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## Simulation and education

# Socio-demographic characteristics of basic life support course participants in Denmark



Theo Walther Jensen<sup>a,\*</sup>, Fredrik Folke<sup>b</sup>, Mikkel Porsborg Andersen<sup>c</sup>,  
Stig Nikolaj Blomberg<sup>d</sup>, Anne Juul Jørgensen<sup>e</sup>, Mathias Geldermann Holgersen<sup>f</sup>,  
Annette Kjær Ersbøll<sup>g</sup>, Ole Mazur Hendriksen<sup>h</sup>, Freddy Lippert<sup>i</sup>,  
Christian Torp-Pedersen<sup>j,k</sup>, Helle Collatz Christensen<sup>l</sup>

<sup>a</sup> Copenhagen Emergency Medical Services & Department of Clinical Medicine, University of Copenhagen, Copenhagen, Denmark

<sup>b</sup> Head of Research Dep., Copenhagen Emergency Medical Services & Department of Cardiology, Herlev Gentofte University Hospital, Copenhagen & Department of Clinical Medicine, University of Copenhagen, Copenhagen, Denmark

<sup>c</sup> Department of Cardiology, Nordsjaellands Hospital, Hillerød, Denmark

<sup>d</sup> Copenhagen Emergency Medical Services & Department of Clinical Medicine, University of Copenhagen, Copenhagen, Denmark

<sup>e</sup> Copenhagen Emergency Medical Services & Department of Clinical Medicine, University of Copenhagen, Copenhagen, Denmark

<sup>f</sup> Paediatric Pulmonary Service, Department of Paediatrics and Adolescent Medicine, Copenhagen University Hospital, Rigshospitalet & Department of Clinical Medicine, University of Copenhagen, Denmark

<sup>g</sup> National Institute of Public Health, University of Southern Denmark, Copenhagen, Denmark

<sup>h</sup> Prehospital Center Region Zealand, Næstved & Department of Clinical Medicine, University of Copenhagen, Copenhagen, Denmark

<sup>i</sup> Copenhagen Emergency Medical Services & Department of Clinical Medicine, University of Copenhagen, Copenhagen, Denmark

<sup>j</sup> Department of Cardiology, Nordsjaellands Hospital, Hillerød, Denmark

<sup>k</sup> Aalborg University Hospital, Aalborg & Department of Clinical Medicine, University of Copenhagen, Copenhagen, Denmark

<sup>l</sup> Copenhagen Emergency Medical Services & Danish Clinical Quality Program (RKKP), National Clinical Registries & Department of Clinical Medicine, University of Copenhagen, Copenhagen, Denmark

## Abstract

**Background:** Bystander-initiated basic life support (BLS) plays an important role in improving survival after out-of-hospital cardiac arrest. In 2009, laws mandating BLS course participation when acquiring a driver's licence were implemented in Denmark. The aim of this study was to characterise Danish BLS course participants.

**Methods:** This study is a Danish, registry-based, follow-up study that examined all Danish BLS course participants from 2016 to 2019. Data concerning BLS course participation were supplied by the major Danish BLS course providers. Socio-economic and healthcare data on all Danish inhabitants were assessed using national registers from Statistics Denmark.

**Results:** Between January 1, 2016, and January 1, 2020, 3.6% of the entire adult population of Denmark attended certified BLS courses annually. Since the implementation of a law mandating BLS course participation when acquiring a driver licence in 2009, approximately 44% of the adult population has participated in a BLS course. BLS course participants were commonly younger and healthier than the general population (mean 31.3 years old vs. 51.3 years old,  $P < 0.001$ ). Furthermore, law-mandated BLS course participants had a lower disposable income (adjusted OR: 0.23; 95% CI: 0.23–0.23;  $P < 0.001$ ) and were more likely to live in rural areas (adjusted OR: 0.57; 95% CI: 0.57–0.58;  $P < 0.001$ ).

**Conclusion:** In Denmark, 3.6% of the entire adult population attend certified courses annually. BLS participants are commonly male, younger, healthier, less likely to have small children in the household, and more likely to live in rural areas. Law-mandated BLS course participation prior to acquiring a driver's licence has been successful in reaching segments of the society that are known to have limited participation.

**Keywords:** BLS, Resuscitation, Mass education

\* Corresponding author at: Copenhagen Emergency Medical Services, University of Copenhagen, Telegrafvej 5, 2750 Copenhagen, Denmark.

E-mail address: [theo.walther.jensen.01@regionh.dk](mailto:theo.walther.jensen.01@regionh.dk) (T.W. Jensen).

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## Background

Bystander-initiated basic life support (BLS) plays an important role in improving survival after out-of-hospital cardiac arrest (OHCA). The Global Resuscitation Alliance emphasises the need to educate laypersons in BLS, and 4 of the 10 steps to improve survival after OHCA involve educating BLS providers on a community level.<sup>1–2</sup> In Denmark, approximately 5200 OHCA cases occur annually in a population of 5.8 million. Since 2001, a fourfold increase in survival has been linked to a significant increase in bystander-initiated cardiopulmonary resuscitation (CPR) prior to the arrival of emergency medical services.<sup>1–3</sup> Bystander-initiated CPR rates increased from 20% to 77% in the same period.<sup>3–5</sup>

Data from Norway, Australia, and Japan show that those trained in BLS are more willing and more likely to act in response to OHCA.<sup>6–8</sup> In Denmark, several population-based voluntary participation campaigns have been initiated to increase the number of laypersons who are willing and able to assist in responding to OHCA. To increase bystander CPR rates in Denmark, mandatory BLS course participation was decreed by law for primary schools in January 2005, when acquiring a driver's licence for all vehicles, and for several vocational educational programmes in October 2006 (implemented in 2009).<sup>4,9–11</sup> Studies with different designs and from different countries show that the annual rates of BLS training vary from 0.51% to 22%.<sup>6–7,12–15</sup> However, many of these studies are survey studies that used limited data.<sup>6–7,12–14</sup>

Several studies have shown that it is more challenging to recruit BLS training participants in some sections of the society than in others. The factors known to be associated with lower rates of BLS training include lower education and income levels, living in rural areas, and older age.<sup>6–7,13–17</sup> However, it is not known which sections of the society do not participate in BLS courses in Denmark. Although mandatory BLS participation has been implemented in Denmark for 10 years, it is not known how many have participated or whether segments of society that would not have otherwise been engaged have been reached.

