

# Non-response and attrition in the NorLAG panel study

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## Foreword

The Norwegian study on life course, ageing and generation (NorLAG) is a multidisciplinary and longitudinal study that includes data on well-being, health, work, care and family relations in the second half of life (age 40 +) (Holmøy 2004; Slagsvold et al. 2012). So far, two waves of data collection have been collected, the first in 2002/03, the second five years later, in 2007/08. The second wave was merged with the international investigation, Generations and Gender Survey (GGS) (Lappegård & Veenstra 2010). The merged survey was named LOGG (the Norwegian study on life course, generation and gender) and includes individuals aged 18+ (Bjørshol, Høstmark & Warehouse Power 2010; Brunborg, Slagsvold & Lappegård 2009).

The ACCESS Life Course Database project is part of the National Financing Initiative for Research Infrastructure at the Norwegian Research Council (grant no.: 195403/F50) from 2010 to 2014. The aim of this infrastructure project is to facilitate access to and stimulate use of the data from these life-course studies. Anonymous data from NorLAG and LOGG are made available through the Norwegian Social Science Data Services (NSD).

This is the second ACCESS working paper. ACCESS working papers provide documentation of the data from NorLAG and LOGG, including key variables (psychometric measures, indexes and registry data) and representativeness. Morten Blekesaune is editor of the series. This working paper was written by Kristine Koløen, Ivar Lima and Marijke Veenstra. Morten Blekesaune and Torhild Sager have also edited the final version. More information about NorLAG, LOGG and ACCESS is available at [www.norlag.nova.no](http://www.norlag.nova.no).

## Introduction

This working paper describes non-response and attrition in the Norwegian panel study of life course, ageing and generation (NorLAG), which currently has two waves of data from 2002/2003 and 2007/2008. The NorLAG study should stimulate empirical research on the consequences of life-course behaviour and transitions on issues such as demographic behaviour and health-care demands, as well as the participation and quality of life of older people. For that purpose, longitudinal data are needed, following individuals over time. NorLAG is multidisciplinary and includes four main domains: work and retirement, health and care, family and intergenerational relationships, and quality of life.

Many of the survey instruments in NorLAG are based on instruments from established international longitudinal ageing studies, including the Longitudinal Aging Study Amsterdam (LASA), the Berlin Ageing Study (BASE), the Swedish National Study on Aging and Care (SNAC), the Health and Retirement Study (HRS) and Midlife in the United States (MIDUS). It also includes items from other large surveys from Statistics Norway – namely, their Level of Living, Health and Labour Force surveys.

Non-response is of great concern for survey studies and, in particular, longitudinal survey data (Banks et al. 2010; Fitzgerald et al. 1998). Panels of survey data also include a related issue of attrition, defined as non-response in wave 2 of the eligible respondents from wave 1. Non-response and attrition will typically introduce bias in the study sample compared to the population of interest. Bias occurs when the non-respondents differ from the respondents on relevant characteristics. Such bias may have serious consequences for the validity of the results (Banks et al. 2010, p.2). A high response rate may result in a less biased sample, but not necessarily. If the non-response is random, then a sample would be representative even with a low response rate. Krosnick (1999) describes examples of surveys with a low response rate which are more representative of the population of interest than comparable surveys with a high response rate.

Measures of socio-economic status are often correlated with main response variables in ageing studies and are therefore important in analysis of attrition. Unfortunately, non-response and attrition is seldom random across socio-economic subgroups. Most studies find that both non-response and attrition are associated with low socio-economic status (Gray et al. 1996; Watson 2003). Fitzgerald et al. (1998, p.295) conclude that "Attritors tend to have lower earnings, lower education levels, lower marriage propensities, and appear to be generally drawn from the lower tail of the socioeconomic distribution."

In the Norwegian part of the European Union Statistics on Income and Living Conditions (EU-SILC), another longitudinal survey, Wilhelmsen (2012), finds that low educational level and low household income are strongly associated with non-response and attrition. In an analysis of attrition in the Health and Retirement Study (HRS) and the English Longitudinal Study of Ageing (ELSA), Banks et al. (2010) find only an age-dependent association between socio-economic status and attrition in ELSA and no association in HRS. One explanation of different findings could be survey maturity, as the ELSA sample was drawn from households who had responded to the Health Survey for England (HSE) in 1998, 1999 and 2001, and the

respondents to the HRS survey had previously participated in the survey from anywhere from three to six waves. Consequently, the respondents with a high propensity to drop out had already left the studies (Banks et al. 2010).

