

# **Differences in rate of complete excision of basal cell carcinoma by dermatologists, plastic surgeons and general practitioners: a large cross-sectional study**

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*Dermatology 2018;234:86-91*

## ABSTRACT

**Background:** Due to the increasing incidence of basal cell carcinoma (BCC) and rising health care costs, health care insurance companies seek ways to shift skin surgery for BCC from secondary to primary care.

**Objectives:** To study the differences in complete excision of BCC by general practitioners (GPs), dermatologists, and plastic surgeons.

**Methods:** A retrospective cross-sectional study of pathology records of 2,986 standard excisions of primary BCCs performed by a GP, dermatologist, or plastic surgeon in the Southwest area of the Netherlands between 2008 and 2014. To compare the risk of an incomplete BCC excision between the specialties, the odds ratio (OR) was used adjusted for patient age, sex, tumour site, size, and histological subtype.

**Results:** BCCs were completely excised by GPs in 70% of the excisions, which was lower than the 93% by dermatologists and 83% by plastic surgeons ( $p < 0.001$ ). Compared to the dermatologist, BCCs which were excised by a GP were six times higher at risk of an incomplete excision (adjusted OR 6, 95% CI 5-8) and two times higher at risk when excised by a plastic surgeon (adjusted OR 2, 95% CI 2-3).

**Conclusion:** BCCs were more often completely excised by dermatologists than by GPs and plastic surgeons. Dermatologists probably perform better because of their extensive training and high experience in BCC care. To minimize incomplete BCC excision, GPs should receive specific training before the shift of BCC care from secondary to primary care is justifiable.

## INTRODUCTION

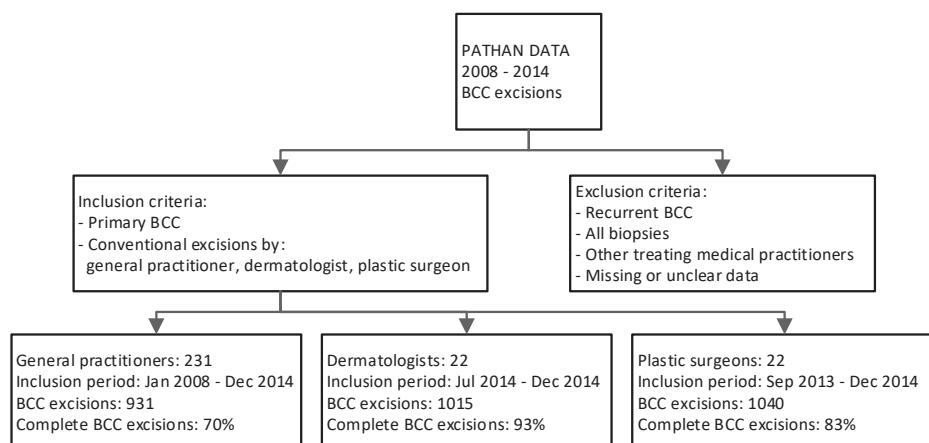
Basal cell carcinoma (BCC) is the most common cancer in the Netherlands. According to the Netherlands Cancer Registry, the BCC incidence rate is about 40,000 per year with an increase of 5% each year.<sup>1</sup> In the Netherlands, patients initially visit a general practitioner (GP) for their skin lesions. The GP decide whether to treat the patient themselves or to refer to a specialist. Although Dutch GPs are not specifically trained in skin tumour care (unlike counterparts in the UK and Australia), they do excise 27% of the benign skin tumours they encounter and 31% of the skin tumours they suspect to be malignant.<sup>2,3</sup> If GPs refer a patient with a skin tumour, this is most often to a dermatologist or plastic surgeon, and less often to an ophthalmologist, general surgeon or ear-nose-and-throat specialist. In the Netherlands, until June 2017, a specific BCC guideline for GPs was lacking, while specialists could refer to their multidisciplinary conducted Dutch BCC guideline since 2002. Adherence to guidelines, however, might vary within and between specialists, which may result in different treatment choices and quality of care. According to the Dutch BCC guideline, the first choice of treatment for BCC is a standard excision, with a clinical tumour free excision margin of 3 mm for nonaggressive BCC subtypes (i.e., nodular and superficial) < 2 cm and a 5 mm margin for larger BCCs or BCCs with an aggressive histological subtype (i.e., infiltrative or micronodular).<sup>4</sup> Incompletely excised BCCs need re-excision to prevent recurrence, as recurrent BCCs can be more aggressive and therefore more difficult to treat, leading to impaired functional and cosmetic outcome for patients and higher costs for society.

