Busselton Hospital workforce cancer analysis

Public Health Intelligence Directorate

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Executive summary

A number of cancer cases have been reported by staff at the Busselton Hospital site. In the interest of the staff at the hospital the Public Health Intelligence Directorate undertook a study to investigate the likelihood of the existence of a cancer cluster at the site.

The reported cases were matched to the Western Australian Cancer Registry (WACR) to verify their occurrence and obtain additional details required for the analysis.

- Of the 17 cases reported, 15 were matched to the WACR, with the year of diagnosis ranging from 1989 to 2008.
- Ten different types of cancers were included in the 17 cases and breast cancer was the most common, which was not unexpected given a large proportion of the workforce was female.
- Generally, the year of diagnosis of the cases was spread over the twenty year period, with the exception of four cases reported in 2006.
- The time from commencement of employment to date of diagnosis ranged from 1 to 21 years, with an even distribution indicating some cases were influenced by exposure to risk factors other than those in the workplace.
- Apart from the report of two cases of brain cancer among younger females, the age at diagnosis for most cases was similar to that expected in the general population.

A comparison was made of the actual cases reported among the workforce and those expected based on the incidence of three reference populations; State, Metropolitan area and the Busselton Local Government Area for two periods; 1989 to 2007 and 2003 to 2007. Results show:

- For male employees, the number of cancers reported was low but not different from that observed in the reference populations in both time periods.
- The number of reported cases among female employees was not different from the reference populations based on the data over the period 1989 to 2007. For the shorter study period (2003-2007) however, the number of reported cases was higher than expected but not statistically significant.

From this analysis there is no evidence that the characteristics of the cancer cases among the Busselton Hospital workforce represent a cancer cluster. The analysis was unable to demonstrate that the reported number of cancer cases among the workforce was higher than expected when compared to the incidence in other reference populations. In addition, the cancer cases reported were neither of a similar nor rare type and the majority were not reported among an unusual age group.

The small increase in cancers cases reported during 2003 to 2007 compared to earlier years may warrant further investigation but due to the small the numbers involved it will difficult to determine if this is due to anything other than chance.

Background

The Busselton Hospital was opened in May 1978 at the current site and has been operational for 30 years. The site was the location of a timber mill prior to the hospital being built on the site.

The issue of a link between cancer cases reported among staff and the hospital site was raised by Busselton Hospital management in February 2007 at which time the Department of Health decided a detailed analysis of the cancer incidence was not warranted and the situation would continue to be monitored. Recent publicity of the situation has raised staff awareness of the issue.

In response to the concerns of the staff, the Public Health Intelligence Directorate has undertaken a preliminary study to assess the likelihood of a cancer cluster existing among the workforce at the Busselton Hospital site.

Cancer in WA

Cancer is relatively common with 9,151 new cases registered in WA during 2005 and the estimated lifetime risk of cancer to age 75 of 1 in 3 for males and 1 in 4 for women (Threlfall and Thompson, 2007).

In females the most common cancers reported in 2005 were breast, colorectal, melanoma of the skin and lung cancer, while for males the most common cancers reported were prostate, lung, colorectal and melanoma of the skin (Threlfall and Thompson, 2007).

Cancer is most common among older people, with over 70% of cancers among males occurring in men 60 years and older and 70% of cancers among females occurring in women 55 years and older in WA during 2005 (Threlfall and Thompson, 2007). With increasing life expectancy more people are living longer and an increase in the number of cancer cases is expected because of a growing number of elderly people in the population.

There are many different types of cancer, each with known or suspected risk factors associated with its development that may be common with other types or unique to the specific cancer. The development of cancers associated with exposure to risk factors may take many years, even decades before diagnosis, which makes it difficult to identify the cause of that cancer.

How to identify a cancer cluster?

A disease cluster is the occurrence of a greater than expected number of cases of a particular disease within a group of people, a geographic area, or a period of time. The expected number of cases is determined by applying the age and sex specific rates of a reference population to the age and sex specific numbers in the workforce. The period of time over which the cancers were observed must be matched by the period over which the rates of the reference population were calculated.

The occurrence of only primary cancers is considered to avoid including any cases that may have resulted from the spread of the cancer from another organ rather than due to exposure to a risk factor.

Typically a suspected cancer cluster is more likely to be a true cluster if there is an increased number of cases of a single or similar cancer types in an age group that is not usually affected by that type of cancer (National Cancer Institute. USA).