The aim of this study was to characterise Danish BLS course participants to evaluate and optimise BLS recruitment campaigns. The results of this study can be used to target future campaigns to the sections of society that are currently not reached to improve survival on a national level.

## Methods

This Danish, registry-based, follow-up cohort study comprised all Danish citizens above the age of 15 years and considered the earliest BLS training when receiving a BLS course certificate.<sup>18</sup> There were no upper age limits for the inclusion.

### Setting

In Denmark, most BLS courses (>95%) are provided by two organisations: the Danish First Aid Council and the Danish Heart Association. A minor proportion of the courses serving approximately 2500–4000 participants annually is provided by the Danish Resuscitation Council/the European Resuscitation Council (ERC). All providers roughly followed the standards of the ERC guidelines.<sup>21</sup> All courses include four hours of training in BLS, including CPR and use of automated external defibrillators (AEDs). The Danish Heart Association

“Give Life” campaign provides 30-minute courses with instructions on CPR and AED use and collects participants' names, addresses and birthdates.

### Data sources

Since 2016, the Danish First Aid Council, which has conducted most of the courses, has registered all certificates electronically with the participants' Central Person Register Number (CPR-Number), type of course, and date of passing the course. Participants can potentially participate in several courses in the period; hence, only the first attended course is registered. Through Statistics Denmark,<sup>19</sup> sociodemographic data were obtained and linked to encrypted and pseudoanonymised versions of the official Danish 10-digit CPR-Number for all Danish citizens.<sup>20</sup>

The demographic information of the participants and the general population was obtained from the Danish nationwide registries and the Danish Civil Registration System.<sup>22</sup> Age was calculated as the “age when course was attended”, and the participants were categorised as young (15–25 years) or other (above 25 years) on the basis of the common age for acquiring a driver's licence. Population density was similarly obtained from the Danish Civil Registration System<sup>20</sup> and linked with the municipal population density. Population density was stratified by the 2012 EUROSTAT degree of urbanisation (DEGURBA) system and included a three-level geographical urbanisation stratification.<sup>23</sup> Educational data on the highest ended or highest currently enrolled education level were extracted from the Danish Education Registers.<sup>24</sup> Healthcare data for the calculation of the Charlson score were extracted from the Danish National Patient Register.<sup>26</sup>

### Course certificates

All courses included training in BLS, including CPR and AED use. Three types of BLS certifications can be obtained by a participant when acquiring a driver's licence depending on whether the licence is for a car, scooter, or commercial vehicle. The participants primarily attended these courses to, lawfully, acquire a driver licence, not to learn BLS. Henceforth, the course participants mandated by law will be referred to as “law-mandated” participants as opposed to “non-law-mandated” participants.

### Statistical analysis

The participation rate in BLS courses was calculated by age group and divided by sex by using descriptive statistics. Median and mean age were calculated, and the age differences between the course participants of different sexes were compared using an unpaired *t*-test. To illustrate the course participation rate, the curve was smoothed using the loess algorithm.<sup>27</sup> Data on income, education level, civil status, age of youngest child, DEGURBA, and ethnicity are presented with the BLS course participation rate, odds ratios (OR) adjusted for age and sex, and 95% confidence intervals (CIs). The ORs and CIs were calculated using logistic regression. The Charlson Comorbidity Index (Charlson Index) was calculated for all Danish citizens using data from the national patient registry of Denmark. The Charlson Index is presented with the rate of BLS course participation and the ORs adjusted for age and income with 95% CIs.

The cumulative percentage of individual course participants was created on the basis of extrapolation from the number of course certificates from the years prior to this investigation. It was expected that the number of certificates would be higher than the number of individ-

uals (persons) who had participated (i.e. the same person could participate in several courses). Therefore, the extrapolation was based on the lowest calculated percentage of individuals per number of course certificates within the study period.

Data were stored and analysed on secure servers *via* Statistics Denmark by using the R statistics software™.<sup>28</sup>

### Ethics and protocol registration

A retrospective registry-based study in Denmark did not require ethical approval or informed consent. The region ethical committee waived the need for approval (ref. 20003033). Furthermore, the regional data safety authority waived the need for approval upon application of special rights for the storage and handling of data. The study protocol was uploaded to clinical.trials.org [NCT04251325].

## Results

A total of 4,832,553 Danish citizens aged between 15 and 105 years on the last day of entry (January 1 2020) were identified *via* the Danish National Population Registry. Between January 1, 2016, and January 1, 2020, a total of 1,017,825 certificates were issued. Due to missing CPR-numbers, duplicates, and instructor certificates, a total of 90,552 certificates were excluded, thus amounting to 927,273 verified course certificates between January 1, 2016, and January 1, 2020. In total, there were 197,127 verified course certificates in 2016; 243,385 verified course certificates in 2017; 229,124 verified course certificates in 2018; and 235,099 verified course certificates in 2019 (Fig. 1).

There were 704,640 verified individual BLS certificate holders, with approximately 150,000 people attending more than 1 course in the period. This population covered 14.6% of the entire adult Danish population over four years. Fig. 2 shows that approximately 44% of the Danish population had attended a BLS course in the 10-year period from the implementation of law-mandated BLS courses. Growth is seen in both law and non-law-mandated attendance (Fig. 2).

