



# Doctors educated in Bodø – who are they and where do they work?

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## ORIGINAL ARTICLE

### ÅSA LANGEN WESTLIE

Paediatric department  
Nordland Hospital Trust, Bodø

She has contributed to the analysis of the questionnaire data and collection of follow-up data, classification of the results and the drafting of the article.

Åsa Langen Westlie is a specialty registrar.

The author has completed the ICMJE form and declares no conflicts of interest.

### MARGRETE GASKI

Norwegian Centre for Rural Medicine  
UiT The Arctic University of Norway, Tromsø

She has contributed to the analysis of the data and the drafting of the article.

Margrete Gaski, PhD in health sciences, MSc in political science and Researcher I.

The author has completed the ICMJE form and declares no conflicts of interest.

### BIRGIT ABELSEN

Norwegian Centre for Rural Medicine  
UiT The Arctic University of Norway, Tromsø  
and

Department of Community Medicine  
UiT The Arctic University of Norway, Tromsø

She has contributed to the analysis of the data and the drafting of the article.

Birgit Abelsen, PhD in health sciences, MSc in statistics and MSc in public health. She is head of research and a professor.

The author has completed the ICMJE form and declares no conflicts of interest.

### HILDE GRIMSTAD

Faculty of Medicine and Health Sciences  
NTNU – Norwegian University of Science and Technology

She has contributed to the analysis of the data and the drafting of the article.

Hilde Grimstad, professor of general practice and behavioural medicine. Chair of PLUS (Pedagogical, teaching and learning support) at NTNU. She was vice dean of medical education at the same faculty, headed the Grimstad committee in 2019 and chairs the programme group for medical education in RETHOS (National Curriculum Regulations for Norwegian Health and Welfare Education).

The author has completed the ICMJE form and declares no conflicts of interest.

### EIRIK HUGAAS OFSTAD

eirikofstad@gmail.com  
Department of Medicine

Nordland Hospital Trust, Bodø  
and

Department of Community Medicine

UiT The Arctic University of Norway, Tromsø

He contributed the research idea, collected questionnaire data, participated in the collection of follow-up data and analysis of the material as well as the drafting of the article.

Eirik Hugaas Ofstad, PhD, specialist in emergency medicine and pre-hospital care and in general internal medicine. He is department head in the emergency department and observation post, associate professor and local head of studies for the Bodø model.

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## BACKGROUND

Every year since 2009, up to 24 medical students at UiT The Arctic University of Norway have undertaken the last two years of their undergraduate medical education in Bodø (referred to as the Bodø model). We mapped the municipalities where the students had grown up, their preferences as to future specialties, where they worked and what they worked with after Part 1 of their specialist training.

## MATERIAL AND METHOD

Medical students who graduated from the Bodø model in the period 2012–18 completed a questionnaire in the first week of their sixth year of study, containing questions about where they had grown up and their preferences for future place of work and specialty. We mapped their place of work and specialty as of January 2021 as well as that of the two cohorts graduating in 2010–11. The place where the latter had grown up was mapped via direct contact, contact with their cohort or open internet sources. The covariation between where they grew up and their place of work, specialty preferences and choice of specialty were analysed using chi-square tests and logistic regression.

## RESULTS

Out of a total of 146 doctors, 91 of whom were women (62.3%), who had completed their undergraduate medical education under the Bodø model as well as Part 1 of their specialist training, 40 (27.4%) had grown up in Bodø municipality and for 56 (38.4%) this was their place of work. For the remainder of the county of Nordland, the corresponding figures were 54 (37.0%) and 38 (26.0%), for Troms og Finnmark 23 (15.8) and 19 (13%) and for the remainder of Norway 29 (19.9%) and 33 (22.6%). A total of 51 (34.9%) worked as GPs, of whom 34 (66.7%) worked in rural municipalities. There was a higher probability of working in a rural area if the doctor had grown up in a rural community (odds ratio (OR) 3.0 (95% CI 1.5 to 6.1)) and of working in general medicine if this had been their preference as a student (OR 3.7 (95% CI 1.8 to 7.6)).