Workforce size and structure

A count of the total workforce on the site by age and gender, as at 30 June, for 2003 to 2008 was obtained from the South West Regional Office of the WA Country Health Service. Over the six-year period the workforce remained relatively stable and ranged from 219 in 2004 to 256 in 2008. In 2008, 84% of the workforce was female. Around 70% of the staff was either permanent or fixed-term, with the remainder either casual or sessional. Based on the 2008 data the workforce size and structure was extrapolated back to 1989 using anecdotal information that the workforce had decreased by 10% since 1989.

The workforce data was used to estimate the person-years of exposure to conditions at the Busselton Hospital site on the assumption that one staff member in each year was equivalent to one person-year. The process provided estimates of person-years of exposure for the workforce for the 20 year period of 1989 to 2008 and the last six-year period of 2003 to 2008.

Total cancers among workforce

A total of 17 cancers cases have been reported among Busselton Hospital workers.
The number and type of cancers reported is shown in Table 1. The most common cancer was breast cancer, with colorectal and brain cancer the only other types with multiple cases.

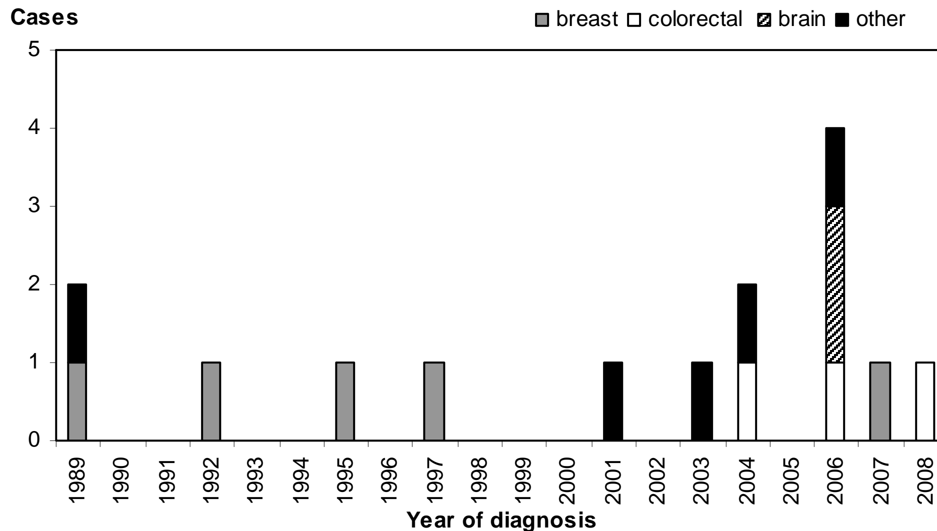
Table 1: Number and type of cancers reported by Busselton Hospital workers

Cancer type	Number of cases
Breast	5
Colorectal	3
Brain	2
Lung	1
Prostate	1
Spine	1
Ovarian	1
Leukaemia	1
Thyroid	1
Small intestine	1
Total	17

Details of these cases were matched with the WA Cancer Registry (WACR) to verify the type of primary cancer and determine the date of diagnosis of the primary cancer. A match was found for 15 of the 17 reported cases, with the year of diagnosis spanning from 1989 to 2008. Of the unmatched cases one was speculated to have been diagnosed in 2008 and was yet to be registered, while the other related to an individual that had moved interstate and may have been registered elsewhere.

The distribution of the diagnosis of cases over time for the 15 matched cases is shown in Figure 1. On average there has been less than one case of cancer reported per year within the Busselton Hospital workforce. During 2006 four cancer cases were recorded comprising of two cases of brain cancer, one of breast cancer and one of cancer of the thyroid gland.

Figure 1: Year of diagnosis for cases with known diagnosis date by cancer type.



Exposure time of cases

Exposure time is the time between commencing work at the Busselton hospital site and the date of diagnosis. Three cases either had no information from the WACR or the date of starting employment at the site wasn't recorded. Exposure time raged from one year to 21 years, with an average of 11.4 years for the 14 cases for which an exposure time could be calculated. The number of cases for exposure times is shown in Figure 2. There were 5 out of the 14 cases with exposure times less than ten years.