### Law-mandated and non-law-mandated courses

Between January 2016 and 2020, 376,597 law-mandated participant certificates and 550,676 non-law-mandated participant certificates were issued (Fig. 1). Among the law-mandated participants, 147,068 (47%) and 167,166 (53%) participants were females and males, respectively, and there were 217,960 females (65%) and 172,446 males (45%) among the non-law-mandated participants (Fig. 1, Table 1). Approximately 34,000 people acquired both types of certificates during this period.

### Age

The median age of all BLS course participants was 25 years (interquartile range [IQR]: 18–44 years; mean: 31.3 years). There was a significant difference ( $P < 0.001$ ) between the age of the course participants and that of the general adult population (general adult population mean: 51.3 years). The age-specific participation rate of 18-year-olds was the largest group (17% of all courses), followed by 17- and 15-year-olds (Fig. 3). There were significant differences in age between the sexes ( $P < 0.001$ ). The mean age of the female course participants was 29.9 years (IQR: 18–41), and the mean age of the male participants was 32.6 years (IQR: 18–45).

Law-mandated course participants showed a spike in age-specific participation rates between 15 and 20 years of age, representing more than 73% of all cases, with the highest age-specific participation rate at 18 years of age (33% of all law-mandated participants; Fig. 3). Non-law-mandated course participants showed a similar spike in the younger age class, with the highest age-specific participation rate at 18 years of age (3.5% of all non-law-mandated course participants). However, the age-specific distribution flattened and had a large broad hump spanning from approximately 40 to 60 years of age (Fig. 3). Law-mandated course participants were 0.03 times less likely to be over 25 years of age (OR: 0.03 [95% CI: 0.03–0.03;  $P < 0.001$ ]). Those attending a non-law-mandated course were 0.43 times less likely to be over 25 years of age (OR: 0.43 [95% CI: 0.43–0.44;  $P < 0.001$ ]) than the general population (Table 2).

### Income

The median annual income for all registered Danes was USD 42,911 (IQR: 29,081 to 54,482; mean: 46,064 USD). Table 1 shows the income distribution on the quartiles and the relevant ORs. No clear differences by sex were observed among the participants. Fig. 4 shows the participation rate of law-mandated and non-law-mandated participants by income decile at all ages and for 18- to 25-year-olds. Fig. 4a and Fig. 4b illustrate that a large variation in income exists for 18- to 25-year-old non-law-mandated participants compared with the general population. Fig. 4d and Fig. 4c show considerably less to no variation in the income distribution for law-mandated participants. There was a significant difference in disposable income between the law-mandated participants and the general population (Table 2). Participants in non-law-mandated courses were more likely to have a personal disposable income above the median (OR: 1.43; 95% CI: 1.43–1.31).

### Education

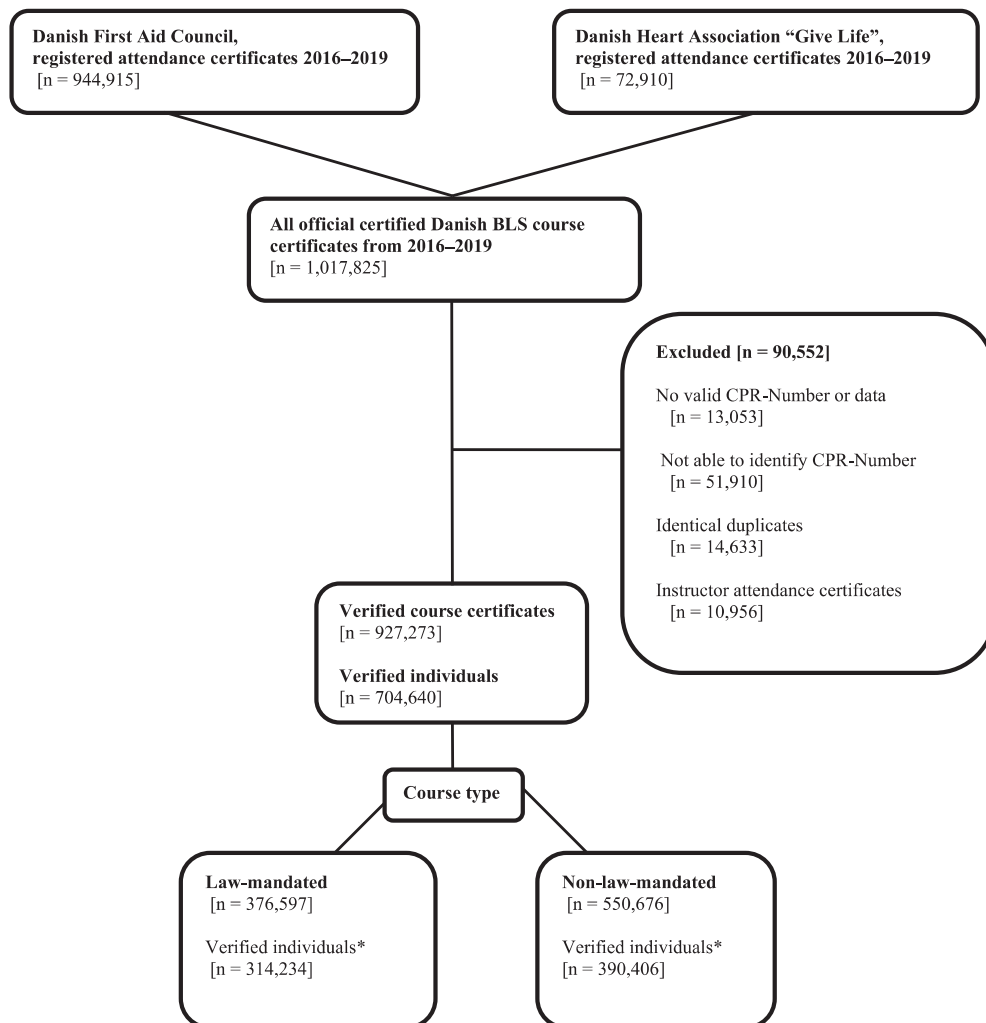
A decreasing participation rate was observed with increasing education when considering all courses (Fig. 5). The highest participation rate in the BLS courses was within the lowest education level in both sexes (36% of all females and 45% of all males). Fig. 5a shows the education level of course participants of all ages, and Fig. 5b shows the educational level of participants aged 18- to 25 years old. Non-law-mandated course participants had similar education levels as the general population when adjusting for age and sex. Law-mandated course participants had a significantly lower education level than the general population when adjusting for age and sex (OR: 0.23 [95% CI: 0.23–0.23]).

