Non-coverage and Health Telephone Survey Estimates: Evaluating the need for a dual frame

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Abstract

Objectives. The exclusion of adults without mobile telephone access may bias estimates derived from health-related telephone surveys.
Methods. We took data from the European Social Survey 2006/97 (ESS 3), which comprised more than 40,000 respondents, and used logistic regression to compare the odds of health status for general adults to those for adults with mobile telephone access.
Results. When interviewed, about 3 % of all adults in households did not have telephones and 24 % of all households have only mobile telephone access. Relative to all adults, adults with mobile telephone access had greater odds of depressive symptoms, greater odds of ill-health and in two countries greater odds of hampered in daily activities.
Conclusion. As people substitute mobile telephones for fixed telephones (the percentage is currently for eight countries under 12 % low) which minimizes the bias resulting from their exclusion from telephone surveys. In about eight countries the percentage is currently more than 20 % high. Their exclusion from telephone surveys could increase the bias. Bias between 10 through 20 percentage point is expected for estimates of depressive symptoms and about 5 through 10 percentage point of ill-health.

Keywords: Telephone Survey – mobile telephone access – non-coverage – bias health estimates

Almost all households have telephone access in the EU27 (95%), either by way of a mobile phone, a fixed phone or both. The penetration rates in the European Union´s fifteen old Member States appear to be significantly higher (97% vs. 91%) than those in the twelve new Member States (European Opinion Research Group 2008). That was approximately one mobile telephone for every second adult in 22 European countries. 71% of all households have fixed telephone access, 24 % have only a mobile telephone access and 57 % have dual-access, mobile and fixed (European Opinion Research Group 2008). It is perhaps not surprising than, that some mobile telephone users especially we assume in the old Member States have substituted a mobile telephone for their residential fixed telephone. This mobile substitution has potential implications for the representativeness of most current random-digit-dialled (RDD) household telephone surveys because the sampling frames for these surveys have traditionally been limited to fixed telephone access (Lavrakas 2007). Non-coverage of households without fixed telephones has always been a concern of telephone survey researchers, and several studies in the United States (Blumberg. et al. 2007, Keeter et

al. 2007, Link et al. 2007) and one for Europe (Fuchs 2008) have been undertaken to examine the potential non-coverage bias. Health-related telephone surveys in Europe to examine the potential non-coverage bias don´t exist. With mobile substitution, however, the characteristics of the non-fixed telephone population may be changing. Now, a growing proportion of adults living without a fixed telephone access may have chosen to do so because of lifestyle preferences (Geser 2004, Castells et al. 2006) especially by the old Member States of the European Union we could observe similar tendencies (European Opinion Research Group 2008b).

Data and methods

Sample and Variables

The analyses are based on the European Social Survey 2006/07 (Jowell & the Central Co-ordinating team 2007). Data from face to face interviews were available from Austria (AT), Belgium (BE), Bulgaria (BG), Switzerland (CH), Germany (DE), Denmark (DK), Estonia (EE), Spain (ES), Finland (FI), France (FR), United Kingdom (GB), Hungary (HU), Ireland (IE), Netherlands (NL), Norway (NO), Poland (PL), Portugal (PT), Russia (RU), Sweden (SE), Slovenia (SI), Slovakia (SK), Ukraine (UA). The data and extensive documentation are freely available for downloading at the Norwegian Social Science Data Services (NSD). Probability sampling from all private residents aged 15 years and older was applied in all countries. The European Social Survey includes 42,999 cases. The response rate ranging from 46% in France to 73.2% in Slovakia (Fitzgerald, Widdop 2008) This calculation follows the formula for Response Rate 6 in the AAPOR Standard Definitions (AAPOR 2000). Because we use telephone access in households, we exclude persons under age 18 to minimise the number of respondents whose living at home and have not an own household. And we exclude Cyprus. This restriction results in a sample size of 40,235 participants. Response rates, numbers of remaining cases for each country and the distribution of the study variables are shown in Table 1.

