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COVID-19 vaccine uptake in Skåne county, Sweden, in relation to individual and regional sociodemographic factors

Mitchell A, Inghammar M, Moghaddassi M, Björk J



Covid 19 pandemic

- In 2019, coronavirus disease (COVID-19) was identified in the human population and later declared as a global health crisis.
- With the emergence of more infectious variants, maximizing vaccine uptake with multiple vaccination doses is of importance.¹
- Achieving a high rate of vaccination in the entire population is critical to slow infection, reduce hospital admissions, and help healthcare systems recover.²



Covid 19 Vaccination Sweden

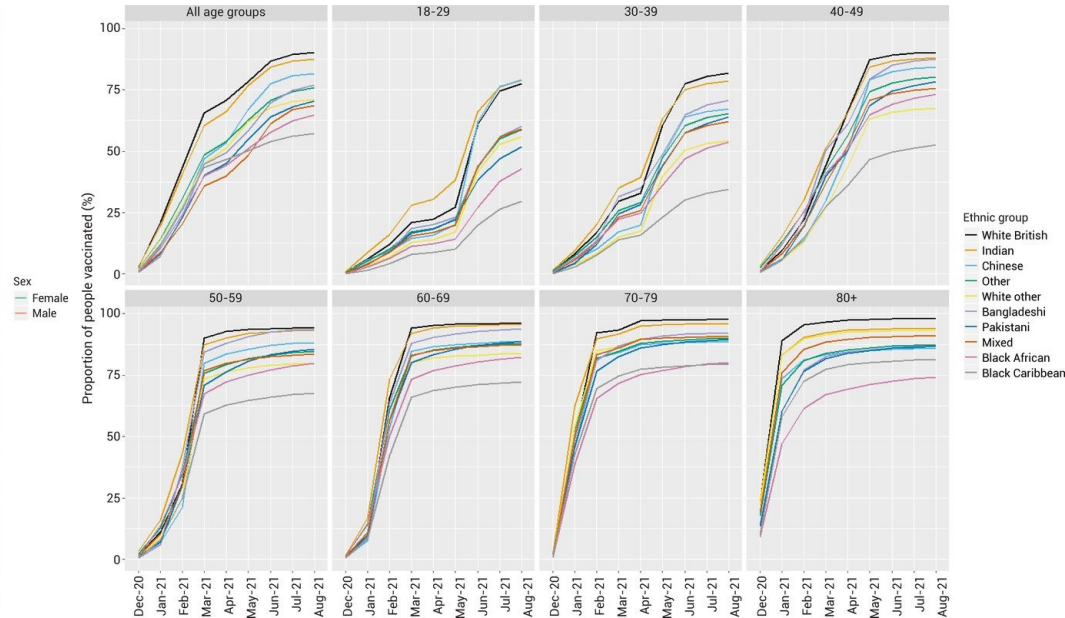
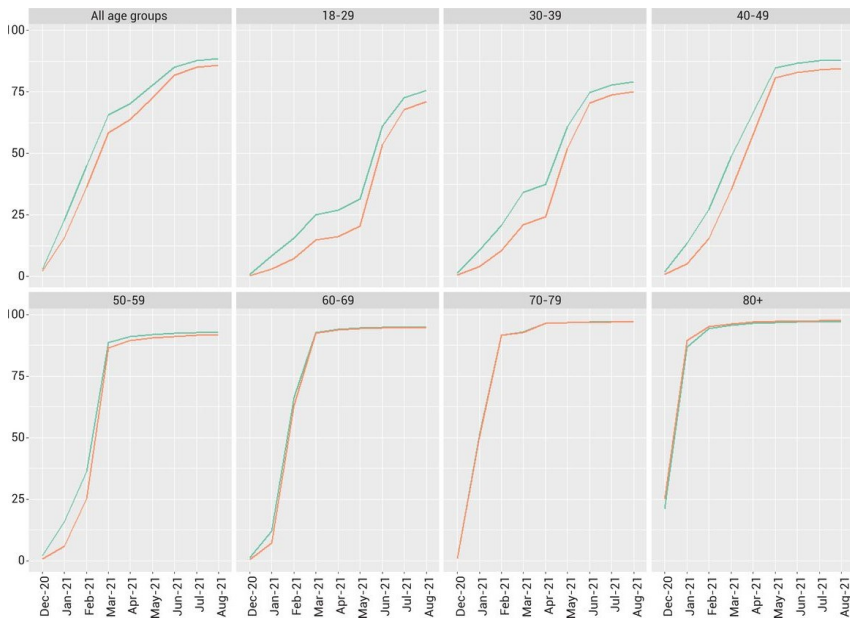
- The vaccination program in Sweden started on 27th December 2020 and was implemented in four sequential stages.
- 1. Older adults in assisted living facilities, residential and health care workers or workers in the elderly care homes.
- 2. Adults ≥ 65 years, those with functional disabilities, and certain specific risk groups.
- 3. Individuals aged 60–64 years, and various risk groups aged 18–59 years.
- 4. Individuals aged 18–59 years who had not been part of phases 1–3.

