Voluntary association growth and mortality in Sweden 1895-1930

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Abstract

Living in an area with an active associational life can be good for population health. This study examines whether the establishment of a voluntary association in an area affected population-level mortality in Sweden from 1895 to 1930. This is done using data on total mortality on a parish level combined with data on the presence of three types of voluntary associations in the parish; Free-churches, temperance associations and unions. I estimate the lagged impact of the establishment of a voluntary association on future mortality levels using distributed non-linear lag models. The study finds that a negative relationship between period mortality levels and the founding of a union (-0.6/1000, CI: -0.73 -0.49) and temperance association (-0.25/1000, CI: -0.30 -0.04), and finds no relationship to the founding of a Free church. The effect of union presence was cumulative and reached a peak after eight years while the effect of temperance presence showed no effect in the first five years. These findings show that the emergence of voluntary organisations in Sweden had a positive impact on population health. Results which suggests that the establishment of a union or a temperance association increased social capital in the areas which lowered period mortality risks in the population.

1 Introduction

Living in an area with an active associational life can be good for one's health. Voluntary associations, such as unions, temperance groups and free churches, can increase feelings of trust, improve access to public health institutions and increase the availability of social support in an area (Borgonovi, 2008; Gallagher et al., 2019; Musick, Herzog, & House, 1999; Oman, Thoresen, & McMahon, 1999; Thoits & Hewitt, 2001). These are local improvements in social capital which is also linked to good public health. At the same time, these are social resources which a welfare state provides, diminishing the

return on public health from local voluntary association engagement. In this study, we contribute with an analysis of how voluntary association were associated with public health on an aggregate level, during the emergence of the Swedish welfare state (1895-1930).

Social capital has been shown having a positive effect on individual health (Kumar, Calvo, Avendano, Sivaramakrishnan, & Berkman, 2012; Rocco & Suhrcke, 2012). Formal social networks, such voluntary associations, has been proposed to be important for raising feelings of trust, increasing the potential for collective action and improving access to social and health care (Berkman & Krishna, 2014; Eriksson & Emmelin, 2013). Living in an area with strong voluntary associations has also been empirically shown to be related to good health and increased survival. However, voluntary associations are also more likely to establish in areas with strong social capital (Putnam, 2001; Sandell & Stern, 1998). Thus, the relationship between voluntary association presence and mortality might be confounded by other factors, such as industrialisation, urbanisation or previous mortality trends. The field has primarily been focused on studying the relationship in contemporary populations. The current study contributes to the field by providing an analysis of historical patterns, furthering our knowledge on whether these positive health effects are a resent development or part of a long-term phenomenon.

The object of this study is to assess whether the establishment of a voluntary association affected mortality on a local level. This is done using cross-sectional time-series data on crude mortality at a parish level and information on the size and location of three of the largest voluntary association groups in early 20th century Sweden, free churches, temperance associations and unions.

2 Data and setting

Between 1895 and 1930, crude mortality fell from around 19 per 1000 to around 15, see Figure 1. This pattern of decline was a continuation of the ongoing demographic transition in Sweden with falling mortality and fertility.

The data on mortality consists of crude mortality data on a parish level in Sweden, between 1895 and 1930. The Summary population accounts (*summariska folkmängsredogörelser*) reports gender-specific total mortality and population counts from 1865 to 1930. In the 1930s, the Myrdahl group gathered data for the period 1895 to 1930 (Thomas & others, 1941) and in the 1990s the Demographic Database at Umeå University, digitalised it. For the current study, we need to create continuous panel-time-series data across the period. However, parish boundaries change over the study period. To account for this, the parishes were aggregated to temporally stable geographical