Three indicators of health that have been found to be appropriate for comparative studies on health inequalities (e.g. Cavelaars et al 1998) are used: self-reported general health, limiting longstanding illness and a modified CES-D scale (Radloff 1977). Self reported general health was conducted from a variable asking; ‘How is your (physical and mental) health in general?’ Eligible responses were ‘very good’, ‘good’, ‘fair’, ‘bad’ and ‘very bad’. The variable was dichotomized into ‘very good or good’ health vs. ‘ill’ health (‘fair’, ‘bad’, and ‘very bad’). Regarding the second variable, participants were asked; ‘Are you hampered (limited,

restricted) in daily activities in any way by any longstanding illness or disability, infirmity or mental health problem?' Eligible responses were 'yes a lot', yes to some extent' and 'no'. The variable was dichotomized, into 'yes' (regardless of whether to some extent or a lot) and 'no'. Depressive symptoms were assessed using a modified and short form of the Center for Epidemiological Studies-Depression Scale (Radloff 1977). Full or partial versions of the instrument have been incorporated in many large-scale surveys (e.g. Prince et al. 1999, Inaba et al. 2005). This frequently applied screening instrument contains questions about the 7-day incidence of different types of depressive symptoms. Participants were asked; 'I will now read out a list of the ways you might have felt or behaved during the past week. Using this card, please tell me how much of the time during the past week….', 'you felt depressed?', 'you felt that everything you did was an effort?', 'your sleep was restless?', 'you felt lonely?', 'you enjoyed life?', 'you felt sad?', 'you could not get going?' and 'you felt anxious?'. Answers are given on a 4-point Likert-scale ranging from 'none or almost none of the time' (1), 'some of the time' (2), 'most of the time' (3) to 'all or almost all of the time (4). A sum score of the 8 items (scores ranged from 8 to 32) were calculated, with higher values indicating higher symptom load. The internal consistency of the questionnaire was appropriate (Cronbachs's alpha for the whole sample = 0.82; lowest in Denmark =0.73 and highest in Bulgaria =0.87). However, as the score was not normally distributed we calculated logistic instead of linear regression models. For this purpose the score was dichotomised. The upper quintile-based cut-off point for the whole sample was chosen because the distribution of the (modified) CES-D scores in this sample differed from the reference population for the instrument. A cut-off point of 16 or more were classified as 'cases' (Frerichs et al, 1981). This cut-off point has been validated against a diagnosis of clinical case-level depression in both younger and older subjects (Breslau 1985, Beekman et al 1994).

The social characteristics here are the following: sex, age, general education, currently in paid work, household size**,** born outside of the country, subjective urbanisation (Living not in a big city). Education was coded according to the International Standard Classification of Education (ISCED-97, UNESCO, 1997). Respondent's highest level of education was classified ranging from 'not completed primary education' to 'second stage of tertiary education' on a 7-point scale. The subject were divided into two groups (1) lower secondary, second stage of basic education, primary education, first stage off basic education or not completed primary education; (0) secondary, post secondary, first stage of tertiary or second stage of tertiary education. Table 1 shows marked differences in educational levels between the countries under study. In Norway, Russia and Ukraine almost 10 % of the only mobile user have a lower secondary education or less, in Austria, Spain and Portugal the rate is about 60-70 %. In household size we could observe marked differences between the countries too.

In Bulgaria, Hungary, Ireland, Poland, Portugal Russia, Slovakia and Ukraine at most 10 % of the only mobile user living alone, in Switzerland, Germany, Denmark, Norway and Sweden the rate is about 40-52%. In most old member countries are higher rates of low education and living alone of the only mobile users.

Statistical analyses

Prevalence estimates are presented for all adults, adults with mobile telephone access, adults with fixed phone access (who may or may not have mobile phone access in addition to fixed phone) and no telephone access. A weight has been applied (dweight) to correct for design effects due to sampling designs in countries where not all individuals in the population have an identical selection probability (for example, the unweighted samples in some countries over- or under-represent people in certain types of address or household, such as those in larger households). The regression models predicted health status from telephone status. The reported odds ratios were adjusted to account for group differences in gender; age, education, employment status, household size, born in the country and subjective urbanisation. These variables were chosen because they have been used to adjust the sampling weights of RDD or modified RDD sample (Kalsbeek, Agans 2007). Statistically significant adjusted odds ratios would indicate that telephone status still accounted for variance in measures of health after control for the other characteristics. The statistical significance of differences between all adults and adults with mobile telephone access was identified by computing 95% CIs from the standard error of the difference between the two groups. The calculation of the standard error of the difference assumed a binomial normal distribution and accounted for non-independence of the two groups by incorporating their covariance. All analyses are conducted with the statistical program package SPSS 16.0.

Results

As shown in Figure 1, the proportion of households that have only mobile phone access is mostly higher in new European Union Member States. The exception is Finland. In 14 old European Union Member States more than half of households have access to both (double) mobile and fixed telephone access. The average of households that have no phone access is about 3 % but marked differences about 15-30 % are in Russia, Bulgaria and Ukraine. As shown in Table 1, the prevalence of mobile phones was greater for certain demographic subgroups: men, adults aged 29 years and younger, singles, employed, higher education, adults with higher occupation status and higher household income.

