



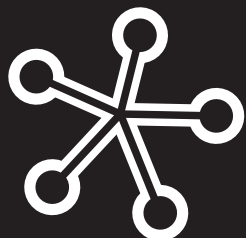
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Mobile CATI: An Overview of Issues

Ana Slavec and Daniele Toninelli



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Mobile CATI: An Overview of Issues

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Abstract

With the increasing popularity of mobile phones, there is a gradual decline of the coverage rates in landline surveys and these are no longer sustainable. Our objective is to explore various issues that arise with the incorporation of mobile phones in surveys. We aim at providing researchers with general and practical guidelines. In particular, we focus on legal and ethical issues, and we study coverage, sampling, nonresponse, measurement and adjustment issues. We found important differences in degrees of respondents' protection, between different countries. However, researchers should follow some general ethical guidelines which take this into consideration. Furthermore, we used Eurobarometer data to observe differences in phone use. In some countries mobile phone only users are prevailing, while in others most people use both mobile and landline phones. We discuss also differences in measurement and nonresponse. Finally, we recommend some weighting approaches that can account for the differences between the introduced segments (that is mobile, landline and overlap). Despite the strong differences observed by country, this work aims at summarizing and integrating various research findings and recommendations that can be widely applied to enhance the quality of collected data and minimize the impact of several of the discussed issues.

Keywords:

Mobile phone surveys; legal issues; coverage; nonresponse; multiple frames

1 Introduction

With the increasing popularity of mobile phones, landline telephone surveys are undergoing a gradual decline in coverage and response rates (Blumberg and Luke, 2013). Consequently, the traditional CATI approach is no longer sustainable in most countries and survey research organizations need to incorporate mobile phones to improve coverage. As a consequence of this integration, new complexities arise and updated guidelines are needed in order to make an optimal transition to the new data collection mode. This paper provides an overview of the main issues related to the use of mobile phone numbers in telephone surveys, focusing on coverage, sampling, nonresponse and measurement. Most of the literature deals with the US situation, whereas there are fewer resources available referred to European countries. The aim of this work is to summarize and integrate various research findings and recommendations and provide researchers with general guidelines that can be helpful in approaching mobile phone surveys issues.

In the first part of the paper, we overview the main legal and ethical issues connected to the use of mobile phones, especially how the topic should be treated country by country, according to the different legislations and regulations. In the second part, we discuss some topics connected with coverage issues, such as territorial coverage, within household coverage and mobile-only coverage. Based on Eurobarometer data, we study the share of mobile-only population and the overlap of mobile and landline phone. In the third section, we discuss the main differences in nonresponse between landline and mobile phones: the research suggests that they are often narrow and, contrary to expectations, there is not much indication of poorer data quality in mobile phone surveys. In the last part of the paper, seen that mobile phones cannot be used as the only frame (even in countries with very high mobile coverage), we show how to combine landline and mobile frames to minimize the impact of several of the discussed issues. This requires applying a dual frame sampling design and a special system of weighting. At this regard, several approaches are introduced and compared.

2 Legal and ethical issues

Before conducting a survey, researchers have to take into consideration various legal and ethical issues which are usually related to the country where the survey is conducted. Even though there are specific rules and the various regulations are still changing rapidly, usually some general principles have to be followed. According to Jones (2011) there are at least three topics that should be addressed by online researchers: privacy and public availability, anonymity and confidentiality, and informed consent. Privacy and public availability are mostly issues of non-reactive data collection, whereas for surveys only the remaining principles are actually relevant. Anonymity law aim at guaranteeing the identity of potential respondents, and by means of confidentiality one aims to protect data provided in the framework of a research. In the case of surveys, anonymity means that the responses cannot be matched with information that can practically reveal the identity of respondent (e.g., the interviewed telephone number, or its address). With confidentiality we intend that information provided by a respondent cannot be revealed to third parties. Lastly, informed consent requires the research organization to clearly inform potential respondents about the use of the collected data, its treatment and the main research purposes; this means that the organization has to provide complete information to assure that the respondent makes an autonomous and voluntary decision to participate in a survey. Given these general definitions of ethical principles, substantial differences can be actually observed in their application between cultures: for example, in the US freedom of information is more important than the protection of personal data, whereas in European countries, especially in Germany, it is the opposite (Grünwald, 2013).

The principles listed above brought to several different measures or laws aiming at protecting respondents and/or information collected through surveys. In particular, focusing on phone surveys (both landline and mobile), in some countries the legislation aims at limiting the burden and the intrusiveness caused by survey participation. This is mainly made providing citizens with harassment laws that could limit, for example, the number of callbacks in telephone surveys. For similar purposes, in some countries there is a both ethical and legal identification of the most appropriate time-of-the-day to carry on surveys: this issue is especially important in the US, where there is a big time gap between different parts of the countries (AAPOR, 2010). In general, in several countries a “do not call register” is set by the national authority to limit the burden caused by unsolicited contacts. According to ESOMAR (2013), in Austria, Cyprus, Germany, Latvia, Lithuania, Poland, Slovakia, Slovenia, Spain, an *opt-in* list is set: only people that asked to be

included in this list can be contacted for surveys purposes. Nevertheless, in some European countries (e.g., the UK and Ireland), in US and in Canada, an *opt-out* model is used: people can ask to be added to a not-call list. Even if in most of the countries companies that make calls for marketing purposes have to check the opt-in/opt-out lists before unsolicited contacts, usually, when a list is set, agencies are not required to check that list before contacting the respondents for marketing researches. Exceptions are Austria, Italy, Germany, Netherlands and Poland, where for research companies it is mandatory to check these lists prior to the unsolicited contact. A consequence of this regulations is that, in case of complains about unsolicited calls by people on the list, some mobile phone service providers may cut services (ESOMAR, 2011). Some other countries (Japan, Brasil, South Korea, and Mexico) do not have regulations at all for unsolicited contacts (ESOMAR, 2013).