## INTERPRETATION

The Bodø model has mainly attracted students with an affiliation to the region. At the time of the survey, a large percentage of the graduates who took part of their undergraduate medical education in Bodø worked at the Nordland Hospital in Bodø and in general practice, particularly in rural municipalities.

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## MAIN FINDINGS

Students who chose the decentralised programme of undergraduate medical education in Bodø generally had a strong affiliation to the region.

The Bodø model has given Bodø and the remainder of Norway south of Nordland a net increase in the number of doctors.

A total of 51 (35%) undergraduate students in the Bodø model became general practitioners, and 34 (67%) of these worked in rural municipalities.

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The 2019 report of the Grimstad committee concluded that medical education capacity in Norway was too low and recommended increasing it by 440 medical students annually (1). Offering medical studies at more health institutions was proposed as a strategy for increasing the number of students.

Studies of decentralised programmes of medical education in Canada, the United States and Australia show that where a student grew up, specialty preferences and a desire to work in rural areas prior to the start of their studies are decisive factors for recruitment to rural areas when they have completed their studies (2–5). Two important predictors were rural background and an expressed preference to work as a general practitioner at the start of their studies (6).

Wesnes et al. found that in Norway, place of study is associated with choice of specialty, particularly in the case of general practice (7). Aaraas et al. showed that more than half the medical graduates from UiT The Arctic University of Norway in the period 1979–2012 were still working in Northern Norway in 2013 (8). Gaski et al. found that as of 2013, over half of the GPs working in Northern Norway had been educated in Tromsø (9). The same applied to doctors working at the University Hospital of North Norway. To the best of our knowledge, there are no European studies that compare where medical graduates grew up, their specialty preferences and desire to work in rural areas with the place of work and specialties that were actually chosen.

UiT The Arctic University of Norway decentralised the sixth year of its undergraduate medical education programme to Bodø as of autumn 2009 (10). The reason was that there was a lack of capacity for practical clinical training at the University Hospital of North Norway in Tromsø (11). In Bodø, good access to patients, and smaller groups with a maximum of six students, could be offered. The fifth year (four months of practice in hospitals, two months of general practice and three months on the master's degree thesis) had already been decentralised to all hospitals in Northern Norway, including Bodø.

The decentralised programme of undergraduate medical education in Bodø – the Bodø model – was to follow the same curriculum as the students in Tromsø. The first cohort graduated in spring 2010.

Who are the doctors who completed their studies via the Bodø model and where have they chosen to work? In our study, we wanted to examine the associations between the municipality where they grew up, specialty preferences, current place of work and choice of specialty among those who completed their fifth and sixth year of undergraduate medical education in Bodø.

## Material and method

In the period 2010–21, 216 doctors graduated from UiT The Arctic University of Norway via the decentralised Bodø model. The study was based on the 146 doctors who graduated in the period 2010–18 and who had thus completed the first year of their specialist training (Part 1, previously known as internship) at the time of the survey. All graduates had chosen the Bodø model through voluntary enrolment in the first year of their undergraduate medical education (first come, first served principle with a waiting list if needed).

### QUESTIONNAIRE

In the period 2011–17, a questionnaire was distributed to all final year students affiliated with the Bodø model who participated in a study excursion in the first week of their final year of study (N = 127, graduated 2012–18). In the questionnaire, students were asked their name, where they came from, age and what specialty they were most interested in (three possible free text responses in ranked order, see the Appendix). We asked the students to estimate the probability of them becoming a general practitioner (GP) as a percentage (in

free text 0–100 %). If they consented to being contacted for a follow-up qualitative study, they were asked to give their contact details. A total of 120 out of 127 (94.5 %) answered the questionnaire and 117 out of 120 (97.5 %) supplied their contact details.