Health insurance companies and governments worldwide promote a shift of minor skin surgery from secondary to primary care in order to reduce health care costs.<sup>5-7</sup> Accordingly, the Dutch Collaborating Centre of the WHO promotes a shift of BCC care, even though it is unknown whether the quality of BCC care among GPs is sufficient compared to medical specialists. The quality of BCC care among GPs and medical specialists needs to be carefully assessed, as quality of care should not be compromised in order to reduce costs. One of the indicators for the quality of BCC care is the rate of completely excised BCCs. This retrospective cross-sectional study of pathology records compared the rate of completely excised BCCs between GPs, dermatologists, and plastic surgeons in the Netherlands.

## METHODS

For this retrospective cross-sectional study we analysed all pathology records of standard excisions of primary BCCs performed by a GP, dermatologist or plastic surgeon in the Southwest area of the Netherlands between 2008 and 2014 (Figure 1). Pathology

records were extracted from PATHAN. PATHAN is a regional pathology laboratory that serves GPs and secondary care hospitals in the Southwest area of the Netherlands. To identify all records of excisions of primary BCCs in PATHAN, an algorithm was used with a filter on the diagnosis according to the Systematized Nomenclature of Medicine (SNOMED) classification which is implemented in the Dutch Pathology Database system (PALGA). Pathology records were included from the 31<sup>st</sup> of December 2014 and consecutively backwards until enough cases per specialty were included. The length of inclusion period differed per specialty, due to the different excision frequencies per year per specialty. The different lengths of inclusion period per specialty were accepted because the Dutch BCC guidelines did not change during the entire study period. Pathology records were excluded if they concerned surgical techniques other than standard excision (e.g. shave excision or Mohs micrographic surgery) or if the data of interest were missing (see the studied variables below). The following variables were extracted from the pathology records: physician (i.e. GP, dermatologist or plastic surgeon), histological conclusion on tumour free margins (complete or incomplete BCC excision), tumour site (i.e. head and neck, trunk or limbs), histological subtype [i.e. nodular, superficial, infiltrative (including micronodular), nonaggressive mixed subtypes (i.e. mixed nodular and superficial subtypes) or aggressive mixed subtypes (i.e. nodular and or superficial mixed with infiltrative subtypes)] and specimen size (i.e.  $\leq$  or  $>$  2.5 cm in shortest dimension). Specimen size was used as a proxy of tumour size because the tumour size was missing in the majority of records. To correct for the assumed surgical excision margin and tumour shrinkage, specimen size was categorized in  $\leq$  or  $>$  2.5 cm in shortest dimension as a proxy of small ( $\leq$  2 cm) and large ( $>$  2 cm) BCCs.<sup>4</sup>



**Figure 1.** Flowchart of material and methods.

BCC, basal cell carcinoma; PATHAN, regional pathology laboratory that serves general practitioners and secondary care hospitals in the Southwest area of the Netherlands.

## Study outcomes

The primary outcome of this study was the proportion and the likelihood of complete excisions by GPs, dermatologists and plastic surgeons. The secondary outcomes were the proportion of complete excisions per specialty, per site and per histological subtype.

## Histological assessment

All specimens were assessed postoperatively by pathologists for tumour free margins using the bread loaf technique after histochemical staining with haematoxylin and eosin. Because of the retrospective design of this study, pathologists were not blinded for the operating physician.

## Statistical analysis

The power calculation showed that 974 BCC excisions per specialty were needed to assess whether there was a difference between GPs, dermatologists and plastic surgeons in proportions of complete BCC excisions. Oneway ANOVA, Pearson Chi-Square test and Fisher's exact test were used to determine if there were differences between the specialties in patient and tumour characteristics. The significance level was 0.0125 (Bonferroni correction for multiple testing, power 80%). Comparison of the risk of an incomplete BCC excision between GPs, dermatologist and plastic surgeons was assessed with univariable and multivariable logistic regression models adjusted for patients' age, sex, tumour site, tumour size and histological subtype.