A functionality of mobile phones that could facilitate contacting respondents is text messaging. However, we can come across restrictions or legal limits for the use of text messages in some countries: for instance, they cannot always be used in the US (see CAN-SPAM Act, 2003), whereas in Austria the respect of an opt-in list is mandatory to send these messages for mobile surveys. Another restriction of a potentially useful instrument in the US affects automatic telephone dialing system that cannot be used without user's prior consent (AAPOR, 2010).

Even though we observed different degrees of respondents' protection in different countries, and some subjects are not considered by the currents legislations, research organizations should also follow professional codes and guidelines. At this regard, ICC/ESOMAR International Code on market and Social Research suggests that "the same fundamental, ethical and professional principles of face to face, mail and online research also apply to mobile phones surveys" (ESOMAR, 2011). This means that researchers should assure respect, transparency and disclosure (identification of calling party, of the research organization, the purpose of the survey, and so on); moreover they should guarantee confidentiality, privacy protection and the voluntary nature of participation.

A crucial aspect to be taken into consideration, strictly connected with the nature of mobile surveys, is the safety of respondent, seen that the respondent might be in a situation where it is not safe to take a call (e.g., driving; in some countries it is not even legal taking a call while driving). If this is a general rule, other relevant dispositions might apply in different cultures, "which may mandate a stricter standard of practice" accordingly (ESOMAR, 2011). For instance, researches should always carefully check the legally and socially accepted age of children and seek consent from parents (for further information, see ESOMAR, 1999).

In addition the new technologies allow us to gather further information about respondents, such as location data, but also other paradata. However, in most countries, this kind of data cannot be collected and used without the informed consent of the surveyed (for more about this topic, see Couper and Singer, 2011).

3 Mobile phone coverage

One of the most important aspects of mobile surveys is coverage rates. As mentioned in the introduction, the principal reason for introducing mobile CATI in data collection is the declining coverage of landline surveys. According to Eurobarometer data, from 2004 to 2013 the coverage registered a median drop of about 17 percentage points; the highest decline were observed in Finland (52.7) and Czech Republic (47.1), whereas France and Hungary are two exceptions, seen that the coverage has increased of, respectively, just 2.7 and 81.4 percentage points (see Table 1). At the same time, mobile phone coverage is gradually increasing, and it is more than compensating the trend of the landline coverage, so that the general rate of no-phone population is decreasing. In median mobile coverage has increased of about 13 percentage points from 2004 to 2013, with the highest growth observed in Bulgaria, +41.0, and Serbia, +39.3 (see same Table 1).

Table 1 - Changes in coverage rate between 2004 and 2013 (percentage points)

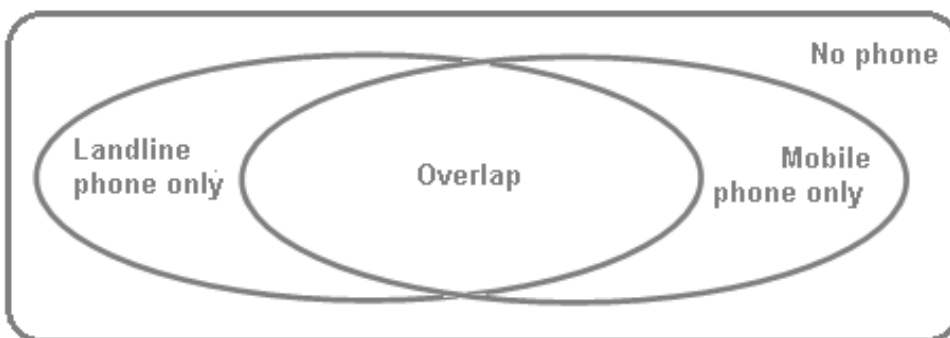
	Mobile phone	Landline phone
AT	15.4	-37.6
BE	11.2	-9.7
BG	41.0	-38.3
CY	13.5	-18.7
CZ	10.2	-47.1
DE	15.6	-4.3
DK	14.2	-33.8
EE	12.6	-18.5
ES	8.5	-17.1
FI	5.5	-52.7
FR	14.7	2.7
GB	18.2	-5.0
GR	16.2	-6.7
HU	85.2	81.4
IE	14.6	-17.9
IT	8.8	-26.6
LT	13.2	-6.3
LU	19.0	-12.8
LV	11.4	-7.4
MT	21.8	-27.2
NL	11.0	-0.2
PL	1.8	-9.8
PT	20.5	-43.4
RO	5.4	-4.9
SE	39.3	-23.2
SI	1.9	-2.3
SK	7.5	-13.9
	Median 13.2	Median -17.1
	Average 14.2	Average -19.2

Although both the mobile phone and the landline coverage are very high in many European countries, in most cases this is not sufficient to reach satisfactory survey coverage of the whole population. Consequently, a combination of both types of phones should be considered when designing a survey.