### Civil status

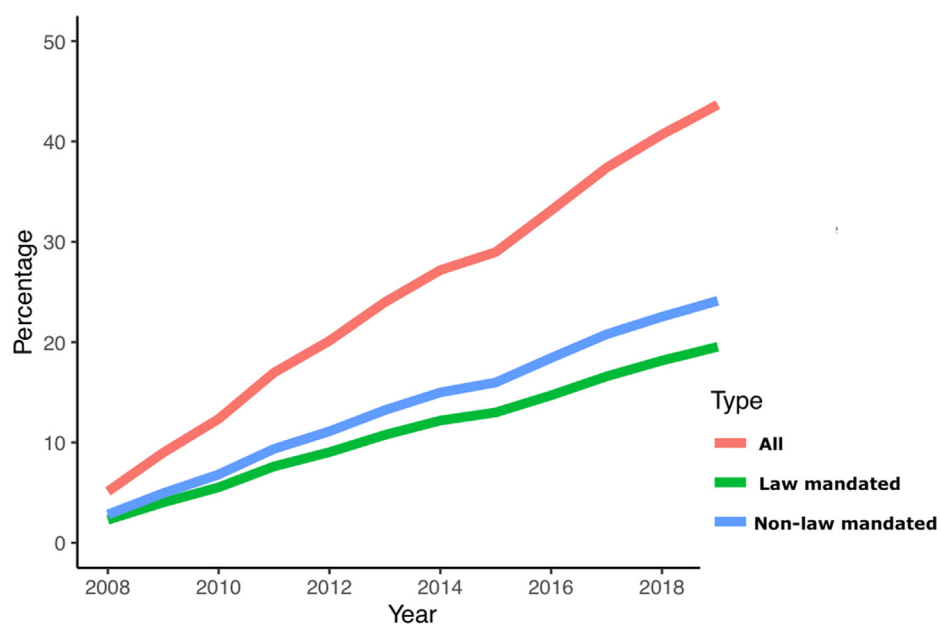
The BLS course participants did not differ from the Danish adult population. Table 1 shows the course participation rate and OR according to the civil status. Several results were significant but were not deemed relevant. There was a slight increase in the OR of having participated in a BLS course for males living in mixed-household of 1.43 (95% CI: 1.43–1.44).

### Age of youngest child

Having small children had the same effect on both sexes: a decrease in course participation (Table 1). Females with children aged 0–3 years were 0.83 times less likely to participate in a BLS course (OR: 0.83 [95% CI: 0.83–0.84]), and males were 0.88 times less likely (95% CI: 0.88–0.89) to participate in a BLS course compared with those with no children. Both sexes were twice as likely to partic-