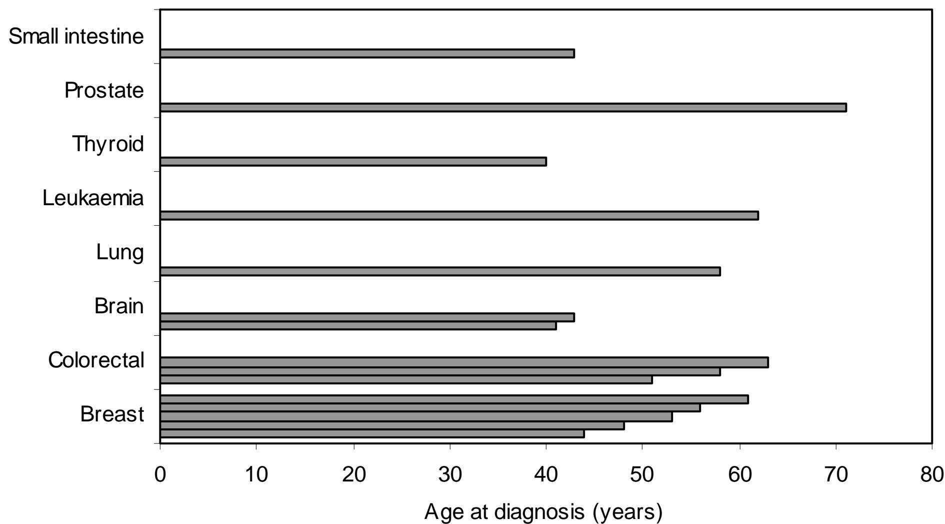
Figure 2: Number of cases by time of employment before diagnosis

Age at diagnosis

The ages at diagnosis of the cases matched to the WACR ranged from 40 to 63 years. Information from the WACR indicates that some cancer types occur more commonly in people of certain ages in the general population. For example, thyroid cancer occurs among younger age groups, while breast cancer is most common among middle aged women and colorectal cancer occurs most commonly in older ages. The age at diagnosis by cancer type among the Busselton Hospital workforce is shown in Figure 3. Generally the age at diagnosis for each cancer type among the Busselton workforce matches that expected in the general population. The occurrence of two cases of brain

cancer and one case of small intestine cancer in the 40-44 year age-group is less common.

Figure 3: Age at diagnosis by cancer type



Standardised Incidence Ratios (SIR) by gender

The actual number of total cancers was compared to the number expected based on the age and gender specific incidence from three scenarios. A comparison was made based on the State population age and gender specific incidence to determine if the incidence was different among the workforce. As it was thought the Metropolitan area population might have similar characteristics as the workforce the age and sex specific incidence of the Metropolitan area was applied to the workforce population in the second scenario. The third scenario involved applying the age and sex specific cancer incidence of the local population (Busselton Local Government Area) to the workforce population. The expected numbers of total cancers were estimated by applying the age and gender specific incidence of the three reference populations to the estimated workforce population for the periods 1989 to 2007 and 2003 to 2007. The first period was selected as this represented the period over which all reported cases were diagnosed. The one case diagnosed in 2008 was excluded because notifications of cancers are complete up to 2007 on the WACR. The period 2003 to 2007 was chosen because more accurate workforce data was available and the period coincided with a more frequent reporting of cases.

The SIR is calculated by dividing the actual cases by the expected cases. If the incidence of cancer cases was the same among the Busselton Hospital workforce as the reference populations then the number of actual cases will be the same as the number of expected cases and the SIR will be equal to one. Statistical significance of an excess of cases compared to the reference population is assessed by determining if the confidence interval of the SIR is greater than the value of one. Statistical significance of a lower number of cases compared to the reference population is assessed by determining if the confidence interval of the SIR is lower than the value of one.

The SIRs calculated for both genders indicate that the actual number of cancers among the Busselton Hospital workforce from 1989 to 2007 were lower than the number expected based on State, Metropolitan and Busselton incidence. The actual

number was not statistically significantly lower than the expected number based on the 95% confidence intervals (Table 2).

Table 2: Standardised Incidence Ratio (SIR) of actual cancer cases to expected for Busselton Hospital site workforce by gender, 1989 to 2007

	Males				Females			
	Act.	Exp.	SIR	95% CI	Act.	Exp.	SIR	95% CI
State	2	4	0.52	(0.01-1.45)	14	18	0.76	(0.38-1.21)
Metropolitan	2	4	0.51	(0.01-1.43)	14	18	0.76	(0.38-1.21)
Busselton	2	3	0.59	(0.01-1.64)	14	19	0.74	(0.36-1.17)

The SIRs calculated for males over the period 2003 to 2007 indicate that the actual number of cancer cases was similar to that expected based on the age and gender specific incidence of the reference populations (Table 3).

The calculation of the SIR for females over the period 2003 to 2007 included the two unmatched cases. It was assumed in the worst case that both cases were diagnosed in the period 2003 to 2007. While the SIR indicates that there was nearly double the number of cases reported among the female workforce than expected, the excess of cases was not statistically significant (Table 3).

