



## **Epidemiology and secondary prevention of melanoma in rural southern Queensland**

Journal:	<i>Australian Journal of Rural Health</i>
Manuscript ID	AJRH-01-2019-0003
Manuscript Type:	Original Research
Keywords:	Melanoma, epidemiology, health service models, oncology, primary health care

SCHOLARONE™  
Manuscripts

1  
2  
3 **Epidemiology of melanoma in rural southern Queensland**  
4  
5  
6  
7

8 Objective

9  
10 The objective of this study is to define the epidemiology of melanoma in rural communities  
11 in southern Queensland.  
12  
13

14 Design

15  
16 The design used was a 6-year clinical record audit of melanoma cases identified by billing  
17 records and electronic clinical records, confirmed and typed with histology.  
18  
19

20 Setting and Participants

21  
22 This study was based in seven agricultural communities on the Darling Downs with patients  
23 presenting to local primary care clinics.  
24  
25

26 Main outcome measures

27  
28 Outcomes measured were confirmed type, depth and anatomic distribution of melanoma  
29 identified at these practices during the study period.  
30  
31

32 Results

33  
34 The results from 317 cases of melanoma found anatomic and subtype distribution was  
35 different to that reported previously from the Queensland Cancer Registry. A high proportion  
36 of melanoma-in-situ and lentigo maligna were found in the overall epidemiology of  
37 melanoma in these rural communities.  
38  
39

40 Conclusions

41  
42 Conclusions drawn from these findings is that melanoma risk is not so much lesser in rural,  
43 inland communities compared to coastal and metropolitan regions, but different. These  
44 differences may relate to comprehensive data capture available in rural community studies  
45 and to different sun exposure and protection behaviours contributing to different subtypes and  
46 anatomic distribution.  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

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  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

## What is already known on this subject

- Cancer morbidity and mortality, including for melanoma, are generally less favourable in rural areas of Australia,
- Rural lifestyle and health care access are proposed to contribute to these outcomes, and
- No specific epidemiology for inland rural communities is available.

## What this paper adds

- The epidemiology of melanoma in inland rural communities is different to that measured state-wide in Queensland,
- The high rate of early stage melanoma found here does not support delays in diagnosis in this region,
- Early identification and local management of melanoma in rural general practice contributes to different and early stages of melanoma identified, and
- More comprehensive research detailing melanoma epidemiology is possible with electronic clinical records available in primary care practices.

## Key words

Rural

Melanoma

Epidemiology

## Introduction

Cancer morbidity and mortality are generally less favourable in rural areas of Australia with an estimated additional 9000 deaths in the decade from 2001-2010 compared to metropolitan Australia.<sup>1</sup> More specifically, an age-adjusted fatality rate for melanoma was found to be 20% higher in rural areas, attributed to differences in access and management practices in rural areas.<sup>2</sup> Inner regional areas of Australia have the highest incidence of the four commonest notifiable cancers, including melanoma.<sup>3</sup> Accordingly, on the eastern Darling Downs in Queensland, there is a modest collective rate ratio (1.07) of the five commonest cancers recorded (Breast, Colorectal, Lung, Melanoma and Prostate Cancers) compared to the Australian population, however, this is largely due to the significantly greater age standardised incidence rate (ASIR) of melanoma (87.2/100,000 people) over the Australian rate (49.3/100,000).<sup>4</sup> Notably, this rate on the Darling Downs is also higher than the Queensland ASIR of melanoma (73.3/100,000).<sup>5</sup>

The region was noted to have a similar incidence of melanoma to Queensland in 2002, but has had a significantly higher rate of increase in melanoma over preceding two decades.<sup>6</sup> At this time, coastal regions were considered higher risk for melanoma than rural, inland regions, due to different sun exposure in the “rural lifestyle”. In fact, by 2014, the region of the Darling Downs and West Moreton Primary Health Network (PHN) was alongside the Gold Coast PHN reporting highest ASIR of melanoma in Queensland. The reported rates are higher than those in (rural) central and northern Queensland and well above western Queensland.<sup>7</sup> However, there is limited specific epidemiology of the nature and management of melanoma presenting in rural inland regions such as the Darling Downs. The largest industry in the region is agriculture. Outside the city of Toowoomba, there are rural communities which are small (ASGC-RA MMM 4-5) with health care generally delivered