**Fig. 1 – Modified CONSORT flow diagram.**



**Fig. 2 – Ten-year cumulative percentage of adults with basic life support course certificates in Denmark.**



**Table 1 – Characteristics of Danish BLS-educated population vs. the general Danish population.**

	Female			Male		
	No certificate <i>n</i> (%)	Certificate <i>n</i> (%)	OR <sup>▼</sup> (CI 95%)	No certificate <i>n</i> (%)	Certificate <i>n</i> (%)	OR <sup>▼</sup> (CI 95%)
<b>Income level</b>						
1, (lowest) quartile	532,867 (26)	89,435 (25)	Ref	480,444 (23)	90,216 (27)	Ref
2, (lower-middle) quartile	548,195 (26)	81,950 (22)	1.30* (1.29–1.32)	489,146 (24)	73,670 (22)	1.22□ (1.21–1.24)
3, (upper-middle) quartile	486,167 (23)	101,393 (28)	1.62* (1.60–1.63)	511,923 (25)	93,479 (28)	1.44* (1.42–1.46)
4, (upper) quartile	483,546 (23)	91,237 (25)	1.76* (1.74–1.78)	536,920 (26)	81,258 (24)	1.54* (1.52–1.57)
Not registered	27,470 (1)	1,013 (0)		31,235 (2)	989 (0)	
<b>Educational level</b>						
Primary and lower secondary	426,375 (21)	131,835 (36)	Ref	337,902 (16)	154,190 (45)	Ref
High school and vocational	947,054 (45)	144,624 (40)	0.61* (0.6–0.61)	1,153,417 (56)	135,360 (40)	0.39* (0.39–0.39)
Higher education	648,223 (31)	86,133 (24)	0.52* (0.52–0.53)	499,893 (24)	46,757 (14)	0.32* (0.32–0.33)
Not registered	56,593 (3)	2,436 (1)		58,406 (3)	3,305 (1)	
<b>Civil status</b>						
Single	808,655 (39)	122,102 (33)	Ref	729,911 (36)	124,223 (37)	Ref
Living with person of same sex	2,724 (0)	559 (0)	1.01 (1.00–1.21)	2,383 (0)	329 (0)	1.06 (0.94–1.20)
Living with person of opposite sex	1,086,997 (52)	195,891 (54)	1.28* (1.27–1.29)	1,127,892 (55)	176,475 (52)	1.43* (1.42–1.44)
Multi-household	179,869 (9)	46,476 (13)	1.06□ (1.05–1.08)	189,482 (9)	38,585 (11)	0.99 (0.98–1.01)
Not registered	0 (–)	0 (–)		0 (–)	0 (–)	
<b>Age of youngest child in household</b>						
No children	1,347,140 (65)	123,147 (34)	Ref	1,385,327 (68)	121,424 (36)	Ref
0–3 years old	163,839 (8)	30,766 (8)	0.83□ (0.82–0.84)	151,253 (7)	23,500 (7)	0.88* (0.87–0.89)
3–6 years old	85,103 (4)	19,105 (5)	1.18□ (1.16–1.20)	76,650 (4)	10,799 (3)	0.97** (0.95–0.99)
6 + years old	482,163 (24)	192,010 (53)	1.99* (1.97–2.01)	436,438 (21)	183,889 (54)	2.31* (2.29–2.33)
Not registered	0 (–)	0 (–)		0 (–)	0 (–)	
<b>Degree of urbanization</b>						
Rural areas, thinly populated	679,804 (33)	132,474 (36)	Ref	688,754 (34)	125,407 (37)	Ref
Towns and suburbs, intermediate density	635,461 (31)	116,296 (32)	0.88* (0.87–0.89)	623,638 (30)	107,997 (32)	0.88* (0.87–0.89)
Cities, densely populated	741,756 (36)	116,111 (32)	0.57* (0.57–0.58)	714,099 (35)	105,933 (31)	0.58* (0.57–0.58)
Not registered	21,224 (1)	147 (0)		23,177 (1)	275 (0)	
<b>Ethnicity</b>						
Born in Denmark to Danish parents	1,788,359 (86)	317,462 (87)	Ref	1,758,568 (86)	294,244 (87)	Ref
Born in Denmark to non-Danish parents	257,025 (12)	33,254 (9)	0.55* (0.54–0.55)	256,166 (12)	30,450 (9)	0.55* (0.54–0.56)
Immigrated to Denmark	32,870 (2)	14,312 (4)	0.95□ (0.93–0.97)	34,934 (2)	14,918 (4)	0.93□ (0.91–0.96)
Not registered	0 (–)	0 (–)		0 (–)	0 (–)	
<b>Healthcare status (level of chronic disease)</b>						
Charlson index 0–1	1,926,156 (84)	357,834 (95)	Ref	1,887,068 (85)	333,520 (96)	Ref
Charlson index 2+	152,089 (16)	7,211 (5)	0.74* (0.73–0.76)	162,600 (15)	6,092 (4)	0.92□ (0.89–0.94)
Not registered	0 (–)	0 (–)		0 (–)	0 (–)	

▼ Adjusted for age and sex.

\* Significant within  $P < 0.001$ .\*\* Significant within  $P < 0.05$ .□ Significant within  $P < 0.001$  but with predefined clinically irrelevant strength of result.

ipate in a BLS course if they had children older than six years of age compared with those with no children.

### Degree of urbanisation

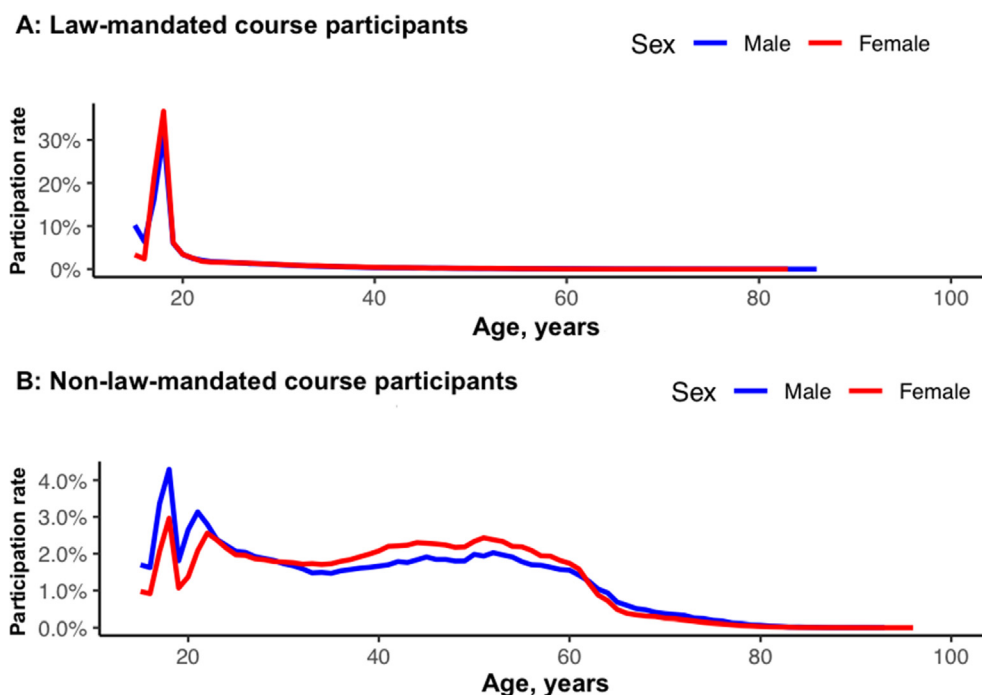
Overall, participants in the BLS courses tended to live in rural areas with a lower DEGURBA scores regardless of sex (Table 1). Higher urbanisation level showed a lower degree of course participation. Both male and female course participants were less likely to live in a rural area (male OR: 0.58 [95% CI: 0.57–0.58]; female OR: 0.57 [95% CI: 0.57–0.58]). The difference in the urbanisation level was the highest among law-mandated course participants (Table 2).