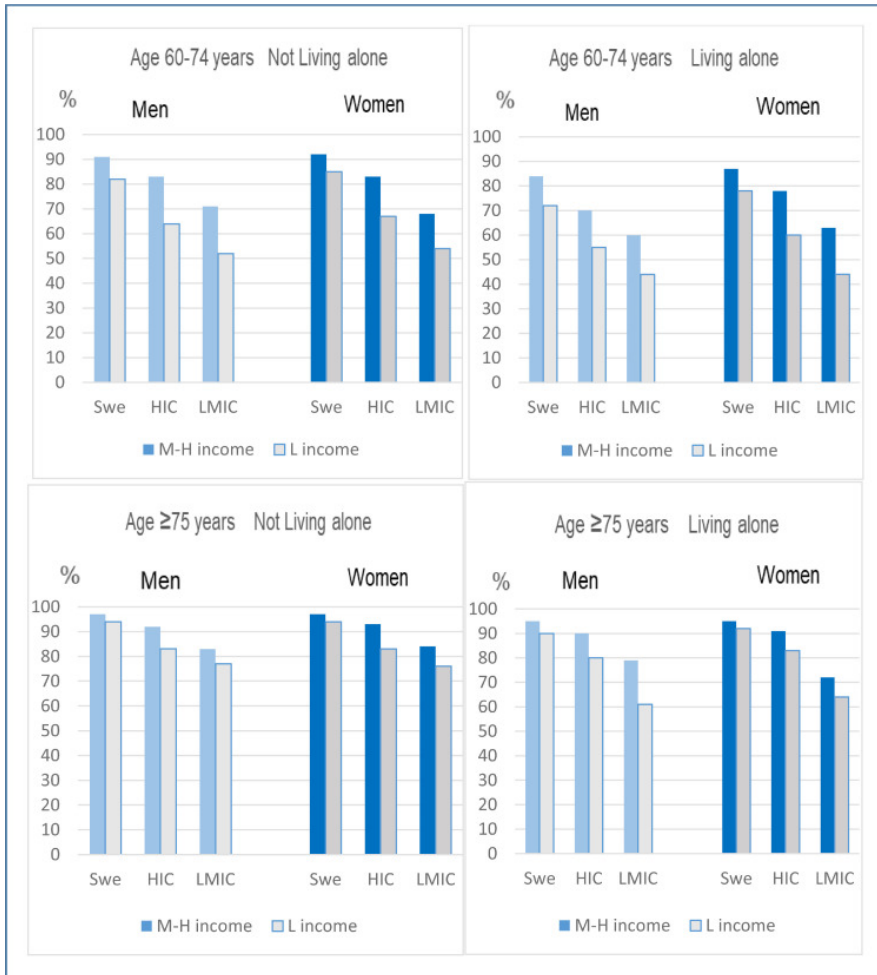
Vaccination hesitancy

- Vaccination hesitancy in general has increased and was reported as one of the top ten threats to global health by the WHO in 2019.
- Concerns about vaccine safety and government control.
- The rates of vaccination for a variety of diseases have been shown to be lower among certain ethnic groups ³ and in areas of higher deprivation.⁴
- This also appears to be similar for Covid 19 vaccination with lower uptake of vaccination reported in several defined groups.

Covid 19 – Sociodemographic differences in vaccine uptake

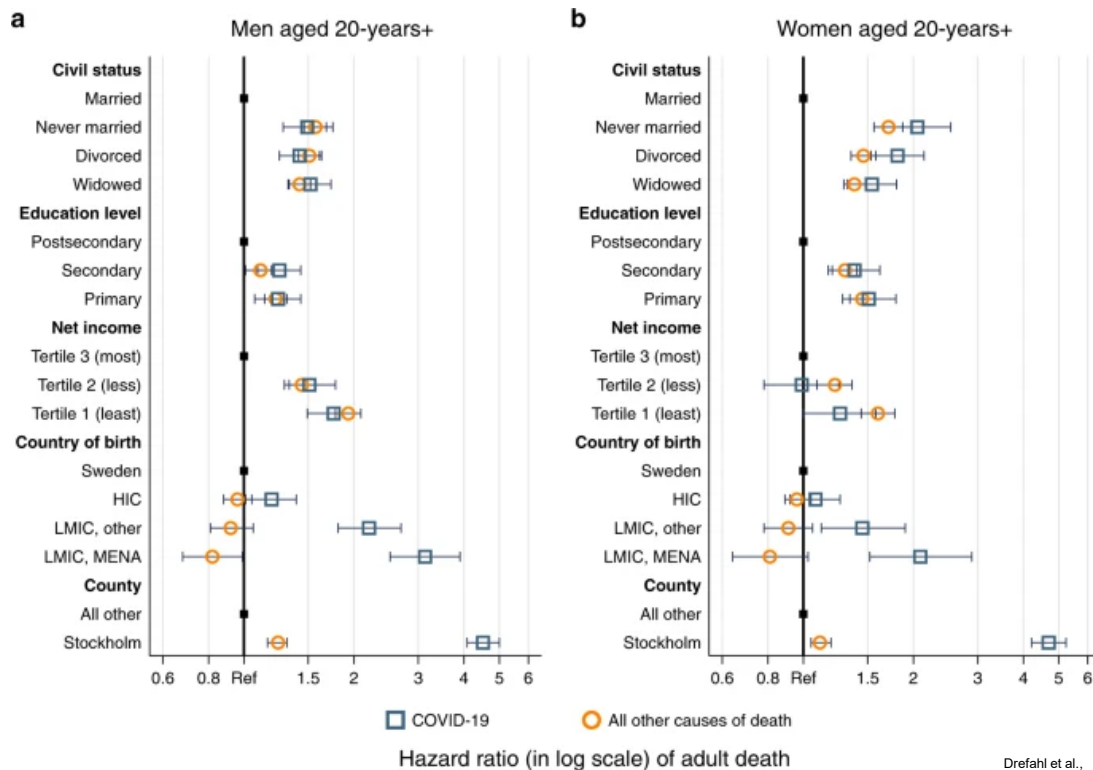
From a study population of 35,223,466 adults aged 18 years or over in the UK, first dose vaccination rates differed by sex, ethnic group, area deprivation and educational attainment. 2





In Sweden, from a population of 60 years or older:
 Younger age, male sex, lower income, living alone, and being born outside of Sweden, were all associated with a lower uptake of at least one dose vaccination. ⁵

- From Swedish population register data including 7,943,843 individuals aged 20 and above on March 12, 2020, being male, having less individual income, lower education, not being married and being an immigrant from a low- or middle-income country all predicted higher risk of death from COVID-19. 6



Covid-19 vaccination and severe disease

- Khan et al, reported markedly lower risks of severe disease among vaccinated individuals with at least two doses of a COVID-19 vaccine. 7
- Therefore, if socioeconomic differences are associated with higher risk of severe disease and death from covid-19, and the vaccination is protective...
- Understanding which sociodemographic, economic and cultural factors are associated with lower or higher odds of receiving two, three or more Covid-19 vaccination doses, can have major implications for public health policy and identify specific areas to target in order to maximise a vaccination strategy.

Study Aims

- To investigate sociodemographic determinants of COVID-19 vaccine uptake among adults (≥ 18 years) in a general population from southern Sweden.
- Comparing individuals with ≥ 2 doses vs 0 doses
- Comparing individuals with ≥ 3 doses vs 2 doses
- Individual level and regional level sociodemographic covariates.
- To map the uptake of the vaccine through different regional statistic areas of southern Sweden.

Study Population

- The study cohort included all adults (≥ 18 years) residing in Skåne county, Sweden, on 27 December 2020 (baseline) when vaccinations first started in Sweden.
- Followed until June 12th 2022. Individuals who died during follow up were censored on the date of death.
- Linkage from different data sources was facilitated using the personal identification number.
- Individual-level data on sex, date of birth, country of birth, civil status (marital status), education, comorbidity, disposable income and employment status were obtained from the Swedish Total Population Register and Statistiska centralbyråmyndigheten (SCB).
- Data on vaccine dose, vaccination date and type of vaccine during follow up was obtained from the National Vaccination Register at Public Health Agency, Sweden together with positive PCR tests from regional health care registers.