1  
2  
3 only by primary care providers.<sup>8</sup> Considering earlier concerns of specialist care access and a  
4 rural lifestyle contributing to different melanoma epidemiology the aim of this research was  
5 to determine the epidemiology and management of melanoma presenting in rural  
6 communities of the Darling Downs.  
7  
8  
9  
10  
11  
12  
13

## 14 **Methods**

15  
16 This study used a clinical record audit of melanoma cases identified by billing records in  
17 rural medical practices in seven rural communities on the Darling Downs over a six-year  
18 period. These communities included Clifton (population 1456 people in the 2016 Census),  
19 Warwick (population of 12,222), Pittsworth (3294 residents), Millmerran (1543 residents),  
20 Kingsthorpe (1867 residents), Oakey (population 4705 people) and Goondiwindi (population  
21 6,355). While the populations listed reflect the towns, practices also serve surrounding  
22 farming areas.  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33

34  
35 Cases were identified by billing records of specific Medicare item numbers for the  
36 management of melanoma and by review of cases billed for biopsy of a lesion. All cases  
37 identified from Medicare billing data were linked to histology reports from specialist  
38 pathologists available through the patient's electronic clinical record (ECR). For inclusion in  
39 the study all cases needed to be confirmed and typed from these histology reports. Typing of  
40 melanoma was undertaken and categorised using terminology employed by reporting  
41 histopathologists.  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52

53 Melanoma cases were included from biopsy when the histology reported melanoma. Caution  
54 was exercised that individual melanoma were not double counted. Cases of second melanoma  
55 were scrutinised to determine whether they were second primary or recurrence of an earlier  
56  
57  
58  
59  
60

1  
2  
3 primary melanoma. Study records were anonymised upon extraction of data from the ECR to  
4  
5 ensure that identified clinical records did not leave the respective practice. Descriptive  
6  
7 analysis of histologically-confirmed tumour type is provided with anatomical distribution and  
8  
9 relative tumour density (RTD) on defined body sites. RTD was calculated by dividing the  
10  
11 proportion of tumours occurring at a specified site by the proportion of skin area of that site.  
12  
13  
14 The study was approved by the RACGP NREEC and supported with funding by the Skin  
15  
16 Cancer College of Australasia. Clinical investigators were medical students attached to the  
17  
18 rural practices where the study was conducted. The process was overseen by a designated  
19  
20 clinical supervisor at each practice.  
21  
22  
23  
24  
25

## 26 **Results**

27  
28 Overall, 317 melanoma were identified, typed and clinical circumstances reviewed. Patients  
29  
30 were predominantly males (183, 58%). Ages of these patients ranged from 26 to 102 years  
31  
32 with a mean age of 68 years (SD 14) for males and 65 years (SD 17) for females. Thirteen  
33  
34 patients were diagnosed with two primary melanoma in this six-year period of sampling.  
35  
36  
37 Nine patients were diagnosed with second primary melanomas having a history of earlier  
38  
39 primary melanoma diagnosed prior to the sampling period. One patient was diagnosed with a  
40  
41 recurrence of a primary melanoma diagnosed and treated prior to the sample period.  
42  
43  
44 Therefore there were 294 patients seen with first primary melanoma. They had the same  
45  
46 gender distribution (42% female). Of these, 13% were melanoma greater than 1mm thick at  
47  
48 diagnosis.  
49  
50  
51  
52  
53

54 Notably, of the 13 patients with two primary melanoma in this period, seven (2% of 294)  
55  
56 were found to have two lesions diagnosed as melanoma concurrently. One of these patients  
57  
58 was considered to have a cutaneous metastasis. Patients with more than one melanoma  
59  
60