#### FOLLOW-UP DATA

The process of mapping the place of work and specialty of the graduates in the period 2012–18 who had answered the questionnaire was commenced by the first author in 2018, as part of a qualitative study. In the questionnaire responses, 120 of the 127 students gave information about where they had grown up. In winter 2020/21, the place of work and where the student had grown up were mapped for the 19 students who had graduated in 2010–11 and who did not receive a questionnaire in their final year of study, as well as for the seven who had not answered the questionnaire and the three who had not supplied contact details. This was achieved with the help of contact persons in their cohort or through internet searches of publicly available information. In most cases, it resulted in direct contact with the former students. The mapping of place of work for all students who had graduated in 2010–18 was updated and completed in winter 2020/21 by the first and last authors. The place of work as of January 2021 was used in the analyses.

#### ANALYSES

For the 146 doctors who graduated in 2010–18 and who had completed the first year of the specialist training, we had a complete dataset covering where they grew up and their place of work. In addition, for 120 out of the 146 (82.2 %), we had questionnaire data on specialty preferences and their estimated probability of becoming a GP.

The centrality of the municipality where they had grown up and the municipality where they worked was categorised using Statistics Norway's six centrality indices as of 2020 (12). Municipalities with a centrality level of 1–3 were categorised as urban in the analyses, while those with a centrality level of from 4–6 were categorised as rural municipalities. Municipalities where the students had grown up and the municipalities where they now worked were categorised according to distance from the place of study, under the categories Bodø, the remainder of Nordland, Troms og Finnmark and the remainder of Norway (referred to from now on as area where they grew up and area where they worked).

Specialties were grouped into ten categories: general practice (including nursing home medicine, community medicine and municipal GP services), paraclinical disciplines (including radiology, clinical chemistry, pathology and microbiology), internal medicine (all internal medicine specialties, oncology, neurology and physical medicine and rehabilitation), surgery (all surgical specialties, orthopaedics), psychiatry (including child and adolescent psychiatry), anaesthesiology, gynaecology/obstetrics, paediatrics, ophthalmology and otorhinolaryngology.

Gender, age, municipality where they grew up, current specialty and work municipality as well as the specialty preference in the sixth year of study are presented descriptively. The covariation between the municipality where they grew up and the work municipality as well as specialty and specialty preferences were analysed using cross tabulation, chi-squared tests and logistic regression in IBM SPSS Statistics 27. The study was evaluated and approved in 2017 by the data protection officer for research (Norwegian Centre for Research Data, project number 56910) and the data protection officer at Nordland Hospital.

## Results

As of January 2021, 146 doctors educated under the Bodø model (graduated 2010–18) had completed their first year of specialist training (from 1–9 years previously) and had chosen their place of work and specialty (Table 1). Of these, 91 (62.3 %) were women, and average age on completion of undergraduate medical education was 27.7 years (women 27.2 years, range of distribution 24–33 years; men 28.5, range of distribution 24–42 years).

**Table 1**

Distribution by gender and age, municipality where they grew up and place of work as of January 2021 categorised by health service level, centrality and distance to place of study for doctors who graduated in Bodø from 2010–18 and who have completed their first year of specialist training.

Variable	Total (%)
All	146 (100)
Gender	
Male	55 (37.7)
Female	91 (62.3)
Age (years)	
23–25	58 (39.7)
26–30	78 (53.5)
30–41	10 (6.8)
Place of work in health service	
Hospital	93 (63.7)
General practice	51 (34.9)
Other	2 (1.4)
Centrality of municipality where they grew up	
Urban (Statistics Norway's Centrality Index 1–3)	72 (49.3)
Rural (Statistics Norway's Centrality Index 4–6)	74 (50.7)
Centrality of work municipality	
Urban (Statistics Norway's Centrality Index 1–3)	91 (62.3)
Rural (Statistics Norway's Centrality Index 4–6)	55 (37.7)
Place where they grew up	
Bodø	40 (27.4)
Remainder of county of Nordland	54 (37.0)
Troms og Finnmark	23 (15.8)
Remainder of Norway	29 (19.9)
Area where they work	
Bodø	56 (38.4)
Remainder of county of Nordland	38 (26.0)
Troms og Finnmark	19 (13.0)
Remainder of Norway	33 (22.6)