Regional level data

- Area-level data on socioeconomic conditions were obtained for each Regional Statistic Areas (RegSO) from Statistics Sweden.
- Sweden is divided into 21 geographical regions and each of these regions has been further divided into 465 different Regional Statistic Areas (RegSOs), with population sizes ranging from 363 to 22 622. (SCB).
- These geographical areas remain unchanged over time and are not affected by changes to the national postal code system which allows future replication of analysis.

Outcome

- The study outcomes were split in to two:
 - 1. Reception of either two or more doses vs 0 doses
 - 2. Three or more doses vs only 2 doses
- Of an approved COVID-19 vaccine (Pfizer-BioNTech, AstraZeneca or Moderna) by the end of follow up 12th June 2022.

Individual level sociodemographic covariates

- **Sex**, male or female.
- **Age**, 18 - 50 years, 51 - 64 years, 65 - 79 years and ≥ 80 years.
- **Marital status**, married, single, divorced or widowed.
- **Previous infection** with Covid 19 was defined has a positive covid test reported prior to either receiving the second vaccine dose or the third dose depending on the specific analysis.
- **Education**, Primary, Short secondary, Long secondary, Tertiary.
- **Disposable income** (100* SEK), quartiles (≤ 1420 , 1421 - 1990, 1991 – 2734, ≥ 2735).
- **Country of birth**, Sweden, Other Nordic, West Europe, Central and East Europe, Middle-East, Africa and other.
- **Employment status**, Unemployed, employed, sick leave, retired.
- **Comorbidity** (0, 1 or ≥ 2 comorbidities).

Regional level data (RegSo)

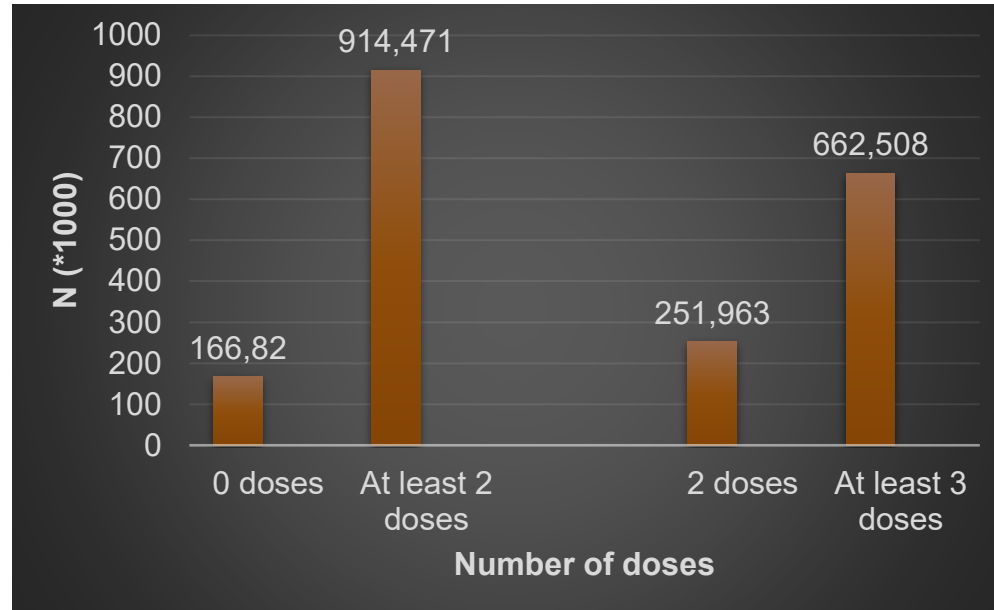
- On the RegSo level, a socio-economic index was used to define area types categorized as:
 - 1. Areas with major socio-economic challenges
 - 2. Areas with socio-economic challenges
 - 3. Socio-economically mixed areas
 - 4. Areas with good socio-economic conditions
 - 5. Areas with very good socio-economic conditions
- The area types are based on how many standard deviations from the index mean a RegSO is located. The more standard deviations above the index mean a RegSO is, the worse socio-economic conditions the RegSO is characterized by.
- The more standard deviations below the index mean a RegSO is, the better socio-economic conditions the RegSO is characterized by.

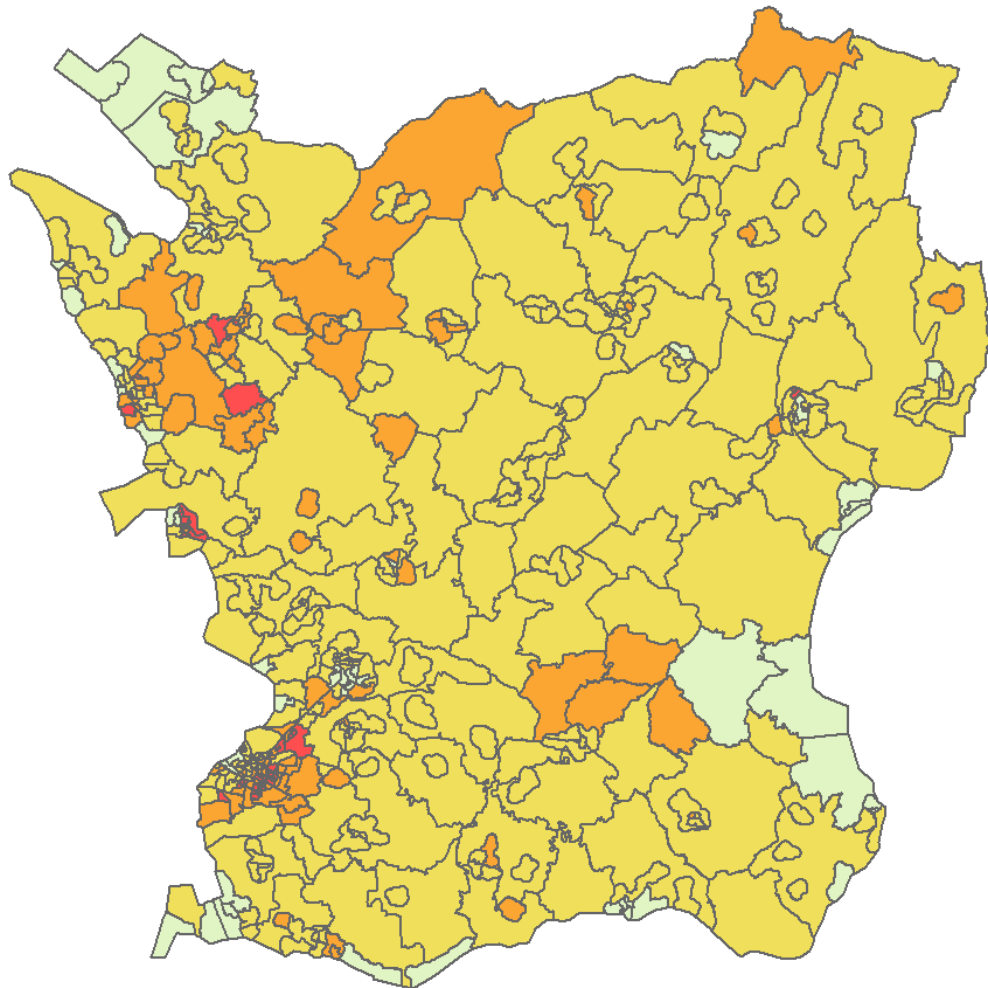
Statistical analyses

- Associations between sociodemographic factors and vaccination uptake were first modelled with logistic regression models and reported as odds ratios (ORs) together with 95% confidence intervals (CIs).
- Then we estimated the average marginal effects of individual covariates but then also combinations of specific covariates set at specific levels.
- First, we ran univariate models, assessing each covariate individually.
- Then combined into fully adjusted multivariable models including all covariates.
- Vaccination uptake by RegSO, mapped using R packages.