The sample size was calculated with the statistical program R version 3.1.1. (<http://Rproject.org>) and the statistical analyses were performed with SPSS for Windows version 21 (SPSS, Chicago, IL, USA). The study was conducted and reported according to the STROBE guidelines for cross-sectional studies. The Medical Ethical Committee of the Erasmus University Medical Center Rotterdam approved the study protocol (reference number NL52923.078.15).

## RESULTS

In total 2,986 pathology records of BCC excisions were included. The patients' median age was 69 years (SD 13 years), and 52% were men. Of the 2,986 BCCs, 931 were excised by a GP (n = 231) in a period of six years, 1,015 by a dermatologist (n = 22) in a period of six months, and 1,040 by a plastic surgeon (n = 22) in a period of 15 months (Table 1).

Overall, BCCs were completely excised in 82% (2,462/2,986) (Table 1). BCCs were completely excised by GPs in 70% (649/931), which was lower than the 93% (946/1,015) by

**Table 1.** A comparison of patient characteristics and number of complete basal cell carcinoma excisions between specialties, with subdivisions per site and histopathological subtype.

	GP n (%)	DE n (%)	PS n (%)	GP, DE, PS n (%)	GP, DE, PS P-value	GP vs DE P-value	PS vs DE P-value
Excisions, n	931	1015	1040	2986			
Physicians, n	231	22	22	275			
Patients							
Age yr (mean SD)	67 (13)	70 (12)	69 (14)	69 (13)	<0.001		
Men	468 (50)	608 (60)	469 (45)	1545 (52)	<0.001	<0.001	<0.001
Complete excisions	649 (70)	946 (93)	867 (83)	2462 (82)	<0.001	<0.001	<0.001
Per site							
Head/neck	173 (56)	414 (89)	638 (80)	1225 (78)	<0.001	<0.001	<0.001
Trunk	299 (78)	356 (97)	126 (93)	781 (88)	<0.001	<0.001	.062
Limbs	177 (74)	176 (96)	103 (95)	458 (86)	<0.001	<0.001	.501
Per subtype							
Nodular	305 (73)	441 (96)	386 (89)	1132 (86)	<0.001	<0.001	<0.001
Superficial	129 (81)	212 (94)	102 (92)	443 (90)	<0.001	<0.001	.417
Infiltrative	33 (45)	49 (88)	79 (69)	161 (66)	<0.001	<0.001	.008
Mixed nonaggr <sup>a</sup>	58 (67)	90 (90)	58 (74)	206 (78)	.001	<0.001	.006
Mixed aggr <sup>b</sup>	124 (64)	154 (89)	242 (80)	520 (78)	<0.001	<0.001	.015
Per site/per subtype							
Head/neck							
Nodular	112 (65)	238 (93)	323 (87)	673 (84)	<0.001	<0.001	.022
Superficial	3 (50)	31 (89)	28 (80)	62 (82)	.075		
Infiltrative	9 (24)	28 (82)	65 (65)	102 (59)	<0.001	<0.001	.058
Mixed nonaggr <sup>a</sup>	6 (38)	32 (87)	35 (69)	73 (70)	.002	<0.001	.052
Mixed aggr <sup>b</sup>	43 (56)	85 (83)	187 (78)	315 (75)	<0.001	<0.001	.334
Trunk							
Nodular	143 (82)	143 (99)	34 (97)	320 (90)	<0.001	<0.001	.275
Superficial	62 (83)	134 (97)	44 (98)	240 (93)	<0.001	<0.001	.809
Infiltrative	19 (79)	15 (94)	8 (100)	42 (87)	.198		
Mixed nonaggr <sup>a</sup>	27 (68)	31 (86)	14 (88)	72 (78)	.089		
Mixed aggr <sup>b</sup>	48 (69)	33 (100)	26 (84)	107 (80)	.001	<0.001	.016
Limbs							
Nodular	50 (69)	60 (98)	29 (97)	139 (85)	<0.001	<0.001	.604
Superficial	64 (82)	47 (90)	30 (97)	141 (88)	.083		
Infiltrative	5 (46)	6 (100)	6 (86)	17 (71)	.036		
Mixed nonaggr <sup>a</sup>	25 (83)	27 (100)	9 (82)	61 (90)	.076		
Mixed aggr <sup>b</sup>	33 (70)	36 (97)	29 (97)	98 (86)	<0.001	.001	.880

Percentage were rounded.

aggr, aggressive; DE, dermatologist; GP, general practitioner; n, number; nonaggr, nonaggressive; PS, plastic surgeon; SD, standard deviation; yr, years.