The spreading of the mobile phone coverage is a phenomenon that is involving most of the countries, not only the European ones. In the US, for example, the National Health Interview Survey (NHIS) has been observing the increasing percentage of mobile-only households since 2003. At the end of 2005 there were less than 8% of adults living in mobile-only households which grew to 14.5% at the end of 2007 and to 24.5% in 2009 (Blumberg and Luke, 2009). In 2013 the mobile only rate increased to 39.4% of households (Blumberg and Luke, 2013). Table 2 (available in the Appendix) shows how the mobile-only category is changed in some European countries between 2004 and 2013 (source: Eurobarometer, 2013).

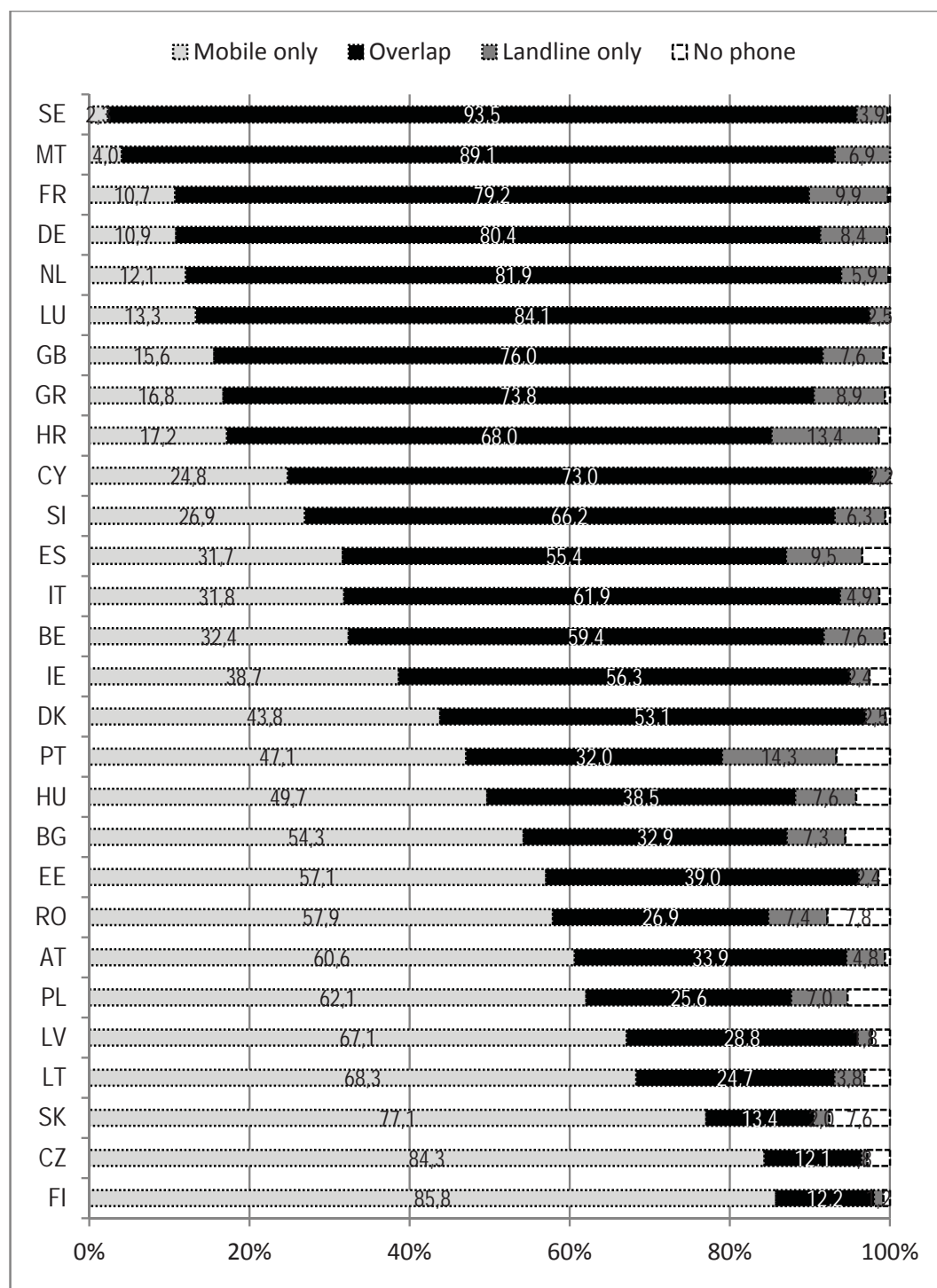
Before going further with our analysis, we need to define a precise classification of the main group of potential respondents, according to the kind of coverage. To describe a surveyed population according to phone coverage, Brick et al. (2005 and 2006) suggest to consider the following four groups of units (see Figure 1): the first group includes those that are only covered by landlines (landline-only), the second group consist of people that own only mobile phones (mobile-only), the third is made by those who are covered by both a landline and mobile phones (overlap group), and, finally, the last group comprises those who remain uncovered (no-phone population).

Figure 1 - Four groups of phone use: Mobile-only, Overlap, Landline-only, No-phone.



In Table 3 (based on 2013 Eurobarometer data), available in the Appendix, we can clearly see that the relative size of these four groups varies a lot over countries. We used this data to draw Figure 2.