1  
2  
3 diagnosed in the period, or a history of melanoma previously, averaged 78 years of age.  
4  
5 Compared to the Queensland registry data, males were less prevalent in both the total series  
6  
7 of melanoma cases and individuals with first primary melanoma.  
8  
9

10  
11  
12 Table 1: Age distribution of patients diagnosed with melanoma  
13  
14

15  
16  
17 The patient group diagnosed with melanoma in these Darling Downs communities were  
18 significantly ( $\chi^2=19.8$ ,  $p<0.01$ ) older (Table 1) than those across the State of Queensland.<sup>9</sup>  
19  
20 Thirty-one cases were diagnosed on biopsy before definitive excision and 44 cases were  
21 referred for further care. Referral reasons were for wider margins of excision most  
22 commonly, and for primary excision following biopsy typically for deeper melanoma. Cases  
23 with melanoma greater than 1mm depth not referred (n=27) were generally older patients  
24 (median age 79 years) including many with nodular melanoma (n=13, median age 80 years).  
25  
26  
27  
28  
29  
30  
31  
32  
33

34  
35 Table 2: Anatomical distribution and relative tumour density of melanoma  
36  
37

38  
39  
40 The anatomic distribution of melanoma diagnosed in these rural communities were found to  
41 be significantly different ( $\chi^2=9.6$ ,  $p<0.05$ ) (Table 2) to that previously reported from the  
42 Queensland Cancer Registry.<sup>9</sup> Most notable were differences in head and neck and limb  
43  
44  
45  
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  
72  
73  
74  
75  
76  
77  
78  
79  
80  
81  
82  
83  
84  
85  
86  
87  
88  
89  
90  
91  
92  
93  
94  
95  
96  
97  
98  
99  
100  
101  
102  
103  
104  
105  
106  
107  
108  
109  
110  
111  
112  
113  
114  
115  
116  
117  
118  
119  
120  
121  
122  
123  
124  
125  
126  
127  
128  
129  
130  
131  
132  
133  
134  
135  
136  
137  
138  
139  
140  
141  
142  
143  
144  
145  
146  
147  
148  
149  
150  
151  
152  
153  
154  
155  
156  
157  
158  
159  
160  
161  
162  
163  
164  
165  
166  
167  
168  
169  
170  
171  
172  
173  
174  
175  
176  
177  
178  
179  
180  
181  
182  
183  
184  
185  
186  
187  
188  
189  
190  
191  
192  
193  
194  
195  
196  
197  
198  
199  
200  
201  
202  
203  
204  
205  
206  
207  
208  
209  
210  
211  
212  
213  
214  
215  
216  
217  
218  
219  
220  
221  
222  
223  
224  
225  
226  
227  
228  
229  
230  
231  
232  
233  
234  
235  
236  
237  
238  
239  
240  
241  
242  
243  
244  
245  
246  
247  
248  
249  
250  
251  
252  
253  
254  
255  
256  
257  
258  
259  
260  
261  
262  
263  
264  
265  
266  
267  
268  
269  
270  
271  
272  
273  
274  
275  
276  
277  
278  
279  
280  
281  
282  
283  
284  
285  
286  
287  
288  
289  
290  
291  
292  
293  
294  
295  
296  
297  
298  
299  
300  
301  
302  
303  
304  
305  
306  
307  
308  
309  
310  
311  
312  
313  
314  
315  
316  
317  
318  
319  
320  
321  
322  
323  
324  
325  
326  
327  
328  
329  
330  
331  
332  
333  
334  
335  
336  
337  
338  
339  
340  
341  
342  
343  
344  
345  
346  
347  
348  
349  
350  
351  
352  
353  
354  
355  
356  
357  
358  
359  
360  
361  
362  
363  
364  
365  
366  
367  
368  
369  
370  
371  
372  
373  
374  
375  
376  
377  
378  
379  
380  
381  
382  
383  
384  
385  
386  
387  
388  
389  
390  
391  
392  
393  
394  
395  
396  
397  
398  
399  
400  
401  
402  
403  
404  
405  
406  
407  