Another typical finding affecting ageing studies is that the response rate is lower among the young and old age groups (Gray et al. 1996). This is true for both the Norwegian EU-SILC, with higher attrition among the oldest (80+), and for SHARE. An important issue for ageing studies (ELSA, HRS, SHARE) is whether (poor) health affects attrition. In a meta-analysis of panel ageing studies, Chatfield et al. (2005, p. 13) conclude that: «People who were very ill or frail had higher dropout rates, and people in worse health were less likely to be recontactable». This is also true for SHARE, where persons with good or worse subjective health have a higher attrition than persons with very good health (Schröder 2008). In more mature surveys, such as HRS and ELSA, Banks et al. find no health-related attrition (Banks et al. 2010, p. 20).

Initial non-response may have different correlates than subsequent attrition. Participants of an initial wave have shown a willingness to participate in the survey, and one could therefore expect a more random attrition over subsequent waves. Empirical research indicates similar correlates in initial non-response and later attrition: «One conclusion that could be drawn is that the type of people who fail to continue in panel surveys (attritors) may not be that different from those who fail to respond to a single initial survey request» (Gray et al. 1996, p. 165). This pattern is also confirmed in the study of attrition in EU-SILC (Wilhelmsen 2012).

The main aim of this working paper is to describe the response rates for the different waves and interview modes in NorLAG (the Norwegian panel study of life course, ageing and generation) and thus provide useful information about the sample to the users of the NorLAG panel study. A secondary aim is to explore how demographic characteristics are correlated with attrition and how popular response variables, such as subjective health, anxiety, depression and quality of life, are related to attrition. We also compare the different interview modes of NorLAG – i.e., the telephone interview versus the postal questionnaire.

# The study

## *Sample design*

Sampling and data collection were conducted by Statistics Norway. The sampling design was described in two documentation reports – from wave 1 (2002/03) and wave 2 (2007/08) – from Statistics Norway (Bjørshol et al. 2010; Holmøy 2004). Statistics Norway drew the sample from the National Population Register (Folkeregisteret), which covers the entire population of Norway and is updated several times per month. Persons living in institutions were not included.

The NorLAG study was designed as a panel study with a random stratified sample of persons aged 40 to 79 living in 24 municipalities and six districts of Oslo. They were selected from four Norwegian regions/counties: Oslo and Akershus, Agder, Nord-Trøndelag and Troms. The municipalities were selected using the following criteria: population size, proportion living in densely populated areas, proportion of young versus old persons, economic structure, municipality income, and a level of living index (Holmøy 2004, p. 7).

The 30 municipalities and Oslo districts were selected to be representative for three main types of areas, labelled strata: 12 rural municipalities, 12 towns/cities and six Oslo districts. To achieve a net sample with an adequate sample size for each unit, 334 persons were randomly drawn from each municipality and 667 were drawn from each of the six Oslo districts, regardless of the number of inhabitants. Within each municipality/district the sample was weighted for gender composition and age composition using four age groups: 40–49, 50–59, 60–69 and 70–79. Compared with the national population, the gross sample oversampled rural municipalities (compared to towns and cities) and older (compared to middle-aged) persons.

The initial gross sample size was 9,529 persons. The first – and main – interview was done as a computer-assisted telephone interview. Hence, all persons with an unknown telephone number were excluded, reducing the sample to 8,547 persons (89.7%). Statistics Norway then drew 8,490 persons from the 8,547 persons in order to get an equal number of 2,830 persons from each of the three main strata. By the time of the interview, a further 192 persons had died, moved from the municipality or district, or been institutionalized. The final gross sample therefore consists of 8,298 persons at wave 1 collected in 2002/03.

In wave 2 (2007/08), the final gross sample from wave 1 was contacted again, regardless of previous participation, and 31.4 per cent of those who did not participate in NorLAG1 participated in wave 2 (Bjørshol et al. 2010:23). Statistics Norway also contacted the persons who had moved from the municipality or township within Norway after the first wave. The gross sample was reduced to 7,583 persons (Bjørshol et al. 2010)

The NorLAG study was designed as a longitudinal study in which the gross sample was supposed to be participating every five years. Thus, a new cohort of persons aged 40–44 was included and a supplementary sample was added for the age groups 45–79. The second wave was also extended to include respondents between 18 and 40 years old, from the same regions and municipalities. These supplementary samples are not included in the analyses of this paper.

### ***Data sources***

The data were collected by Statistics Norway, in both waves combining survey questionnaires and register data. A first main interview was done as a computer-assisted telephone interview (CATI). Participants in the phoned survey then received a self-administered postal questionnaire.

Data from administrative registers were used at different stages for particular reasons: for sampling, for data quality control and as a supplementary data source, as described by Lappegård and Veenstra (2010, p. 7-8). Postal questionnaire are suitable for collecting information of a more sensitive nature (Dillman et al. 2008, p. 115) because an interviewer (in a telephone or face-to-face interview) may inhibit socially undesirable answers. NorLAG includes some data of a sensitive character, including mental health, quality of life and loneliness. Postal questionnaires also shortened the duration of the telephone interview to approximately 45 minutes (Lappegård & Veenstra 2010, p. 7).