Study Population

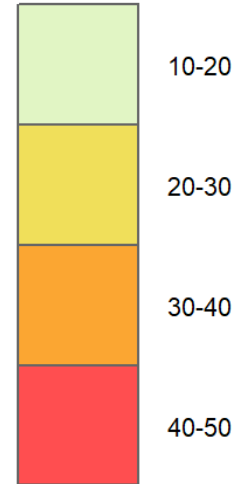
Population restricted by date of birth to ensure all included were 18 years old at baseline.

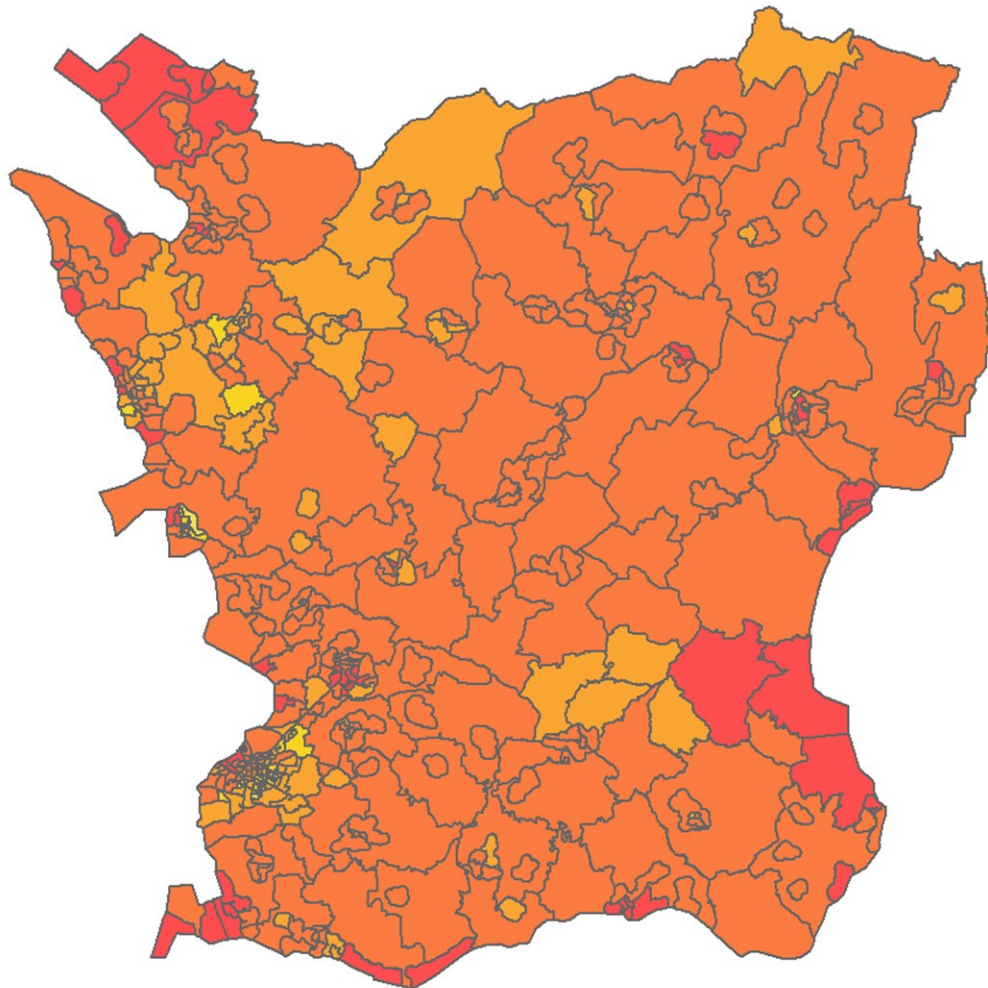




Dos_0

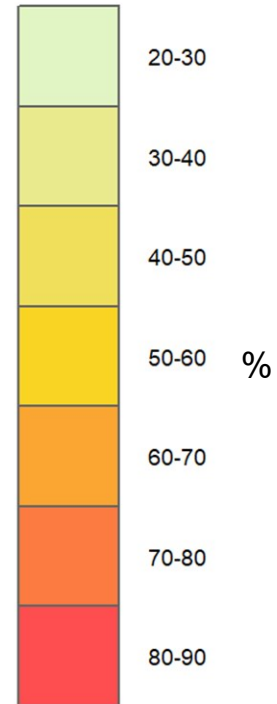
Percentage of individuals
with 0 vaccination doses
by RegSo, Skåne county