408  
409  
410  
411  
412  
413  
414  
415  
416  
417  
418  
419  
420  
421  
422  
423  
424  
425  
426  
427  
428  
429  
430  
431  
432  
433  
434  
435  
436  
437  
438  
439  
440  
441  
442  
443  
444  
445  
446  
447  
448  
449  
450  
451  
452  
453  
454  
455  
456  
457  
458  
459  
460  
461  
462  
463  
464  
465  
466  
467  
468  
469  
470  
471  
472  
473  
474  
475  
476  
477  
478  
479  
480  
481  
482  
483  
484  
485  
486  
487  
488  
489  
490  
491  
492  
493  
494  
495  
496  
497  
498  
499  
500  
501  
502  
503  
504  
505  
506  
507  
508  
509  
510  
511  
512  
513  
514  
515  
516  
517  
518  
519  
520  
521  
522  
523  
524  
525  
526  
527  
528  
529  
530  
531  
532  
533  
534  
535  
536  
537  
538  
539  
540  
541  
542  
543  
544  
545  
546  
547  
548  
549  
550  
551  
552  
553  
554  
555  
556  
557  
558  
559  
560  
561  
562  
563  
564  
565  
566  
567  
568  
569  
570  
571  
572  
573  
574  
575  
576  
577  
578  
579  
580  
581  
582  
583  
584  
585  
586  
587  
588  
589  
590  
591  
592  
593  
594  
595  
596  
597  
598  
599  
600  
601  
602  
603  
604  
605  
606  
607  
608  
609  
610  
611  
612  
613  
614  
615  
616  
617  
618  
619  
620  
621  
622  
623  
624  
625  
626  
627  
628  
629  
630  
631  
632  
633  
634  
635  
636  
637  
638  
639  
640  
641  
642  
643  
644  
645  
646  
647  
648  
649  
650  
651  
652  
653  
654  
655  
656  
657  
658  
659  
660  
661  
662  
663  
664  
665  
666  
667  
668  
669  
670  
671  
672  
673  
674  
675  
676  
677  
678  
679  
680  
681  
682  
683  
684  
685  
686  
687  
688  
689  
690  
691  
692  
693  
694  
695  
696  
697  
698  
699  
700  
701  
702  
703  
704  
705  
706  
707  
708  
709  
710  
711  
712  
713  
714  
715  
716  
717  
718  
719  
720  
721  
722  
723  
724  
725  
726  
727  
728  
729  
730  
731  
732  
733  
734  
735  
736  
737  
738  
739  
740  
741  
742  
743  
744  
745  
746  
747  
748  
749  
750  
751  
752  
753  
754  
755  
756  
757  
758  
759  
760  
761  
762  
763  
764  
765  
766  
767  
768  
769  
770  
771  
772  
773  
774  
775  
776  
777  
778  
779  
780  
781  
782  
783  
784  
785  
786  
787  
788  
789  
790  
791  
792  
793  
794  
795  
796  
797  
798  
799  
800  
801  
802  
803  
804  
805  
806  
807  
808  
809  
810  
811  
812  
813  
814  
815  
816  
817  
818  
819  
820  
821  
822  
823  
824  
825  
826  
827  
828  
829  
830  
831  
832  
833  
834  
835  
836  
837  
838  
839  
840  
841  
842  
843  
844  
845  
846  
847  
848  
849  
850  
851  
852  
853  
854  
855  
856  
857  
858  
859  
860  
861  
862  
863  
864  
865  
866  
867  
868  
869  
870  
871  
872  
873  
874  
875  
876  
877  
878  
879  
880  
881  
882  
883  
884  
885  
886  
887  
888  
889  
890  
891  
892  
893  
894  
895  
896  
897  
898  
899  
900  
901  
902  
903  
904  
905  
906  
907  
908  
909  
910  
911  
912  
913  
914  
915  
916  
917  
918  
919  
920  
921  
922  
923  
924  
925  
926  
927  
928  
929  
930  
931  
932  
933  
934  
935  
936  
937  
938  
939  
940  
941  
942  
943  
944  
945  
946  
947  
948  
949  
950  
951  
952  
953  
954  
955  
956  
957  
958  
959  
960  
961  
962  
963  
964  
965  
966  
967  
968  
969  
970  
971  
972  
973  
974  
975  
976  
977  
978  
979  
980  
981  
982  
983  
984  
985  
986  
987  
988  
989  
990  
991  
992  
993  
994  
995  
996  
997  
998  
999  
1000