Forty (27.4%) had grown up in the municipality of Bodø and 56 (38.4%) were currently working there. For the remainder of Nordland, the corresponding figures were 54 (37.0%) and 38 (26.0%), for Troms og Finnmark 23 (15.8%) and 19 (13.0%). For the remainder of Norway, the corresponding figures were 29 (19.9%) and 33 (22.6%). A total of 54 (36.9%) of the doctors worked in the municipality where they had grown up, while 82 (56.2%) worked in the area where they had grown up (Table 2).

**Table 2**

Area where they work and area where they grew up for doctors who graduated in Bodø in the period 2010–18 (N = 146). Data are presented as a percentage (%). Text in bold/diagonal line in the table = correlation between the area where they work and the area where they grew up. Non-bold text = no correlation between the area where they work and the area where they grew up.

Area where they work	Place where they grew up				Total
	Bodø	Remainder of Nordland	Troms og Finnmark	Remainder of Norway	
Bodø	<b>29 (19.9)</b>	21 (14.4)	1 (0.8)	5 (3.4)	56 (38.4)
Remainder of Nordland	7 (4.8)	<b>23 (15.8)</b>	3 (2.0)	5 (3.4)	38 (26.0)
Troms og Finnmark	0 (0.0)	5 (3.4)	<b>12 (8.2)</b>	2 (1.4)	19 (13.0)
Remainder of Norway	4 (2.7)	5 (3.4)	7 (4.8)	<b>17 (11.6)</b>	33 (22.6)
	40 (27.4)	54 (37.0)	23 (15.8)	29 (19.9)	146 (100.0)

The Bodø area and the remainder of Norway employed more doctors than the number of students they originally contributed through the Bodø model. For example, 56 graduates from the Bodø model worked in Bodø, but only 40 had grown up there. Fewer doctors returned to work in the remainder of Nordland and Troms og Finnmark compared with the number of students the area contributed through the Bodø model. There was a statistically significant correlation between the area where they worked and the place where they had grown up ( $p < 0.001$ ).

A total of 69 doctors (47.3%) worked in a municipality with the same level of centrality as the municipality where they grew up (Table 3), 23 (15.8%) worked in a less central municipality while 42 (28.8%) worked in a more central municipality. The correlation between the centrality of the work municipality and the municipality where they grew up was statistically significant ( $p < 0.001$ ). The odds ratio (OR) adjusted for gender and age for doctors working in rural areas was 3.5 (95% CI 1.7 to 7.3), i.e. more than three times higher if the doctor had grown up in a rural area compared with not growing up in a rural area.

**Table 3**

Geographical area where they work and area where they grew up by centrality among doctors educated via the Bodø model in the period 2010–18 (N = 146). The data are given as a percentage (%). Text in bold/diagonal line in the table = correlation between the area where

they work and the area where they grew up by centrality. Non-bold text = no correlation between the area where they work and the area where they grew up by centrality. Centrality was categorised using Statistics Norway's centrality indices (16), where level 1 includes the most central municipalities, level 2 the next most central, level 3 medium central 1, level 4 medium central 2, level 5 next least central, and level 6 the least central municipalities.