## **Response rates**

At wave 1 the response rate was 67.0 per cent (N= 5,559). Of these, 4,149 (74.6%) also responded to the postal questionnaire.

In a study of two waves, response rates become more complicated. A distinction can be made between conditional and unconditional response rates. The unconditional longitudinal response rate is the proportion of the sample participating in both waves who were eligible in both waves (see Cheshire et al. 2011:128). The conditional longitudinal response rate is the proportion of the net sample from the first wave also participating in the second wave. We can further separate between the response rates for telephone interviews and those for postal questionnaires.

**Table 1: Response rates in the (first) two waves of NorLAG**

	<b>N</b>	<b>Per cent</b>
<b>Wave 1 (2002/2003)<sup>1</sup> age 40-79</b>		
<i>Telephone interview</i>		
Persons drawn for interview	8409	
Ineligible due to emigration, death, moved into institution	192	
Gross sample	8298	100.0
Non-response	2709	32.6
Lost because of error	30	0.4
<b>Net sample</b>	<b>5559</b>	<b>67.0</b>
<i>Postal questionnaire wave 1</i>		
Gross sample	5559	100.0
Non-response	1410	25.4
<b>Net sample</b>	<b>4149</b>	<b>74.6</b>
<b>Conditional longitudinal response rate wave 2<sup>2</sup> age 45-84</b>		
<i>Telephone interview</i>		
Sample (persons interviewed by telephone wave 1)	5559	
Ineligible due to emigration by 31.12.2006	25	
Ineligible due to death by 31.12.2006	264	
Ineligible due to being in institution 31.12.2006	<i>Unknown</i>	
Eligible	5270	100.0
Attrition	1496	28.4
<b>Net sample</b>	<b>3774</b>	<b>71.6</b>
<i>Postal questionnaire wave 2</i>		
Eligible	3774	100.0
Non-response	791	21.0
<b>Net sample</b>	<b>2983</b>	<b>79.0</b>
<b>Postal conditional longitudinal response rate</b>		
Sample (persons who responded to post wave 1)	4149	
Attrition (death or emigration by 31.12.2006)	188	
Eligible	3961	100.0
<b>Net sample</b>	<b>2672</b>	<b>67.5</b>
<b>Unconditional longitudinal response rates two waves</b>		
a. Gross sample wave 2	7583	100.0
<b>b. Telephone response rate (b/a)</b>	<b>3774</b>	<b>49.8</b>
<b>c. Postal response rate (c/a)</b>	<b>2672</b>	<b>35.2</b>

Of the 5,559 persons participating in wave 1, 264 had died and 25 had emigrated at the time of sampling for wave 2 (by the last day of 2006), leaving 5,270 eligible persons for wave 2. We do not know how many persons in the gross sample that were institutionalised by the time they were contacted by an interviewer. Public registers show that a further 82 persons died in 2007 (45 were aged 70+).

<sup>1</sup> All numbers about response rates in wave 1 are from Holmøy, 2004, p. 5

<sup>2</sup> All numbers about longitudinal response rates are calculated by the authors of this paper.



The conditional longitudinal response rate of the telephone interview at wave 2 is 71.6 per cent (table 1), indicating that 71.6 per cent of the initial respondents were retained in wave 2. The unconditional longitudinal response rate is 49.8 per cent, meaning that 49.8 per cent of the eligible gross sample participated in the telephone interview in both waves.

The postal conditional longitudinal response rate is 67.5 per cent. This number is calculated by dividing the number of persons responding to the postal questionnaire at wave 2 by the number of eligible persons responding to the postal questionnaire at wave 1. The postal unconditional response rate is 35.2 per cent, with 2,672 respondents. In other words, 35.2 per cent of the eligible gross sample responded to both the telephone interview and the postal questionnaire in both waves.

## Non-respondents

### *Characteristics of the initial non-respondents*

This section provides a summary of non-response in the first wave from the documentation report from Statistics Norway (Holmøy 2004). Statistics Norway has information about the national population from administrative registers and can use this information to describe the characteristics of the non-respondents on various variables of interest. Table 2 describes response rates and reasons for non-response by gender, age, educational level, and region.