1  
2  
3 The highest density of lentigo maligna (LM) tumours was on the head and neck. The average  
4  
5 age of these patients at diagnosis of LM was 71 years and 23/95 (24%) were invasive at  
6  
7 diagnosis, representing 19% of invasive melanoma.  
8  
9

10  
11  
12 Nodular melanoma were more common among older patients. A high proportion of nodular  
13  
14 melanoma (17/19, 89%) were invasive at diagnosis representing 14% of invasive melanoma  
15  
16 found.  
17  
18  
19

20  
21 A high proportion (87%) of melanoma diagnosed by these General Practitioners were 1 mm  
22  
23 or less when treated. These were evenly distributed between males and females.  
24  
25  
26

## 27 28 **Discussion**

29  
30 This study examines the nature of melanoma presenting in rural communities in southern  
31  
32 Queensland from clinical data derived from primary care practices. It has illustrated some  
33  
34 notable differences to previous population-level studies. The seven practices from which  
35  
36 these cases were drawn serve rural communities - ASGC-RA MMM 5 and one MMM  
37  
38 category 4 community. The region has a higher median age (40.4 years) than the Australian  
39  
40 population (37.2 years) and our data has not been age-standardised as the Queensland Cancer  
41  
42 Registry. Notwithstanding, these findings illustrate differences to the conventional  
43  
44 epidemiology of melanoma described from population-level studies. These may arise for a  
45  
46 number of reasons such as the nature of sun exposure and protection in rural communities  
47  
48 and the model of health services available.  
49  
50  
51  
52  
53

54  
55  
56 This study has a number of strengths. Using this method we were able to capture more  
57  
58 comprehensive data at the community level. Completeness of data captured was high and  
59  
60



1  
2  
3 more detailed with the addition of related clinical and demographic information from the  
4  
5 ECR. The data is also more specific to the community providing more internally valid  
6  
7 epidemiological data that could help in making more accurate assumptions about etiology and  
8  
9 preventive interventions. However, there may be a concurrent risk of reduced external  
10  
11 validity or generalizability to other rural areas.  
12  
13  
14  
15  
16

17 In this rural region, a major difference to population-level findings is a gender variation.  
18  
19 Males (58%) were under-represented in this rural series compared to the 67.5% of  
20  
21 Queenslanders diagnosed with (first) melanoma in the 2005-2009.<sup>8</sup> Depth, level and anatomic  
22  
23 distribution of melanoma in the Queensland population is available from the Queensland  
24  
25 Cancer Registry (QCR) and reported in previous studies.<sup>8,10</sup> The distributions described in the  
26  
27 QCR data were also found to be different to that seen in these rural communities.  
28  
29  
30  
31  
32

33 Melanoma type varies with the pattern of sun exposure, age and site and site distribution of  
34  
35 melanoma subtypes have been noted to be changing in Queensland.<sup>10,11,12</sup> Compared to this  
36  
37 large dataset investigating invasive melanoma in the Queensland Cancer Registry from 1982-  
38  
39 2008, we found a lower proportion of invasive superficial spreading melanoma (67%) than  
40  
41 previously described (78%), but a higher proportion of lentigo melanoma (19%) in this region  
42  
43 than recorded in the QCR between 1982-2008 (9%) and a comparable proportion of nodular  
44  
45 melanoma (14%) to Queensland (13%). These distributions, particularly the higher  
46  
47 proportion of lentigo melanoma, found on the head and neck, likely reflect the chronic sun  
48  
49 exposure, lower recreational sun exposure and older population in these rural communities  
50  
51 and is consistent with that previously described for lentigo melanoma.<sup>13</sup>  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 Another potential aetiology for variance in these locally generated rural findings is inclusion  
4 of in situ lesions in the analysis. Approximately half of all SSM and three quarters of LM are  
5 found in these practices at the in situ stage. Studies from the QCR for the period 1982-2002  
6 recognize in situ lesions increasing in incidence over the period at a greater rate than invasive  
7 melanoma.<sup>6</sup> The investigators have proposed greater diagnosis in primary care as the  
8 potential source. From the raw data of the QCR presented in this report, 35% (20,712) were  
9 in situ melanoma. Our findings certainly support the understanding that in situ lesions are  
10 increasing as a proportion of melanoma diagnosed, at least in this series generated from  
11 primary care practice data.  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25

