Data collection method in the Swedish Living Conditions Survey of Children

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Abstract

The Living Conditions Survey of Children (Children's LCS) is a survey of children 12-18 years old given by Statistics Sweden since 2001. Survey topics include economy and material resources, health, and social relations. The Children's LCS was previously a supplementary survey to the Living Conditions Survey (LCS). Because of declining response rates and changes in the LCS design, the Children's LCS will turn into a stand-alone survey.

Because most surveys of children are supplementary surveys or classroom surveys, knowledge of surveys of children with direct element sampling is limited. For example, there is substantial uncertainty on data collection method, response rates, and representativity of responding sample persons. To address this, Statistics Sweden carried out an experiment on the choice of data collection method for the stand-alone Children's LCS. In the experiment, mixed mode using telephone and web questionnaires were compared with single mode web questionnaires.

The response sets generated by the two data collection methods were evaluated with respect to desired quality and granularity. Comparisons were made of, for example, response rates, expected number of respondents, and the bias and variance of estimates. The overall response rate was 56 % in mixed mode and 38 % in web. The results were similar for both methods when the sample sizes were adjusted for the difference in overall response rate. Moreover, the quality was deemed to be adequate for both methods.

Because of lower data collection costs, it is possible to choose a larger sample size in web for the same overall cost, which results in a larger response set compared to mixed mode, and consequently, smaller variance. Hence, Statistics Sweden recommends using web as data collection method for the Children's LCS. In addition, Statistics Sweden recommends conducting proxy interviews by telephone.

Keywords: Survey of children, data collection, experiment, mixed mode, web

1. Introduction

Statistics Sweden has carried out the Living Conditions Survey of Children (Children's LCS) since 2001. The survey aims to describe the living conditions and everyday life of children in Sweden and include topics such as school, economy and material resources, spare time, health, and social relations. The target population of the survey is Swedish children 12 to 18 years old.

Between 2001 and 2019, the Children's LCS was carried out as a supplementary survey to the Swedish Living Conditions Survey (LCS), whose target population is the Swedish population aged 16 years and older. Children to the LCS respondent or the LCS respondent's spouse living in the same household as the LCS respondent were eligible to take part in the survey. At the end of the LCS interview, the LCS respondent was asked to give consent for the Children's LCS interview. If consent was given from the LCS respondent and from the child, an interview was carried out for the Children's LCS.

The previous data collection procedure in the Children's LCS resulted in non-response from multiple sources. Non-response among LCS sample persons resulted in an indirect non-response from possible participants in the Children's LCS living in the same household as non-responding LCS sample persons. Then, non-response occurred among children living in the same household as an LCS respondent if the LCS respondent or the child did not provide consent for the Children's LCS interview. The large non-response rate resulted in a substantial loss of accuracy in survey estimates, which affected the possibility to produce statistics with acceptable quality for domains such as children to single parents, children with disabilities, and children with foreign background. For the 2017 survey, the non-response rate was estimated at 72 percent (SCB, 2019).

Because of the large non-response rate, and because of changes to the design of the LCS, including the transition from a yearly cross-sectional survey to a rotating panel survey, Statistics Sweden has decided to carry out the Children's LCS as a stand-alone survey. The realisation of a stand-alone Children's LCS has been further detailed, e.g., by a shell table of the suggested publication of estimates. The shell table is not shown in detail, but includes domains such as age, parent's education level,

foreign/Swedish background, and household economy. Note that all official statistics of Sweden, which includes the Children's LCS, should be reported by sex.

Data collection method in the Children's LCS

When the Children's LCS was a supplementary survey to the LCS, both surveys used the same data collection method since the interview for the Children's LCS typically took place directly after the interview for the LCS. The data collection method was CAPI prior to 2007 and CATI from 2007 and onwards. When the Children's LCS becomes a stand-alone survey, it is possible to choose data collection method independently of the data collection method used in the LCS.

Previous work showed that mixed mode data collection with telephone and web questionnaires (CATI-CAWI) and data collection with web questionnaires (CAWI) were possible to use for a stand-alone Children's LCS (SCB, 2021). Because of the limited prior knowledge of surveys with direct element sampling of children, the effect on the quality of the statistics of choosing either data collection method was difficult to assess beforehand.

In June 2021, the Government commissioned Statistics Sweden to develop the data collection method for the Children's LCS. As part of the assignment, Statistics Sweden carried out an experiment on the choice of data collection method. The present paper describes the design, realisation, and results of this experiment. The focus of the paper is on the methodological aspects of the experiment.

2. Experiment

Experimental design

The aim of the experiment was to assess the possibility to use CATI-CAWI and/or CAWI in the stand-alone Children's LCS. This should be evaluated with respect to the quality of the statistics and the proposed shell table. The experiment should also result in a recommendation of which data collection method to use in a stand-alone Children's LCS.