### Ethnicity

Course participation was significantly higher among those born in Denmark with Danish-born parents than among those whose parents

were immigrants for both sexes. Individuals with immigrant background were 0.55 times less likely to have participated in BLS courses (male OR: 0.55 [95% CI: 0.54–0.55]; female OR: 0.55 [95% CI: 0.54–0.56]). Table 1 shows the participation rate and OR of participation in the general ethnic groups of Denmark. The difference in course participation between individuals born in Denmark to Danish-born parents and individuals born to immigrant parents was not within the predefined limit of what is considered relevant (Table 1).

Individuals born in Denmark to Danish-born parents participated more in non-law-mandated courses than immigrants or descendants of immigrants. Immigrants and descendants of immigrants were 0.64 times less likely to have participated in a BLS course (95% CI: 0.63–0.65,  $P < 0.001$ ). For law-mandated course participants, unadjusted measures showed that immigrants and descendants of immigrants



**Fig. 3 – Participation rate in BLS courses by age.**

had a higher relative course participation than those with Danish-born parents; however, this difference was reversed to a non-significant difference when adjusting for age and sex (Table 2).

### Healthcare status

Course participants were less affected by chronic illness than the general Danish adult population (Table 1).

Females who had participated in a BLS course were 0.75 times less likely (OR: 0.75 [95% CI: 0.73–0.76]) to have a Charlson Index > 1, which indicates a low healthcare status. For males, a similar trend was observed; however, this is mostly attributable to age (Table 1). The association was strongest among participants on law-mandated courses, with an adjusted OR of 0.64 (95% CI: 0.63–0.65).

## Discussion

The aim of this study was to characterise Danish BLS course participants in order to evaluate and optimise BLS recruitment campaigns. In Denmark, 3.6% of the entire adult population attends certified courses annually, and approximately 44% have participated in a BLS course since 2009. BLS participants were more commonly male, younger, healthier, less likely to have small children in the household, and likely to live in a rural area. The results from the current study show that in Denmark, approximately 45% of all BLS training is now *via* law-mandated courses. Law-mandated course participation was introduced in 2006 and was fully implemented in 2009 prior to acquiring a driver's licence for all types of vehicles. Law-mandated courses have increased the number of laypersons who are able to provide BLS in Denmark. The law-mandated courses have successfully engaged segments of society that are known to have limited coverage by non-law-mandated courses.

The results show that 44% of the entire Danish adult population has participated in a BLS course since 2009. This seems to be a high proportion of the population with verified certified BLS training. Nonetheless, telephone-based surveys reporting BLS training rates of up to 22% of the population annually would suggest otherwise.<sup>6–7,12,14</sup> However, differences in the study design and data sources limit comparisons. A comparable study that examined the training rates in the United States in 2017 found that a remarkably low proportion (0.51%) of the adult population had received BLS training.<sup>13</sup>

Law-mandated course participation was implemented in 2009 and has engaged approximately 45% of all the course participants, particularly younger generations of all societal segments. A proportion equating to 45% of all course participants would, in direct comparison with the available studies, be considered a large proportion. Law-mandated course participation is a requirement for acquiring a driver's licence in Norway. A Norwegian telephone survey examining BLS training in 2017 found that 13% of the respondents had participated in BLS courses *via* mandated programmes.<sup>6</sup> However, the data are not completely comparable; hence, a direct comparison is not valid.

Unlike other studies, the current study found no indication of socio-economic disparity between participants who attended and participants who did not attend BLS courses.<sup>6–7,12–17</sup> This is likely a consequence of the introduction of law-mandated courses. The course participation rate is evenly spread in terms of income and better resembles that of the general population in law-mandated courses. This is also the case when the data is subdivided into age groups where a majority participants attend law-mandated courses (Fig. 4). Furthermore, the education level of law-mandated participants illustrates that law-mandated courses, to a much larger degree, engage sections of the society with a lower education level. However, some disparities remain, and some segments of the



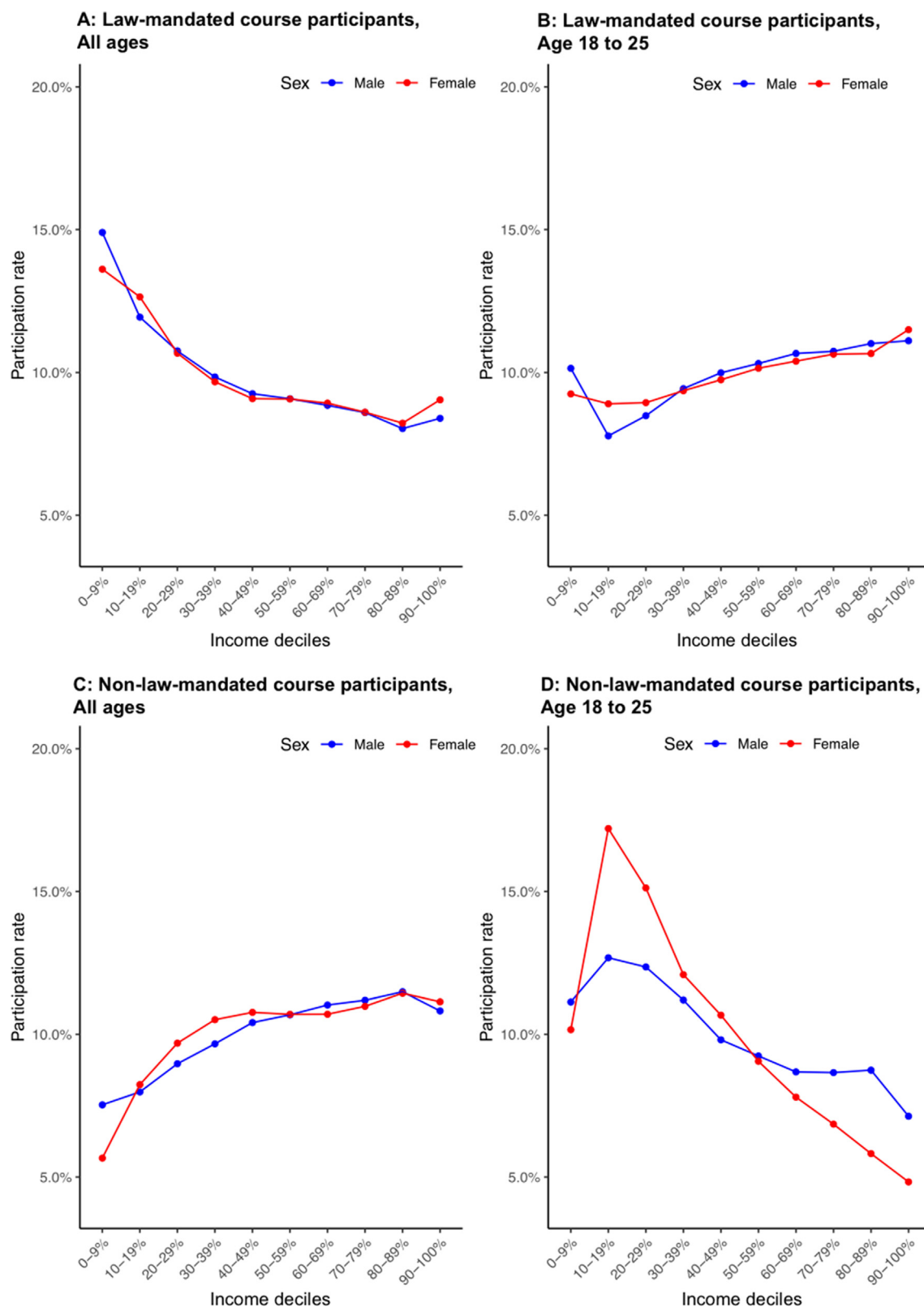
**Table 2 – Sociodemographic characteristics and ORs stratified by subgroups of law-mandated and non-law-mandated courses.**