Figure 2 - Phone coverage in European countries by groups (2013)



For landline-only the highest rates are observed for Portugal (14.3%) and Croatia (13.4%); on the other hand Czech Republic (84.3%) and Finland (85.7%) have the highest rate of mobile-only. If we consider the combination of landline and mobile (overlap), the highest coverage rates are observed for Sweden (93.5%) and Malta (89.2%). For non-coverage the two highest rates are Romania (7.8%) and Slovakia (7.6%), where- as there are three countries with complete coverage: Cyprus, Malta and Luxembourg.

Even if we don't consider the noticeably high differences in coverage rates among countries, there is an additional issue that has potentially a bigger impact on the quality and representativeness of data than the coverage rate: the different groups of potential respondents have noticeably different socio-demographic structures. In fact, several studies showed that the mobile-only population includes mostly the young, well-educated, with high incomes (Fuchs, 2002; Arthur, 2007; Blumberg and Luke, 2007), and usually with more advanced technological competencies (Fuchs and Busse, 2009; Nicolai, 2009). On the other hand, the no-phone population is socio-demographically quite different from the mobile only population. A question was raised by Busse and Fuchs (2012) regarding the two contradictory trends, i.e. increasing mobile-only and decreasing no-phone: are the two effects compensating in terms of coverage bias? By studying Euro-barometer data, the two authors showed that to a certain extent there is a compensation for some variables (such as age) and in some specific countries (especially where high rates of mobile-only and of no phone is registered). Nevertheless, for other variables (such as type of community) the two effects are not being compensated, but rather they sum up; this also happens for certain countries (with high or low mobile-only and low no-phone rates).

When the population frame includes more than one territorial unit (i.e. country, region, province, or municipality) and surveyed units or mobile devices cannot be precisely attributed to a specific territory, the problem of territorial coverage arises. In addition to this, sometimes, it is really hard to define the areas covered by wireless service. In fact, mobile phone service providers can have different coverage which does not necessarily overlap with landline providers; moreover, every mobile provider is likely to have a different coverage (AAPOR 2010). To make things even more complicated, it is sometimes difficult to locate a user within a country or region (e.g. there could be temporary or definitive movements of units). Moreover, a user can have more than one mobile device and different devices can be associated with and/or work with different operators. In addition, in some countries an increased portability between operators is observed (e.g., Poggio and Callegaro 2012).

Another problem related to territory is non in-scope units; however, this is more a problem of sampling frames and will be further discussed in the next section.

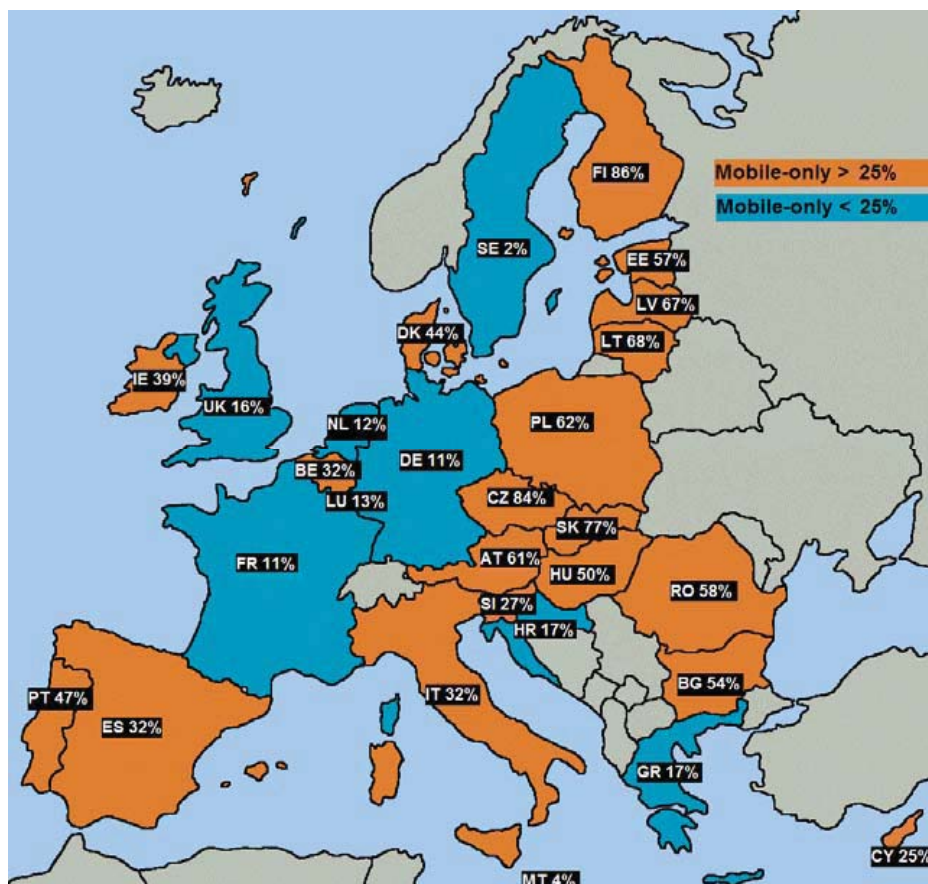
A potential general solution given by the AAPOR guidelines (2010) for territorial coverage issues is simply to ask respondents for residential information, during the survey. When a survey is combining landline and mobile frames, the researchers should fully disclose how the integration was dealt within the survey.