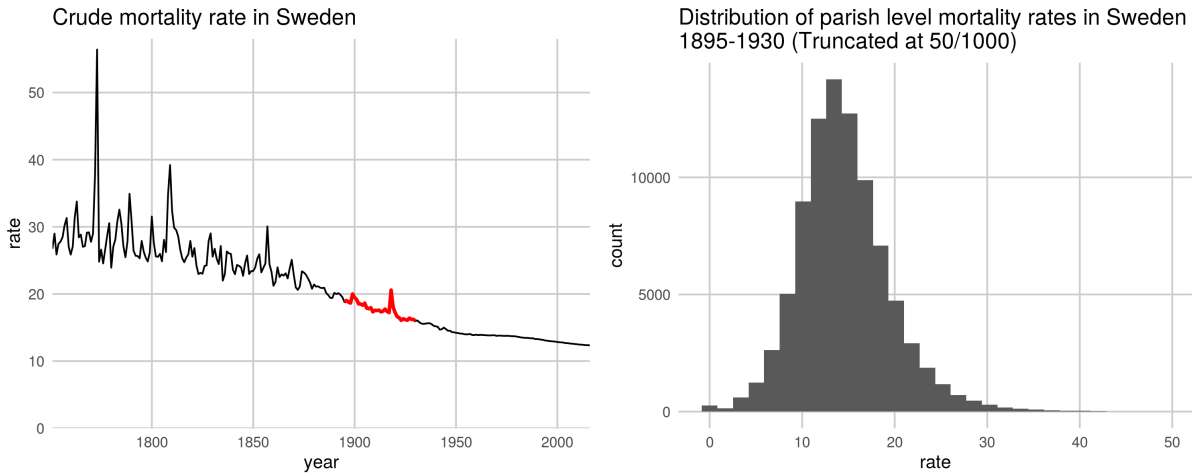


Figure 1: Crude mortality trends and distributions in Sweden

units (demotrendsblog, 2017). Additionally, the data contained errors, caused either by reporting errors by the minister, transcribers or the data entry assistant who entered the wrong number. The extreme errors are identified using outlier detection and replaced by estimated values using Friedman's "SuperSmoother" (Hyndman et al., 2019; Hyndman & Khandakar, 2008).

Voluntary associations consist of groups who were large, independent of the state and were membership was voluntary (Lundkvist, 1980; Sills, 1968). This study focuses on the three largest associations in Sweden, the free churches, temperance associations and workers movement (in this paper represented by unions). The free churches grew rapidly and were in the late 19th century the largest association, and then stagnated around the turn of the century. The temperance associations grew into the largest association in the early 20th century and then declined after around 1910. Although the workers' movement was later to establish in Sweden than the other associations, they soon grew to be the largest group in Sweden after 1918. In total around a third of the adult population were members of at least one of the three association in 1930.

Aggregate level information on voluntary organisation size is gathered from the Popular Movement Database. The database contains yearly membership numbers for local organisations which were part of the popular movement, the free-churches, temperance organisations, unions and the Social Democratic Party between 1881 and 1945 (Andrae, 1984; Andrae & Lundkvist, 1998). Each local group represents a local organisation with their own board, holding regular meetings with their local members (Ambjörnsson, 1998; Lundkvist, 1977). However, as the membership records were not collected annually, the missing values were imputed using linear interpolation. The locations of the local groups were geocoded; the process is described in greater detail by Junkka (2018b).

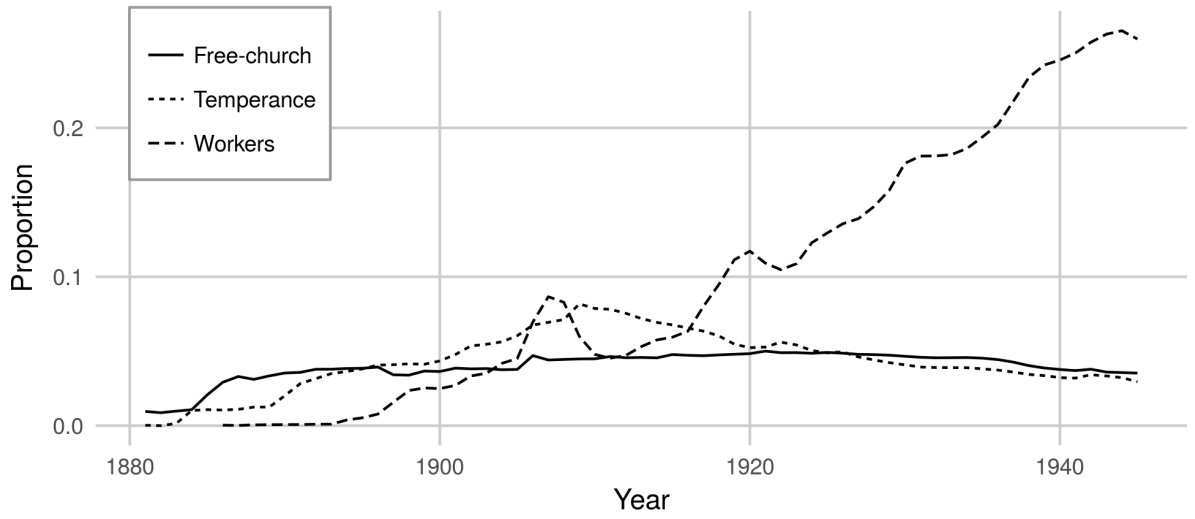


Figure 2: Size of voluntary associations in proportion to the size of the adult population between 1881 and 1945