26 All of these rural community general practices provide services including identification and  
27 management of melanoma. They tend to find a high proportion of superficial spreading  
28 melanoma typically among younger patients and high proportion of lentigo maligna  
29 melanoma, most densely represented on the head and neck, found in the in situ phase of  
30 growth. The rate of identification of early lesions is notable with 87% of melanoma  
31 diagnosed and treated with a depth of 1mm or less. This is markedly greater than the  
32 proportion of melanoma recorded in the QCR from 1982-2006 (66%), and is also better than  
33 the proportion previously diagnosed in this range in rural areas of Queensland (69%).<sup>2</sup> In this  
34 study by Coory et al. that investigated rural:urban factors in survival from melanoma,  
35 proposed upstream factors were socioeconomic disadvantage and downstream factors were  
36 higher cancer risk factors (smoking, sun exposure) and delays in diagnosis, comorbidities and  
37 treatment disparities. The high rate of early stage melanoma found here does not support  
38 delays in diagnosis being as active in this region.  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 Regarding access to treatment, in this series, most cases were managed locally. A minority of  
4 cases were referred for further management (n=44, 14%). Such management in public  
5 facilities from these communities require patient travel from one to three hours by road.  
6  
7 Cases not transferred for whom management might be expected to include referral for further  
8 evaluation of nodal spread (>1mm depth),<sup>14</sup> were older patients (median age 79 years) half of  
9 whom had high-grade nodular melanoma (n=13). Along with depth, these are two major  
10 negative influential determinants for melanoma survival.<sup>15</sup> While access to referred  
11 management services has been suggested as a barrier to patient care in rural environments  
12 and the decisions taken by these patients may have been influenced by distances and logistics  
13 of distant referrals, the counter argument that must be considered is whether further  
14 investigation to lead to further intervention is not consented or indeed contraindicated  
15 considering co-morbidities and life expectancy. While patients can be reassured that these  
16 findings indicate rural practices are finding thin, early stage melanoma and manage most of  
17 these melanoma locally, further research of the reasons for non-referral from rural locations is  
18 be required.  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39

40 Our findings indicate that it is more accurate to describe melanoma epidemiology as different  
41 in inland, rural communities, than what has been previously reported in coastal and  
42 metropolitan regions and Queensland-wide. These differences warrant further investigation,  
43 but appear to arise from being able to gather comprehensive data in rural communities, where  
44 probable differences in sun exposure and protection behaviours contribute to different  
45 subtype and anatomic distributions of melanoma; and the model of health services available  
46 from rural GP finding melanoma earlier and managing them locally.  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