Finally, we will discuss the within household coverage, that can be observed when we are not sure if the answering unit corresponds to the actually selected unit. It is more common for landline phones but it can also be observed in case of mobile phones (for instance with shared devices). In this case, we should identify the primary user of the device. However, the researcher should keep in mind that this can increase the refusal rate. Another issue is that mobile devices can be used also for business purposes. In this case, we should decide if we want to include these units, accordingly to the purpose of the survey. Usually, if we are interested in households, we include that unit only if the device is used also for private purposes. Thus, also in case of a business device, we should ask for additional information about the use of the device (if this is relevant to the purposes of the survey).

4 Sampling frames

The most important criteria for selecting a sampling frame for a survey is coverage. In the section we presented Eurobarometer data (2013) which show that there are basically two groups of countries according to phone use (see Figure 3). First, there are countries with a very low share (less than 25%) of households that do not have a landline phone and can be reached only by a mobile phone number: the so called mobile-only. In Europe there were nine countries with under a quarter of mobile-only population segment (from low to high): Sweden (2%), Malta (4%), France (11%), Germany (11%), Netherlands (12%), Luxembourg (13%), United Kingdom (16%), Croatia (17%) and Greece (17%). In these countries landline-only surveys might still be sustainable, if the socio-demographic differences between the segments would not produce any bias (this will be discussed in further sections). Second, in most countries the mobile-only segment is already over 25% of the population. In particular, the highest percentages are observed in Finland (86%), Czech Republic (84%) and Slovakia (77%), while at the bottom we find Slovenia (27%) and Cyprus (25%). In these countries it is almost necessary to use both the landline and mobile phone as frames.

Figure 3 - Mobile-only coverage in European countries



Multiple frame surveys refer to two or more frames that can cover the target population. They are used to sample populations that are rare or hard-to-reach and/or cannot be reached by a single frame (Groves, 2004). Furthermore, they usually have considerably high costs, if compared to analogously accurate single frame designs. Dual frame samples are increasingly used in the US (see Brick et al., 2006) to address the growing cell-only population. However, their use in Europe is less widespread, at least to our knowledge. One of the rare European surveys that uses it is Flash Eurobarometer¹ and the sample is composed of 60% of landline and 40% of mobile numbers (European Commission 2008), where the two categories overlap. However, a study by Vehovar and Slavec (2012) showed that the optimal composition should differ by country, according to the composition of the four phone-use groups we defined above (mobile-only, landline-only, overlap, no-phone).

One of the main drawbacks of using dual frames is that units that use both mobile and landline phones (overlap) have a higher probability of being selected than those that use only a landline or only a mobile phone. There are two common approaches to face this issue: the screening and the weighting approach (Brick, 2009). In the screening approach by means of a screening question asked by the interviewer, the overlap units are kept in the survey for one frame (e.g. the mobile) and are excluded in the second frame (e.g. landline). A disadvantage of this approach is that it is more expensive to be carried out; moreover the discarding of a lot of units can be viewed as a waste of resources. The second approach, weighting (further discussed in section 6), is recommended for populations for which estimates of telephone status exist. For many types of surveys, however, these estimates are not available and in these cases the researcher should rely on the screening approach.

The most convenient way of sampling for phone surveys is, of course, registers of telephone numbers. However, they are usually very incomplete for mobile phones and, in some countries, even for landline phones. Thus, a complex random digit dialing (RDD) for sampling telephone survey has been developed and is commonly used for landline phone surveys in many countries. Recently, similar techniques are also used for mobile phones; however, with different providers and many missing numbers it is even more difficult and expensive to obtain them.

As mentioned in the section 3, a sampling problem also related to territorial coverage is the presence of territorial non in-scope units. One kind of these units are users that live in a country or region different than where the mobile device was purchased. The second kind of users is mostly specific of users in

1 See: http://ec.europa.eu/public_opinion/archives/flash_arch_en.htm.

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North American countries that can live in an area different than where the exchange rate center² is located (AAPOR, 2010): some territories don't have rate centers; subscribers resides in a sampled territory but belong to a different rate center; subscribers does not reside in the sampled territory but are linked to the corresponding rate center; subscribers moved to a different area for a certain period of time.

2 A rate center is a geographically specified point associated to a specific area that is used for determining mileage-dependent rates for phone calls.

5 Nonresponse and measurement

In comparison with traditional landline survey methods, the newer mobile phone technologies allow the researcher to reach the potential respondent with less effort, since the mobile devices are by definition portable and the user can easily take them anywhere. In addition, many users almost constantly check their devices. As a consequence, a noticeable reduction of noncontact rate is usually observed. On the other hand, these characteristics of mobile devices make it more likely to reach a respondent at an inconvenient time and/or place, which lead to an increased refusal rate. Thus, the nonresponse rate is usually higher than in comparable landline surveys. Nevertheless, this difference is getting narrower according to the AAPOR report (2010).

There are three components that contribute to nonresponse: noncontacts, refusals, and undetermined eligibility. Given that sufficient call attempts are made (i.e. more than five), *noncontact* is about the same as in traditional landline surveys (AAPOR, 2010). As mobile phone owners are reachable most of the day, the noncontact for mobile decreases; moreover, people who use their cell phones frequently are observed as being more likely to participate to surveys (Brick et al., 2006). Differently, for landlines noncontact is increasing as people tend to spend less time at home and an overload of unsolicited marketing/commercial communication is occurring. In addition Brick et al. (2006) found that frequent mobile phone users rarely answer their landline phones.

