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# Lower education and immigrant background are associated with lower participation in a diabetes education program – Insights from adult patients in the Outcomes & Multi-morbidity In Type 2 diabetes cohort (OMIT)

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A R T I C L E I N F O

*Keywords:*
Type 2 diabetes mellitus
Diabetes self-management education and support
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Education

A B S T R A C T

*Objectives:* Diabetes educational programmes should be offered to patients with type 2 diabetes mellitus (T2DM). We assessed the proportion of diabetes educational program participation among adults with T2DM, and its associations with place of residence in Norway, education, and immigrant background.
*Methods:* We identified 28,128 diagnosed with T2DM (2008–2019) in the Outcomes & Multi-morbidity In Type 2 diabetes cohort. To examine associations between sociodemographic factors and participation in diabetes start courses (yes/no), we computed adjusted risk ratios (95% CI) using log-binomial regression.
*Results:* Overall, 18% participated on the diabetes start course, but partaking differed by Norwegian counties (range:12–34%). Individuals with an immigrant background were 29% less likely to participate (RR 0.71, CI 0.65–0.79). Similarly, those with a lower educational level were 23% less likely to participate (RR 0.77, CI 0.72–0.83) than those with the highest education. The association between education and start course participation was not significant in the subgroup of immigrant individuals (RR 0.88 CI 0.70–1.12).
*Conclusions:* We found that diabetes start course participation was overall low, especially in individuals with low education and immigrant background.
*Practice implications:* More efforts are needed to promote diabetes start courses in patients with T2DM.

## 1. Introduction

Type 2 diabetes mellitus (T2DM) constitutes about 90% of the individuals with diabetes worldwide [1]. A healthy lifestyle and optimal management of blood glucose levels and other risk factors can help prevent or delay development of diabetes complications. The American Diabetes Association (ADA) Standards of Medical Care therefore recommends a healthy diet and sufficient physical activity for people with T2DM, in addition to glucose-lowering medications, with non-insulin anti-diabetic drugs most often preferred in the early phases whereas insulin therapy may be added later on if needed [2].

Many people with T2DM have a complex disease status with a high prevalence of various co-morbidities [3,4]. A Dutch cohort study has demonstrated moderate or severe polypharmacy in more than half of those treated in primary or secondary/tertiary care settings [5]. A meta-analysis of randomised controlled trials in people with multi-morbidity reported that physical activity seemed to have a beneficial effect on physical and psychosocial health [6], yet diabetes self-care was considered to be unsatisfactory among people with T2DM [7]. Healthy lifestyle behaviours to prevent or postpone T2DM complications are essential [8], and the ADA guidelines emphasise that individuals with diabetes should participate in diabetes self-management education and support (DSMES) [8]. Systematic reviews of DSMES-studies reported that self-management education was associated

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with improved $HbA_{1c}$ [9,10], another systematic review and meta-analysis reported that DSMES could reduce the all-cause mortality risk in people with T2DM [11].

A diagnosis with T2DM is a key time point of implementing DSMES [12], and in Norway, general practitioners (GPs) should inform all those newly diagnosed about their right to be referred to a free diabetes educational programme, called *diabetes start course* [13]. These group-based courses are organised at Centres for Learning and Mastery, mostly located in hospitals, and last two or three days over a three-week period. The courses intend to provide lifestyle and diabetes related information, as addition to the individual follow-up, and include relevant topics for those recently diagnosed, such as knowledge about diabetes, treatment, risk factors, daily self-management of blood glucose, hypoglycaemia, diet, and physical activity [13,14]. The course has an interdisciplinary approach with lectures by health care providers, in addition to involvement of laypersons who share experiences of living with T2DM [15]. The objectives are to increase the individual's knowledge of diabetes, the treatment and self-management, diet and physical activity and to promote insight into the psychological aspects of living with diabetes. The courses include open discussions and opportunities to ask questions, and travel expenses and accommodation costs of patients if needed are covered at standard terms [14]. A Norwegian study of individuals with T2DM referred from primary care to diabetes start courses [15] found that the mean knowledge level significantly improved and was sustained for at least three months. Moreover, individuals in a group-based T2DM self-management program, reported that sharing experiences and discussing practical issues and coping strategies were essential [16].