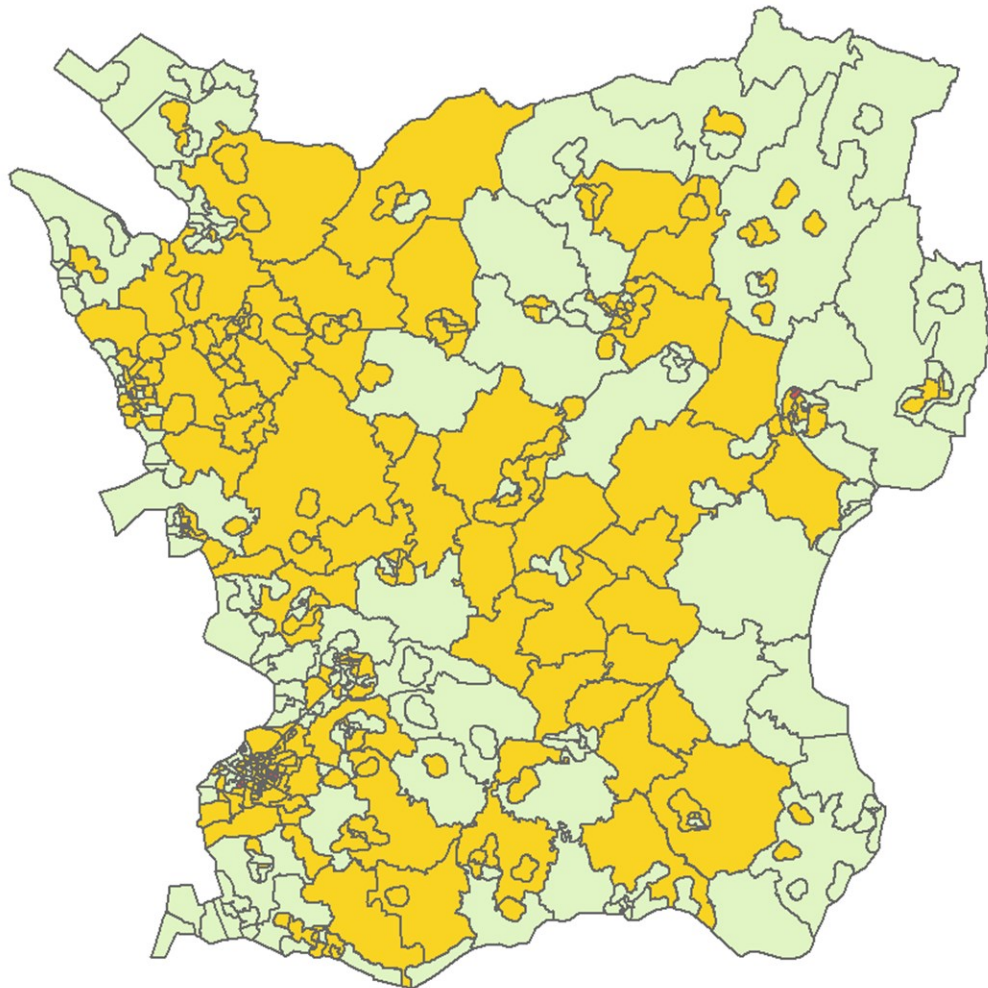




Dos_2_or_more

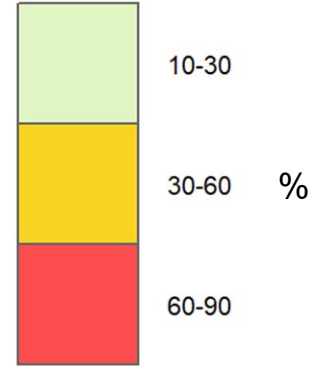
Percentage of individuals
with 2 or more
vaccination doses by
RegSo, Skåne county

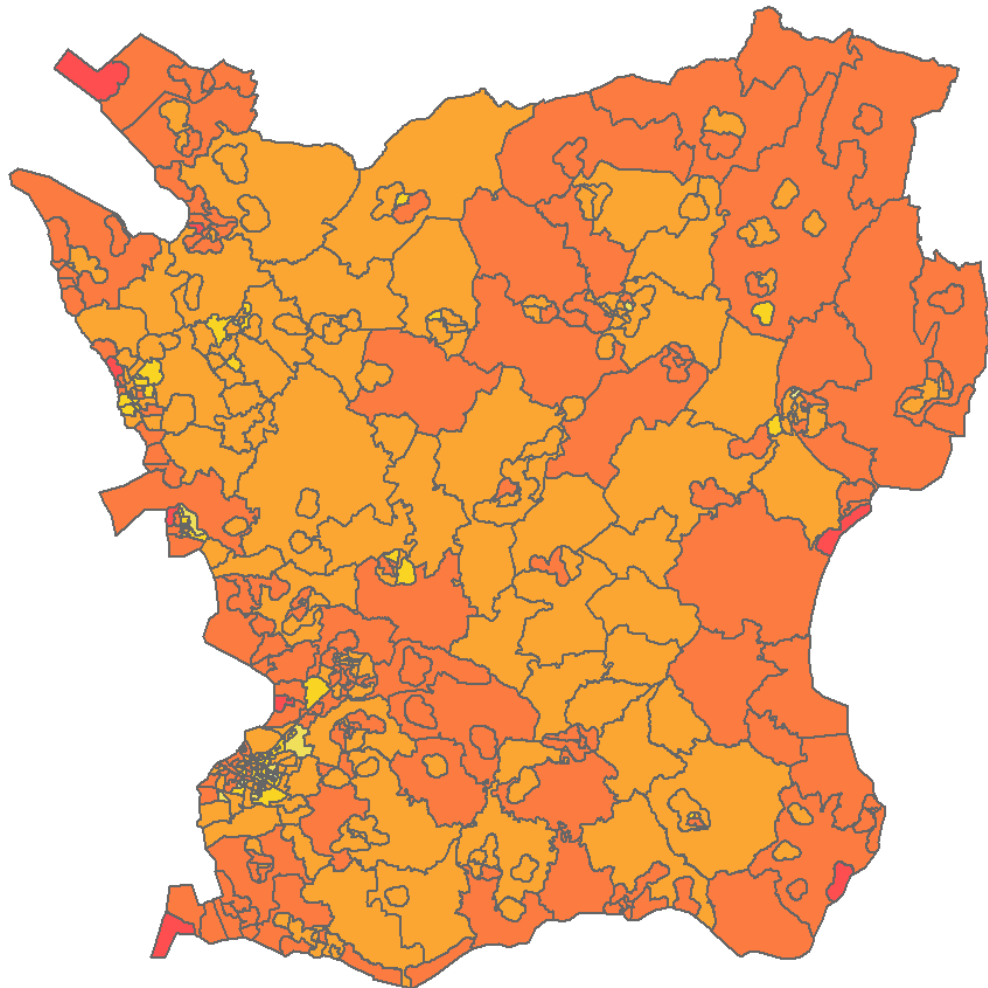




Dos_2_only

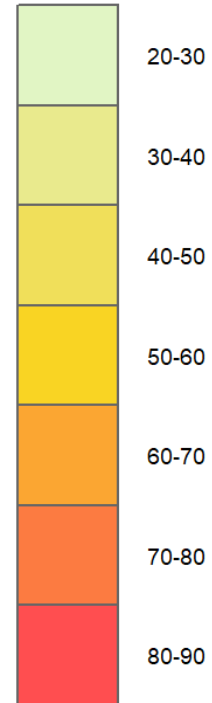
Percentage of individuals
with only 2 vaccination
doses by RegSo, Skåne
county





Dos_3_or_more

Percentage of individuals
with 3 or more
vaccination doses by
RegSo, Skåne county



%

Results – Regional level

Model 1
Univariate
(unadjusted)

Model 2
Multivariate (previous
infection, sex, age
group, civil status,
employment status,
country of birth,
comorbidity,
education, disposable
income), clustered on
RegSo.