On the other hand, a disadvantage of mobile CATI is increased *refusals* which are currently the main source of nonresponse (AAPOR, 2010). The refusals can be due to different factors. First of all, mobile phones are considered tools for private and personal communication. However, this issues is becoming less important since a wider use of mobile devices is observed for different purposes (e.g. business). Second, the interviewed person can be charged for the incoming call (ESOMAR, 2011) and, moreover, in some countries additional costs are applied for calls between different regions and across national boundaries. At this regard, unfortunately, reimbursing the respondents is often not an option due to technical limitations. However, the good news is that the increasing competition between operators is lowering the connection costs. Third, the variety of settings in which the respondent can be reached is also a factor pushing refusal rates, because he/she might not be willing to respond or busy (e.g. in a restaurant, during a meeting, while driving, etc.). Fourth, in general, also considering the previous three reasons, in a mobile survey it is more

difficult to convert a refusal. However, this is not necessarily a drawback, since Groves and Peytcheva (2008) demonstrated that there is risk to increase the nonresponse bias, while trying to reduce nonresponse.

Compared to landline phones, the *undetermined eligibility* is even more critical (AAPOR, 2010). In fact, it can be very hard to determine the working status of a mobile device, and this for different reasons. First, it is not easy to determine the main purpose of the device, i.e. business/commercial or private. Second, the so-called “churn” (i.e., the turnover of mobile numbers) is a more frequent phenomenon than for landlines, as it is easier to switch operator. Third, the irregular use of some mobile devices (e.g. emergency calls) is also making it harder to understand if the unit is eligible. Fourth, highly different messages across wireless operators make it even harder to unambiguously classify the status of a phone number. The last two causes of unknown eligibility are becoming less relevant, due to a decrease of the sporadic use of mobile phones (e.g. for emergency purposes) and due to the consolidation of the industry, that is producing a more standardized message system across operators.

A central issue within nonresponse studies is also *differential nonresponse*. Within mobile surveys it is characterized as an overestimated percentage of the mobile-only segment as they have higher contact rates and lower refusal rates, if compared to those who own both a landline and a mobile phone (overlap). Moreover, the mobile only respondents show a higher rate of completed interviews (AAPOR, 2010). Differential nonresponse should be taken into account when weighting (see section 6).

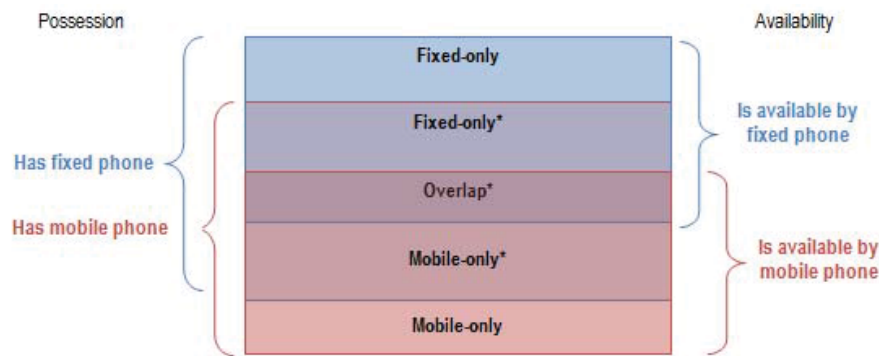
Finally we briefly discuss about measurement error, which is an additional component of survey error. In mobile phone interviews the measurement error is usually higher than in comparable landline surveys as accuracy is affected by the various contexts. For instance, the interviewed might be responding in a socially desirable way because of being in a public place, in particular if sensitive questions are asked. Moreover, due to noisy locations and bad volume settings, the respondent might have difficulties in hearing and/or comprehending the questions asked by the interviewer, and also the interviewer might have difficulties in hearing the answers. Furthermore, time constraints and concerns about the costs might press the respondent to rush through the interview and give less accurate answers. An important issue, raised by Kennedy (2010) is that respondents might be distracted by being engaged in other activities while responding to a survey. Thus, to evaluate the quality of collected data, it is important to ask also questions about the context of the interview (AAPOR, 2010; Lavrakas, 2012). As Lavrakas (2012) showed, there is some indication that respondents who are away from home provide answers of poorer quality, even if, in general, mobility is not always associated with a higher measurement error.

6 Adjustment

Given the complex dual frame design and the issues associated with nonresponse and measurement error, it is necessary to weight data obtained by means of mobile CATI. We are usually weighting to account for different probabilities of selection, differential propensities to respond and for coverage and/or sampling errors. A prerequisite for using the weighting approach for the problem of the dual frame overlap (already discussed in section 3) is having a good source of population estimates of phone status.

Different sources of phone use estimates exist both in Europe (Labour Force Survey, European Social Survey, Eurobarometer, and Flash Eurobarometer) and in the US (Current Population Survey, National Health Interview Survey, and PEW Research Centre). However, different sources use different question wordings for asking questions about phone use. Thus, for a certain sample that we intend to weight we need to make sure that we replicate the same question wording of the source of estimates. Comparing question wordings in different sources (see Table 4, in the Appendix) we noted that these vary according to the definition of device (i.e. working or non-working), the device ownership (i.e. individual or household, personal or company) and, most importantly, according to the definition of use (i.e. possession or availability; see Figure 4). In some sources only the possession wording is used, in others only availability, while some use both. For instance, the Flash Eurobarometer (European Commission, 2008) uses both the possession wording (e.g. “Do you personally have a mobile/landline phone?”) and also the availability wording (e.g. “Could I have reached you just now on your mobile/landline phone?”). Using Flash Eurobarometer data, Slavec and Vehovar (2011) showed that there are six groups of phone users (instead of the four listed in section 3). Two sub-groups are extracted from the overlap group. On one side, we have the mobile-mostly, i.e. those that have both a landline and a mobile device but are in practice only reachable by a mobile-phone. On the other hand, landline-mostly are those that have both devices but are, in practice, only available through a landline phone.