However, there seems to be a challenge regarding recruiting all relevant individuals for participation in DSMES. For instance, 86% of individuals with high risk of T2DM invited to attend a lifestyle programme, declined participation [17]. A systematic review reported a multitude of reasons as to why individuals with diabetes declined, and illustrated this in the two broad categories of those who *could not* participate (for instance due to insufficient insurance cover, or costs related to travel to the course venue) and those who *would not* participate (for instance due to perceived low benefit, feelings of having sufficient knowledge already, or for emotional and cultural reasons) [18]. Structural factors could also serve as barriers – GPs might prefer to have the responsibility for patient education themselves, leading to a lower referral rate for start course programmes [19]. A focus group study found that some GPs mainly referred those they considered in need of more extensive support to achieve lifestyle changes [20].

Health care providers should discuss the benefits of DSMES with the individual patient and address potential barriers that could impact their participation after referral [12]. More knowledge about the diverse group of people who have T2DM would benefit health-care providers in addressing such barriers. Socioeconomic status, specifically a low level of education, is associated with higher $HbA_{1c}$ in people with T2DM [21], thus highlighting the importance of developing strategies to stimulate participation in DSMES. Also, there is a need for a better understanding of what might explain the challenges of T2DM in migrant populations from different world regions [22]. The aim of this study was therefore to assess the overall proportion of diabetes start course participation, and to investigate the associations between place of residence, education, and immigrant background with participation among adults with T2DM.

## 2. Methods

### 2.1. Design, study sample and setting

The current study is part of the Outcomes & Multi-morbidity In Type 2 diabetes (OMIT) cohort, which is a national registry-based observational cohort containing various sources of national registry data, including data from the Norwegian Diabetes Register for Adults (NDR-A) and Statistics Norway (SSB) among other sources [23]. All data are individually linked using the national identity number for each person. SSB contains information about the Norwegian population regarding sociodemographic characteristics and immigration [24]. The NDR-A was set up by the Norwegian Organization for Quality Improvement of Laboratory Examinations (Noklus) in 2006 with the aim of improving the quality of care for people with diabetes in hospitals and primary care [25,26]. The physicians in the specialist health service and GPs use electronic medical records to capture and register diabetes-specific patient information, which is sent annually to the NDR-A [25].

The study sample of the current study was derived from the NDR-A. A total of 28,453 cases were registered as having been diagnosed with diabetes in the NDR-A during the period of 2008–2019. Those registered with another type of diabetes other than T2DM were excluded (289 cases), in addition to those younger than 18 years old (36 cases), resulting in a total sample of 28,128 (Fig. 1). The study population was followed until December 31st 2019.

### 2.2. Diabetes start course participation (outcome)

Individual participation (yes/no) in a diabetes start course was the primary outcome and we collected this data from the NDR-A. In the current analyses all visits registered in the NDR-A from the year of diagnosis until December 2019 were searched for registration of start course participation. An individual was defined as having participated if the "Yes"-option occurred at least once. All other individuals were assumed not to have participated. Information about the year of partaking in the diabetes start courses was not available.

### 2.3. Education and immigrant background (exposures)

Information regarding the patients' educational level and immigrant background were derived from SSB. We used the information registered in the year of the individual's T2DM diagnosis, or next available year if the data were missing. Educational level was defined as the highest level of completed education: primary education, high school, or university/college. Immigrant background was defined as having been born outside