| | OR | 95% CI | | OR | 95% CI | |
|--|-----------------------------|--------|------|---------|--------|------|
| | At least 2 doses vs 0 doses | | | | | |
| RegSo area type | Model 1 | | | Model 2 | | |
| Areas with major socio-economic challenges (reference) | 1.00 | | | 1.00 | | |
| Areas with socio-economic challenges | 1.73 | 1.70 | 1.77 | 1.28 | 1.25 | 1.31 |
| Socio-economically mixed areas | 2.41 | 2.37 | 2.45 | 1.41 | 1.38 | 1.44 |
| Areas with good socio-economic conditions | 3.83 | 3.76 | 3.89 | 1.83 | 1.79 | 1.86 |
| Areas with very good socio-economic conditions | 6.90 | 6.70 | 7.11 | 2.73 | 2.64 | 2.82 |
| | At least 3 doses vs 2 doses | | | | | |
| Areas with major socio-economic challenges (reference) | 1.00 | | | 1.00 | | |
| Areas with socio-economic challenges | 1.86 | 1.81 | 1.90 | 1.35 | 1.32 | 1.39 |
| Socio-economically mixed areas | 2.53 | 2.48 | 2.58 | 1.47 | 1.43 | 1.50 |
| Areas with good socio-economic conditions | 3.48 | 3.42 | 3.55 | 1.78 | 1.74 | 1.82 |
| Areas with very good socio-economic conditions | 5.27 | 5.14 | 5.41 | 2.39 | 2.30 | 2.47 |

Results - Individual level

Model 1
Univariate
(unadjusted)

Model 2
Multivariate (previous infection, sex, age group, civil status, employment status, country of birth, comorbidity, education, disposable income), clustered on RegSo.

| | OR | 95% CI | | OR | 95% CI | |
|------------------------------------|----------------|--------|-------|----------------|--------|------|
| At least 2 doses vs 0 doses | | | | | | |
| Previous infection | Model 1 | | | Model 2 | | |
| No | 1.00 | | | 1.00 | | |
| Yes | 0.45 | 0.44 | 0.45 | 0.47 | 0.46 | 0.48 |
| Sex | | | | | | |
| Male | 1.00 | | | 1.00 | | |
| Female | 1.24 | 1.22 | 1.26 | 1.19 | 1.17 | 1.20 |
| Age group | | | | | | |
| 18-49 | 1.00 | | | 1.00 | | |
| 50-64 | 2.17 | 2.14 | 2.20 | 1.81 | 1.78 | 1.84 |
| 65-79 | 3.81 | 3.74 | 2.88 | 2.68 | 2.55 | 2.81 |
| ≥ 80 | 3.31 | 3.22 | 3.41 | 2.20 | 2.10 | 2.33 |
| Comorbidities | | | | | | |
| 0 | 1.00 | | | 1.00 | | |
| 1 | 1.63 | 1.60 | 1.65 | 1.32 | 1.29 | 1.34 |
| ≥ 2 | 2.19 | 2.15 | 2.24 | 1.49 | 1.45 | 1.53 |
| At least 3 doses vs 2 doses | | | | | | |
| Previous infection | | | | | | |
| No | 1.00 | | | 1.00 | | |
| Yes | 0.59 | 0.58 | 0.59 | 0.65 | 0.64 | 0.65 |
| Sex | | | | | | |
| Male | 1.00 | | | 1.00 | | |
| Female | 1.30 | 1.28 | 1.32 | 1.27 | 1.25 | 1.28 |
| Age group | | | | | | |
| 18-49 | 1.00 | | | 1.00 | | |
| 50-64 | 3.65 | 3.60 | 3.69 | 3.16 | 3.11 | 3.20 |
| 65-79 | 11.42 | 11.20 | 11.64 | 6.80 | 6.50 | 7.12 |
| ≥ 80 | 8.25 | 8.03 | 8.49 | 4.85 | 4.60 | 5.12 |
| Comorbidities | | | | | | |
| 0 | 1.00 | | | 1.00 | | |
| 1 | 1.94 | 1.92 | 1.97 | 1.23 | 1.22 | 1.25 |
| ≥ 2 | 3.03 | 2.97 | 3.09 | 1.21 | 1.18 | 1.24 |

Results - Individual level

Model 1
Univariate
(unadjusted)

Model 2
Multivariate (previous
infection, sex, age
group, civil status,
employment status,
country of birth,
comorbidity,
education, disposable
income), clustered on
RegSo.

| | OR | 95% CI | | OR | 95% CI | |
|------------------------------|-----------------------------|--------|-------|---------|--------|------|
| | At least 2 doses vs 0 doses | | | | | |
| Civil status | Model 1 | | | Model 2 | | |
| Married | 1.00 | | | 1.00 | | |
| Unmarried | 0.50 | 0.49 | 0.50 | 0.57 | 0.56 | 0.58 |
| Divorced | 0.67 | 0.66 | 0.68 | 0.62 | 0.61 | 0.63 |
| Widow | 1.93 | 1.86 | 2.00 | 0.87 | 0.84 | 0.90 |
| Employment status | | | | | | |
| Unemployed | 1.00 | | | 1.00 | | |
| Employed | 3.91 | 3.86 | 3.96 | 2.92 | 2.88 | 2.96 |
| Sickness | 2.42 | 2.36 | 2.49 | 1.66 | 1.62 | 1.71 |
| Retired | 8.16 | 8.01 | 8.31 | 1.99 | 1.89 | 2.09 |
| Education level | | | | | | |
| Primary | 1.00 | | | 1.00 | | |
| Short secondary | 1.80 | 1.77 | 1.83 | 1.14 | 1.12 | 1.16 |
| Long secondary | 1.39 | 1.37 | 1.41 | 1.15 | 1.13 | 1.16 |
| Tertiary | 2.48 | 2.44 | 2.51 | 1.89 | 1.86 | 1.92 |
| Disposable income (*100 SEK) | | | | | | |
| ≤ 1420 | 1.00 | | | 1.00 | | |
| 1421 - 1990 | 2.58 | 2.55 | 2.62 | 1.55 | 1.52 | 1.57 |
| 1991 - 2734 | 3.48 | 3.43 | 3.53 | 2.03 | 1.99 | 2.06 |
| ≥ 2735 | 5.70 | 5.60 | 5.80 | 2.58 | 2.53 | 2.63 |
| | At least 3 doses vs 2 doses | | | | | |
| Civil status | | | | | | |
| Married | 1.00 | | | 1.00 | | |
| Unmarried | 0.38 | 0.37 | 0.38 | 0.60 | 0.59 | 0.61 |
| Divorced | 0.92 | 0.90 | 0.93 | 0.76 | 0.75 | 0.78 |
| Widow | 3.47 | 3.35 | 3.60 | 0.73 | 0.71 | 0.76 |
| Employment status | | | | | | |
| Unemployed | 1.00 | | | 1.00 | | |
| Employed | 2.46 | 2.42 | 2.49 | 1.36 | 1.33 | 1.38 |
| Sickness | 3.01 | 2.93 | 3.09 | 1.89 | 1.83 | 1.95 |
| Retired | 15.24 | 14.93 | 15.55 | 1.95 | 1.86 | 2.05 |
| Education level | | | | | | |
| Primary | 1.00 | | | 1.00 | | |
| Short secondary | 1.89 | 1.87 | 1.92 | 1.21 | 1.19 | 1.24 |
| Long secondary | 0.81 | 0.80 | 0.82 | 1.04 | 1.02 | 1.05 |
| Tertiary | 1.57 | 1.55 | 1.59 | 1.73 | 1.71 | 1.76 |
| Disposable income (*100 SEK) | | | | | | |
| ≤ 1420 | 1.00 | | | 1.00 | | |
| 1421 - 1990 | 1.95 | 1.93 | 1.98 | 1.24 | 1.23 | 1.26 |
| 1991 - 2734 | 2.11 | 2.09 | 2.14 | 1.59 | 1.56 | 1.61 |
| ≥ 2735 | 3.76 | 3.70 | 3.81 | 2.11 | 2.08 | 2.15 |