Centrality of area where they work	Centrality of area where they grew up						Total
	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	
Level 1	<b>3 (2.1)</b>	1 (0.7)	6 (4.1)	0 (0.0)	0 (0.0)	1 (0.7)	11 (7.5)
Level 2	1 (0.7)	<b>1 (0.7)</b>	1 (0.7)	0 (0.0)	2 (1.4)	4 (2.7)	9 (6.2)
Level 3	1 (0.7)	1 (0.7)	<b>39 (26.7)</b>	7 (4.8)	11 (7.5)	12 (8.2)	71 (48.6)
Level 4	0 (0.0)	1 (0.7)	7 (4.8)	<b>11 (7.5)</b>	0 (0.0)	3 (2.1)	22 (15.1)
Level 5	2 (1.4)	2 (1.4)	4 (2.7)	2 (1.4)	<b>10 (6.8)</b>	6 (4.1)	26 (17.8)
Level 6	1 (0.7)	0 (0.0)	1 (0.7)	0 (0.0)	1 (0.7)	<b>4 (2.7)</b>	7 (4.8)
	8 (5.5)	6 (4.1)	58 (39.7)	20 (13.7)	24 (16.4)	30 (20.5)	146 (100.0)

At the time of the survey, 93 doctors (63.7 %) worked in hospitals. A total of 23 of these (25.3 %) worked in the field of internal medicine and 18 (19.8 %) in the field of surgery, while 15 (16.5 %) worked in the field of psychiatry, 11 (12.1 %) in the field of anaesthesia, 9 (9.9 %) in the paraclinical disciplines, 8 (8.8 %) in gynaecology and obstetrics, 6 (6.6 %) in paediatrics and 3 (3.3 %) in ophthalmology. A total of 48 (52.7 %) worked at the Nordland Hospital in Bodø, 1 (1.1 %) at the Nordland Hospital in Lofoten, 15 (16.5 %) at the Helgeland Hospital (10 of whom (66.7 %) worked at Sandnessjøen), 8 (8.8 %) worked at the University Hospital of North Norway (UNN) Tromsø, 2 (2.2 %) worked at UNN Harstad, 1 (1.1 %) at UNN Narvik and 1 (1.1 %) at Finnmark Hospital in Kirkenes. The remaining 17 (18.7 %) hospital doctors worked in different health trusts throughout Norway.

A total of 51 doctors (34.9 %) worked in the primary healthcare service, either solely as GPs or in combination with nursing home or municipal positions. Of the doctors in the primary healthcare service, 8 (15.7 %) worked in Bodø, 21 (41.2 %) in the remainder of Nordland, 8 (15.7 %) in Troms og Finnmark and 14 (27.5 %) in the remainder of Norway. A total of 13 (25.5 %) worked in municipalities with centrality level 3 (equivalent to Bodø and Tromsø), while 34 (66.7 %) worked in less central municipalities (centrality level 4 or lower). Two out of the 146 (1.3 %) doctors did not work in either a hospital or in general practice.

In answer to the question on the probability of working in general practice, the average estimate was 46 %, and 30 of the students (25 %) answered 50 % likely, 37 (30 %) answered more than 50 % likely and 38 (25 %) answered 20–49 % likely. Adjusted for gender and age, the odds ratio for working in general practice was 3.7 (95 % CI 1.8 to 7.6) if the doctor answered 50 % or more likely as compared with doctors who answered less than 50 % likely.

Eighty-eight (60.3 %) of the doctors worked in one of the three specialties they had chosen as their preference at the start of the final year of study. Of these, 41 (80.4 %) who became GPs correctly predicted this choice. Those who preferred specialties such as paediatrics,



gynaecology and obstetrics, and surgery also had a high prediction accuracy (80 %, 67 % and 65 % respectively). None of those who worked in psychiatry or as ophthalmologists had chosen this as one of their three preferences.

## Discussion

In the course of its first nine years, the Bodø model has largely attracted medical students from Bodø and the surrounding area and the remainder of Nordland. When following up the 146 doctors who studied in Bodø and had completed the first year of their specialist training and had started on or completed their specialty, we found that the Nordland Hospital in Bodø had retained a considerable number of these (48 doctors), and that recruitment figures were also good at Helgeland Hospital (15 doctors). There was a low intake at the University Hospital of North Norway (8 doctors) and few of the doctors (five) were employed at small hospitals north of Bodø.