The evaluation of the quality of the statistics concerned the possibility to publish statistics following to the proposed shell table, primarily with respect to relevance and

accuracy. Specifically, suppression of estimates, sampling error, and non-response error were studied.

Sampling design

The sampling frame consisted of children 12-18 years in the total population register dated 2020-12-31. The frame had 845 000 elements. The sampling design was simple random sampling, and the sample size was 3 500 sample persons. The sample was randomly split into 1 000 sample persons, which were assigned CATI-CAWI, and 2 500 sample persons, which were assigned CAWI. The sample size and the size of the groups were chosen from expected response rates and for financial reasons.

Data collection

The invitation letter of the survey was sent out during the end of August 2021. For children 15 years and older, the invitation letter was addressed directly to the child, and for children 12-14 years old, it was addressed to the caregiver(s) of the child. During the first two weeks, only web questionnaires were available. After two weeks, telephone interviews in CATI-CAWI started. The total length of the data collection period was six weeks. Two reminders were sent out during this period.

Each participating child was offered a movie ticket or a gift certificate as a reward. This procedure is the same as when the Children's LCS was a supplementary survey to the LCS.

Table 1 shows the number of respondents and response rate in CAWI and CATI-CAWI. In CAWI 960 children out of 2 502 responded to the survey, and in CATI-CAWI, 564 children out of 1002 responded.

Table 1. The number of repondents and the response rate in CAWI, and the number of respondents and response rate in web and telephone in CATI-CAWI.

	CAWI		CATI-CAWI	
	Number of respondents	Response rate	Number of respondents	Response rate
Web	960	38 %	436	43 %
Telephone			128	13 %
Total	960	38 %	564	56 %

In CATI-CAWI, the main reasons for non-response were *unavailable* (163 sample persons), *no contact information* (137 sample persons), and *consent not provided* (123 sample persons). In CAWI, almost all non-respondents were marked *unavailable* since very few sample persons contacted Statistics Sweden to tell why they did not participate in the survey.

Figure 1 shows the evolution of the response rate during the data collection period for both data collection methods. The response rates are similar for both modes until the start of telephone interviews, after which the response rate in CATI-CAWI increases faster than the response rate in CAWI.