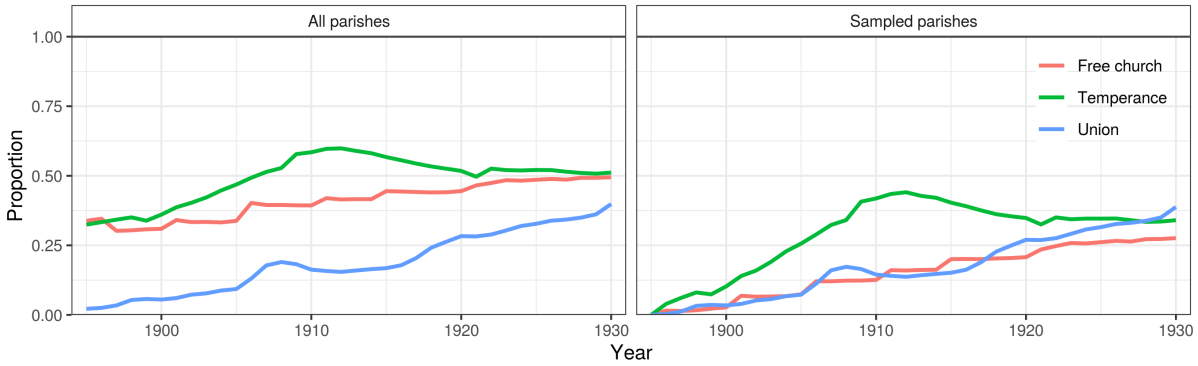


Figure 3: Proportion of parishes with a voluntary association by year

3 Method

The effect of a voluntary association presence on mortality is estimated for all parishes without an organisation of that type at the start of the study period (1895). Therefore the analysis is performed separately for each voluntary association type, see table 1. As seen in Figure 3, the majority of parishes did not have an association at the beginning of the study period.

To estimate how the establishment of a voluntary association was related to future mortality levels on a parish level, I use multi-level linear regression models. There were large spatial variations in the level and pace of mortality decline in Sweden during the period 1885 to 1930. To account for this spatial heterogeneity, I estimate both a separate intercept and a separate slope for each parish in the sample using linear mixed-effects

regression models (lme) (Bates, Mächler, Bolker, & Walker, 2015). Additionally, the overall temporal effect is specified as nonlinear function, specifically as a cubic spline with 5 degrees of freedom. Thus the measurements were adjusted for both parish level trends as well as overall period effects. Additionally, the model also includes dummies for the presence of any of the other type of organisation. Voluntary association presence has also been shown to be associated with low fertility which could be an underlying mechanism for low mortality, thus I adjust the measurements for parish-level crude fertility rate (Junkka, 2018b, 2018a; Junkka & Edvinsson, 2016). Finally, to account for differences between urban and rural locations, the models were adjusted for and the log of population density as a proxy for urbanisation.

Furthermore, in these models, I assume that the effect of a voluntary organisation has a lagged effect on mortality, that, over time, would have a nonlinear relationship to mortality. In other words, we can expect the effect of the establishment of an organisation would not have an immediate effect on mortality levels, but rather a lagged effect that would vary as time progressed. To account for this delayed, nonlinear relationship the linear model is combined with a distributed lag nonlinear. model (DLNM) (Gasparrini, Armstrong, & Kenward, 2010). Additionally, to account for the overall trend in mortality, the models include a nonlinear function of calendar time, modelled as a polynomial cubic spline with three degrees of freedom. Thus splitting the overall time trend into three chunks wherein mortality would follow a nonlinear polynomial function.

The DLNM process entails a specification of a cross basis function of yearly information on the presence of an organisation in the past ten years. The cross basis function describes a lagged response curve with polynomial cubic spline with five degrees of freedom, splitting the lagged response into five two year periods. The relationship between mortality and voluntary association presence, described by the model, is thus both lagged and nonlinear. In order to interpret how the relationship changes after the establishment of an organisation, I calculated the cumulative predicted changes in mortality rate as the number of lives saved per 1000 individuals over the full lag interval, between 0 and 10 years. The models are implemented using R, and the `lme4` and `dlnm` packages.

4 Results

Parishes with a voluntary association had on average lower mortality than other parishes, independently of the type of organisation as seen in Table 1. By calculating the mortality rates within parishes with an organisation against those without (Figure 4) we see that parishes with an organisation had, from the beginning of the period had

Table 1: Descriptive statistics of the three samples.