Figure 1 Estimates of telephone access in 22 European countries (%)

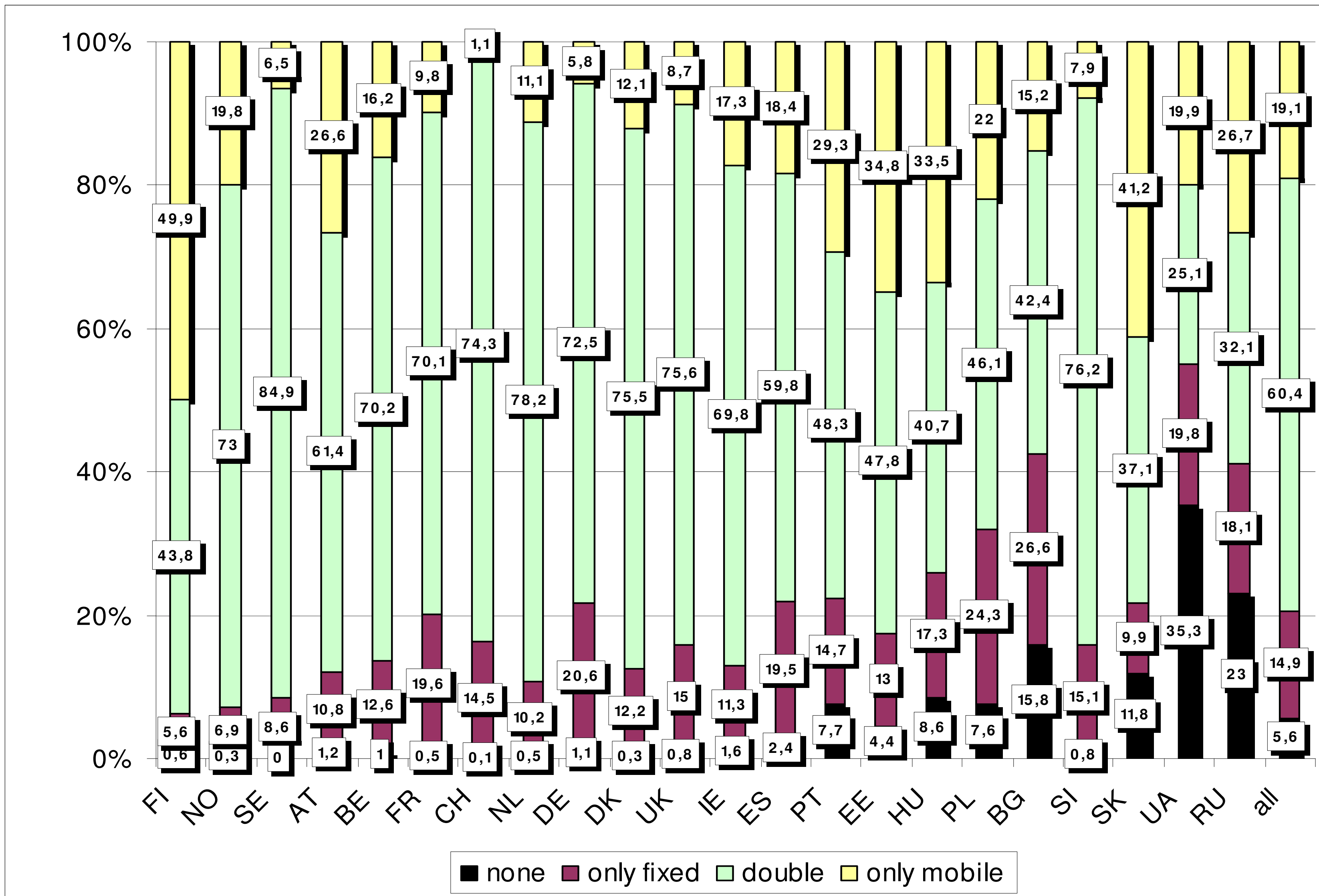

Table1 Household Telephone Status and socio-demographic characteristics; ESS, (weighted)