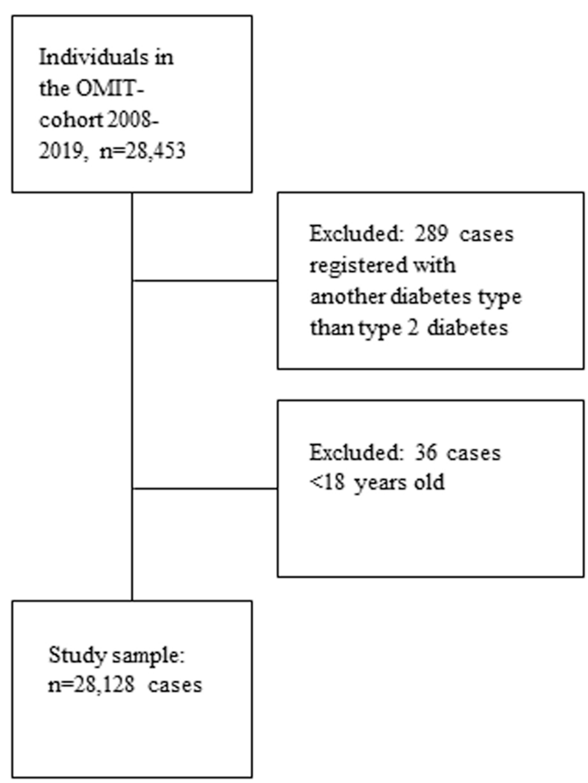


**Fig. 1.** Flow chart of exclusions.

of Norway to two foreign-born parents (n = 2758). Individuals characterised as 'Norwegians' included those: born in Norway by Norwegian-born parents (n = 23,764); born in Norway with two foreign-born parents (n = 79); foreign-born with one Norwegian-born parent (n = 110); Norwegian-born with one foreign-born parent (n = 465) and; foreign-born with two Norwegian-born parents (n = 170). Five cases could not be placed into neither the category 'Immigrant background' nor the 'Norwegian' category due to missing information of immigrant background and were therefore excluded from the analyses.

Information about the individual's country of birth was used to further categorise those with an immigrant background into world regions: Europe (n = 768), the Middle East (n = 507), Africa (n = 393), Asia (n = 982), the USA and South America (n = 108). The two latter were merged because of the small number of cases. In addition, 777 cases in the immigrant group had missing information regarding country of birth and were thus coded under an individual category: 'Unknown country of origin background'.

### 2.4. Other variables

Information on the patients' county of residence at the year of T2DM diagnosis, or closest year, was derived from the NDR-A. We used ISO codes for 19 counties that were valid until 2018. The adjustment variables year of T2DM diagnosis, and age at the time of diagnosis were derived from NDR-A (as a continuous variable). Information about their sex (male, female) and marital status (unmarried, married, divorced/widow(er)) were derived from SSB.

### 2.5. Statistical analysis

The proportions of individuals who had participated in a diabetes start course in the total study sample as well as within each county of residence, were calculated. To examine the associations of educational level and immigrant background with diabetes course participation, we performed log-binomial regression models. The associations were reported by crude and adjusted risk ratios (RR) with 95% confidence intervals (CI) using the highest level of education and the 'Norwegians' as reference categories. In the analyses of education, we adjusted for age, sex, marital status, migrant background, and year of T2DM diagnosis. In the analyses of immigrant background, we adjusted for age, sex, education, and year of T2DM diagnosis. In both analyses, age was included as a continuous quadratic model term due to its non-linear relationship with start course participation.

To examine whether the above-described associations were modified by sex (man, woman) or whether patients were registered in the NDR-A hospital or NDR-A GP (patient type), analyses were repeated by including main and interaction terms of sex and patient type in separate analyses. A formal test for interactions of sex and patient type regarding education and immigrant background was then conducted by comparing the models with and without the interaction terms using likelihood ratio tests. The analyses showed no significant difference between models ($P > 0.05$) in either the crude or fully adjusted regression analyses, indicating no important effect modification by sex or patient type. The results were, therefore, not presented across categories of sex and patient type.

When investigating the association between educational level and diabetes start course participation, we adjusted for immigrant background to account for potential confounding of this variable on the association. However, educational level may interact with immigrant background, yielding different associations between educational level and diabetes start course participation for 'immigrants' and 'Norwegians'. To test for this interaction, we used the likelihood ratio tests (as described previously for sex and patient type), and additionally performed subgroup analysis for each group.

We primarily used the method of listwise deletion for missing data in the regression analyses. However, as listwise deletion due to missingness can lead to biased results, we also performed a sensitivity analysis accounting for missing data by utilising a multiple imputation technique, using the fully conditional specification and sequential chained equations as implemented in the "mi" suite of commands in Stata [27]. The imputation model included all variables from the previous analytical models to create 100 imputed datasets for analyses. The pooling of RRs with 95% CIs across imputed datasets were performed using Rubin's combination rules [28].

### 2.6. Ethical approval

The OMIT-cohort was approved by the Medical Research Ethics committee – South-East Norway (REC South-East, reference 74012).

## 3. Results

Of the 28,128 individuals, 22,628 cases were registered in the NDR-A general practice, 4423 cases in the NDR-A hospital and 1077 cases were registered in both NDR-A GP and NDR-A hospital. The mean age at T2DM diagnosis was 58 years and 60% were men. About 35% had completed primary education and the majority had completed high school education (45%). 88% had a 'Norwegian' background, and those with immigrant background had a higher $HbA_{1c}$ mean level than those with a 'Norwegian' background (59.6 mmol/56.7 mmol) (Table 1). Those who had completed the diabetes start course with primary and high school education, had a slightly higher $HbA_{1c}$ than those who had not participated in the course, while among those with the highest educational level, participants and non-participants had about similar $HbA_{1c}$ (Table A.1).