			All parishes							Parishes with a organisation					
Sample	N	Variable	Mean	Min	25th	Median	75th	Max	N	Mean	Min	25th	Median	75th	Max
Union	85979	Union pres.	0.17						15011	1					
		Free-church pres.	0.4							0.71					
		Temperance pres.	0.48							0.84					
		Pop. density	0.075	4.2e-05	0.013	0.021	0.034	35.89		0.14	0.00021	0.012	0.022	0.045	35.89
		Fertility	0.043	0	0.034	0.042	0.051	0.33		0.042	0	0.033	0.041	0.05	0.16
		Population	1972.86	4	644	1154	2117	1e+05		4065.98	145	1578	2676	4643.25	1e+05
		Mortality rate	14.55	0	11.36	14.12	17.28	48.75		13.1	0	10.78	12.77	15.1	48.75
		Year	1912.5	1895	1904	1913	1921	1930		1919.29	1896	1913	1921	1926	1930
Temperance	59321	Union pres.	0.1						17423	0.23					
		Free-church pres.	0.28							0.47					
		Temperance pres.	0.29							1					
		Pop. density	0.091	0.00014	0.014	0.022	0.034	35.89		0.055	0.00017	0.013	0.019	0.03	13.37
		Fertility	0.042	0	0.033	0.042	0.051	0.16		0.042	0	0.033	0.041	0.05	0.16
		Population	1485.84	81	542	903	1517	1e+05		1962.81	96	781	1299	2198	60213
		Mortality rate	14.63	0	11.18	14.22	17.64	48.23		14.2	0	11.2	13.8	16.77	46.51
		Year	1912.51	1895	1904	1913	1922	1930		1915.75	1896	1909	1916	1923	1930
Free church	58136	Union pres.	0.12						9035	0.32					
		Free-church pres.	0.16							1					
		Temperance pres.	0.37							0.67					
		Pop. density	0.071	0.00014	0.015	0.023	0.036	18.79		0.044	0.00021	0.012	0.02	0.032	1.14
		Fertility	0.043	0	0.034	0.042	0.051	0.16		0.041	0	0.032	0.04	0.049	0.16
		Population	1529.88	81	559	952	1630	78504		2183.78	81	803	1365	2555.5	28631
		Mortality rate	14.57	0	11.14	14.15	17.54	48.23		13.69	0	10.69	13.24	16.16	41
		Year	1912.51	1895	1904	1913	1922	1930		1918.51	1896	1913	1920	1925	1930

similar rates as those without. After the turn of the century, the gap between the groups emerged, showing the most substantial difference for unions followed by temperance associations and the free churches.

Estimating the effect of voluntary association presence on crude mortality without any lag, we find that the estimated effect mirror the crude rates. Figure 5 show that Unions had the largest effect, 1/1000 lower mortality than average, in parishes with a Free church it was 0.25/1000 lower and in temperance parishes, about 0.23 lower. Comparing the estimates from the OLS regressions with the ones from the linear mixed-effects models, we see that estimates are substantially lower when adjusting the estimates spatial heterogeneity in addition to differences in population density, fertility-level and period effects. Thus, there seems to be a spatial bias, wherein voluntary associations seem to start up in parishes with already low mortality. However, there are still negative associations to union and temperance presence.

These averaged effect hide significant lagged patterns. This becomes evident when calculating the estimated cumulative effect of voluntary association presence from the predicted lag coefficients, see Figure 6. The effect of union presence a steady positive

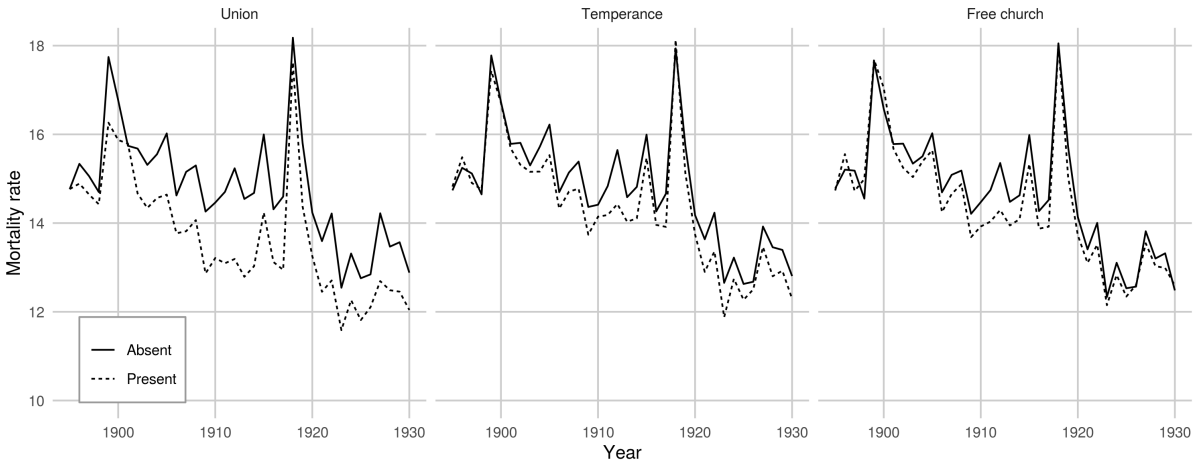


Figure 4: Mean crude mortality in parishes with and without a voluntary association