**Table 2: Response rates, non-response rates and causes of non-response by gender combined with age groups at time of sampling (31.12.2001). Percentages from Holmøy (2004:15)**

	Total	Response	Reasons for non-response				Gross sample	Net sample
			Refusal	Prevented	No-contact	Other		
Total	100	67.0	21.2	4.9	3.7	3.2	8298	5559
<b>Men</b>								
40-49	100	69.1	18.0	2.4	6.5	4.0	1190	822
50-59	100	67.0	22.1	2.7	5.1	3.1	1146	768
60-69	100	69.2	20.4	4.7	2.5	3.1	891	617
70-79	100	66.6	18.2	9.7	2.7	3.1	742	494
Total	100	68.1	19.8	4.3	4.5	3.3	3969	2701
<b>Women</b>								
40-49	100	72.8	16.7	3.3	3.6	3.6	1229	895
50-59	100	69.0	22.6	2.8	2.8	2.8	1195	825
60-69	100	64.4	24.8	4.6	3.3	2.9	967	623
70-79	100	54.9	27.9	12.5	2.5	2.2	938	515
Total	100	66.0	22.6	5.5	3.0	2.9	4329	2858
<b>Region</b>								
Oslo and Akershus	100	62.7	22.8	6.0	4.1	4.2	3455	2167
Agder	100	67.1	22.2	4.5	4.1	2.1	1619	1086
Nord-Trøndelag	100	73.3	18.9	3.0	2.8	2.0	1615	1185
Troms	100	69.7	19.1	4.8	3.5	3.0	1609	1121
<b>Educational level</b>								
Compulsory (8-10)	100	56.2	28.2	8.1	4.2	3.3	2168	1219
Secondary (11-14)	100	69.1	20.4	3.5	4.0	2.9	4213	2912
Higher (14 +)	100	76.5	14.8	3.8	2.5	3.2	1815	1388
Unknown	100	39.2	21.6	28.4	5.9	-	102	40

The response rate at wave 1 is slightly higher among men (68.1) than among women (66.0). Among women there is a linear decrease in response rate with age. Women aged 70–79 have a response rate of 54.9 compared to 72.8 for the age group 40–49. Among men there is no clear relation between age and response rate. (Holmøy 2004)

distinguishes between three reasons for non-participation: (1) refusal, (2) prevented, and (3) no contact. The main reason for non-response in the first wave of the NorLAG study is refusal; 21.2 per cent of the gross sample refused to participate. This reason for non-participation varies by age and gender. Among women there is a linear increase in the percentage of refusals with increasing age, with 16.7 per cent refusals among those aged 40–49 and 27.9 per cent among the oldest, 70–79 years. There is less age variation in refusals among men.

The oldest age groups are overrepresented among those prevented, with 9.7 per cent of the men and 12.5 per cent of the women in the oldest age classified in this category. The youngest age group is more frequent in the no-contact category than other age groups. Health problems among the oldest individuals might well have prevented them from participating. This group could consequently be under-represented in the net sample.

There is also regional variation in response rates in wave 1. The capital Oslo and its surrounding county of Akershus had the lowest response rate, while the more rural county of Nord-Trøndelag had the highest response rate. Response is also correlated with educational level, with a 20.3 percentage point higher response rate among higher educated people compared to those with only compulsory education.

Privacy rules regarding informed consent prevents Statistics Norway from distributing data about non-responders to external researchers. Only Statistics Norway can access information about the characteristics of non-respondents. We cannot distinguish between the different types of attrition (refusal, prevented, no-contact and other) in the further analyses of this paper.

## ***Attrition in the telephone interview***

### **Telephone duration**

In the SHARE study, respondents with a short interview in wave 1 were less likely to participate in wave 2 (Schröder 2008). In the NorLAG study, there is no significant difference in interview duration when comparing participants (M=35.6 minutes) and non-participants (M=39.3 minutes) in wave 2.

### **Telephone interview attrition**

Attrition rates for the telephone interview between wave 1 and wave 2 are presented in Table 3. Attrition rates are similar for men and women. More non-partnered than partnered respondents dropped out in the second waves: the difference is 3.9 percentage points. Attrition rates also vary by age, education, income and health. Attrition is comparatively low among those aged 50–59, 23.4 per cent of whom did not participate in the second wave, compared to 42.1 per cent of those aged 70–79. High attrition in the oldest age group could be explained by poor health and impairment.

Attrition is 28.0 percentage points lower among those with university or college education than among those with compulsory schooling (43.7 versus 15.7). Response rates also vary between the lowest and the highest income quartile by 21.2 percentage points (Table 3). Global subjective health can also predict attrition. Among those in poor health in the first wave, 44.4 per cent do not participate in the second wave, compared to 22.2 per cent of those reporting very good or excellent health. Finally, attrition is somewhat lower for Oslo/Akershus region and in larger municipalities compared to smaller municipalities.