### 3.1. Diabetes start course participation by county

In total, 4936 (18%) of the participants were registered as having completed a diabetes start course in the period of 2008–2019. Our findings detected regional variation, with the highest proportion of participation in the county of Troms (34%), followed by Sogn og Fjordane (24%), Buskerud (22%), and Finnmark (21%). The counties with the lowest proportion of participation (<14%), were Aust-Agder, both Nord-Trøndelag and Sør-Trøndelag, as well as Vest Agder and Vestfold (Fig. 2).

### 3.2. Associations of educational level with participation in diabetes start course

In unadjusted regression analyses, those who had achieved high school level and primary level education were less likely to participate on diabetes start courses compared to those with a university/college degree: High school = RR 0.89 (CI 0.83–0.95); Primary education = RR 0.76 (CI 0.71–0.81) (Table 2). This association also remained after adjusting for age, sex, marital status, immigrant background (world regions), and year of T2DM diagnosis (High school = RR 0.90, CI 0.84–0.96; Primary education = RR 0.77, CI 0.72–0.83). In the subgroup of immigrants this association did not reach significance (RR 0.88 CI 0.70–1.12) (Table A.2). However, the interaction between population group and education was not significant (p for interaction=0.72).

### 3.3. Associations between immigrant background and participation in a diabetes start course

In unadjusted regression analyses, we also found a lower risk ratio of completing the diabetes start course in the total immigrant background group compared to the 'Norwegian' group (RR 0.80, CI 0.73–0.88). After adjusting for age, sex, education level, and year of T2DM diagnosis, the RR for this association was 0.71 (CI 0.65–0.79) (Table 2).

When investigating associations for immigrant groups by region of origin in more detail, people from the Middle East (RR 0.66, CI

**Table 1**
Characteristics of the total study sample (n = 28,128) by educational level and immigrant background.

| Characteristics | Total n = 28,128 | Educational level | | | Background | | |
|---|---|---|---|---|---|---|---|
| | | Primary education | High school | University/ college | 'Norwegian'[a] | Immigrant[b] | Unknown[c] |
| Sex, n (%) | | | | | | | |
| Men | 16,777 (59.7) | 5631 (56.8) | 7812 (61.5) | 3106 (61.7) | 14,801 (60.2) | 1531 (55.5) | 442 (56.9) |
| Women | 11,351 (40.4) | 4292 (43.3) | 4884 (38.5) | 1932 (38.4) | 9787 (39.8) | 1227 (44.5) | 335 (43.11) |
| Marital status, n (%)[d] | | | | | | | |
| Unmarried | 5819 (20.7) | 2259 (22.8) | 2432 (19.2) | 1035 (20.5) | 5448 (22.2) | 282 (10.2) | 89 (11.5) |
| Married | 15,852 (56.4) | 5154 (51.9) | 7323 (57.7) | 3091 (61.4) | 13,364 (54.4) | 1964 (71.2) | 524 (67.4) |
| Divorced/widow(er) | 6446 (22.9) | 2508 (25.3) | 2939 (23.2) | 910 (18.1) | 5771 (23.5) | 511 (18.5) | 164 (21.1) |
| Age at diagnosis, mean±SD[d] | 57.6 ± 12.8 | 57.7 ± 13.6 | 58.4 ± 12.2 | 56.4 ± 12.4 | 58.7 ± 12.6 | 50.2 ± 11.5 | 50.9 ± 12.2 |
| $HbA_{1c}$, mmol/L, mean±SD[d] | 57.1 ± 19.1 | 56.9 ± 18.9 | 56.8 ± 18.9 | 57.4 ± 19.5 | 56.7 ± 18.9 | 59.6 ± 20.2 | 59.8 ± 21.2 |
| Education, n (%)[d] | | 9923 (35.3) | 12,696 (45.4) | 5038 (17.9) | | | |
| Primary education | 9923 (35.3) | | | | 8624 (35.1) | 1040 (37.7) | 259 (33.3) |
| High school | 12,696 (45.4) | | | | 11,697 (47.6) | 765 (27.7) | 234 (30.1) |
| University/ college | 5038 (17.9) | | | | 4166 (16.9) | 650 (23.6) | 222 (28.6) |
| Background, n (%)[d] | | | | | | | |
| 'Norwegian' background[a] | 24,588 (87.4) | 8624 (86.9) | 11,697 (92.1) | 4166 (82.7) | | | |
| Immigrant background[b] | 2758 (9.8) | 1040 (10.5) | 765 (6.0) | 650 (12.9) | | | |
| Unknown background[c] | 777 (2.8) | 259 (2.6) | 234 (1.8) | 222 (4.4) | | | |
| Start course, n (%) | | | | | | | |
| No | 23,192 (82.5) | 8382 (84.5) | 10,390 (81.8) | 4005 (79.5) | 20,153 (82.0) | 2359 (85.5) | 675 (86.9) |
| Yes | 4936 (17.6) | 1541 (15.5) | 2306 (18.2) | 1033 (20.5) | 4435 (18.0) | 399 (14.5) | 102 (13.1) |