Country (response rate in %; N)	Female (%)				Age (mean)				Education (lower sec. or less, %)			
	all	mob	fix	no	all	mob	fix	no	all	mob	fix	no
AT (64,0; 2256)	54,6	53,5	55,1	48,0	43,7	37,1	46,1	43,0	62,8	63,1	62,2	92,0
BE (61,0; 1726)	53,2	47,8	55,4	38,9	47,4	38,9	49,1	47,2	33,4	30,6	33,7	50,0
BG (64,8; 1366)	59,6	58,3	60,6	56,5	47,9	38,7	49,9	50,5	32,1	36,9	23,3	65,9
CH (51,5; 1748)	53,7	17,6	54,0	+	48,5	38,3	48,6	+	16,9	23,5	16,8	+
DE (54,5; 2816)	50,6	40,5	51,2	53,6	48,6	39,2	49,1	61,1	11,7	18,3	11,0	39,3
DK (50,8; 1486)	51,2	39,1	52,9	+	50,2	36,7	52,1	+	20,0	17,5	20,2	+
EE (65,0; 1468)	56,6	56,2	57,4	49,2	48,0	43,5	50,5	56,8	23,8	24,1	21,3	56,9
ES(65,9; 1839)	51,9	48,2	53,0	46,3	46,6	37,6	48,6	54,6	61,2	64,6	59,4	97,6
FI (64,4; 1838)	51,1	50,2	51,9	58,3	49,7	41,3	58,2	55,5	32,6	23,4	41,3	66,7
FR (46,0; 1935)	51,5	55,3	51,1	54,5	46,6	34,5	47,9	47,7	49,1	55,3	48,3	70,0
GB (54,6; 2327)	52,3	47,1	53,0	36,8	48,0	34,6	49,3	57,6	46,2	52,9	45,1	89,5
HU (66,1; 1483)	57,9	59,1	58,2	50,4	48,2	40,9	52,4	55,5	59,1	65,0	51,2	90,9
IE (56,8; 1652)	53,3	48,4	54,4	50,0	45,2	33,9	47,6	48,6	35,1	33,0	35,0	69,6
NL (59,8; 1860)	52,3	46,6	53,1	44,4	47,6	35,6	49,1	49,1	37,0	37,7	36,7	60,0
NO (65,5; 1707)	48,9	41,1	50,9	+	46,6	34,5	49,6	+	17,2	9,9	19,1	+
PL (70,2; 1657)	52,6	50,4	52,5	58,7	44,1	36,7	46,4	58,8	55,7	57,5	51,0	96,4
PT (72,8; 2172)	59,2	59,8	58,1	66,3	48,0	40,1	51,6	63,1	73,9	70,8	72,5	96,4
RU (69,5; 2326)	58,6	50,8	61,3	61,6	42,2	36,2	45,3	53,6	17,0	8,0	12,8	36,4
SE (65,9; 1874)	50,8	37,4	51,7	+	48,0	31,6	49,2	-	29,7	21,1	30,3	+
SI(65,1; 1429)	54,9	52,6	55,1	58,3	47,5	46,1	47,6	+	49,3	51,3	48,7	91,7
SK (73,2; 1674)	52,1	51,7	52,6	52,1	42,5	38,8	45,8	57,2	19,1	13,4	15,4	54,5
UA (66,4; 1959)	57,1	56,5	57,9	56,4	45,5	38,0	48,9	56,5	19,6	10,0	14,5	31,7

+ (n<0,5%)