A total of 51 (35 %) doctors educated via the Bodø model had chosen general practice as a specialty. In comparison, the percentage working in general practice of those who had graduated in the period 2002–05 from the four Norwegian universities varied between 22 % and 29 % in 2010 (7). With the exception of a few extra days of general practice, some one-day excursions to rural areas organized by general practice teachers and an extended offer of a trial examination in general practice, the Bodø model does no more than the Tromsø model to expose students to general practice.

The Bodø model aids recruitment to general practice in Bodø and the surrounding area and to Nordland as a whole (29 doctors in total). It also helps recruitment to general practice in what Statistics Norway's centrality index categorises as small and medium-sized municipalities. The hospital that trains the doctors has good recruitment figures, as demonstrated by the findings of an earlier Norwegian study (9). Undergraduate medical education in Tromsø have successfully recruited students who have an affiliation to the region partly because of a quota scheme. After twelve years of undergraduate medical education in Bodø, we are also now seeing the same impact in Bodø and the surrounding area and Nordland. It is reasonable to ask whether the doctors who were educated via the Bodø model would have ended up in the same place regardless of the decentralised programme model. Our study cannot answer this question.

The covariation analyses between the municipality where the students grew up and place of work indicate that there is a considerable 'salmon effect' also for doctors educated via the Bodø model – i.e. that students return to the municipality/area where they grew up or to a place with equivalent centrality to their place of origin. This concurs with earlier international (2–6) and national (8,9) studies, and in particular the 1963 study by Bertelsen et al., that showed a clear correlation between doctors' birthplace, place of study and place of work (13).

Nevertheless, we see that many of the graduates who work as hospital doctors at Nordland Hospital in Bodø and as GPs in Bodø and the surrounding area did not grow up in this area. It is not unreasonable to assume that professional and personal bonds can be created through a decentralised model and by exposing students to a local hospital, the primary healthcare service, the town and the surrounding area. This may reduce the risk of moving away from the area after graduation. We need further research on these mechanisms.

Our questionnaire reveals that the desire to become a GP is a predictor of choosing general practice as a specialty. When admitting students to decentralised programmes of undergraduate medical education, countries such as Canada, the United States and Australia place importance on where applicants want to work in the future and their motivation for becoming a GP. Follow-up studies have shown that this method of recruitment produces the desired effect (2–4), (4,14,15). Our study indicates that the



mapping of students' preferences in terms of specialty and centrality can be useful in admissions to decentralised programmes of undergraduate medical education if one of the main objectives is to recruit doctors to rural areas and general practice.

A strength of the study is that we have complete information about the municipality where the doctors grew up, their place of work and the specialty preferences of all doctors who had completed the first year of the specialist training and were in the course of or had completed their specialty at the time of the survey. The response rate for the questionnaire answered by students in the first week of the final year of study was very high (94.5%). Overall, the dataset is limited but includes 82 % of all doctors who have graduated so far in the Bodø model.

A weakness of the study is that the number of years in work after completing the first year of specialist training differs among doctors, and recent graduates only have one year of experience.

For doctors with shorter experience within a specialty, there generally tends to be a higher probability of change in specialty and place of work compared to those who have completed their specialist training and have a permanent post. Another weakness is that we have no control group for comparison.

Our study cannot answer why doctors make the choices they do. Qualitative studies or questionnaires will give us greater insight in this respect. When we have more knowledge of doctors' preferences, we will be better able to design the undergraduate and postgraduate educational programmes in order to satisfy the Norwegian health service's need for doctors, especially where the needs are greatest.

## CONCLUSION

The decentralised undergraduate medical education at UiT The Arctic University of Norway – the Bodø model – has largely attracted students with a regional affiliation. At the time of the survey, a large percentage of students educated via this model worked at Nordland Hospital in Bodø and in general practice, particularly in rural municipalities.

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