiratory conditions, gross (visible) mold and mold spore contamination should be eliminated. Following the completion of mold removal activities, conduct simultaneous indoor and outdoor airborne mold tests to ensure that the major sources of indoor mold have been eliminated.

- Consider replacing carpets with nonabsorbent materials such as tile in high-traffic and moisture prone areas. Carpeting has a much larger surface area than tile and can accumulate allergens that cause indoor air quality problems.

- Review and implement the Environmental Protection Agency's Tools for Schools environmental assessment program to improve the school's indoor air quality: http://www.epa.gov/iaq/schools/index.html.

References

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Health Effects Group, Inc. Indoor Air Quality Assessment: Tempe Union High School District. October 31, 2006.

Health Effects Group, Inc. Post-Remediation Microbial Air Sampling: Tempe Union High School District. February 1, 2007.

Health Effects Group, Inc. Post-Remediation Microbial Air Sampling: Tempe Union High School District. May 6, 2007.

Attachment 1: Cover Letter and Inquiry Report Form

Arizona Department of Health Services

Division of Public Health Services
Office of the Assistant Director

150 N. 18th Avenue, Suite 550
Phoenix, Arizona 85007
(602) 542-7320
(602) 542-7362 FAX

JANET NAPOLITANO, GOVERNOR
SUSAN GERARD, DIRECTOR

March 5, 2008

Mr. Steve Adolph
Tempe Union High School District
500 West Guadalupe Road
Tempe, AZ 85283

Dear Mr. Adolph:

Thank you for your recent inquiry about cancer in your school. Staff from the Arizona Cancer Registry is available to review the cases of cancer reported among the staff and students at Corona Del Sol High School. The attached form will help us compile pertinent information about the staff and students at Corona Del Sol. As mentioned in our phone conversation, our staff can document the case information and report on what we find. This report can help your contracted environmental hygienists better understand the types of tumors occurring at the school. A second purpose of this report is to assure the cases reported are documented in the Registry. As I mentioned in our recent conversation, it would be unrealistic to expect that a case assessment would identify a cause of the cases.

Please ask interested persons at Corona Del Sol to fill out this form and return it to a designated person in your office. Once you feel all report forms have been received by your office, please send them to the Arizona Cancer Registry, Attn: Veronica Vensor, 150 North 18th Avenue, Suite 550, Phoenix, AZ 85007.

Sincerely,

Veronica M. Vensor

Tim Flood, M.D.

Veronica M. Vensor
Data Section Manager
Arizona Cancer Registry
Arizona Department of Health Services
150 North 18th Avenue, Suite 550
Phoenix, AZ 85007

Tim Flood, MD
Medical Director
Bureau of Public Health Statistics
Arizona Department of Health Services
150 North 18th Avenue, Suite 550
Phoenix, AZ 85007

Enclosure (1)

Leadership for a Healthy Arizona

Date: _____/_____/_____

Inquiry Report Form

Patient Information

_____ _____ _____
First Name Middle Name Last Name

_____ _____
Day Phone: Evening Phone:

SEX: ____ MALE ____ FEMALE

Date of Birth: _____

Residence Address at time of Diagnosis: Dates of Residence at this address:

_____ _____
Number and Street From: (MM/DD/YYYY)

_____ _____
City, State, Zip code To: (MM/DD/YYYY)

Illness or Disease Information

Name of Cancer or Tumor (Specify): _____

Body Site of Cancer or Tumor (Specify): _____

Histology (Cell type) if known (Specify): _____

Date of Diagnosis: _____/_____/_____
Month Day Year

Hospital or Doctor who made the diagnosis: _____

Work Address at Diagnosis: _____

Usual Job: _____

Dates of Employment at this Work Address: From _____/____/_____ To: _____/___/_____
Month Day Year Month Day Year

Smoking Status:

- ❑ Smoker
- ❑ Past Smoker
- ❑ Never smoked

Arizona Cancer Registry
150 N. 18th Avenue, Suite 550
Phoenix, AZ 85007

Attachment 2: Tables & Graphs

Table 1: Illness* with No Relation to Cancer or Tumors

RESPONDENT #	Headaches	Fatigue	Sinus Infection	Asthma	Other
1					√
2	√			√	√
3					√
4					√
5					√
6					√
7					√
8					√
9					√
10					√
11	√	√			√
12	√	√	√		√
13		√			√
14	√	√		√	√
15	√	√			√
16	√	√		√	√
17	√	√		√	√
18	√	√			√
19		√			
20		√			√
21	√				√
22	√				√
23	√		√		√
24	√		√		√
25			√		√
26	√	√	√		√
27	√	√	√		√
28	√		√		√
29	√		√		√
30			√		√
31	√		√		
32	√	√			
33	√				
34	√				√
35	√	√			√
36	√	√			
37	√	√			√
38	√	√			√
39	√	√			√
40	√				√
41	√	√			
42	√	√			√
43	√	√			√
44	√				√
45	√	√	√		√

RESPONDENT #	Headaches	Fatigue	Sinus Infection	Asthma	Other
46	√	√			√
47	√				
48	√				√
49	√				√
50	√		√		√
51	√				
52	√				√
53	√				√
54	√		√		√
55	√				√
56				√	√
57				√	
58				√	√
59	√		√	√	√
60				√	√
61				√	
62	√			√	√
63					√
64					√
65					√
66					√
67					√
68					√
69					√
70					√
71				√	
TOTAL	**43**	**23**	**14**	**12**	**60**

* These conditions were annotated onto the form that asked for reports of tumors.