continued table 1

Country (response rate in %; N)	Not paid work (%)				Born out of the country (%)				Living alone (%)				Living not in a big city (%)			
		mob	fix	no		mob	fix	no		mob	fix	no		mob	fix	no
AT (64,0; 2256)	34,1	28,3	36,1	36,0	5,9	7,4	5,3	12,0	9,3	14,5	7,2	20,0	86,4	82,0	88,2	79,2
BE (61,0; 1726)	47,1	33,8	49,6	55,6	8,8	12,2	8,0	11,1	12,8	25,2	9,6	72,2	88,2	79,1	90,3	66,7
BG (64,8; 1366)	54,1	45,7	51,6	72,9	0,8	1,0	1,0	0	6,2	5,5	5,5	10,3	57,3	65,8	50,4	79,4
CH (51,5; 1748)	36,6	23,5	36,7	+	20,1	17,6	20,1	+	16,9	41,2	16,6	+	93,0	88,2	93,0	+
DE (54,5; 2816)	45,9	49,4	45,2	88,9	9,4	13,4	9,1	13,8	22,1	51,9	19,8	65,5	83,0	71,5	83,6	86,2
DK (50,8; 1486)	35,8	28,7	36,8	+	6,2	10,6	5,5	33,3	20,1	43,9	16,9	+	84,6	63,7	87,4	+
EE (65,0; 1468)	40,3	33,0	42,0	73,8	21,6	18,1	22,0	43,1	18,1	19,7	15,0	47,7	67,3	76,1	60,8	87,7
ES(65,9; 1839)	44,2	28,0	47,4	61,9	7,7	20,0	4,6	14,6	9,4	11,9	8,2	31,0	79,2	81,5	78,3	90,5
FI (64,4; 1838)	45,9	35,3	56,0	91,7	3,1	3,8	2,2	16,7	24,2	27,1	20,8	50,0	84,5	82,4	86,7	83,3
FR (46,0; 1935)	41,6	39,7	41,8	45,5	9,9	11,7	9,6	30,0	12,2	19,7	11,3	20,0	82,4	75,7	83,3	54,5
GB (54,6; 2327)	40,6	51,0	39,2	78,9	10,7	11,7	10,6	+	16,1	26,7	14,7	52,6	93,1	87,9	93,1	94,7
HU (66,1; 1483)	51,7	42,9	53,2	78,0	2,0	1,6	2,1	2,5	11,3	9,2	10,7	24,6	78,4	75,8	78,6	87,6
IE (56,8; 1652)	40,9	38,8	40,8	73,9	13,6	20,8	11,7	28,0	9,0	8,1	8,8	32,0	93,7	86,6	94,9	75,0
NL (59,8; 1860)	36,9	37,0	36,8	66,7	9,3	21,3	7,8	+	16,5	30,9	14,5	44,0	80,8	65,7	82,7	80,0
NO (65,5; 1707)	29,4	25,4	30,3	+	7,2	9,0	6,6	+	19,6	40,2	14,3	+	85,7	75,5	88,2	+
PL (70,2; 1657)	50,7	39,4	50,7	84,0	1,3	1,7	1,2	1,6	7,8	7,4	6,0	26,2	79,5	81,5	77,5	91,3
PT (72,8; 2172)	49,2	36,7	52,2	72,3	6,5	10,3	5,2	3,0	7,6	6,7	6,4	20,5	85,4	86,6	81,9	90,4
RU (69,5; 2326)	43,7	30,9	42,0	61,9	7,3	7,3	7,6	6,3	11,3	8,5	7,6	22,6	70,0	78,5	56,8	86,8
SE (65,9; 1874)	33,6	39,8	33,1	-	11,2	15,4	10,9	+	21,6	52,0	19,5	+	87,2	75,6	87,8	+
SI(65,1; 1429)	50,6	48,2	50,3	100	7,4	12,4	6,9	16,7	9,2	25,4	7,5	41,7	91,8	93,0	91,5	100
SK (73,2; 1674)	43,3	31,1	43,7	85,7	3,4	2,9	3,8	3,7	9,7	9,4	5,9	26,2	82,2	81,2	80,5	90,6
UA (66,4; 1959)	57,2	44,5	51,6	71,6	9,7	10,0	10,1	9,1	10,4	3,3	6,1	19,9	88,9	91,6	82,0	96,2

+ (n<0,5%)

Even when adjusted to account for these demographic and socioeconomic covariates, the logistic regression analyses revealed that relative to all adults, adults with mobile telephone access and adults without any phone access had significantly greater odds of having morbidity. Not in all, but mostly in old European Union Member States these associations are particularly strong. The logistic regression analyses (Table 2) revealed that relative to all adults, adults with mobile telephone access (Austria, Belgium, Switzerland, Denmark, France, Netherlands, Norway and Portugal) and adults without any phone access (Germany, Portugal and Slovakia) had significantly greater odds of having depressive symptoms. Adults with fixed phone access, relative to all adults, had in nine countries (Austria, Belgium, Bulgaria, Germany, Denmark, France, Netherlands, Norway and Portugal) lower odds of having depressive symptoms. In all the other points we didn't identify significant differences.

Table 2 Prevalence Rates and Relative Odds of depressive symptoms, by household telephone status: ESS 2006/07