**Table 3: Response rate and attrition wave 2 in the telephone interview by individual characteristics, percentages.**

	Continuers	Attritors	Total	$\chi^2$	N
<b>Total</b>	71,6	28,4	100		5270
<b>Gender</b>				NS	
Men	72,8	27,2	100		2525
Women	70,5	29,5	100		2745
<b>Partner status 2002</b>				**	
Not partnered	69,1	30,9	100		1859
Partnered	73,0	27,0	100		3411
<b>Age</b>				***	
40-49 years	72,8	27,2	100		1699
50-59	76,6	23,4	100		1554
60-69	73,2	26,8	100		1170
70-79	57,9	42,1	100		847
<b>Age men</b>				***	
40-49	71,4	28,6	100		812
50-59	78,7	21,3	100		746
60-69	75,8	24,2	100		570
70-79	60,2	39,8	100		397
<b>Age Women</b>				***	
40-49	74,1	25,9	100		887
50-59	74,6	25,4	100		808
60-69	70,8	29,2	100		600
70-79	55,8	44,2	100		450
<b>Region</b>				***	
Oslo/Akershus	75,6	24,4	100		2056
Agder	69,8	30,2	100		1017
Nord-Trøndelag	69,7	30,3	100		1134
Troms	67,7	32,3	100		1063
<b>Municipality size</b>				***	
< 10,000	66,8	33,2	100		1848
10,000-50,000	74,2	25,8	100		1479
50,000 +	74,3	25,7	100		1943
<b>Educational level</b>				***	
Compulsory (8-10)	56,3	43,7	100		1113
Secondary (11-14)	71,8	28,2	100		2774
Higher (14+)	84,3	15,7	100		1347
<b>Income quartiles</b>				***	
1.quartile (low)	59,8	40,2	100		1277
2.quartile	69,3	30,7	100		1297
3.quartile	75,5	24,5	100		1340
4.quartile (high)	81,0	19,0	100		1356
<b>Subjective health</b>				***	
Very good	77,8	22,2	100		2396
Good/Quite good	68,6	31,4	100		2413
Bad	55,6	44,4	100		457

Chi square test: \* $\leq 0.05$ ; \*\* $\leq 0.01$ ; \*\*\* $\leq 0.001$

The bivariate associations in Table 3 might overlap. For example, older people have less education and are typically in poorer health than middle-aged people. For a better understanding of the reasons for attrition we estimate a multiple logistic regression model, including all characteristics (from Table 3). Regression results (Table 4) show that the bivariate associations with region and municipality size are explained by other characteristics, notably educational level. Respondents in Oslo/Akershus are more educated than respondents in smaller municipalities.

Particularly educational level but also income predicts attrition in the second wave. Those with compulsory education are three times more likely to drop out of the study than those with higher education. Poor health also predicts attrition. The strong association with age in Table 3 is smaller in the multivariate analysis of Table 4, where the oldest age group 70–79 has 1.25 higher odds of dropping out than the reference group 40–49. Much of the age variation in Table 3 is thus explained by low income, less education and poor health in the oldest age group.

Table 3 shows higher attrition among women than men in all age groups except the youngest age group. This is also the case in the multivariate model, where women aged 70–79 have the highest odds to not participate in the second wave.

To summarise, the strongest independent predictors for attrition in the telephone interview are education, income and subjective health. This goes for both men and women.