Table 2: Site and Histology as Reported on the Inquiry form (n=72)

Site and Histology	Number
Appendix Carcinoid	1
Benign Brain Ganglioma	1
Benign Brain Hemangioblastoma	2
Benign Brain Meningioma	3
Benign Brain Neurilemmoma	1
Benign Brain Pituitary Prolactinoma	1
Bladder	2
Bone Benign	1
Bone Lesion	1
Brain Cyst	1
Breast	2
Breast Benign	2
Colorectal	2
Endocrine: Pituitary Adenoma*	2
Fallopian Tube Benign	1
Hand Cyst	1
Hodgkin Lymphoma	4
Kidney	1
Knee Benign	1
Leukemia Lymphocytic	1
Lung Carcinoid	1
Lymphoma (Unknown)	1
Malignant Brain Astrocytoma	1
Malignant Brain Glioblastoma	1
Malignant Brain Glioma	1
Malignant Brain Neuroblastoma	1
Malignant Brain Pilocytic Astrocytoma	1
Maxillary Sinus Neuroblastoma	1
Mediastinum Germinoma	1
Melanoma	2
Neck Benign	1
Non-Hodgkin Lymphoma	4
Ovary	1
Ovary Benign	4
Pelvic Benign Mass	1
Sarcoma	3
Skin Basal Cell	1
Testis	2
Thyroid	3
Thyroid Benign	2
Unknown	4
Uterus Benign	4
Total	72

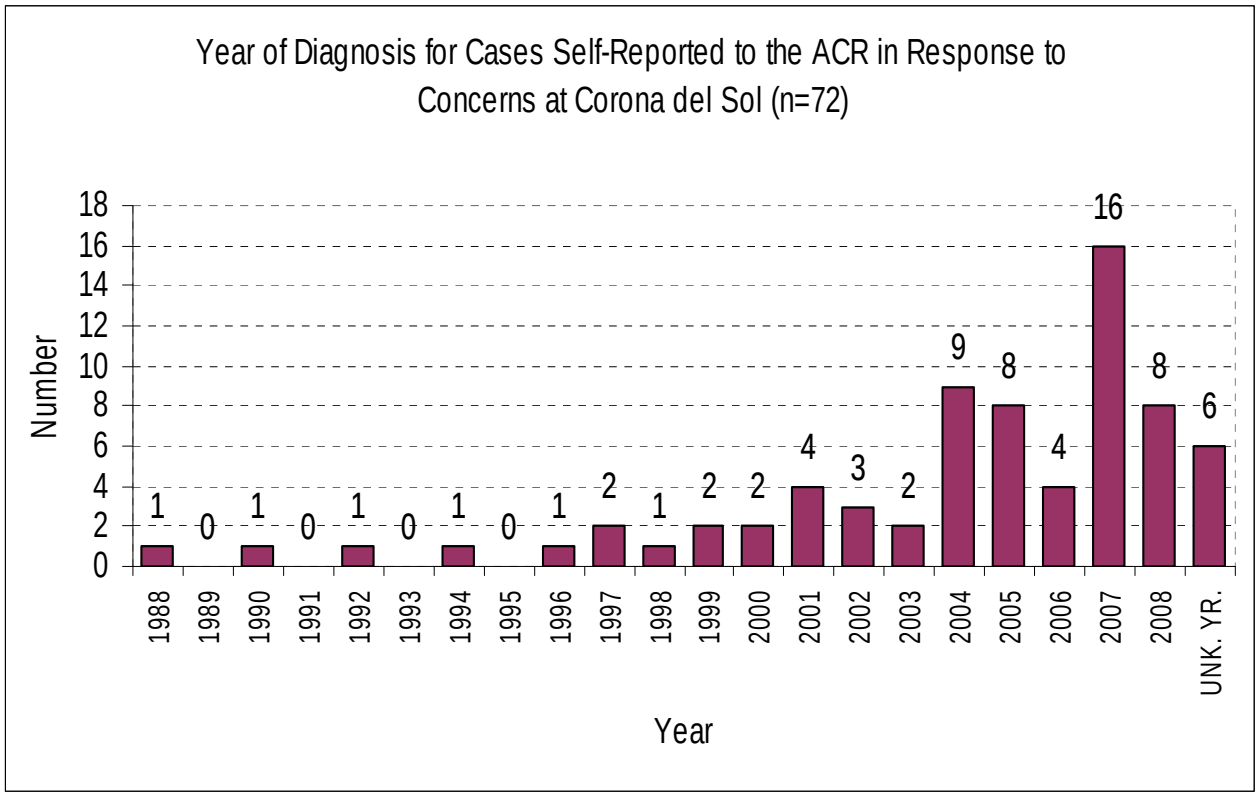
* Pituitary adenomas can be described in either the central nervous system or the endocrine system. In the other tables and graphs they are shown as a benign brain tumor.