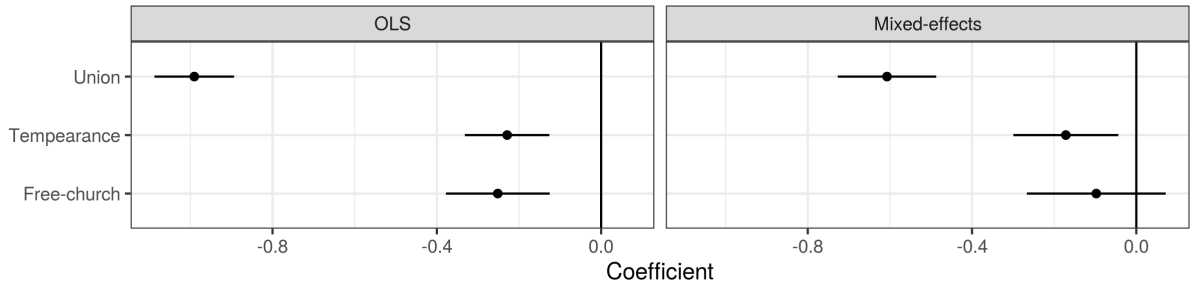


Figure 5: Estimated overall effects of voluntary association presence on parish level crude mortality

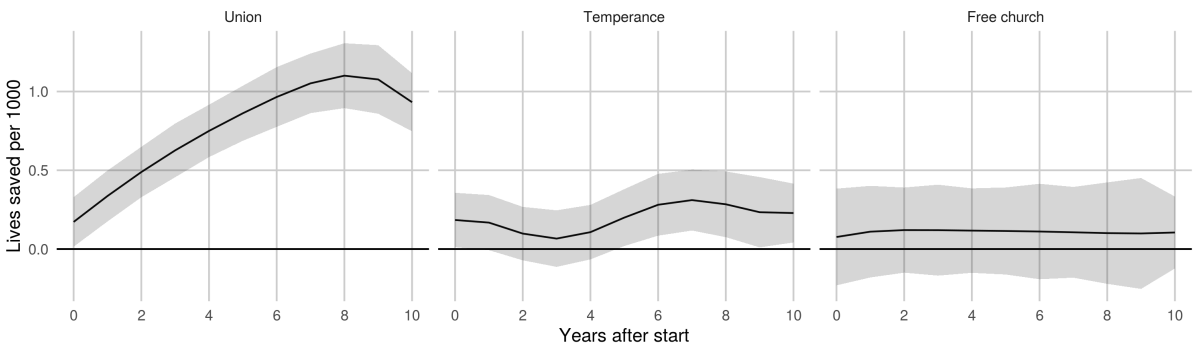


Figure 6: Cumulative mortality effect of voluntary association presence over 10 years after initial establishment.

effect on survival up until eight years after establishment, when the effect peeked at around 1/1000 and then started to decline. Temperance association presence had, within the first year, no to minimal effect on mortality. After around five years, the effect on survival increased, showing at most a 0.25 lower mortality. Free church presence shows no significant effects over the ten following years after establishment.

5 Conclusions

The preliminary results presented in this study shows a relationship between voluntary association presence and crude mortality. Populations in parishes were a union or a temperance association was founded had on average lower crude mortality afterwards than other parishes; however, the establishment of a free church did not seem to be related to mortality outcomes. Furthermore, the study also finds that these relationships hold when adjusting the potential impact of the founding of an organisation for parish-level mortality before its establishment, the presence of other organisations, fertility and overall temporal trends in mortality. Finally, the effects had significant lagged patterns, showing increasing effects for unions until eight years after its founding. For temperance presence, I find that they had initially no effect, and then the strongest effects after 6-8 years after its founding. These temporal findings indicate a causal relationship between voluntary association presence and population health.

The potential explanations of these patterns are that voluntary associations, through its establishment, strengthened social capital within a parish. That, in turn, increased feelings of trust, that would lower stress and improve health in the population at large. Furthermore, there is an ideational link between voluntary associations and healthy behaviours. It is easy to assume that the focus of the unions on ideas of good healthy workers and the temperance associations ideational drive for sobriety had an impact

on, not only population behaviour but also on public policies which would improve health and survival (Ambjörnsson, 1998; Åberg, 1995; Frånberg, 1983; Lundkvist, 1977).