Figure 4 - Additional groups of phone users (Source: Slavec and Vehovar 2011)



After selecting the population source, we need to select a weighting approach. In her work of 2011, Kennedy compared five different weighting approaches:

- 1) *Simple 0.5 Compositing* (studied by Brick et al., 2006 and by Kennedy, 2007);
- 2) *Effective Sample Size Compositing* (Franker et al., 2007);
- 3) *Simple 0.5 Compositing with Modified Household Size* (Keeter et al., 2010);
- 4) *J. Best Raw Sample Size Compositing* (Best, 2010);
- 5) *Response Rate Compositing* (Brick et al, 2011).

There is a bias/variance trade-off between the listed approaches: the approaches 1) and 2) are better in reducing bias but they increase the design effect, whereas the approach 3) and 4) have a small design effect but the bias reduction is very small. A middle way is represented by the Response Rate Compositing (5)), which both reduces the bias and has a small design effect.

7 Conclusions and further research

For every issue associated with using mobile CATI there is usually a very reasonable solution that is easy to apply.

Regarding legal and ethical issues, for example, the main suggestion would be to carefully check both the regulations/legislations that characterize different countries in terms of respect for respondents (i.e. avoiding bothering them) and of their protection. Usually, the interview should start with questions to establish if it is safe and legal to involve the unit in the survey (e.g. asking if the respondent is driving or its age). Furthermore, to guarantee informed consent of the interviewed, the researchers should always clearly disclose detailed information about the main purposes of the survey and about the use of the collected data. There are a lot of documents with guidelines on ethical and legal issues to be followed by survey researchers, such as the AAPOR and ESOMAR reports.

To sum up coverage issues, we discussed three main topics. First, we introduced the differences between countries in phone use according to the four groups in which the respondents can be classified: mobile-only, landline-only, overlap and no-phone. Given the dissimilarities in the coverage of the four groups between countries and the socio-demographic differences that might appear comparing the four groups, these issues should be studied in depth with further research and a solution should be appropriately chosen and applied in other phases of the survey (sampling and/or weighting). Second, for territorial coverage the main issues could be faced by simply asking questions about residential information. Similarly, this method is applied also to the third issue, the within household coverage, for which we should ask information about the primary user and the purpose of use of the device.

As for landline, also mobile CATI requires either telephone registers or random digit dialing. In many cases, multiple frame sampling is recommended, which requires dealing with the overlap of mobile and landline phone users. A weighting approach is recommended, at least for populations for which telephone status estimates are available, whereas the screening approach is the only option when no accurate estimates of telephone status exist.

It appears that higher non response is an issue of mobile phone surveys, however the difference between landline and mobile non response is actually decreasing and it's likely to disappear in few years. This is mainly caused by the decreasing non-contact rate, since most of the respondents are reachable through their devices almost all the time. However the refusals are higher due to the diverse and distracting settings in

which a respondent could be contacted. For the same reason also measurement error is gradually increasing. Coming back to the nonresponse, there are more units for which it is not easy to determine the eligibility; however, the extent of the problem is diminishing with the evolution of mobile phone industry and usage. Lastly it is also important to take into consideration the differential nonresponse between different groups according to their phone status by appropriately weighting data.

The discussed coverage, sampling, nonresponse and measurement issues should also be faced by an appropriate weighting approach. Taking into account the variance/bias trade-off, the best approach is the Response Rate Compositing. This and also other approaches require accurate population estimates. In case they are not available, researcher should better use the screening approach when combining landline and mobile surveys.

To conclude, further research about how to integrate mobile phones in survey research is extremely needed along with a more thorough discussion on the various issues that we summarized in this paper. As a prerequisite, more surveys should include questions about mobile phone use, respondents' reachability, their preferences and device availability. This will enable researchers to better design mobile phone surveys and to properly integrate them with other modes, also considering specificities and regulations that characterize different countries.

Appendix

Table 2 - Mobile-only category: percentages (from 2004 to 2013) and 9-year changes (in percentage points)