Table 3: Site and Histology for Cancers Confirmed and Verified by the ACR (one case pending verification) (n=38)

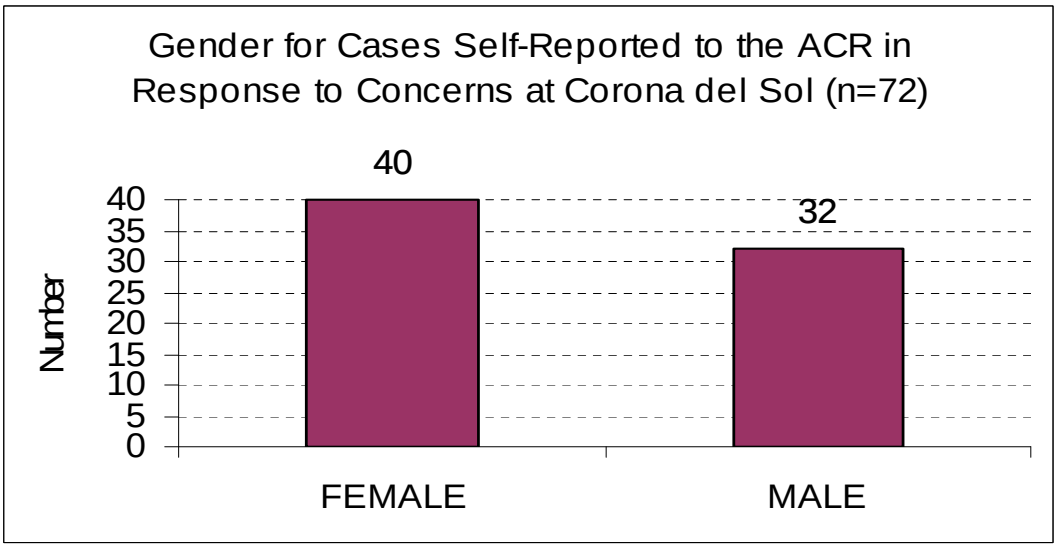
Site and Histology	Number
Benign Brain: Ganglioma	1
Benign Brain: Hemangioblastoma	2
Benign Brain: Meningioma	2
Benign Brain: Neurilemmoma	1
Bladder	1
Breast	2
Colorectal	1
Endocrine: Pituitary Adenoma*	2
Hodgkin Lymphoma	4
Kidney	1
Leukemia, lymphocytic	1
Lung Carcinoid	1
Malignant Brain: Astrocytoma	1
Malignant Brain: Glioblastoma	1
Malignant Brain: Glioma	1
Malignant Brain: Neuroblastoma	1
Malignant Brain: Pilocytic Astrocytoma	1
Maxillary Sinus Neuroblastoma	1
Mediastinum Germinoma	1
Melanoma	2
Non-Hodgkin Lymphoma	2
Ovary	1
Sarcoma	3
Testis	1
Thyroid	3
Total	38

* Pituitary adenomas can be described in either the central nervous system or the endocrine system. In the other tables and graphs they are shown as a benign brain tumor.