<sup>a</sup> Mixed nonaggressive basal cell carcinoma were superficial with nodular (n = 264).

<sup>b</sup> Mixed aggressive basal cell carcinoma were: superficial with infiltrative (n = 48), superficial with nodular and infiltrative (n = 67), nodular with infiltrative (n = 544), and infiltrative with micronodular (n = 9).

**Table 2.** Risk of incomplete basal cell carcinoma excision between specialties, adjusted for tumour and patient characteristics.

	Univariable OR (95% CI) for incomplete BCC excision	P-value	Multivariable OR (95% CI) for incomplete BCC excision	P-value
Patients				
Men	1.00			
Women	1.1 (0.9-1.4)	.207	1.0 (0.8-1.2)	.768
Age (for a difference of 1 yr)	1.0 (1.0-1.0)	.074	1.0 (1.0-1.0)	.069
Physicians				
Dermatologist	1.00			
General Practitioner	6.0 (4.5-7.9)	<.0001	6.2 (4.6-8.4)	<.0001
Plastic surgeon	2.7 (2.0-3.7)	<.0001	2.0 (1.5-2.7)	<.0001
BCC characteristics				
Trunk	1.00	<.0001	2.7 (2.0-3.6)	<.0001
Head/neck	2.1 (1.7-2.7)	.248	1.1 (0.8-1.5)	.605
Limbs	1.2 (0.9-1.7)	<.0001	0.4 (0.3-0.5)	<.0001
Size ≤ 2.5 cm	1.00	0.055	1.3 (0.9-1.9)	.146
Size > 2.5 cm	0.3 (0.2-0.4)	<.0001	3.4 (2.4-4.7)	<.0001
Nodular	1.00	<.001	2.6 (1.8-3.7)	<.0001
Superficial	0.7 (0.5-1.0)	<.0001	2.0 (1.6-2.6)	<.0001
Infiltrative	3.2 (2.4-4.3)			
Mixed nonaggressive <sup>a</sup>	1.7 (1.3-2.4)			
Mixed aggressive <sup>b</sup>	1.8 (1.4-2.2)			

Percentages were rounded.

BCC, basal cell carcinoma; CI, confidence interval; OR, odds ratio; yr, year.

<sup>a</sup> Mixed nonaggressive basal cell carcinoma were superficial with nodular (n = 264).

<sup>b</sup> Mixed aggressive basal cell carcinoma were: superficial with infiltrative(n = 48), superficial with nodular and infiltrative (n = 67), nodular with infiltrative (n = 544), and infiltrative with micronodular (n = 9).

dermatologists and 83% (867/1,040) by plastic surgeons ( $p < 0.001$ ). Compared to the dermatologist, BCCs which were excised by a GP were six times higher at risk of an incomplete excision (adjusted OR 6, 95% CI 5-8) and two times higher at risk when excised by a plastic surgeon (adjusted OR 2, 95% CI 2-3) ( $p < 0.0001$ ) (Table 2). The risk of an incomplete excision was higher for small BCCs (adjusted OR 0.4, 95% CI 0.3-0.5,  $p < 0.0001$ ). The risk of an incomplete BCC excision was not increased by patients' age or sex.

### BCCs of the head and neck

BCCs of the head and neck were completely excised in 78% of the excisions, which was lower than the 88% of completely excised BCCs of the trunk and 86% of the limbs (Table 1). The risk of an incomplete excision was higher for BCCs of the head and neck

than for BCCs of the trunk and limbs (adjusted OR 3, 95% CI 2-4) ( $p < 0.0001$ ) (Table 2). BCCs of the head and neck were completely excised by GPs in 56% of the excisions, which was lower than the 89% for dermatologists and 80% for plastic surgeons (Table 1). For the complete excision of a BCC of the head and neck, dermatologists performed better than GPs and plastic surgeons ( $p < 0.001$ ). When BCCs of the head and neck were subdivided per histological subtype, GPs still showed the lowest proportion of complete excisions when compared to the dermatologists ( $p < 0.001$  for each subtype), while differences between dermatologists and plastic surgeons were not significant ( $p > 0.0125$ ).