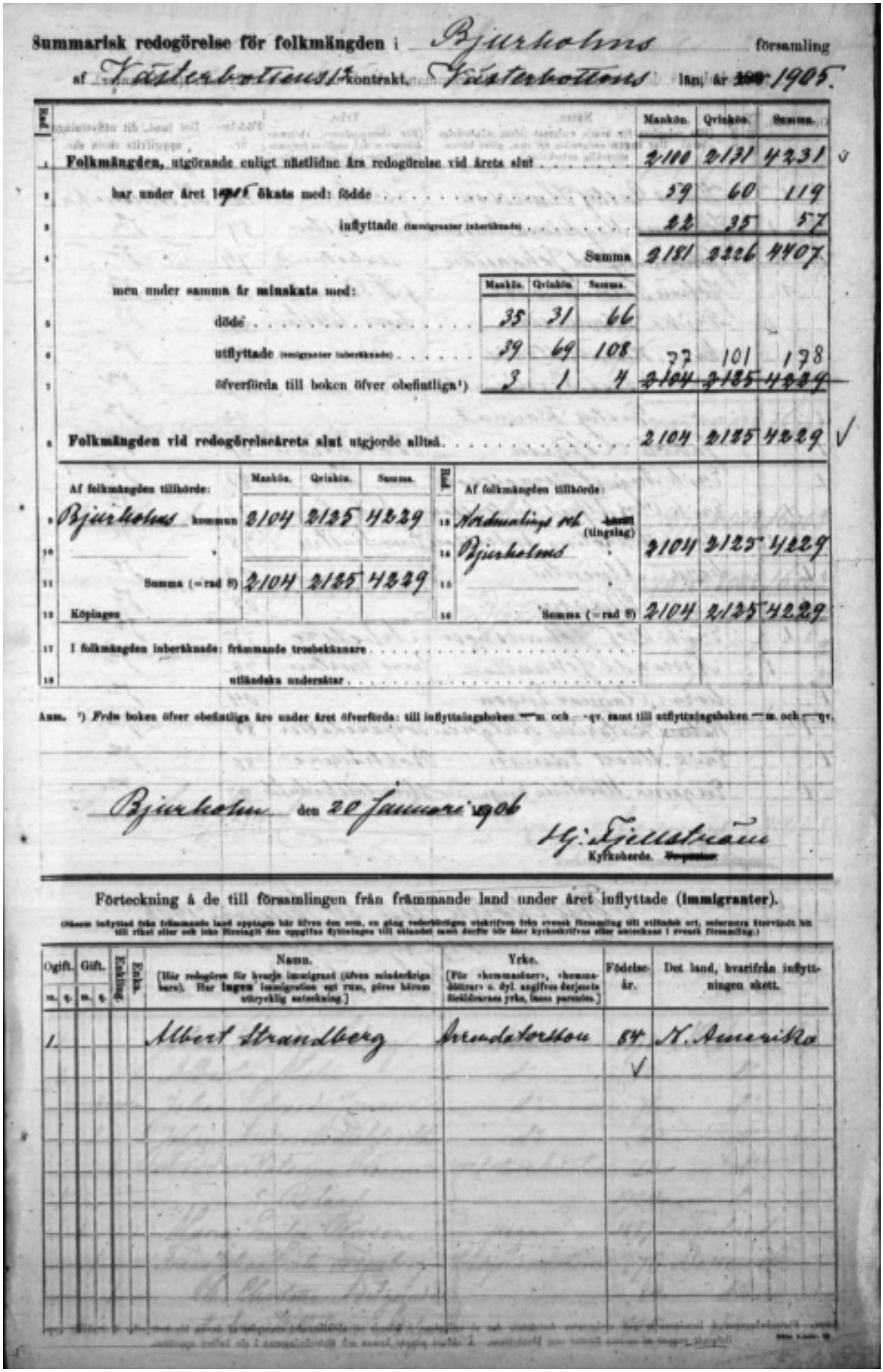
However, using crude measurements of mortality, this study is not able to detect any age-specific or gender-specific effects. This is a significant limitation, as the associations recruited from quite different groups, for example, were the free churches dominated by women while men were numerically dominating the unions. Furthermore, in order to assess the reliability of the models, sensitivity tests are needed, primarily to check whether there were any lead effects before the foundation of a voluntary association. Any lead effects would indicate some form of selection mechanisms which is not captured by the model.

6 Appendix

Table 2: OLS regression models

	Crude mortality rate		
	Union	**Temperance**	**Free church**
Organisation present	-0.991^{***}	-0.229^{***}	-0.252^{***}
	$(-1.088, -0.893)$	$(-0.332, -0.126)$	$(-0.378, -0.125)$
Temperance present	-0.184^{***}		-0.206^{***}
	$(-0.258, -0.110)$		$(-0.301, -0.111)$
Union present		-1.099^{***}	-0.988^{***}
		$(-1.250, -0.949)$	$(-1.131, -0.845)$
Free church present	-0.045	-0.003	
	$(-0.119, 0.029)$	$(-0.103, 0.096)$	
Fertility rate	0.024^{***}	0.025^{***}	0.026^{***}
	(0.021, 0.027)	(0.021, 0.029)	(0.022, 0.030)
Log of population density	-0.172^{***}	-0.209^{***}	-0.190^{***}
	$(-0.205, -0.140)$	$(-0.253, -0.165)$	$(-0.232, -0.148)$
Calendar time: Knot 1	3.603^{***}	3.525^{***}	3.405^{***}
	(3.299, 3.908)	(3.135, 3.914)	(3.016, 3.794)
Calendar time: Knot 2	-1.353^{***}	-1.157^{***}	-1.245^{***}
	$(-1.575, -1.131)$	$(-1.450, -0.864)$	$(-1.537, -0.954)$
Calendar time: Knot 3	3.088^{***}	3.054^{***}	3.035^{***}
	(2.804, 3.372)	(2.686, 3.422)	(2.667, 3.403)
Calendar time: Knot 4	-2.381^{***}	-2.323^{***}	-2.510^{***}
	$(-2.623, -2.139)$	$(-2.630, -2.016)$	$(-2.818, -2.202)$
Calendar time: Knot 5	-0.150	-0.057	-0.252^{*}
	$(-0.379, 0.078)$	$(-0.352, 0.239)$	$(-0.548, 0.045)$
Intercept	13.567^{***}	13.352^{***}	13.511^{***}
	(13.370, 13.764)	(13.095, 13.610)	(13.258, 13.763)
N	85979	59321	58136
R-squared	0.053	0.043	0.048
AIC	516808.000	365284.000	356840.100