Abbreviations: SD, standard deviation
[a]Norwegian background: Born in Norway with Norwegian-born parents (n = 23,764), born in Norway with foreign-born parents (second generation immigrants, (n = 79); foreign-born with one Norwegian-born parent (n = 110); Norwegian-born with one foreign-born parent (n = 465); foreign-born with two Norwegian-born parents (n = 170)
[b]Immigrant background: Foreign-born with foreign-born parents. Europe, n = 768; Middle East, n = 507; Africa, n = 393; Asia, n = 982; USA and South America, n = 108 We refer to immigrant background based strictly on country of birth and parents' country of birth, and this variable does not imply a Norwegian citizenship
[c]Unknown country of origin background
[d]The percentage does not add up to 100% all places due to missing data. Missing cases, n (%): Marital status, 11 (0.04); age at diagnosis, 1821 (6.5); $HbA_{1c}$, 725 (2.6); Education, 471 (1.7); Immigrant background, 5 (0.02)

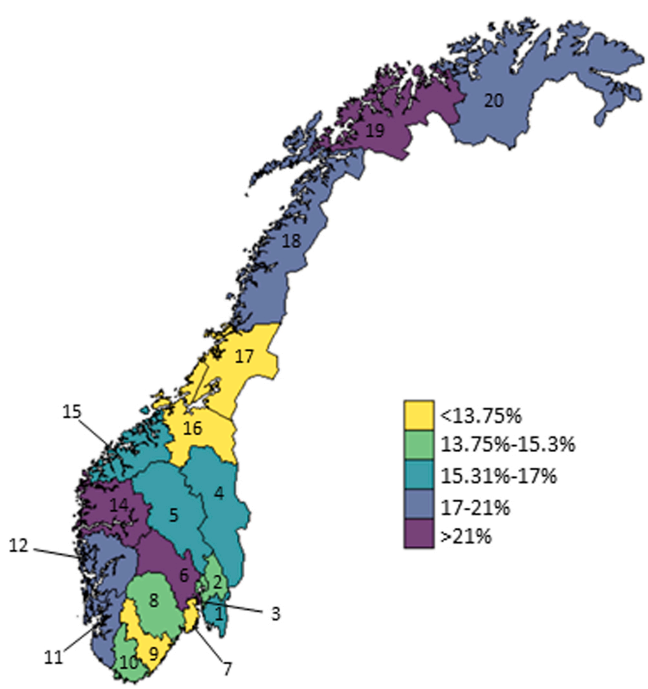


**Fig. 2.** Proportion of people who participated on a diabetes start course programme within the counties of Norway. County legend (ISO- codes): 1 Østfold (15.41%); 2 Akershus (15.11%); 3 Oslo (15.30%); 4 Hedmark (16.94%); 5 Oppland (15.50%); 6 Buskerud (22.12%); 7 Vestfold (13.53%); 8 Telemark (14.33%); 9 Aust-Agder (11.95%); 10 Vest-Agder (13.75%); 11 Rogaland (18.50%); 12 Hordaland (19.71%); 14 Sogn og Fjordane (23.89%); 15 Møre og Romsdal (16.98%); 16 Sør-Trøndelag* (12.91%); 17 Nord-Trøndelag* (13.19%); 18 Nordland (17.94%); 19 Troms (33.84%); 20 Finnmark (20.90%). *Nord- and Sør-Trøndelag: Combined to one county in 2019, Trøndelag (ISO-code 50).

0.51–0.84), Europe (RR 0.68, CI 0.57–0.83), Africa (RR 0.69, CI 0.52–0.91), and Asia (RR 0.73, CI 0.62–0.85), in addition to the group listed under 'Unknown country of origin background' (RR 0.67, CI 0.55–0.80), were less likely to having participated compared to the 'Norwegian' group (Table 2).