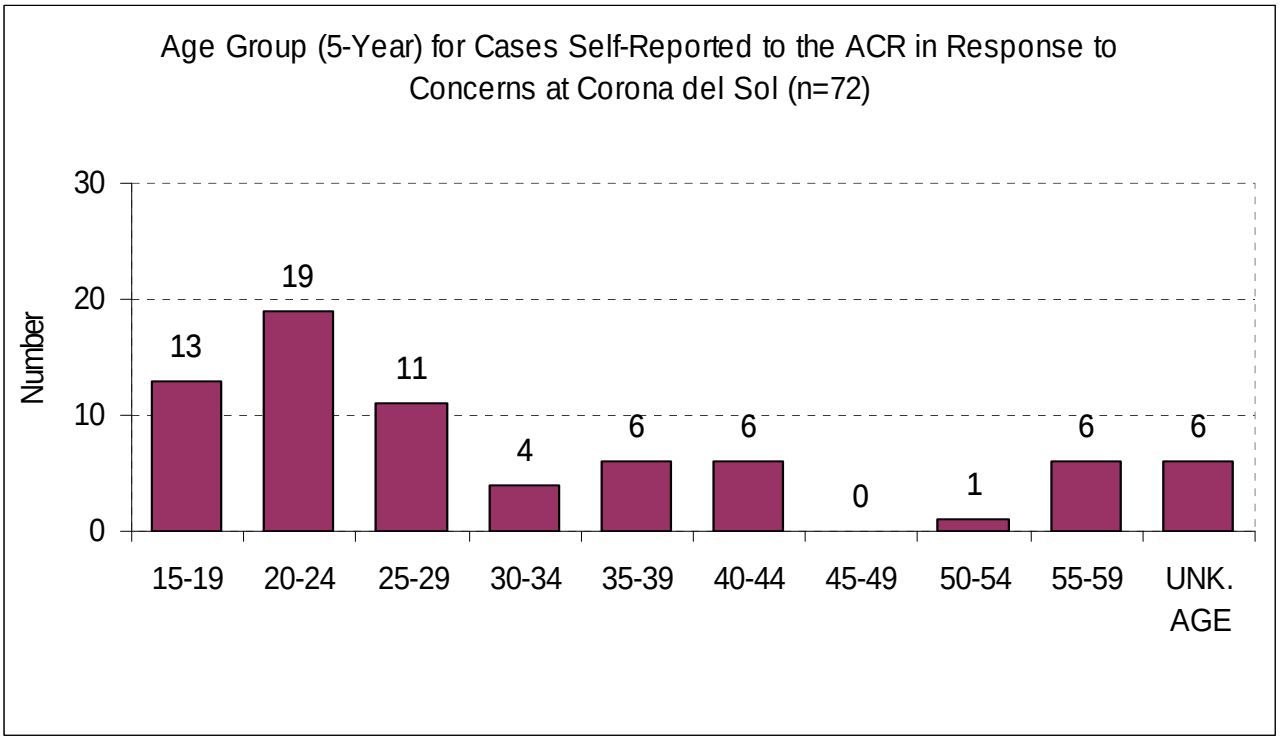
Graph 1: Diagnosis Year for All Cancers



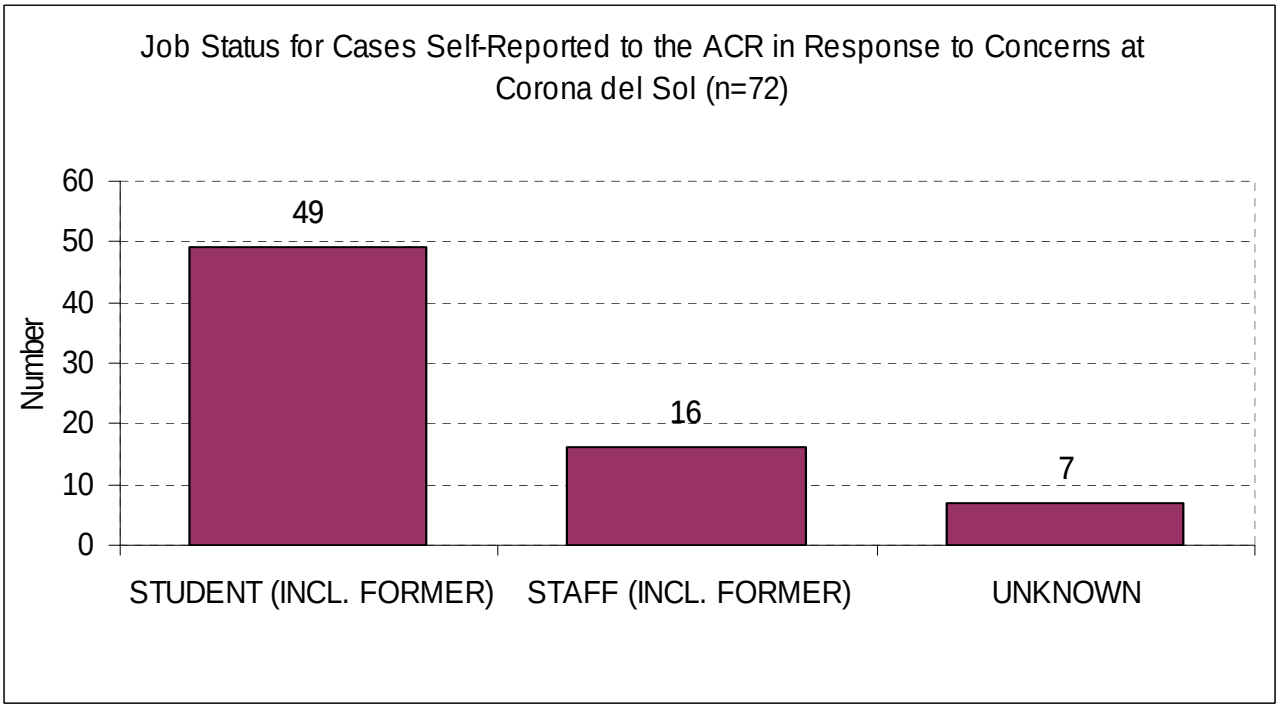
Graph 2: Gender for All Cancers