	all (n=42,770)	mobile phone (n=8,177)			fixed phone (n=32,185)			no phone (n=2,408)		
	%	%	OR	95% CI[a]	%	OR	95% CI[a]	%	OR	95% CI[a]
AT	23,1	27,4	**1.42**	**(1.11,1.82)**	21,5	**0.70**	**(0.55,0.89)**	29,2	1.19	(0.47,2.97)
BE	28,0	38,8	**1.71**	**(1.26,2.31)**	25,9	**0.61**	**(0.46,0.83)**	27,8	0.68	(0.23,2.03)
BG	35,8	44,5	1.35	(0.93,1.97)	34,8	**0.65**	**(0.48,0.88)**	45,6	1.47	(0.99,2.17)
CH	19,6	41,2	**2.77**	**(1.00,7.67)**	19,3	0.39	(0.14,1.06)	+		-
DE	17,9	26,1	1.41	(0.94,2.11)	17,5	**0.58**	**(0.41,0.84)**	55,2	**3.37**	**(1.49,7.59)**
DK	12,5	16,2	**1.70**	**(1.02,2.83)**	12,0	**0.58**	**(0.35,0.96)**	33,3	2.00	(0.13,30.27)
EE	35,7	33,9	0.89	(0.69,1.15)	36,7	1.06	(0.83,1.36)	51,0	1.31	(0.71,2.39)
ES	24,4	26,1	1.18	(0.86,1.60)	24,0	0.86	(0.64,1.15)	28,9	1.01	(0.48,2.15)
FI	12,2	12,2	1.09	(0.78,1.51)	12,2	0.90	(0.65,1.25)	25,0	1.22	(0.31,4.79)
FR	28,2	39,9	**1.50**	**(1.07,2.11)**	27,0	**0.62**	**(0.44,0.86)**	63,6	3.76	(0.98,14.41)
GB	26,2	35,1	1.14	(0.82,1.59)	25,3	0.80	(0.58,1.10)	62,5	2.67	(0.95,7.48)
HU	54,0	56,2	1.10	(0.86,1.40)	52,6	0.87	(0.69,1.11)	66,7	1.14	(0.74,1.77)
IE	20,6	25,7	1.01	(0.71,1.46)	19,5	0.93	(0.65,1.32)	50,0	1.69	(0.59,4.83)
NL	24,1	35,1	**1.55**	**(1.08,2.22)**	22,7	**0.64**	**(0.45,0.92)**	33,3	1.18	(0.23,6.11)
NO	11,5	17,3	**1.65**	**(1.12,2.42)**	10,0	**0.63**	**(0.43,0.92)**	-		-
PL	31,0	28,5	1.13	(0.84,1.53)	31,8	0.85	(0.65,1.11)	55,2	1.17	(0.76,1.81)
PT	45,3	46,8	**1.28**	**(1.03,1.59)**	44,6	**0.69**	**(0.56,0.84)**	69,1	**1.74**	**(1.19,2.53)**
RU	43,1	39,2	0.90	(0.72,1.12)	45,3	1.04	(0.85,1.27)	52,5	1.08	(0.84,1.39)
SE	16,6	22,0	1.39	(0.85,2.28)	16,2	0.71	(0.43,1.17)	-		-
SI	27,0	20,2	0.66	(0.39,1.13)	27,6	1.39	(0.85,2.28)	-		-
SK	43,4	42,3	0.88	(0.70,1.11)	44,3	0.82	(0.66,1.02)	75,1	**2.65**	**(1.76,3.98)**
UA	47,7	45,8	1.07	(0.82,1.39)	48,8	0.86	(0.68,1.08)	61,2	1.12	(0.87,1.44)

Note. CI=confidence interval; OR= odds ratio.
[a]Odds ratios were adjusted for the variables in Table 1. All Adults were the referent group.
Confidence intervals that do not cross 1 are shown in bold type.

In terms of self-rated health (Table 3) these associations are particularly significant in Germany, Denmark, France, Ireland and Russia. Relative to all adults, adults with only mobile access had greater odds of ill health in Germany, Denmark, France and Ireland and in Russia they had lower odds of ill health. Adults without any phone access had significantly greater odds of having ill health in Germany, Denmark, France and United Kingdom and in Ukraine they had lower odds of ill health.

Table 3 Prevalence Rates and Relative Odds of self rated health status (ill-health), by household telephone status: ESS 2006/07