### 3.4. Results from the sensitivity analysis on imputed data

When we used imputed data (N = 28,128) to calculate the adjusted risk ratios of start course participation in those with an immigrant background compared to the 'Norwegians', the adjusted RRs declined even further and CIs became narrower, suggesting more pronounced and precise differences (adjusted RR in 'immigrant background' vs. 'Norwegians' RR 0.63, CI 0.57–0.71, in the group with immigrant background; RR 0.60, CI 0.48–0.74, for the European background; RR 0.61, CI 0.47–0.78 for the Middle-Eastern background; RR 0.63, CI 0.47–0.84 for the African background; RR 0.64, CI 0.53–0.76 for those with an Asian background; and RR 0.58, CI 0.47–0.71 for those with unknown country of origin background). In those with immigrant background from the USA and South America, the RR was 1.06 (CI 0.66–1.68) (Table A.3).

## 4. Discussion and conclusion

### 4.1. Discussion

Results from our large observational registry-based cohort study show that less than one in five individuals with T2DM was registered as having completed a diabetes start course in the period 2008–2019. Moreover, the proportion of people participating in each of the Norwegian counties also varied substantially. People with a low level of completed education were less likely to take part than those who had achieved a higher level of education. Additionally, individuals with an immigrant background appeared less likely to participate than

**Table 2**
Risk ratio of participation in a diabetes start course programme among adults with type 2 diabetes mellitus (n = 28,128), with education level and immigrant background as exposures.

| | Diabetes start course: Yes % (n) | | | Crude analysis | | | Model 1 | | | Model 2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Education** | All | % | (n) | RR[a] | CI[a] | P[a] | RR[b] | CI[b] | P[b] | RR[c] | CI[c] | P[c] |
| University/college | 5038 | 20.5% | (1033) | Reference | | | Reference | | | Reference | | |
| High school | 12,696 | 18.2% | (2306) | 0.89 | 0.83–0.95 | < 0.001 | 0.94 | 0.88–1.00 | 0.049 | 0.90 | 0.84–0.96 | 0.002 |
| Primary education | 9923 | 15.5% | (1541) | 0.76 | 0.71–0.81 | < 0.001 | 0.78 | 0.73–0.84 | < 0.001 | 0.77 | 0.72–0.83 | < 0.001 |
| **Background** | | | | RR[f] | CI[f] | P[f] | RR[g] | CI[g] | P[g] | RR[h] | CI[h] | P[h] |
| 'Norwegian' background[d] | 24,588 | 18.0% | (4435) | Reference | | | Reference | | | Reference | | |
| Immigrant background[e] | 2758 | 14.5% | (399) | 0.80 | 0.73–0.88 | < 0.001 | 0.68 | 0.61–0.74 | < 0.001 | 0.71 | 0.65–0.79 | < 0.001 |
| Europe | 768 | 13.2% | (101) | 0.73 | 0.61–0.88 | 0.001 | 0.67 | 0.56–0.81 | < 0.001 | 0.68 | 0.57–0.83 | < 0.001 |
| Middle East | 507 | 13.6% | (69) | 0.76 | 0.61–0.94 | 0.012 | 0.62 | 0.49–0.77 | <0.001 | 0.66 | 0.51–0.84 | 0.001 |
| Africa | 393 | 14.3% | (56) | 0.79 | 0.62–1.01 | 0.058 | 0.60 | 0.46–0.78 | <0.001 | 0.69 | 0.52–0.91 | 0.008 |
| Asia | 982 | 15.3% | (150) | 0.85 | 0.73–0.98 | 0.030 | 0.70 | 0.60–0.81 | < 0.001 | 0.73 | 0.62–0.85 | < 0.001 |
| USA and South America | 108 | 21.3% | (23) | 1.18 | 0.82–1.70 | 0.371 | 1.15 | 0.80–1.64 | 0.451 | 1.06 | 0.74–1.53 | 0.737 |
| Unknown country background | 777 | 13.1% | (102) | 0.73 | 0.61–0.87 | 0.001 | 0.63 | 0.52–0.76 | < 0.001 | 0.67 | 0.55–0.80 | < 0.001 |