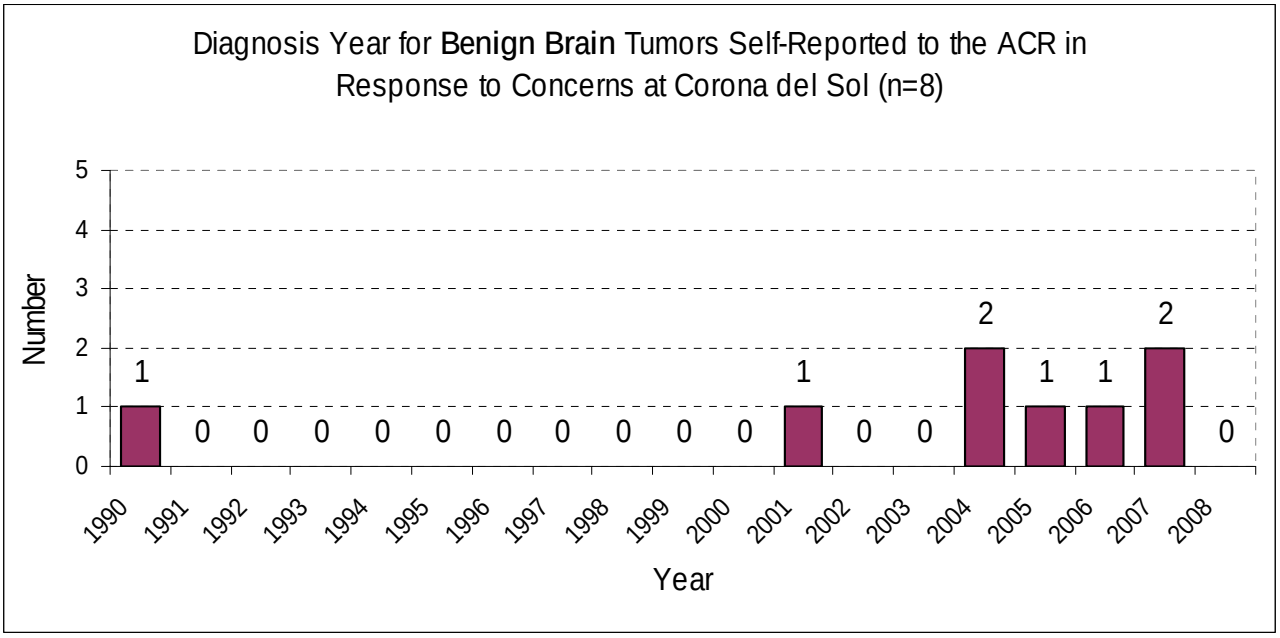
Graph 3: Age Group (5-Year) for All Cancers



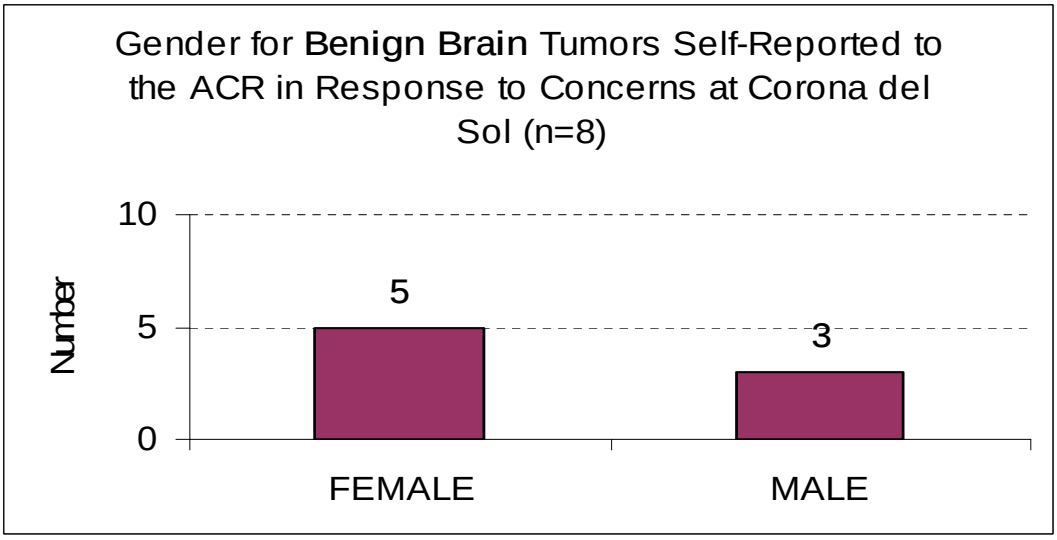
Graph 4: Teacher vs. Student Status for All Cancers