## References

1. Coory M, Ho T, Jordan S. Australia is continuing to make progress against cancer, but the regional and remote disadvantage remains. *Med J Aust* 2013; 199: 605–608.
2. Coory M, Smithers M, Aitken J, Ring I. Urban-rural differences in survival from cutaneous melanoma in Queensland. *Aust NZ J Public Health* 2006; 30: 71-74.
3. AIHW 2017. *Cancer in Australia 2017*. Cancer series no. 101. Cat. No. CAN 100. Canberra: AIHW.
4. Incidence persons 2009-2013. *Cancer incidence and mortality by small geographic areas*. Available at: Australian Institute of Health and Welfare, [www.aihw.gov.au/cancer/](http://www.aihw.gov.au/cancer/) Last accessed 9 January 2019.
5. Australian Institute of Health and Welfare (AIHW) 2017 Australian Cancer Incidence and Mortality (ACIM) books: *Melanoma of the skin*. Canberra: AIHW. Available at: AIHW, [www.aihw.gov.au/acim-books](http://www.aihw.gov.au/acim-books)
6. Buettner P & MacLennan R. Geographic variation of incidence of cutaneous melanoma in Queensland. *Aust J Rural Health* 2008; 16: 267-277.
7. Incidence persons 2009-2013. *Cancer incidence and mortality by small geographic areas. Primary Health Network (PHN)*. Available at: Australian Institute of Health and Welfare, [www.aihw.gov.au/cancer/](http://www.aihw.gov.au/cancer/) Last accessed 9 January 2019.
8. Darling Downs Hospital and Health Service. Queensland Government. Available at: <https://www.health.qld.gov.au/darlingdowns/home> Last viewed 9 January 2019.
9. Whiteman D, Baade P, Olsen C. More people die from thin melanomas than from thick melanomas in Queensland, Australia. *J Investig Dermat* 2015, 135: 1190-1193.
10. Youl P, Youlden D, Baade P. Changes in the site distribution of common melanoma sub-types in Queensland, Australia over time: implications for public health campaigns. *Brit J Dermatol* 2013; 168(1): 136-144.

- 1  
2  
3 11. Whiteman DC, Watt P, Purdie DM *et al.* Melanocytic nevi, solar keratoses, and  
4  
5 divergent pathways to cutaneous melanoma. *J Natl Cancer Inst* 2003; **95**: 806-12.  
6  
7
- 8 12. Anderson WF, Pfeiffer RM, Tucker MA *et al.* Divergent cancer pathways for early-  
9  
10 onset and late- onset cutaneous malignant melanoma. *Cancer* 2009; **115**: 4176-85.  
11
- 12 13. Whiteman D, Stickley M, Watt P, Hughes M, Davis M, Green A. Anatomic site, sun  
13  
14 exposure and risk of cutaneous melanoma. *J Clin Oncol* 2006; 24: 3172-3177.  
15
- 16 14. Sladden M, Neiweg O, Howle J, Coventry B, Thompson J. Updated evidence-based  
17  
18 clinical practice guidelines for the diagnosis and management of melanoma: definitive  
19  
20 excision margins for primary cutaneous melanoma. *Med J Aust* 2018; 208(3): 137-  
21  
22 142.  
23  
24
- 25 15. Green A, Baade P, Coory M, Aitken J, Smither M. Population-based 20-year survival  
26  
27 among people diagnosed with thin melanomas in Queensland, Australia. *J Clin Oncol*  
28  
29 2012; 30(13): 1462-1467.  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

Table 1: Age distribution of patients diagnosed with melanoma

Age group (years)	Darling Downs		Queensland	
	no.	(%) [95% CI]	no.	(%) [95% CI]
<30	4	(1.3) [0.4-3.0]	193	(4.6) [4.0-5.2]
30-39	15	(4.7) [2.8-7.5]	307	(7.3) [6.5-8.1]
40-49	30	(9.5) [6.6-13.1]	534	(12.7) [11.7-13.7]
50-59	43	(13.6) [10.1-17.7]	702	(16.6) [15.5-17.8]
60-69	73	(23.0) [18.6-27.9]	862	(20.4) [19.2-21.7]
70-79	91	(28.7) [23.9-33.9]	994	(23.6) [22.3-24.9]
80+	61	(19.2) [15.2-23.9]	626	(14.8) [13.8-15.9]