### **BCCs with an infiltrative or mixed histological subtype**

Infiltrative BCCs were completely excised in 66% of the excisions, which was lower than the 86% of nodular, 90% of superficial, 78% of mixed nonaggressive, and 78% of mixed aggressive BCCs ( $p < 0.001$ ) (Table 1). The risk of an incomplete excision was higher for BCCs with the following histological subtypes: infiltrative (adjusted OR 3, 95% CI 2-5), mixed nonaggressive (adjusted OR 3, 95% CI 2-4) and mixed aggressive (adjusted OR 2, 95% CI 2-3) ( $p < 0.0001$ ). Infiltrative BCCs were completely excised by GPs in 45% of the excisions, which was lower than the 88% for dermatologists, and 69% for plastic surgeons. For the complete excision of an infiltrative BCC, dermatologists performed better than GPs and plastic surgeons ( $p < 0.0125$ ). For both mixed nonaggressive and mixed aggressive subtypes, GPs had the lowest proportions of completely excised BCCs when compared to dermatologists and plastic surgeons. For the complete excision of mixed nonaggressive and mixed aggressive subtypes, dermatologists performed better than GPs ( $p < 0.001$ ).

## **DISCUSSION**

This retrospective cross-sectional study of 2,986 pathology records from a Dutch regional laboratory, showed that primary BCCs were more often completely excised by a dermatologist (93%) than by a GP (70%) or plastic surgeon (83%). Compared to the dermatologist, BCCs which were excised by a GP were six times higher at risk of an incomplete excision (adjusted OR 6, 95% CI 5-8) and two times higher at risk when excised by a plastic surgeon (adjusted OR 2, 95% CI 2-3) ( $p < 0.0001$ ).

Previous studies found similar proportions of complete BCC excisions; however, these studies lack a sample size calculation, subgroup analyses per tumour site and histological subtype and logistic regressions.<sup>8-11</sup> Dermatologists probably excise BCC more often complete than GPs and plastic surgeons because dermatologists are specifically trained in BCC care during their five years of specialization and dermatologists are more expe-

rienced in BCC care due to the high case load in their daily practice. This might result in better clinical skills among dermatologists in recognizing skin lesions as suspected for BCC, and in demarcating the tumour preoperatively. Both skills contribute to the success of a complete BCC excision.

The risk of an incomplete excision was found higher for BCCs of the head and neck than for BCCs of the trunk and limbs (adjusted OR 3, 95% CI 2-4) ( $p < 0.0001$ ), irrespectively of the specialist who performed the excision. First, this could be explained because BCCs of the H-zone are known to grow more aggressively. Second, physicians might narrow their excision margins for BCCs of the head and neck to preserve functional and cosmetic outcome.

The risk of an incomplete excision was found to be higher for BCCs with an infiltrative or mixed histological subtype than for nodular or superficial BCCs. Smeets et al. showed that excisions with a clinical tumour free margin of 3 mm for primary facial BCCs with an infiltrative histological subtype were more often incomplete (25%) than other subtypes (12%,  $p < 0.05$ ).<sup>12</sup> These findings suggest that preoperative histological subtype determination might be useful to indicate when wider clinical tumour free excision margins are needed. Although in one out of six BCCs the most aggressive growth pattern is missed by the preoperative biopsy (i.e., sampling error), a biopsy was shown to be more sensitive and more specific than the clinical diagnosis on the histological subtype.<sup>13,14</sup> Remarkably, the risk of an incomplete excision was found higher for small BCCs (i.e.  $\leq 2$  cm). The clinical demarcation of a small BCC might be more difficult due to scar formation after a preoperative biopsy.

Strengths of this study are: the comparative design, the large sample size, analysis per tumour site and histological subtype. This study was limited to a retrospective design which implicated selection bias between the specialties. Therefore, risk of an incomplete BCC excision between the specialties was adjusted for BCC site, specimen size, histological subtype, patients' age and sex. But due to missing data, BCC localization in the H-zone and exact clinical tumour size could not be specified. Also, it was unknown whether the BCC diagnosis was confirmed histologically prior to the excision and which excision margins were used. The real proportion of completely excised BCCs was overestimated in all groups due to missing tumour on the histological margins by applying the bread loaf technique.

In conclusion, this study shows that primary BCCs were more often completely excised by dermatologists than by GPs and plastic surgeons. Among GPs, complete excisions were specifically low for BCCs of the head and neck and BCCs with an infiltrative subtype.

Dermatologists probably perform better because of their extensive training and high experience in BCC care. Before a shift of BCC care from secondary to primary care, there is a strong need for an integrated care pathway, including adequate training for GPs.

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