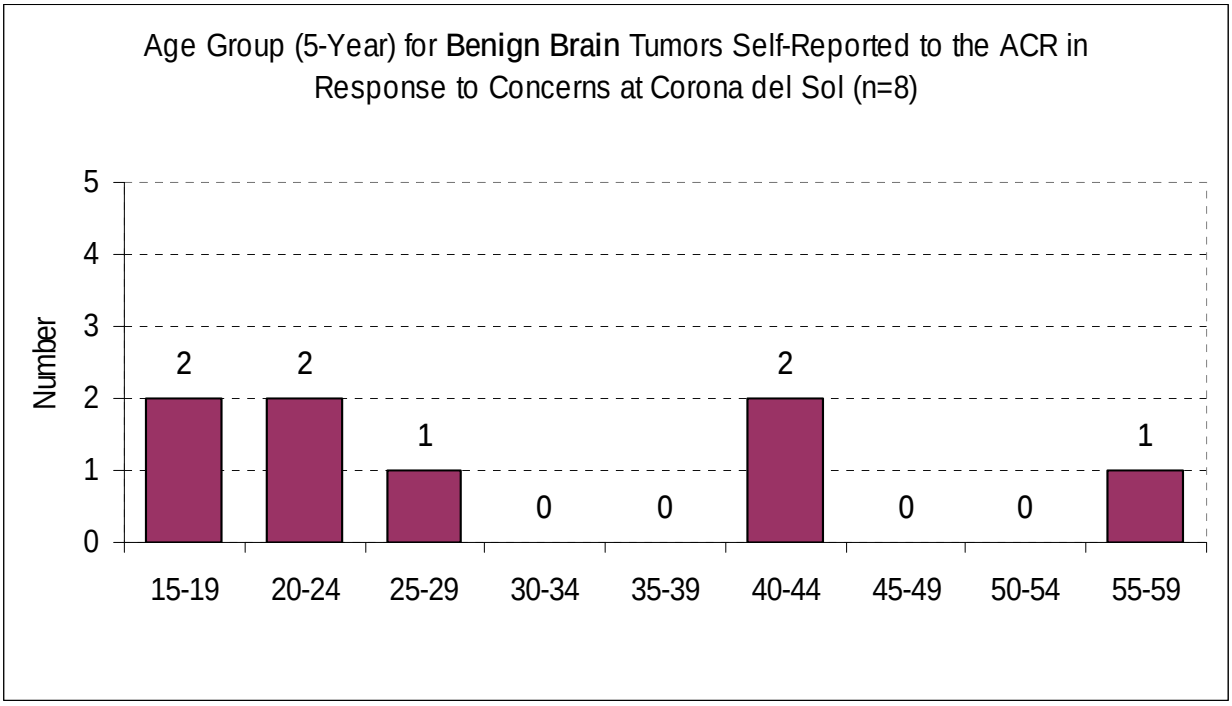
Graph 5: Diagnosis Year for Benign Brain Tumors