$^{***}p < .01$; $^{**}p < .05$; $^{*}p < .1$



Summarisk redogörelse för folkmängden i Bjurholms **församling**
af Västerbottens **kontrakt,** Västerbottens **län, år** 1905.

Rad		Mankön.	Qvinkön.	Summa.
1	**Folkmängden,** utgörande enligt nästlidne års redogörelse vid årets slut	2100	2131	4231
2	har under året 1905 ökats med: födde	59	60	119
3	inflyttade (immigranter inberäknade)	22	35	57
4	Summa	2181	2226	4407
	men under samma år **minskats** med:	Mankön.	Qvinkön.	Summa.
5	döde	35	31	66
6	utflyttade (emigranter inberäknade)	39	69	108
7	öfverförda till boken öfver obefintliga[1])	3	1	4
		77	101	178
		~~2104~~	~~2125~~	~~4229~~
8	**Folkmängden vid redogörelseårets slut utgjorde alltså**	2104	2125	4229 ✓

Rad	Af folkmängden tillhörde:	Mankön.	Qvinkön.	Summa.	Rad	Af folkmängden tillhörde:			
9	Bjurholms kommun	2104	2125	4229	13	Nordmalings och ~~Lycksele~~ (tingslag)			
10					14	Bjurholms "	2104	2125	4229
11	Summa (=rad 8)	2104	2125	4229	15				
12	Köpingen				16	Summa (=rad 8)	2104	2125	4229
17	I folkmängden inberäknade: främmande trosbekännare								
18	utländska undersåtar								

Anm. [1]) Från boken öfver obefintliga äro under året öfverförda: till inflyttningsboken —m. och —qv. samt till utflyttningsboken —m. och —qv.

Bjurholm den 20 januari 1906

H. Fjellström
Kyrkoherde.

Förteckning å de till församlingen från främmande land under året inflyttade (immigranter).

(Såsom inflyttad från främmande land upptages här äfven den som, en gång vederbörligen utskrifven från svensk församling till utländsk ort, sedermera återvändt hit till riket eller ock icke förrängt den uppgifna flyttningen till utlandet samt derifrån blir åter kyrkoskrifven eller antecknad i svensk församling.)

Ogift. m.	Ogift. q.	Gift. m.	Gift. q.	Änkling	Änka	Namn. (Här redogöres för hvarje immigrant (äfven minderåriga barn). Har **ingen** immigration ägt rum, göres härom uttrycklig anteckning.)	Yrke. (För »hemmansägare», »hemmansdöttrar» o. dyl. angifves derjemte föräldrarnes yrke, hvem patronen.)	Födelse-år.	Det land, hvarifrån inflyttningen skett.
1.						Albert Strandberg	Arrendatorsson	84 ✓	N. Amerika