	all (n=42,770)	mobile phone (n=8,177)			fixed phone (n=32,185)			no phone (n=2,408)		
	%	%	OR	95% CI[a]	%	OR	95% CI[a]	%	OR	95% CI[a]
AT	21,3	17,3	1.05	(0.79,1.38)	22,7	0.98	(0.75,1.29)	20,0	0.68	(0.23,2.06)
BE	25,4	26,3	1.38	(0.99,1.95)	25,2	0.74	(0.55,1.08)	22,2	0.52	(0.16,1.71)
BG	41,9	35,7	1.21	(0.84,1.75)	43,2	0.77	(0.58,1.06)	53,5	1.23	(0.86,1.76)
CH	16,8	29,4	2.56	(0.79,8.35)	16,6	0.53	(0.17,1.64)	+		-
DE	38,5	42,4	**1.49**	**(1.03,2.13)**	38,3	**0.59**	**(0.42,0.83)**	79,3	**3.35**	**(1.24,9.08)**
DK	24,7	25,7	**1.59**	**(1.03,2.45)**	24,5	**0.60**	**(0.39,0.92)**	66,7	5.14	(0.39,66.65)
EE	56,3	53,6	1.09	(0.84,1.42)	57,8	0.81	(0.62,1.04)	84,6	**2.74**	**(1.24,6.05)**
ES	37,5	28,0	0.91	(0.67,1.23)	39,8	1.07	(0.80,1.42)	52,4	1.10	(0.54,2.26)
FI	34,7	26,4	1.00	(0.78,1.28)	43,1	0.99	(0.79,1.27)	50,0	1.05	(0.27,4.05)
FR	34,3	37,6	**1.78**	**(1.24,2.53)**	33,9	**0.52**	**(0.36,0.73)**	72,7	**5.56**	**(1.29,23.96)**
GB	26,1	23,3	0.79	(0.54,1.16)	26,4	1.03	(0.73,1.48)	73,7	**4.07**	**(1.35,12.27)**
HU	51,8	45,1	1.00	(0.76,1.31)	55,7	0.96	(0.73,1.25)	69,4	1.12	(0.69,1.83)
IE	16,6	19,9	**1.62**	**(1.10,2.38)**	15,9	**0.57**	**(0.39,0.83)**	40,0	2.21	(0.71,6.17)
NL	25,6	25,1	1.06	(0.71,1.58)	25,7	0.98	(0.67,1.46)	20,0	0.49	(0.09,2.55)
NO	21,9	16,9	0.93	(0.65,1.33)	23,1	1.06	(0.74,1.50)	-		-
PL	42,2	35,0	1.06	(0.79,1.42)	44,4	0.95	(0.73,1.24)	68,3	0.98	(0.61,1.56)
PT	52,4	45,9	1.12	(0.89,1.41)	55,4	0.88	(0.71,1.10)	72,9	1.06	(0.69,1.60)
RU	62,6	54,1	**0.80**	**(0.64,0.99)**	67,1	1.09	(0.89,1.35)	79,3	1.19	(0.91,1.56)
SE	22,8	22,1	1.45	(0.88,2.38)	22,8	0.68	(0.42,1.12)	-		-
SI	41,2	41,2	0.94	(0.56,1.56)	46,0	0.96	(0.60,1.55)	-		-
SK	35,2	28,4	0.85	(0.53,1.35)	41,2	1.19	(0.77,1.87)	67,0	0.71	(0.18,2.78)
UA	69,6	58,9	0.97	(0.74,1.27)	74,3	**1.44**	**(1.13,1.83)**	75,5	**0.65**	**(0.49,0.85)**

Note. CI=confidence interval; OR= odds ratio.
[a]Odds ratios were adjusted for the variables in Table 1. All Adults were the referent group.
Confidence intervals that do not cross 1 are shown in bold type.

Compared to depressive symptoms and self-rated health, effect differences are less pronounced in terms of functional limitations (Table 4). Relative to all adults, adults with only mobile access had greater odds of functional limitations in Portugal and in Ukraine and in Slovakia they had lower odds of functional limitations. Adults without any phone access had

significantly greater odds of having functional limitations in Bulgaria Germany, Estonia France, United Kingdom, and in Slovakia and in Ukraine they had lower odds of functional limitations.

Table 4 Prevalence Rates and Relative Odds of functional limitation, by household telephone status: ESS 2006/07