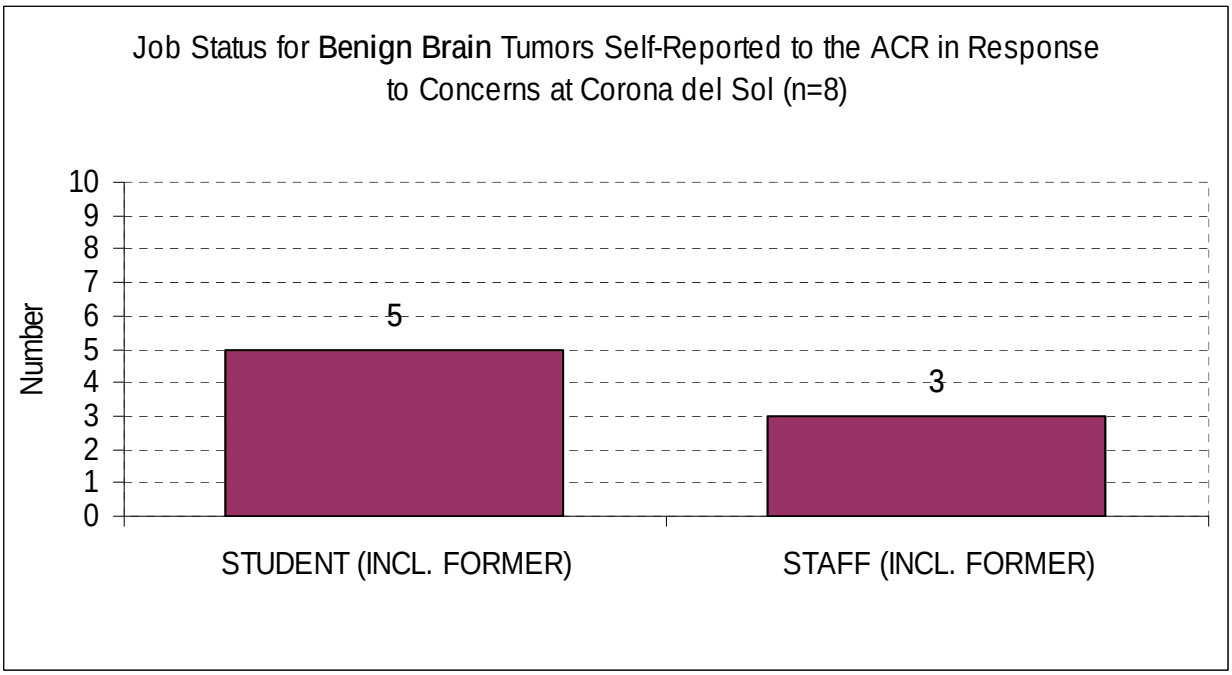
Graph 6: Gender for Benign Brain Tumors



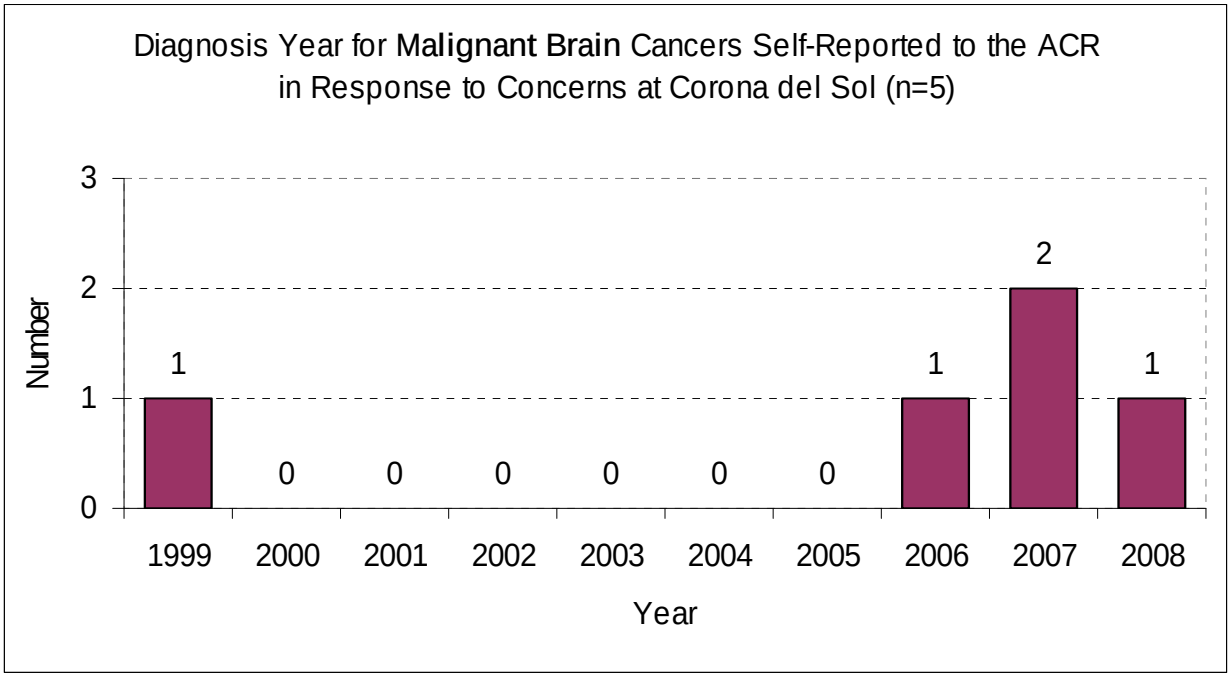
Graph 7: Five-Year Age Group for Benign Brain Tumors



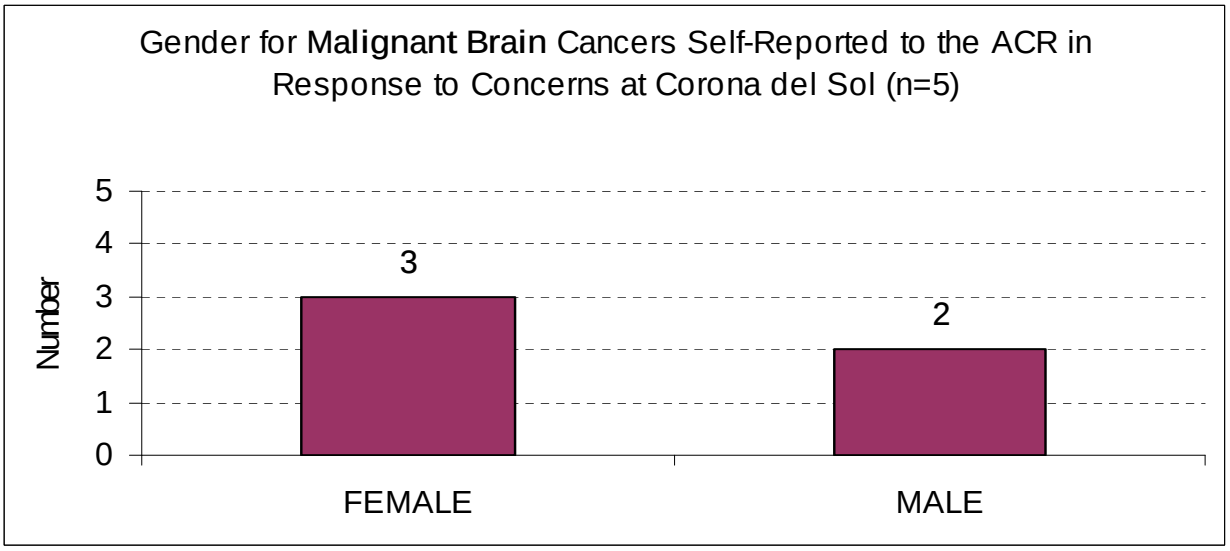
Graph 8: Teacher vs. Student Status for Benign Brain Tumors