**Table 4: Odds ratios from multivariate logistic regression, attrition in the telephone interview**

	Total (N=5230)			Men (N=2502)			Women(N=2728)		
	Exp(B)	95% C.I. for EXP(B)		Exp(B)	95% C.I. for EXP(B)		Exp(B)	95% C.I. for EXP(B)	
		Lower	Upper		Lower	Upper		Lower	Upper
<b>Age groups</b>									
40-49 years (ref)	1,00			1,00			1,00		
50-59 years	<b>,70</b>	,59	,83	<b>,60</b>	,47	,77	,80	,64	1,01
60-69 years	<b>,70</b>	,59	,84	<b>,63</b>	,48	,82	,80	,62	1,03
70-79 years	<b>1,27</b>	1,04	1,54	1,22	,91	1,62	<b>1,39</b>	1,05	1,84
<b>Women</b>									
	,95	,83	1,09						
<b>Partnered (ref. not)</b>									
	,91	,80	1,04	,89	,73	1,09	,93	,77	1,12
<b>Municipality size</b>									
Less than 10000 (ref)	1,00			1,00			1,00		
10000-50000	,87	,73	1,03	,85	,66	1,09	,88	,69	1,10
more than 50000	1,05	,84	1,31	1,07	,77	1,48	1,03	,76	1,39
<b>Region</b>									
Oslo/Akershus (ref)	1,00			1,00			1,00		
Sørlandet	1,13	,90	1,42	1,11	,79	1,56	1,15	,85	1,57
Nord-Trøndelag	1,12	,89	1,41	1,00	,71	1,40	1,23	,90	1,69
Troms	1,16	,94	1,44	1,09	,79	1,48	1,24	,92	1,67
<b>Educational level</b>									
Higher (14+) (ref)	1,00			1,00			1,00		
Secondary (11-14)	<b>1,74</b>	1,46	2,09	<b>1,80</b>	1,38	2,35	<b>1,72</b>	1,34	2,20
Compulsory (8-10)	<b>2,83</b>	2,29	3,51	<b>3,42</b>	2,49	4,68	<b>2,47</b>	1,84	3,32
<b>Income quartiles</b>									
4. quartile (high) ref	1,00			1,00			1,00		
3. quartile	1,22	1,01	1,48	1,07	,84	1,37	<b>1,52</b>	1,09	2,11
2. quartile	<b>1,35</b>	1,10	1,65	1,12	,85	1,48	<b>1,68</b>	1,21	2,33
1. Quartile (low)	<b>1,71</b>	1,37	2,13	<b>1,63</b>	1,20	2,23	<b>1,96</b>	1,39	2,77
<b>Subjective health</b>									
Very good health (ref)	1,00			1,00			1,00		
Good	<b>1,25</b>	1,09	1,44	<b>1,30</b>	1,06	1,59	<b>1,22</b>	1,49	1,01
Bad	<b>1,84</b>	1,47	2,30	<b>2,10</b>	1,50	2,94	<b>1,71</b>	2,31	1,26
-2LL	5839,95			2722,61			3103,23		
Change -2LL	<b>384,12</b>			<b>200,90</b>			<b>194,35</b>		
Nagelkerke R <sup>2</sup>	0,10			0,11			0,10		

All bold coefficients are significant at the 0.05 level

## ***Postal attrition***

The postal conditional longitudinal response rate is 67.5 per cent (Table 2). Respondents numbering 2,672 returned the postal questionnaire in both waves. This section describes attrition in the postal questionnaire in the same way as we described attrition in the telephone interview in tables 3 and 4. The analysis of attrition from the postal questionnaire also includes two further predictors from the postal questionnaire: mental health (depression and anxiety) and quality of life from wave 1, described in Text box 1. Inclusion of these variables results in slightly varying sample sizes due to varying item-nonresponse.

### **Text box 1 Measures of quality of life and mental health from the postal questionnaire**

*Depressive symptoms* is assessed with the CES-D (Center for Epidemiologic Studies Depression scale) (Radloff 1977) with 20 items. A sum scale from 0 to 60 is dichotomised, with 15 as a cut-off point (values higher than 15 are considered as having depressive symptoms).

*Anxiety symptoms* is measured using five items from the Hopkins Symptoms Check List, which are taken from Statistics Norway's health survey 1995 (Holmøy 2004; Wikholm & Hildrum 1995). We use a dichotomous variable where a mean scale from 1 to 4 has been split, with 2 as a cut point (Strand et al. 2003). Persons with scores higher than 2 are at potential risk of developing mental illness.

We include two measures of *quality of life*, PANAS and satisfaction with life scale. The original scale PANAS scale (Watson et al. 1988) has 20 items, NorLAG has kept 12 items, measuring positive and negative affect. The mean scales included here range from 1 to 5, and high values indicate either positive or negative affect. *Satisfaction With Life Scale* (Pavot et al. 1991) is a sum scale measuring the cognitive or evaluative quality of life. It includes 5 items measured on a 5-point scale. Minimum score is 5 and maximum score is 25: higher scores indicate higher satisfaction.

Attrition shows similar patterns for the postal questionnaire (Table 5) and the telephone interview (Table 3). Attrition rates vary similarly by gender, age, educational level, income and subjective health. Attrition is highest among those with compulsory education, low income and poor health.

Quality of life and mental health are also correlated with attrition in wave 2. Those with depressive symptoms have a 9-percentage point higher attrition rate. Similarly, attrition is higher among those with anxiety symptoms than those with no such symptoms. Since the measures of quality of life are continuous, we have reported the mean scores for respondents and attritors. Attritors had a lower mean score on positive affect, higher score on negative affect and a slightly lower score on life satisfaction than participants in wave 2.