Results - Individual level

Model 1
Univariate
(unadjusted)

Model 2
Multivariate (previous
infection, sex, age
group, civil status,
employment status,
country of birth,
comorbidity,
education, disposable
income), clustered on
RegSo.

| | OR | 95% CI | | OR | 95% CI | |
|----------------------------|------------------------------------|--------|------|---------|--------|------|
| | At least 2 doses vs 0 doses | | | | | |
| Country of birth | Model 1 | | | Model 2 | | |
| Sweden | 1.00 | | | 1.00 | | |
| Other Nordic | 0.39 | 0.38 | 0.40 | 0.42 | 0.40 | 0.43 |
| Western Europe | 0.33 | 0.32 | 0.33 | 0.40 | 0.39 | 0.42 |
| Central and Eastern Europe | 0.18 | 0.17 | 0.18 | 0.21 | 0.20 | 0.21 |
| Middle East | 0.26 | 0.25 | 0.26 | 0.58 | 0.57 | 0.59 |
| Africa | 0.22 | 0.21 | 0.23 | 0.43 | 0.42 | 0.45 |
| Other | 0.49 | 0.48 | 0.51 | 0.79 | 0.76 | 0.81 |
| | At least 3 doses vs 2 doses | | | | | |
| Country of birth | | | | | | |
| Sweden | 1.00 | | | 1.00 | | |
| Other Nordic | 0.94 | 0.91 | 0.97 | 0.71 | 0.68 | 0.74 |
| Western Europe | 0.75 | 0.73 | 0.77 | 0.82 | 0.79 | 0.85 |
| Central and Eastern Europe | 0.32 | 0.31 | 0.32 | 0.30 | 0.29 | 0.31 |
| Middle East | 0.14 | 0.14 | 0.15 | 0.25 | 0.25 | 0.26 |
| Africa | 0.15 | 0.14 | 0.15 | 0.25 | 0.24 | 0.27 |
| Other | 0.42 | 0.41 | 0.43 | 0.66 | 0.64 | 0.67 |

Marginal effects

- Odds ratio can be difficult to interpret and be a meaningful measure to stakeholders.
- Marginal effects are a useful way to describe the average effect of changes in covariates on the change in the probability of outcomes from logistic regression and other nonlinear models.
- In effect, you are comparing two hypothetical populations – one all women, one all men – that have the values on the other independent variables in the model that they in fact had.
- Marginal effects provide a direct and easily interpreted answer to the research question of interest.

Margins

- Margins are calculated from predictions of a previously fit model (logistic) at fixed values of some covariates and averaging or otherwise integrating over the remaining covariates.
- For example, Stata's margins command can tell us the average marginal effect of Education on vaccination at a specific level of Education or the average marginal effect of a specific level of disposable income in a specific regional area.
- Results are interpreted as probabilities ranging from 0-1 (0%-100%).

Results Average Marginal Effects (AME) Regional

| RegSo area type | Doses | |
|---|-------------------------------|--------------------------------|
| | 2 or more | 3 or more |
| Areas with major socioeconomic challenges | 0.79 | 0.66 |
| Areas with socioeconomic challenges | 0.82 | 0.71 |
| Socio-economically mixed areas | 0.83 | 0.72 |
| Areas with good socioeconomic conditions | 0.85 | 0.74 |
| Areas with very good socioeconomic conditions | 0.88 | 0.77 |
| | 9 percentage point difference | 11 percentage point difference |

Results Average Marginal Effects (AME) Individual

Average marginal effect, probability of vaccination

| | | |
|--------------------|--------------------------------|--------------------------------|
| Previous infection | Dos 2 | Dos3 |
| no | 0.85 | 0.74 |
| yes | 0.76 | 0.68 |
| | 9 percentage point difference | 6 percentage point difference |
| Sex | | |
| Male | 0.82 | 0.71 |
| Female | 0.84 | 0.75 |
| | 2 percentage point difference | 4 percentage point difference |
| Age Group | | |
| <50 | 0.81 | 0.64 |
| 50-64 | 0.86 | 0.81 |
| 65-79 | 0.90 | 0.90 |
| 80+ | 0.92 | 0.94 |
| | 11 percentage point difference | 30 percentage point difference |
| Risk factors | | |
| No risk | 0.83 | 0.72 |
| 1 risk | 0.86 | 0.75 |
| ≥2 risks | 0.89 | 0.78 |
| | 6 percentage point difference | 6 percentage point difference |

Results Average Marginal Effects (AME) Individual

Average marginal effect, probability of vaccination.

| | | |
|-------------------|--------------------------------|-------------------------------|
| Civil group | Dos 2 | Dos3 |
| Unmarried | 0.81 | 0.69 |
| Married | 0.87 | 0.77 |
| Divorced | 0.82 | 0.73 |
| Widowed | 0.87 | 0.75 |
| | 6 percentage point difference | 8 percentage point difference |
| Employment status | | |
| Unemployed | 0.76 | 0.68 |
| Employed | 0.86 | 0.73 |
| Sickness | 0.83 | 0.77 |
| Retired | 0.84 | 0.78 |
| | 10 percentage point difference | 5 percentage point difference |
| Education | | |
| Primary | 0.81 | 0.69 |
| Short secondary | 0.82 | 0.72 |
| Long secondary | 0.82 | 0.69 |
| Tertiary | 0.87 | 0.77 |
| | 6 percentage point difference | 8 percentage point difference |
| Disposable income | | |
| ≤ 1420 | 0.78 | 0.67 |
| 1421 - 1990 | 0.84 | 0.71 |
| 1991 – 2734 | 0.87 | 0.74 |
| ≥ 2735 | 0.89 | 0.78 |
| | 11 percentage point difference | 11percentagepoint difference |