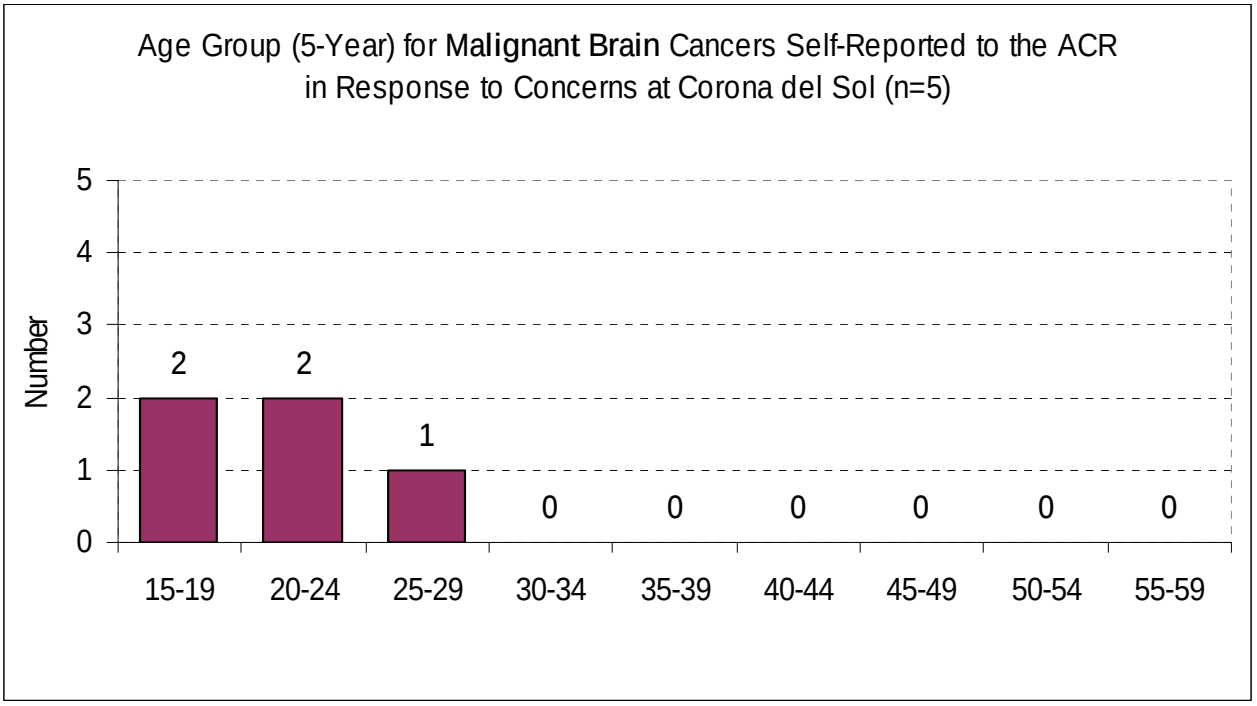
Graph 9: Diagnosis Year for Malignant Brain Cancers



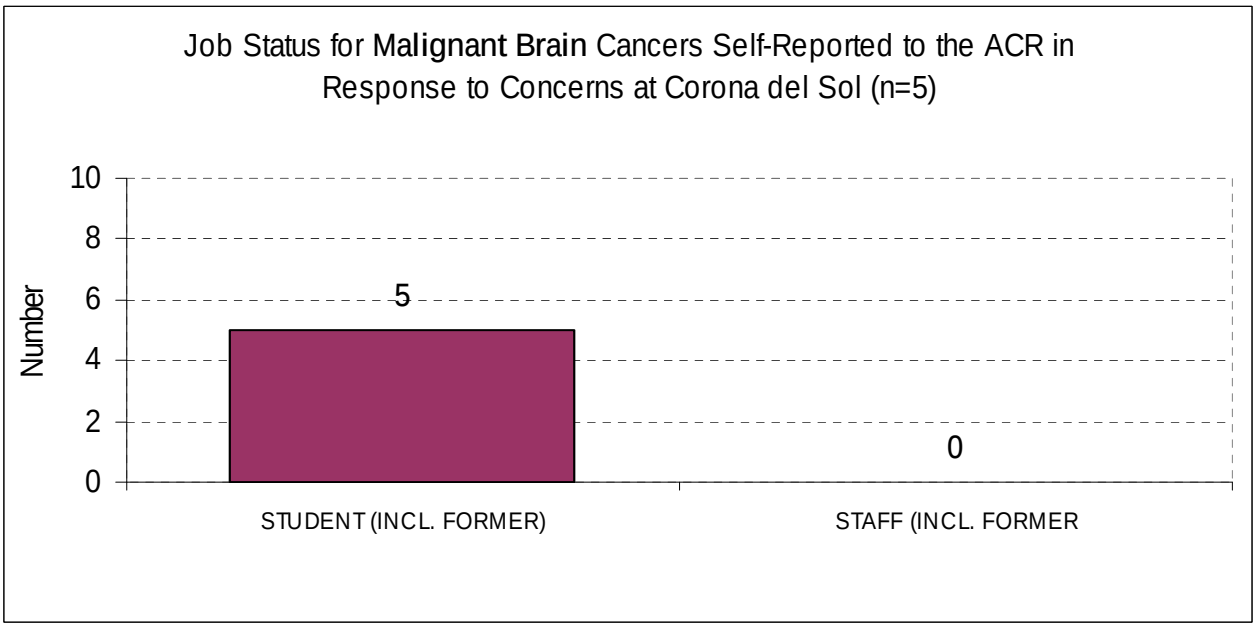
Graph 10: Gender for Malignant Brain Cancers



Graph 11: Five-Year Age Group for Malignant Brain Cancers



Graph 12: Teacher vs. Student Status for Malignant Brain Cancers



FLOWCHART 1: ASSESSMENT OF INQUIRY REPORT FORMS FROM CORONA DEL SOL