**Table 5 Response rate and attrition in wave 2 in the postal questionnaire on relevant respondent characteristics. Percentages.**

	Resp	Attritors	Total	$\chi^2$	N
<b>Total</b>	67.5	32.5	100		3961
<b>Gender</b>				NS	
Men	67.0	33.0	100		1853
Women	67.8	32.2	100		2108
<b>Partnerstatus 2002</b>				**	
Partnered	69.1	30.9	100		1307
Not partnered	64.1	35.9	100		2654
<b>Age</b>				***	
40-49	68.2	31.8	100		1224
50-59	72.2	27.8	100		1206
60-69	69.7	30.3	100		919
70-79	53.1	46.9	100		612
<b>Region</b>				**	
Oslo/Akershus	70.6	29.4	100		1597
Agder	66.0	34.0	100		756
Nord-Trøndelag	65.0	35.0	100		849
Troms	65.0	35.0	100		759
<b>Municipality size</b>				***	
< 10,000	61.8	38.2	100		1336
10,000-50,000	70.4	29.6	100		1147
50,000 +	70.3	29.7	100		1478
<b>Educational level</b>				***	
Compulsory (8-10)	51.3	48.7	100		706
Secondary (11-14)	67.0	33.0	100		2122
Higher (14 +)	79.2	20.8	100		1108
<b>Income quartile</b>				***	
1. quartile (low)	53.6	46.4	100		893
2. quartile	66.3	33.7	100		974
3. quartile	71.3	28.7	100		1056
4. quartile (high)	76.5	23.5	100		1038
<b>Subjective health</b>				***	
Very good	73.8	26.2	100		1878
Good/quite good	63.8	36.2	100		1782
Bad	50.7	49.3	100		300
<b>Mental health</b>					
<b>Depression</b>				***	
Not depressed	70.1	29.9	100		3001
Depressed	61.1	38.9	100		853
<b>Anxiety</b>				***	
No symptoms	68.8	31.2	100		3529
Anxiety symptoms	56.8	43.2	100		375
<b>Quality of life</b>					
Positive affect mean scale	3.13 (0.75)	2.96 (0.78)		***	3914
Negative affect mean scale	1.87 (0.62)	1.94 (0.73)		**	3914
Satisfaction with life sum score	19.08 (3.29)	18.78 (3.52)		*	3894

Chi square test: \* $p \leq 0.05$ ; \*\* $p \leq 0.01$ ; \*\*\* $p \leq 0.001$ ; NS=not significant



The results for the multivariate analysis of attrition in Table 6 are similar to those in Table 5. Education, income and subjective health are the strongest independent predictors of attrition in the postal questionnaire, similar to the results of attrition in the telephone interview – with a couple of exceptions. With the postal survey, women are less likely to drop out than men (the difference not significant in the telephone interview). The odds for not responding to the postal questionnaire are about 20 per cent lower for partnered than for non-partnered individuals (no similar difference for telephone attrition).

Table 6 also shows the multivariate results for men and women separately. There are no significant differences between the age groups for women, but there are for men. The odds ratios for men aged 50–59 and 60–69 are about 0.5 compared to the reference category 40–49. Being in a relationship makes it less likely for women to not respond to the postal questionnaire, while it does not have an effect for men. Education matters more for men than women, and income more for women than for men. But generally, the tendencies for men and women are the same.

**Table 6: Odds ratios from multivariate logistic regression, attrition in the postal questionnaire.**

	Total (N=3730)			Men (N=1757)			Women (N=1973)		
	Exp(B)	95% C.I. for EXP(B)		Exp(B)	95% C.I. for EXP(B)		Exp(B)	95% C.I. for EXP(B)	
		Lower	Upper		Lower	Upper		Lower	Upper
<b>Age groups</b>									
40-49 years (ref)	1,00			1,00			1,00		
50-59 years	<b>0,67</b>	0,56	0,81	<b>0,53</b>	0,40	0,70	0,84	0,65	1,08
60-69 years	<b>0,68</b>	0,55	0,83	<b>0,52</b>	0,38	0,70	0,88	0,66	1,17
70-79 years	1,11	0,88	1,40	1,03	0,74	1,44	1,20	0,86	1,67
<b>Women</b>	<b>0,80</b>	0,68	0,93						
<b>Partnered</b> (ref. not)	<b>0,82</b>	0,70	0,95	0,86	0,68	1,08	<b>0,77</b>	0,62	0,96
<b>Municipality size</b>									
Less than 10000 (ref)	1,00			1,00			1,00		
10000-50000	<b>0,81</b>	0,66	0,98	0,80	0,59	1,07	0,79	0,60	1,03
more than 50000	0,85	0,66	1,10	0,77	0,53	1,12	0,92	0,65	1,29
<b>Region</b>									
Oslo/Akershus (ref)	1,00			1,00			1,00		
Sørlandet	0,86	0,67	1,12	<b>0,67</b>	0,45	0,99	1,05	0,75	1,49
Nord-Trøndelag	0,92	0,71	1,19	0,70	0,48	1,02	1,17	0,82	1,68
Troms	0,92	0,72	1,18	<b>0,67</b>	0,46	0,96	1,26	0,89	1,77
<b>Educational level</b>									
Higher (14+) (ref)	1,00			1,00			1,00		
Secondary (11-14)	<b>1,52</b>	1,26	1,83	<b>1,52</b>	1,16	2,01	<b>1,52</b>	1,17	1,97
Compulsory (8-10)	<b>2,35</b>	1,84	3,00	<b>2,86</b>	2,00	4,08	<b>1,97</b>	1,40	2,77
<b>Income quartiles</b>									
4. quartile (high) ref	1,00			1,00			1,00		
3. quartile	1,23	0,99	1,51	1,17	0,89	1,54	1,34	0,94	1,90
2. quartile	<b>1,31</b>	1,04	1,65	1,16	0,84	1,61	<b>1,51</b>	1,06	2,17
1. Quartile (low)	<b>2,05</b>	1,59	2,64	<b>1,97</b>	1,34	2,90	<b>2,26</b>	1,55	3,29
<b>Subjective health</b>									
Very good health (ref)	1,00			1,00			1,00		
Good	<b>1,27</b>	1,09	1,49	<b>1,33</b>	1,06	1,67	1,20	0,96	1,49
Bad	<b>1,91</b>	1,45	2,51	<b>2,24</b>	1,48	3,38	<b>1,69</b>	1,17	2,45
-2LL	4399,66			2057,73			2320,24		
Change -2LL	<b>259,13</b>			<b>147,74</b>			<b>132,83</b>		
Nagelkerke R <sup>2</sup>	0,09			0,11			0,09		