	NON-LAW-MANDATED		Odds ratio NO COURSE vs. NON-LAW-MANDATED				LAW-MANDATED COURSE		Odds ratio NO COURSE vs. LAW-MANDATED			
Age*	FEMALE <i>n</i> (%)	MALE <i>n</i> (%)	Crude (95% CI)	<i>P</i> -value	Adjusted▼ (95% CI)	<i>P</i> -value	FEMALE <i>n</i> (%)	MALE <i>n</i> (%)	Crude (95% CI)	<i>P</i> -value	Adjusted▼ (95% CI)	<i>P</i> -value
15–25 y/o	36,578 (29)	41,723 (21)	0.43 (0.43–0.44)	<0.001	0.43 (0.43–0.44)	<0.001	116,967(80)	134,433 (80)	0.03 (0.03–0.03)	<0.001	0.03 (0.03–0.03)	<0.001
25 + y/o	181,382 (71)	130,723 (79)					30,101 (20)	32,733 (20)				
Income												
Below average	118,652 (54)	93,268 (54)	1.28 (1.27–1.29)	<0.001	1.43 (1.42–1.44)	<0.001	93,843 (64)	108,405 (65)	0.84□ (0.83–0.84)	<0.001	1.31 (1.30–1.32)	<0.001
Above average	98,937 (46)	78,779 (46)					52,583 (36)	58,171 (35)				
Not registered	371 (0)	399 (0)					642 (0)	590 (0)				
Education												
Primary and secondary education	30,775 (14)	34,178 (20)	1.17□ (1.16–1.18)	<0.001	1.21□ (1.21–1.23)	<0.001	101,060 (69)	120,012 (72)	0.1 (0.09–0.1)	<0.001	0.23 (0.23–0.23)	<0.001
Vocational or university	185,967 (85)	137,008 (79)					44,790 (30)	45,109 (27)				
Not registered	1,218 (1)	1,260 (1)					1,218 (1)	2,045 (1)				
Urbanization level												
Rural and intermediate	149,681 (69)	117,158 (68)	0.83□ (0.83–0.84)	<0.001	0.68 (0.68–0.69)	<0.001	99,089 (67)	116,246 (70)	0.82□ (0.82–0.83)	<0.001	0.57 (0.57–0.58)	<0.001
Cities, high density	68,205 (31)	55,183 (32)					47,906 (33)	50,743 (30)				
Not registered	74 (0)	105 (0)					73 (0)	117 (0)				
Ethnicity												
Born in Denmark to Danish parents	195,545 (90)	156,183 (91)	0.67 (0.66–0.68)	<0.001	0.61 (0.61–0.62)	<0.001	121,917 (83)	138,061 (83)	1.27 (1.26–1.28)	<0.001	0.89□ (0.88–0.90)	<0.001
Other	22,415 (10)	16,263 (9)					25,151 (17)	29,105 (17)				
Not registered	0 (–)	0 (–)					0 (–)	0 (–)				
Health status (level of chronic disease)												
Charlson index 0–1	211,731 (97)	167,354 (97)	0.36 (0.36–0.37)	<0.001	0.64 (0.63–0.65)	<0.001	146,086(99)	166,166 (99)	0.07 (0.07–0.08)	<0.001	0.93□ (0.88–0.96)	0.003
Charlson index 2+	6,229 (3)	5,092 (3)					982 (1)	1,000 (1)				
Not registered	0 (–)	0 (–)					0 (–)	0 (–)				