Country	2004	2006	2007/8	2009	2011	2013	9 year changes
AT	22.5	40.2	41.6	48.0	49.3	60.6	+38.1
BE	20.7	29.0	30.3	33.8	30.7	32.4	+11.7
BG	7.7	17.6	19.1	31.6	42.1	54.3	+46.6
CZ	34.9	53.0	NA	NA	NA	84.3	+49.5
CY	5.7	14.4	48.0	55.5	58.7	(24.8)	(+19.1)
DE	5.2	8.7	10.4	9.8	8.9	10.9	+5.6
DK	10.2	17.4	NA	NA	NA	43.8	+33.6
EE	36.4	46.5	40.3	44.8	49.0	57.1	+20.6
ES	15.2	22.7	24.4	29.3	26.9	31.7	+16.5
FI	33.5	53.8	62.3	71.7	78.3	85.8	+52.3
FR	12.9	17.9	14.2	10.3	11.9	10.7	-2.1
GB	9.1	12.3	12.6	19.2	14.0	15.6	+6.5
GR	9.7	17.1	17.8	20.2	15.7	16.8	+7.0
HU	27.6	42.6	48.3	46.0	47.4	49.7	+22.1
IE	12.1	23.4	19.4	27.0	31.1	38.7	+26.5
IT	23.9	39.6	37.8	29.8	32.3	31.8	+8.0
LT	46.1	49.2	53.1	54.7	61.3	68.3	+22.2
LU	5.5	6.3	4.0	9.2	8.6	13.3	+7.8
LV	32.2	44.6	45.5	49.9	50.0	67.1	+34.9
MT	3.2	3.9	3.9	2.1	2.5	4.0	+0.9
NL	2.4	6.7	8.2	10.3	9.8	12.1	+9.6
PL	15.5	24.7	31.6	42.8	48.3	62.1	+46.6
PT	37.3	34.9	46.1	40.5	34.8	47.1	+9.8
RO	15.0	34.4	35.2	42.0	50.2	57.9	+42.9
SE	0.3	2.4	2.3	0.6	2.0	2.3	+2.0
SI	12.0	12.4	14.6	17.0	16.7	26.9	+15.0
SK	41.4	43.0	49.0	57.6	61.1	77.1	+35.7

Table 3 - Structure of the four groups in 2013

	Mobile only	Overlap	Landline only	No phone	Total
AT	60.6	33.9	4.8	0.6	100
BE	32.4	59.4	7.6	0.7	100
BG	54.3	32.9	7.3	5.6	100
CY	24.8	73.0	2.2	0.0	100
CZ	84.3	12.1	0.8	2.8	100
DE	10.9	80.4	8.4	0.4	100
DK	43.8	53.1	2.5	0.6	100
EE	57.1	39.0	2.4	1.5	100
ES	31.7	55.4	9.5	3.5	100
FI	85.8	12.2	1.2	0.8	100
FR	10.7	79.2	9.9	0.2	100
GB	15.6	76.0	7.6	0.8	100
GR	16.8	73.8	8.9	0.6	100
HR	17.2	68.0	13.4	1.4	100
HU	49.7	38.5	7.6	4.2	100
IE	38.7	56.3	2.4	2.6	100
IT	31.8	61.9	4.9	1.3	100
LT	68.3	24.7	3.8	3.2	100
LU	13.3	84.1	2.5	0.0	100
LV	67.1	28.8	1.8	2.2	100
MT	4.0	89.1	6.9	0.0	100
NL	12.1	81.9	5.9	0.2	100
PL	62.1	25.6	7.0	5.3	100
PT	47.1	32.0	14.3	6.7	100
RO	57.9	26.9	7.4	7.8	100
SE	2.3	93.5	3.9	0.3	100
SI	26.9	66.2	6.3	0.6	100
SK	77.1	13.4	2.0	7.6	100

Table 4 - Phone possession wording in different surveys (Source: Slavec and Vehovar 2011)

Survey	Landline phone possession wording	Mobile phone possession wording
EB	Do you own a fixed telephone in your household?	Do you own a personal mobile telephone?
Flash EB	[Mobile subsample] – D11b. Do you have a fixed telephone at home?	[Landline subsample] – D11a. Do you personally have a mobile phone?
LFS	F71. Does your household have a fixed phone?	F72. Do you have your own mobile phone (including company mobile phone)?
ESS	DOD1. Is there a fixed-line telephone in (your part of) this accommodation? (Note: “your part of” refers to separate ‘households’ living in the same building, not rooms within a household)	DOD2. Do you personally have a mobile telephone?
CPS	Q1. [...] How many different landline telephone numbers does your household have? Q1a. Excluding any numbers used only for faxes and computers, how many of these (Q1) landline phones are used for incoming calls?	Q2. Do you or any other members of your household have a working cellular phone number?
NHIS	N1. Is there at least one telephone inside your home that is currently working and is not a cellular phone?	N2. Does anyone in your family have a working cellular telephone?
CHIS 2007	[Mobile subsample] – CC1. Is this cell phone your only phone or do you also have a regular telephone at home?	[Landline subsample] – CL1. Do you have a working cell phone?
CHIS 2005	[Mobile subsample] – Is this cell phone your only phone or do you also have a regular telephone at home?	/
PEW 2008/09	[Mobile subsample] – PC1. Now thinking about your telephone use ... Is there at least one telephone INSIDE your home that is currently working and is not a cell phone?	[Landline subsample] – PL1. Now thinking about your telephone use ... Do you have a working cell phone?
PEW 2006	[Mobile subsample] – Is the cell phone your only phone or do you also have a regular telephone at home?	[Landline subsample] – Do you happen to have a cell phone or not?
PEW MN-L 2006	[Mobile subsample] – Is this cell phone your only phone or do you also have a regular telephone at home?	[Landline subsample] – Do you happen to have a cell phone or not?

Sources: European Commission (Flash EB), Labour Force Survey (LFS), European Social Survey (ESS), Tucker in drugi 2007 (CPS), Brick in drugi 2010 (NHIS, CHIS 2007, PEW 2008/09), Brick in drugi 2007b (CHIS 2005), Keeter in drugi 2007 (PEW 2006, PEW McN-L 2006).

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