	all (n=42,770)	mobile phone (n=8,177)			fixed phone (n=32,185)			no phone (n=2,408)		
	%	%	OR	95% CI[a]	%	OR	95% CI[a]	%	OR	95% CI[a]
AT	22,0	17,7	0.98	(0.75,1.30)	23,6	1.03	(0.78,1.36)	20,8	0.74	(0.26,2.11)
BE	21,4	19,4	1.05	(0.73,1.51)	21,8	0.97	(0.68,1.39)	22,2	0.75	(0.22,2.48)
BG	17,5	12,9	0.81	(0.49,1.33)	18,5	0.75	(0.53,1.06)	32,2	**1.64**	**(1.12,2.42)**
CH	19,9	29,4	2.15	(0.69,6.66)	19,8	0.44	(0.16,1.26)	+		-
DE	26,9	27,2	1.31	(0.87,1.95)	26,9	**0.64**	**(0.45,0.93)**	72,4	**3.11**	**(1.26,7.68)**
DK	25,3	21,8	1.23	(0.79,1.92)	25,8	0.81	(0.52,1.25)	23,3	1.22	(0.87,17.18)
EE	25,6	22,0	0.85	(0.63,1.14)	27,7	0.95	(0.71,1.26)	60,9	**2.53**	**(1.36,4.69)**
ES	16,5	20,1	0.99	(0.64,1.55)	18,0	0.89	(0.60,1.34)	34,1	1.53	(0.70,3.34)
FI	31,5	25,1	0.90	(0.71,1.14)	38,0	1.08	(0.85,1.37)	50,0	1.54	(0.44,5.36)
FR	21,2	19,0	1.24	(0.81,1.89)	21,5	0.71	(0.47,1.05)	54,5	**4.95**	**(1.34,18.24)**
GB	24,9	20,0	0.76	(0.50,1.14)	25,4	1.09	(0.75,1.60)	66,7	**2.94**	**(1.01,8.62)**
HU	29,1	25,7	1.09	(0.81,1.46)	31,0	0.97	(0.74,1.28)	43,0	0.87	(0.56,1.35)
IE	15,8	14,0	1.16	(0.76,1.79)	16,2	0.78	(0.52,1.17)	33,3	2.20	(0.76,6.38)
NL	25,7	18,8	0.76	(0.49,1.16)	26,5	1.34	(0.88,2.02)	20,0	0.62	(0.12,3.18)
NO	23,4	20,4	1.14	(0.81,1.59)	24,2	0.89	(0.64,1.25)	-		-
PL	26,9	21,6	1.01	(0.72,1.40)	28,5	0.94	(0.71,1.24)	52,1	1.13	(0.73,1.75)
PT	20,8	18,6	**1.34**	**(1.01,1.76)**	21,8	**0.76**	**(0.60,0.98)**	35,5	1.09	(0.75,1.59)
RU	33,7	26,0	0.88	(0.68,1.12)	37,9	1.09	(0.88,1.36)	52,9	1.00	(0.78,1.29)
SE	28,4	22,0	1.14	(0.70,1.86)	28,9	0.87	(0.53,1.42)	-		-
SI	33,4	31,6	0.94	(0.56,1.56)	33,5	0.96	(0.60,1.55)	-		-
SK	19,6	14,3	**0.70**	**(0.52,0.95)**	24,3	1.04	(0.79,1.37)	51,8	**1.67**	**(1.13,2.47)**
UA	41,9	38,1	**1.51**	**(1.15,1.99)**	43,5	1.02	(0.82,1.28)	49,8	**0.71**	**(0.56,0.90)**

Note. CI=confidence interval; OR= odds ratio.
[a]Odds ratios were adjusted for the variables in Table 1. All Adults were the referent group.
Confidence intervals that do not cross 1 are shown in bold type.

Discussion

This study is the first to use data from a large-scale face-to-face survey in 22 European countries to consider the relation between mobile telephone access and health-related variables. Despite changes in telephony over the past 10 years and the growth of the mobile-only population, the results are quite similar to those of these previous studies: non-coverage of households without mobile telephone access continues to result in minimal bias for general

population telephone surveys of adults. This is not to say that adults with mobile telephone access do not differ from the general population in their health. Indeed predominantly in old European Union Member States adults with mobile telephone access had greater odds of depressive symptoms, ill health and functional limitations. Contrary to the results in Russia adults with mobile telephone access had lower odds in ill-health and in Slovakia, they had lower odds of functional-limitations. These differences existed even when we controlled for a lot of socio demographic variables. Despite these significant differences, non-coverage bias was particularly strong (OR>1.5). Perhaps both mobile telephone access and health are related to some lifestyle variables not assessed here.

Our study had some limitations. The estimates of non-coverage bias presented here are on the basis of a sample survey that was subject to its own forms of non-random error, including non-response bias, survey design flaws, data processing mistakes, and respondent classification and reporting error. Surveyors should note that the non-coverage of adults classified here as mobile telephone access cannot be completely eliminated simply by randomly dialling personal mobile telephone numbers. The assignment of the mobile telephone status to adults in this research was based on the ownership; information of their primary use (personal or business) was not measured.

If mobile phone substitution becomes more prevalent, will non-coverage bias increase? As noted earlier, the degree of non-coverage bias is determined by the magnitude of the difference between adults with and without fixed telephone access, and by the percentage of adults without fixed telephone access in the population. To date, increases in mobile phone access substation have added to the magnitude of the second factor. If mobile phone substitution becomes more prevalent, we would expect this trend to continue. In other words, non-coverage bias is not presently a reason to reject the continued use of general population telephone surveys to help guide public health policy and program decisions. Of course, close and continued monitoring of telephone ownership in this rapidly changing technological environment will be necessary to ensure continued confidence in this conclusion.

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