Table 2: Anatomical distribution and relative tumour density of melanoma

Melanoma characteristics and relative tumour density <sup>a</sup>	Tumour location <sup>†</sup> and body surface area				Total
	Head and neck 9%	Trunk 32%	Upper limb 19%	Lower limb 40%	
	No. (%) [95% CI]	No. (%) [95% CI]	No. (%) [95% CI]	No. (%) [95% CI]	
<i>No. of melanoma by location:</i>					
Queensland Registry <sup>b</sup>	747 (23.0) [22-24]	1194 (36.7) [35-38]	633 (19.5) [18-21]	679 (20.9) [20-22]	3253
Qld RTD	2.55 [2.44-2.67]	1.15 [1.09-1.19]	1.02 [0.95-1.11]	0.52 [0.05-0.55]	
Darling Downs series	67 (21.1) [17-26]	117 (36.9) [32-42]	82 (25.9) [21-31]	51 (16.1) [12-20]	317
DD RTD	2.35 [1.89-2.88]	1.15 [1.00-1.31]	1.36 [1.11-1.63]	0.40 [0.30-0.050]	
<i>Type of melanoma:</i>					
Superficial Spreading Melanoma	19 (12.8) [8-19]	60 (40.5) [33-49]	39 (26.4) [20-34]	30 (20.3) [14-27]	148
SSM RTD	1.43 [0.89-2.11]	1.27 [1.03-1.53]	1.39 [1.05-1.79]	0.51 [0.35-0.68]	
Lentigo maligna melanoma	35 (36.8) [28-47]	25 (26.3) [18-36]	22 (23.2) [16-32]	13 (13.7) [8-22]	95
LMM RTD	4.09 [3.11-5.22]	0.82 [0.56-1.13]	1.22 [0.84-1.68]	0.34 [0.20-0.55]	
Nodular melanoma	3 (15.8) [4-37]	3 (15.8) [4-37]	11 (57.9) [35-78]	2 (10.5) [2-31]	19
NM RTD	1.75 [0.44-4.11]	0.49 [0.13-1.16]	2.05 [1.84-4.11]	0.26 [0.05-0.78]	
Unspecified/Other	10 (18.2) [10-30]	29 (52.7) [40-66]	10 (18.2) [10-30]	6 (10.9) [5-21]	55

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  
46

Melanoma characteristics and relative tumour density <sup>a</sup>	Tumour location <sup>†</sup> and body surface area				Total
	Head and neck 9%	Trunk 32%	Upper limb 19%	Lower limb 40%	
	No. (%) [95% CI]	No. (%) [95% CI]	No. (%) [95% CI]	No. (%) [95% CI]	
<i>Depth of invasion:</i>					
Depth ≤ 1mm	56 (21.2) [17-27]	103 (39.0) [33-45]	59 (22.3) [18-28]	46 (17.4) [13-22]	264
RTD ≤ 1mm depth	2.36 [1.89-3.00]	1.22 [1.03-1.41]	1.18 [0.95-1.47]	0.44 [0.33-0.55]	
Depth 1.01-2.0mm	5 (27.8) [11-51]	4 (22.2) [8-45]	8 (44.4) [23-67]	1 (5.6) [1-25]	18
RTD 1.01-2.0mm depth	3.09 [1.22-5.67]	0.69 [0.25-1.41]	2.34 [1.21-3.52]	0.14 [0.03-0.63]	
Depth 2.01-4mm	2 (15.4) [3-42]	3 (23.1) [6-51]	7 (53.8) [27-79]	1 (7.7) [1-33]	13
RTD 2.01-4mm depth	1.71 [0.33-4.67]	0.72 [0.19-1.59]	2.83 [1.42-4.16]	0.19 [0.03-0.83]	
Depth >4mm	1 (12.5) [1-48]	0 (0)	5 (62.5) [28-89]	2 (25.0) [4-61]	8
RTD >4mm depth	1.39 [0.11-5.33]	0 [0-0]	3.29 [1.47-4.68]	0.63 [0.10-1.53]	

<sup>a</sup>Calculated as the ratio of the proportion of tumours at a specific anatomical site to the proportion of skin surface area at that site, ratio and [95% CI].

<sup>b</sup>Whiteman D, Baade P, Olsen C (2005).

Abbreviations: RTD, relative tumour density; SSM, Superficial Spreading Melanoma; LM/LMM, Lentigo Maligna/Lentigo Maligna Melanoma; NM, Nodular Melanoma