Abbreviations: CI, Confidence interval; RR, risk ratio
[a]Number of observations: 27,657
[b]Model 1: Adjusted by age and sex. Number of observations: 25,879
[c]Model 2: Adjusted by age, sex, marital status, migrant background, and year of type 2 diabetes diagnosis. Number of observations: 25,873
[d]'Norwegian' background (n = 24,588): Born in Norway with Norwegian-born parents, Norwegian-born with foreign-born parents (second generation immigrants); foreign-born with one Norwegian-born parent; Norwegian-born with one foreign-born parent; foreign-born with two Norwegian-born parents.
[e]Immigrant background: Birth outside Norway with foreign-born parents
[f]Number of observations: 28,123
[g]Model 1: Adjusted by age and sex. Number of observations: 26,302
[h]Model 2: Adjusted by age, sex, education, and year of type 2 diabetes diagnosis. Number of observations: 25,879

Norwegians.

Clinical guidelines for diabetes care emphasise the need for people with T2DM to be referred to DSMES [8,13]. The variation between counties found in our study could be partly due to a potential lack of available courses regionally, as indicated by GPs who experienced that this could be a barrier in rural districts [20]. Nonetheless, the low proportion participating on diabetes start courses overall, regardless of education and immigrant background, is a concern. This may indicate that awareness, promotion and information from healthcare providers about available courses in Norway are far from optimal, which could have potentially been further exacerbated by the Covid pandemic from 2020.

An interview study among people newly diagnosed with T2DM living in the UK, reported that a main barrier for attendance was lack of information about such courses [29]. In some cases, the patients received no information at all, whereas in other cases, the information provided about the course and the potential benefit was not enough [29]. Many who declined participation in DSMES did not see the point of participating, and it was discussed that some might underestimate their own important role in daily self-management [30]. The perception that T2DM was not a serious disease and a lack of knowledge of the risk of complications were identified as major barriers coming to attending DSMES [31]. In line with this, one driving factor for participation in group-based DSMES courses was having a self-perceived need for information [16].

It is crucial that health care providers aim to empower people with T2DM by giving sufficient information about the DSMES courses [9,12]. A study reported low referral and enrolment in DSMES in individuals with T2DM [32], and GPs and diabetes nurses should acknowledge the important role they have in referring and motivating people to participate, as some patients might not perceive the seriousness of diabetes and its potential complications [31]. It is recommended to discuss the potential benefits of participating on DSMES with the individual following a referral to DSMES, which could include increasing the individual's self-efficacy; lowering their $HbA_{1c}$; improving quality of life; and that DSMES is reported to reduce all-cause mortality [12]. Moreover, the healthcare providers should also address potential barriers that could stop people from participating [12]. The need of support to lifestyle changes in people who participated in a Healthy Life Centre programme, was seen to be differentiated by the individuals' social network and life experiences [33], and a person-centred approach in understanding the individual's potential barriers to attend DSMES is warranted [30].

A focus group study of follow-up care for people with T2DM from the perspective of GPs, reported that a reason for not referring some of those with T2DM was that they could provide the similar service at the GP office, and that they mainly referred individuals they considered would have challenges in adjusting to a healthier lifestyle. However, the GPs also noted that motivating patients to make lifestyle changes was an important, yet demanding task [20]. In a real-life clinical setting, given the lack of resources often reported by GPs – even if the intention is to take responsibility for self-management education themselves and to prioritise health care expenditures in a responsible manner – there might still be a risk that some patients are left with insufficient support regarding their diabetes self-care. Since GPs and certain specialised nurses often have the role as the primary gatekeeper for healthcare resource utilization for educational support [31], the current study suggests that different incentives targeting these key gatekeepers may be needed to encourage more patients to be referred. In addition to this, to emphasize specific information regarding the right of the patient to access DSMES in national clinical guidelines for the healthcare services would be beneficial in helping to promote such uptake. Moreover, the specialised healthcare services should monitor the provision and uptake of diabetes start courses in all counties.