Table 3: Standardised Incidence Ratio (SIR) of actual cancer cases to expected for Busselton Hospital site workforce by gender, 2003 to 2007

	Males				Females			
	Act.	Exp.	SIR	95% CI	Act.	Exp.	SIR	95% CI
State	1	1	0.82	(0.00-3.02)	9	5	1.90	(0.73-3.32)
Metropolitan	1	1	0.81	(0.00-2.97)	9	5	1.88	(0.72-3.30)
Busselton	1	1	0.92	(0.00-3.40)	9	5	1.69	(0.65-2.96)

Excluding the two unmatched cases from the calculation of the SIR for females reduces the SIR. The excess in reported numbers remains statistically non-significant (Table 4).

Table 4: Standardised Incidence Ratio (SIR) of actual cancer cases to expected for Busselton Hospital site female workforce by gender, 2003 to 2007 excluding unmatched cases

	Females			
	Act.	Exp.	SIR	95% CI
State	7	5	1.47	(0.46-2.75)
Metropolitan	7	5	1.47	(0.46-2.73)
Busselton	7	5	1.32	(0.41-2.45)

Discussion

Typically cancer clusters are identified by a common cancer type occurring among a cohort. This is not the case at the Busselton hospital site where 17 cases reported over the twenty-year period from 1989 to 2008 included 10 different types of cancer. The types of cancer found among the workforce are not dissimilar to the common cancers

found in the general population, especially given a large proportion of the workforce were female.

Apart from four cancers being diagnosed in 2006 there was generally an even distribution of cancers diagnosed over the twenty year period, which would be expected from a group drawn from the general population. Similarly, the even distribution of exposure times might suggest some cancers were the result of influences other than within the workplace.

The age at diagnosis for the majority of cases is similar to that expected in the general population based on information from the WACR. The report of two brain cancer cases, both in 2006, among relatively younger women was rare based on the number and distribution of age at diagnosis for brain cancer as reported for the general population in the WACR.

The small number of cases for each specific cancer would not allow analysis of each cancer type, so comparison to the general population was based on the total cancer cases. The analysis of the total cancer cases was also affected by the small number of cases reported over a long period of time among a relatively small cohort. Any measures derived from the analysis were imprecise with large confidence intervals due to the small numbers making it difficult to draw definite conclusions.

The number of males in the workforce was low and consequently the number of cancers reported among male workers was low. The comparison to the three reference groups indicated that the number of cancers reported among males in the workforce for either study period was not different to the reference populations.

With the majority of the workforce female, most cancer cases were reported among the female workforce. For the period 1989 to 2007, the number of cases reported among females was lower than expected based on the incidence in the reference populations. Although the number of cancer cases reported among female staff was higher than expected when compared to the reference populations for the period 2003 to 2007, a statistically significant difference could not be shown due to the relatively small number of cases among a small group. It should be noted that the number of cases was not statistically significant even including in the analysis for the period 2003 to 2007 the two cases for which the year of diagnosis was unknown.

It must be noted that the there are some limitations in the comparison of numbers of cases reported among the staff at Busselton Hospital to the reference populations. There is no certainty that all cancer cases among Busselton Hospital staff have been reported. However, for the number of cases to reach statistical significance over the period 1989 to 2007, twice the number of cases needed to be reported. The method used to estimate of the person-years of exposure among Busselton hospital staff may be an overestimate. The SIR would increase with fewer person-years of exposure. However, to make the female cases significantly higher over the period 1989 to 2007 the person-years of exposure would need to decrease sufficiently to halve the expected cases. In addition, two female cases were not matched with the WACR, so the date of diagnosis, age at diagnosis and exposure time could not be determined for those cases, although these cases were included in the comparison with the reference populations.

Conclusion

From this analysis there is no clear evidence that the characteristics of the cancer cases among the Busselton Hospital workforce fit the criteria of a cancer cluster. The analysis was unable to demonstrate that the reported number of cancer cases among the workforce was higher than expected when compared to the incidence in other comparable populations. In addition the cancer cases reported were neither of a similar nor rare type and the majority were not reported among an unusual age group.

The increased number of cancers from 2003 to 2007 may warrant further investigation, but the numbers of cases are too small to determine if this distribution is due to any factors other than chance.

References

1. Threlfall TJ, Thompson JR (2007). Cancer incidence and mortality in Western Australia, 2005. Department of Health, Western Australia, Perth. Statistical Series Number 81.

2. National Cancer Institute. US National Institutes of Health. <http://www.cancer.gov/cancertopics/factsheet/risk/clusters>