Results Average Marginal Effects (AME) Individual

Average marginal effect, probability of vaccination

| Country of birth | Dos 2 | Dos3 |
|----------------------------|-------|------|
| Sweden | 0.87 | 0.76 |
| Other nordic | 0.77 | 0.71 |
| Western Europe | 0.75 | 0.73 |
| Central and eastern Europe | 0.66 | 0.56 |
| Middle-east | 0.82 | 0.53 |
| Africa | 0.78 | 0.53 |
| Other | 0.70 | 0.70 |

Average Marginal effects multiple covariates

| | | RegSO socioeconomic condition | | | | |
|----------------|-------------|-------------------------------|----|----|----|----|
| Income | | 1 | 2 | 3 | 4 | 5 |
| Dose 2 or more | ≤ 1420 | 72 | 76 | 77 | 79 | 83 |
| | 1421 - 1990 | 79 | 82 | 83 | 85 | 88 |
| | 1991 – 2734 | 83 | 85 | 86 | 88 | 90 |
| | ≥ 2735 | 86 | 88 | 88 | 90 | 92 |
| | Income | | 1 | 2 | 3 | 4 |
| Dose 3 or more | ≤ 1420 | 60 | 65 | 65 | 68 | 71 |
| | 1421 - 1990 | 64 | 69 | 69 | 72 | 75 |
| | 1991 – 2734 | 68 | 72 | 73 | 75 | 78 |
| | ≥ 2735 | 73 | 77 | 77 | 79 | 82 |

Average Marginal effects multiple covariates

Dose 2 or more

| Country | RegSO socioeconomic condition | | | | |
|----------------------------|-------------------------------|------|------|------|------|
| | 1 | 2 | 3 | 4 | 5 |
| Sweden | 0.83 | 0.86 | 0.86 | 0.88 | 0.91 |
| Other Nordic | 0.71 | 0.74 | 0.75 | 0.78 | 0.82 |
| Western Europé | 0.69 | 0.73 | 0.74 | 0.77 | 0.81 |
| Central and eastern Europé | 0.59 | 0.63 | 0.64 | 0.68 | 0.73 |
| Middle-East | 0.77 | 0.80 | 0.81 | 0.83 | 0.87 |
| Africa | 0.73 | 0.76 | 0.77 | 0.80 | 0.84 |
| Other Nordic | 0.81 | 0.84 | 0.84 | 0.86 | 0.89 |

Dose 3 or more

| Country | RegSO socioeconomic condition | | | | |
|----------------------------|-------------------------------|------|------|------|------|
| | 1 | 2 | 3 | 4 | 5 |
| Sweden | 0.72 | 0.74 | 0.76 | 0.78 | 0.79 |
| Other Nordic | 0.65 | 0.68 | 0.70 | 0.72 | 0.75 |
| Western Europé | 0.70 | 0.71 | 0.73 | 0.74 | 0.76 |
| Central and eastern Europé | 0.50 | 0.52 | 0.54 | 0.57 | 0.59 |
| Middle-East | 0.46 | 0.49 | 0.52 | 0.55 | 0.58 |
| Africa | 0.43 | 0.48 | 0.53 | 0.57 | 0.62 |
| Other Nordic | 0.61 | 0.65 | 0.69 | 0.73 | 0.76 |

Average Marginal effects multiple covariates

| | | RegSO socioeconomic condition | | | | |
|----------------|-----------------|-------------------------------|----|----|----|----|
| | | 1 | 2 | 3 | 4 | 5 |
| Dose 2 or more | Education | | | | | |
| | Primary | 76 | 79 | 80 | 82 | 86 |
| | Short secondary | 78 | 81 | 81 | 84 | 87 |
| | Long secondary | 77 | 80 | 81 | 83 | 86 |
| | Tertiary | 83 | 86 | 86 | 88 | 91 |
| | | RegSO socioeconomic condition | | | | |
| | | 1 | 2 | 3 | 4 | 5 |
| Dose 3 or more | Education | | | | | |
| | Primary | 62 | 67 | 67 | 70 | 73 |
| | Short secondary | 65 | 70 | 70 | 73 | 76 |
| | Long secondary | 62 | 67 | 68 | 70 | 74 |
| | Tertiary | 71 | 75 | 76 | 78 | 81 |



Average Marginal effects multiple covariates

| | | Disposable Income | | | |
|----------------|-----------------|-------------------|----|----|----|
| | | 1 | 2 | 3 | 4 |
| Dose 2 or more | Education | | | | |
| | Primary | 75 | 80 | 84 | 87 |
| | Short secondary | 77 | 81 | 85 | 88 |
| | Long secondary | 77 | 81 | 84 | 87 |
| | Tertiary | 82 | 86 | 90 | 92 |
| | | Disposable Income | | | |
| | | 1 | 2 | 3 | 4 |
| Dose 3 or more | Education | | | | |
| | Primary | 56 | 61 | 66 | 71 |
| | Short secondary | 59 | 64 | 69 | 74 |
| | Long secondary | 62 | 64 | 67 | 70 |
| | Tertiary | 66 | 71 | 75 | 79 |

Strengths and Limitations

- **Strengths**

- General population in a socioeconomically diverse region.
- Register data with high coverage.
- Longer follow up, 2 and 3 or more doses.
- SES variables on the individual level.
- Regional data to allow vaccination mapping.
- Results that are meaningful to the public.

- **Limitations**

- Individuals who have moved out of the region.



Conclusions

- Using general population level linked data in southern Sweden, we demonstrate that second dose vaccination compared to no vaccination and further third dose vaccination versus only 2 doses, in adults aged 18 years and over differed by
- Previous infection status
- Sex
- Age
- Comorbidity
- Marital status
- Education
- Employment status
- Disposable income
- Regional area economic condition

Future perspectives

- Previous data has shown sociodemographic inequalities in first dose vaccination. We have added that these differences persist for second and third dose vaccination.
- As has been shown, risk of mortality and severe illness is greater in certain sociodemographic groups. Yet vaccination improves protection against severe illness.
- Targeted interventions to groups who have a lower probability of second or third dose vaccination could improve vaccination coverage.
- Could we mimic the "Uppsala model" with pre-booked vaccinations to selected areas with low coverage.



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Thank you

Adam Mitchell

Adam.Mitchell@med.lu.se



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