Bold coefficients are significant at the 0.05 level

Table 7 shows the results of five separate multivariate logistic regression models of: 1) depressive symptoms, 2) Anxiety symptoms, 3) Positive affect, 4) Negative affect and 5) Subjective well-being. The results are controlled for age, gender, partnership status, municipality size, region, educational level, income and subjective health (as in Table 6). The results indicate that anxiety and negative affect can predict attrition in the postal questionnaire. The results are similar for both men and women, but none of the gender-specific effects reach significance at the 0.05 level. These comparatively small effects of negative affect and anxiety on attrition are good news for a study where health and quality of life are among the main themes.

**Table 7: Odds ratios from multivariate logistic regression of attrition in the postal questionnaire, mental health and quality of life as predictors (N=3730).**

	Total (N=3 730)			Men (N=1757)			Women (N=1973)		
	Exp(B)	95% C.I.for EXP(B)		Exp(B)	95% C.I.for EXP(B)		Exp(B)	95% C.I.for EXP(B)	
		Lower	Upper		Lower	Upper		Lower	Upper
1. Depression symptoms	1,10	,92	1,32	1,18	,90	1,54	1,06	,83	1,34
2. Anxiety symptoms	<b>1,29</b>	1,02	1,64	1,25	,85	1,84	1,35	1,00	1,84
3. Positive affect, mean score	,93	,85	1,03	,91	,79	1,06	,95	,83	1,08
4. Negative affect, mean score	<b>1,12</b>	1,01	1,25	1,12	,94	1,34	1,13	,98	1,30
5. Subjective well-being, mean score	1,01	,98	1,03	1,02	,98	1,05	1,00	,97	1,03

## Conclusion

This paper first investigated response rates and attrition in the NorLAG panel study. Then we explored how attrition in wave 2 relates to various variables in wave 1. Interview duration in wave 1 did not predict later attrition. Older respondents, with low education, low income and poor health are more likely to drop out in the second wave. The high attrition rate in the older age group is partly, but not completely, explained by lower education, lower income and poor health in this age group. These results are in line with the findings of other similar studies (Chatfield et al. 2005; Fitzgerald et al. 1998; Gray et al. 1996; Wilhelmsen 2012).

We do not have the possibility to analyse the characteristics of the initial non-responders in multivariate regression, since only Statistics Norway have access to this information. However, we can look at bivariate correlations published by Statistics Norway (presented in Table 2). It appears (comparing tables 2 and 3) that initial non-responders and attriters share many similar characteristics. Both initial non-response and later attrition are high in the oldest age group and among those with only compulsory education. One exception is region: Oslo had the lowest response rate initially but also the lowest regional attrition in wave 2; Nord-Trøndelag had the highest response rate in wave 1 but also the second highest attrition rate in wave 2. Multivariate regression analyses revealed that much of this regional variation were explained by different educational level in the four regions.

The analyses of attrition in the telephone interview and in the postal questionnaires generally show similar correlates, particularly with low educational level but also with poor health and low income. These findings indicate that similar selection mechanisms are at work in both types of data. A consequence of that lower-educated persons (and those with low income) tend to drop out is that they are strongly underrepresented in the main panel sample and, even more so, in the postal panel sample compared to the gross sample. As attrition is associated with predictors and outcomes of interest to our research, for example health, work and well-being, an important challenge will be to assess the relevance of imputation techniques or perform accurate statistical analyses capable of handling missing data.

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