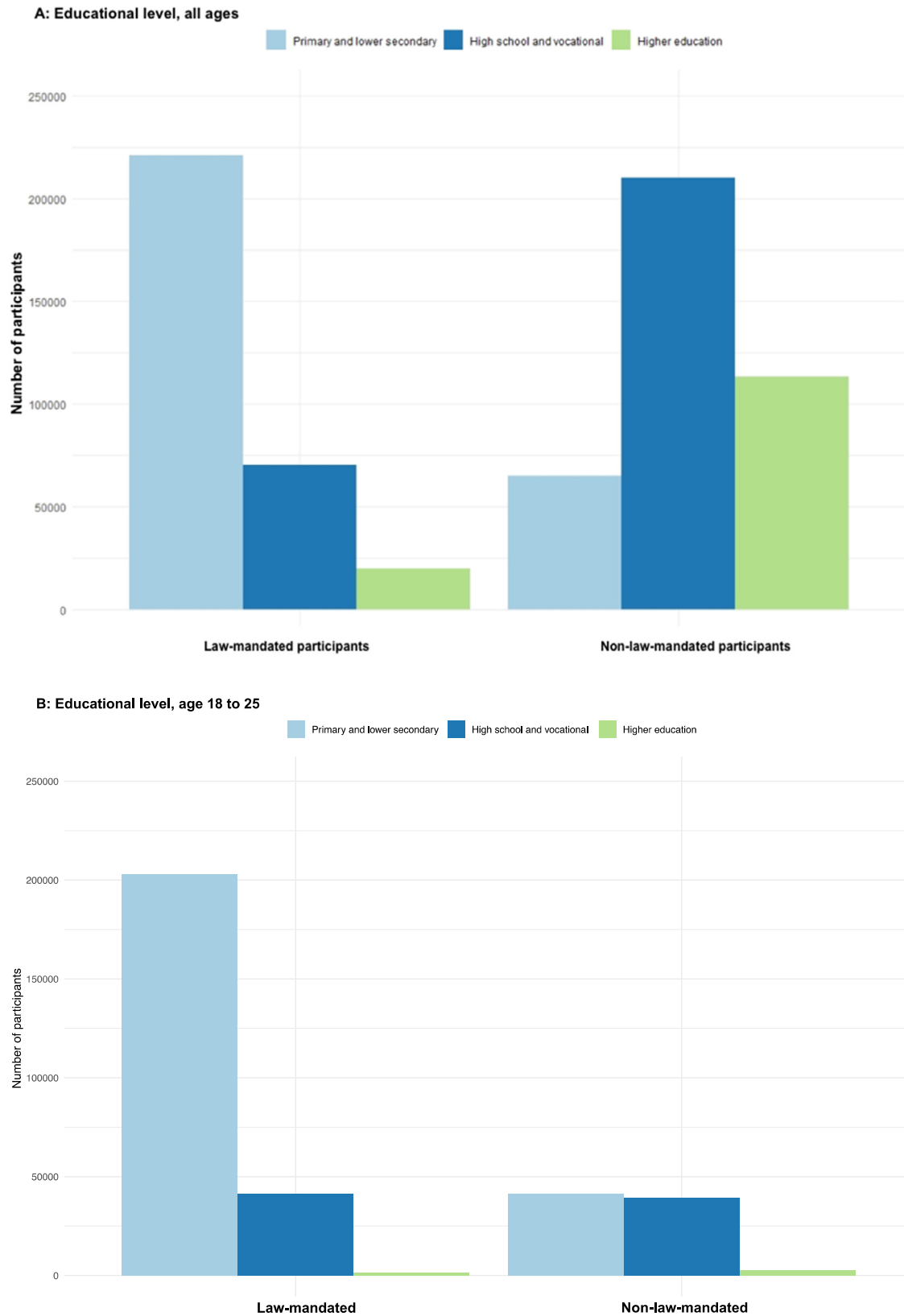
▼ Adjusted for age and sex.

□ Significant within  $P < 0.001$  but with predefined clinically irrelevant strength of result.

\* Per definition no unknown as the age is included in the Danish CPR-Number, which determined inclusion.



**Fig. 4 – Participation rate in BLS courses by income deciles.**



**Fig. 5 – Participation rate of different educational groups in BLS courses in Denmark.**

society are still not engaged to a similar degree. Similar to other studies, lower rates of training were found among the urban and the elderly population.<sup>25–26</sup> Furthermore, the current study showed lower rates of BLS training among participants with a lower healthcare status.

### Strengths and limitations

This study was a nationwide study that eliminated selection and measurement bias. The strength (power) of the analysis lies in the large sample size. The use of CPR numbers ensures a continuous yearly update on all official registers, thus allowing for rigorous studies, such as the present study. This is unique in the sense that it presents the full population results from an entire country, thus resulting in few missing data. All levels of society for all parameters are presented.

To the best of the authors' knowledge, there were no systematic differences between the excluded and included course certificates. This study is limited by its focus on courses as the basis for examining the engagement in acquiring BLS skills. It is further limited in its ability to fully control for age as a confounder. Although the models in this study were adjusted for age, residual confounders may still exist. Some age groups (i.e. the young) are in a period of life with greater expected changes in terms of educational attainment and income. Current and future technological alternatives should be considered in the campaign to achieve widespread coverage. However, this topic is not covered in this study.

### Perspectives

This study provides knowledge that can help optimise public efforts to increase the number of laypersons who are willing to help in emergency situations and increase the knowledge of those willing to aid as bystanders in response to OHCA. When designing future-focused campaigns, it is important to try to connect with the elderly population living in cities, because these individuals are not being reached in the current setting. Furthermore, a minor ethnic disparity seems to exist, with a larger proportion of citizens with a predominantly Danish background participating more frequently in courses than those with a different ethnic background. The results of this study could be used to improve future campaigns and to evaluate current national population-based interventions.

### Conclusion

This nationwide study of all BLS courses shows that 3.6% of the entire adult population of Denmark attends certified courses annually, with approximately 44% of the population attending certified courses over a 10-year period. BLS course participants were commonly younger, healthier, less likely to have small children in the household, and live in rural areas. National campaigns to ensure attendance of law-mandated BLS courses prior to acquiring a driver's licence have been successful in reaching segments of society that are known to have limited participation.

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