People with immigrant background had a higher mean $HbA_{1c}$ level in our study. Another Norwegian study with participants from the Eastern part of Norway, reported that patients with T2DM from minority groups had a worse glycaemic control than the Norwegian group [34]. An improved understanding of what might drive poor diabetes outcomes in the immigrant population is needed, in order to implement culturally tailored care strategies [22], including DSMES. Our results show that when compared to individuals with Norwegian background, a lower proportion of those with immigrant background from almost all world regions had completed the diabetes start course. The finding of immigrants with European background being less likely to having completed a diabetes start course than those with Norwegian background, might be surprising given that these groups come from the same continent. However, our findings are consistent with findings from other studies [35,36] showing that the occurrence of poor outcomes in immigrants may be both higher and lower compared with that in the Norwegian-born individuals, even within the same continent. A possible reason may be language barriers or difficulties for immigrants to navigate in the Norwegian health system [37]. Also, a difference in participation may be attributable to variation in culture, tradition, or health beliefs. In light of this, a qualitative meta-synthesis [38] explored how people from ethnic minorities in Western countries managed their T2DM. For some, there were difficulties due to feelings of powerlessness, issues of accessibility and acceptability of treatment, and with the cultural context of diet, and stigma. For instance, it could be difficult to adapt to the recommended diet, as this often was based on Western dietary recommendations [38]. All these possible explanations may also elucidate why we observed a weaker association between education and start course participation in immigrants compared with the Norwegian group.

A systematic review of patient activation interventions in T2DM, found that culturally tailored interventions were among those that resulted in improved glycaemic control [39], and lack of culturally tailored information in addition to language barriers were reported as limiting factors for T2DM self-management [40]. From our study, those from Europe, the Middle East, Africa, and Asia were less likely to complete a diabetes start course programme compared to the Norwegians, which could imply the need for more culturally-tailored DSMES that offer interpretation services. A peer support approach has shown to improve glycaemic control in people with T2DM [41,42]. Even though the diabetes start course programme already includes laypersons sharing experiences of living with T2DM [15], the use of peer support tailored to the diversity of cultural backgrounds should be further examined. Taken together, more research is required to determine how future DSMES-programmes should be organised as to be effective and well-received across the diverse group of people with T2DM.

Limitations to this study include the categorisation of the start course variable, specifically that those registered as 'Do not know' or with missing data, were registered as non-participants. This lack of precision may affect internal validity and lead to a misclassification bias, i.e., the resulting RR may be biased in either direction. Also, we did not have information about perceived benefit, or other evaluations of course participation, nor information of whether the individuals had attended other self-management courses (e.g., online courses or healthy lifestyle courses). The lack of information about the year of participation on the diabetes start course is another limitation; however, we assumed that the start course was initiated around the time of the T2DM diagnosis. Moreover, a recent study from the USA reported a temporal decrease between 1999 and 2019 in diabetes-related mortality in urban areas, but not in rural areas [43], and discussed the concern that people living in rural areas might be less likely to participate on DSMES [43], as reported by Luo et al. [44] in their study of DSMES participation in North Carolina (2012–2017). We did not have the opportunity to examine participation by rural and urban areas, but the variation of participation on diabetes start courses between Norwegian counties in our study, makes studies of accessibility of DSMES by rural and urban areas needed, to facilitate participation regardless of area of residence. An important strength of this study is the inclusion of information on world region for immigrant participants. Only the group with people coming from USA and South America was more likely to have completed a start course than the Norwegian group, however, the low number of individuals from USA and South America must be taken into consideration and results interpreted with caution.

## 5. Conclusion

The low proportion registered to have participated in a diabetes start course highlights the need for healthcare providers across Norway to organise enough courses, promote the benefits of their use to increase referral practices and motivate newly diagnosed patients to participate. The results support the need to tailor DSMES to the heterogenous group of adults with T2DM, concerning availability of courses when and where needed, in addition to offering culturally tailored content and strategies that can overcome language barriers. Future studies should explore reasons for not participating in sub-groups of immigrants, to facilitate culturally adopted DSMES.

## 6. Practice implications

It is essential that health care providers inform patients who have been recently diagnosed with T2DM about diabetes educational programmes and motivate for participation. That people with a foreign background were less likely to participate, underlines the need to implement DSMES in the context of different cultural backgrounds. This includes efforts to overcome language barriers, in addition to providing culturally adapted course content.

## Author contributions

AKJ, ESB, MMI, RBS and RMN contributed to the design of the study. ESB is the principal investigator of the OMIT-cohort, and AKJ and MMI are co-investigators. JI and RBF made essential contributions to the data handling and analysis. RBS and RMN performed the main analysis of the data and AKJ, ESB, FP, JI, MMI, RBF, RBS, and RMN participated in the interpretation of the data. RBS wrote the first draft and all authors contributed to revisions of the manuscript. All authors approved the final version.

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I confirm all patient/personal identifiers have been removed or disguised so the patient/person(s) described are not identifiable and cannot be identified through the details of the story.

## Declaration of Competing Interest

None declared.

## Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.pec.2022.107577.

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