Figure 7: Example of 'Summariska befolkningsredogörelser' for Bjurholm 1905

Table 3: Linear mixed effects model

	Crude mortality rate		
	Union	**Temperance**	**Free church**
Organisation present	-0.607^{***}	-0.172^{***}	-0.097
	$(-0.727, -0.487)$	$(-0.299, -0.044)$	$(-0.266, 0.072)$
Temperance present	-0.173^{***}		-0.219^{***}
	$(-0.274, -0.073)$		$(-0.347, -0.091)$
Union present		-0.706^{***}	-0.658^{***}
		$(-0.889, -0.523)$	$(-0.831, -0.484)$
Free church present	-0.072	0.008	
	$(-0.187, 0.043)$	$(-0.143, 0.158)$	
Fertility rate	0.023^{***}	0.024^{***}	0.025^{***}
	(0.020, 0.026)	(0.020, 0.027)	(0.021, 0.029)
Log of population density	-0.311^{***}	-0.378^{***}	-0.356^{***}
	$(-0.376, -0.246)$	$(-0.461, -0.294)$	$(-0.437, -0.275)$
Calendar time: Knot 1	3.595^{***}	3.512^{***}	3.394^{***}
	(3.308, 3.882)	(3.143, 3.882)	(3.026, 3.763)
Calendar time: Knot 2	-1.420^{***}	-1.228^{***}	-1.303^{***}
	$(-1.633, -1.208)$	$(-1.511, -0.944)$	$(-1.583, -1.022)$
Calendar time: Knot 3	3.019^{***}	2.975^{***}	2.954^{***}
	(2.744, 3.294)	(2.615, 3.335)	(2.595, 3.313)
Calendar time: Knot 4	-2.533^{***}	-2.457^{***}	-2.658^{***}
	$(-2.778, -2.288)$	$(-2.770, -2.145)$	$(-2.972, -2.344)$
Calendar time: Knot 5	-0.309^{**}	-0.210	-0.412^{***}
	$(-0.546, -0.072)$	$(-0.517, 0.097)$	$(-0.722, -0.103)$
Intercept	13.043^{***}	12.728^{***}	12.902^{***}
	(12.744, 13.342)	(12.349, 13.107)	(12.530, 13.274)
SD of parish intercept	2.13	2.173	2.251
Cor. parish and year	-0.724	-0.744	-0.758
SD of parish specific year effect	0.067	0.07	0.071
N parishes	2394	1651	1618
N	85979	59321	58136
Log Likelihood	-255801.300	-181200.200	-176857.300
AIC	511632.500	362430.500	353744.500
BIC	511772.900	362565.300	353879.100

$^{***}p < .01$; $^{**}p < .05$; $^{*}p < .1$

Table 4: DLNM base models

	Crude mortality rate		
	Union	**Temperance**	**Free church**
Lag of presence: Knot 1	-0.172^{**}	-0.184^{**}	-0.076
	$(-0.329, -0.015)$	$(-0.357, -0.012)$	$(-0.383, 0.230)$
Lag of presence: Knot 2	-0.165	0.304^{*}	0.013
	$(-0.488, 0.159)$	$(-0.050, 0.659)$	$(-0.655, 0.681)$
Lag of presence: Knot 3	-0.090	-0.416	-0.008
	$(-0.557, 0.377)$	$(-0.922, 0.089)$	$(-0.964, 0.947)$
Lag of presence: Knot 4	-0.104	0.158	0.013
	$(-0.451, 0.243)$	$(-0.209, 0.526)$	$(-0.686, 0.712)$
Lag of presence: Knot 5	0.145	0.005	-0.006
	$(-0.044, 0.333)$	$(-0.183, 0.194)$	$(-0.352, 0.340)$
Temperance present	-0.145^{***}		-0.218^{***}
	$(-0.246, -0.044)$		$(-0.346, -0.089)$
Union present		-0.694^{***}	-0.657^{***}
		$(-0.879, -0.510)$	$(-0.831, -0.483)$
Free church present	-0.039	0.018	
	$(-0.154, 0.076)$	$(-0.135, 0.170)$	
Fertility rate	0.023^{***}	0.024^{***}	0.025^{***}
	(0.020, 0.026)	(0.020, 0.027)	(0.021, 0.029)
Log of population density	-0.295^{***}	-0.379^{***}	-0.356^{***}
	$(-0.360, -0.230)$	$(-0.463, -0.296)$	$(-0.437, -0.275)$
Calendar time: Knot 1	3.561^{***}	3.511^{***}	3.395^{***}
	(3.273, 3.848)	(3.141, 3.881)	(3.026, 3.763)
Calendar time: Knot 2	-1.402^{***}	-1.234^{***}	-1.301^{***}
	$(-1.615, -1.188)$	$(-1.520, -0.949)$	$(-1.582, -1.021)$
Calendar time: Knot 3	3.033^{***}	3.023^{***}	2.955^{***}
	(2.757, 3.309)	(2.654, 3.392)	(2.596, 3.314)
Calendar time: Knot 4	-2.468^{***}	-2.458^{***}	-2.656^{***}
	$(-2.713, -2.223)$	$(-2.774, -2.141)$	$(-2.971, -2.341)$
Calendar time: Knot 5	-0.234^{*}	-0.191	-0.411^{***}
	$(-0.473, 0.006)$	$(-0.501, 0.119)$	$(-0.721, -0.100)$
Intercept	13.095^{***}	12.721^{***}	12.902^{***}
	(12.796, 13.394)	(12.342, 13.100)	(12.529, 13.274)
SD of parish intercept	2.132	2.175	2.25
Cor. parish and year	-0.729	-0.745	-0.758
SD of parish specific year effect	0.067	0.07	0.071
N parishes	2394	1651	1618
N	85979	59321	58136
Log Likelihood	-255776.800	-181204.300	-176861.500
AIC	511591.600	362446.600	353761.000
BIC	511769.500	362617.400	353931.500

$^{***}p < .01$; $^{**}p < .05$; $^{*}p < .1$

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