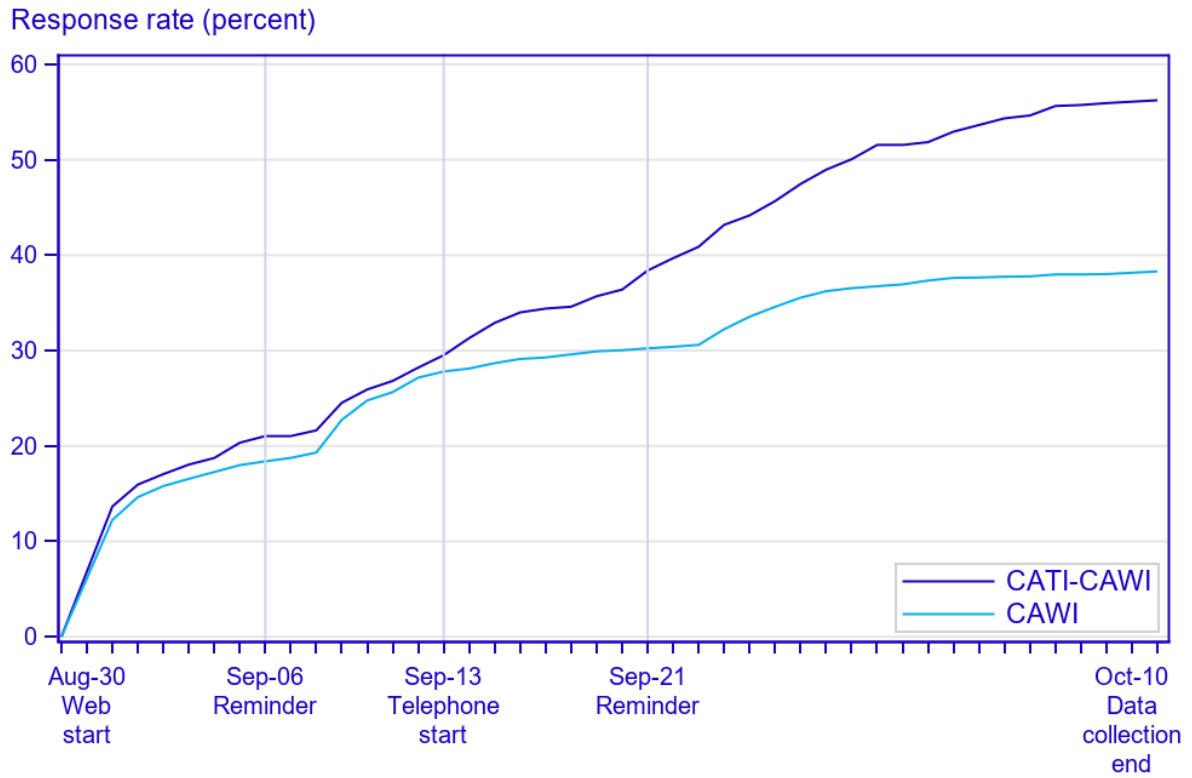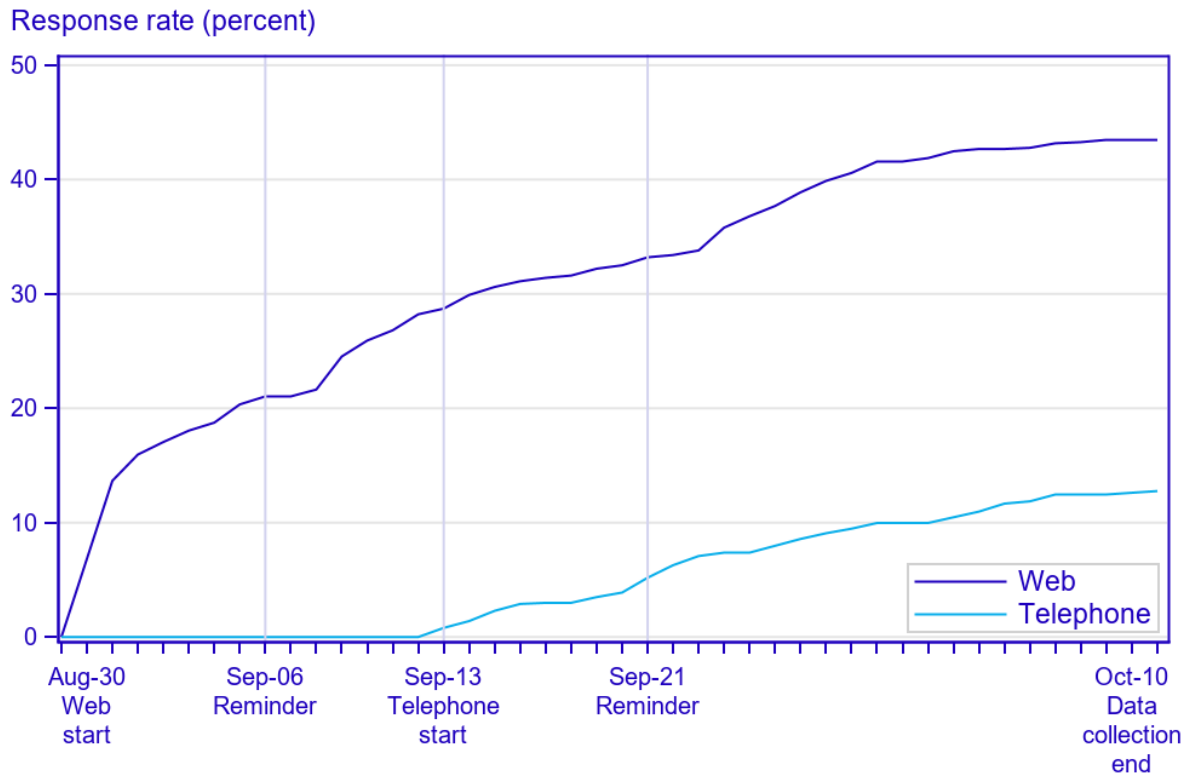*Figure 1. Response rate by date and data collection method.*

Figure 2 shows the evolution of response rate in web and telephone for CATI-CAWI.

Figure 2. Response rate in web and telephone for CATI-CAWI.

3. Results

In the evaluation of the quality of the statistics produced from the response sets from the two data collection methods, we evaluated and compared properties of the response sets and properties of estimates produced from the response sets. The response sets were evaluated with respect to response rates, number of respondents, and representativity. Estimates of survey variables and of register variables were evaluated with respect to bias and variance. Note that time series breaks were not included in the evaluation.

Comparison of data collection methods

When two data collection methods are compared by, for example, number of respondents, the comparison should accurately reflect the difference between the methods when used in the actual survey. Because the two groups in the experiment had different sample sizes, many results from the experiment should not be directly

compared. In addition, the sample sizes should be adjusted to reflect the likely sample sizes and results in the actual survey.

The two possible data collection methods, CATI-CAWI and CAWI, differ with respect to, for example, interviewer interaction, questionnaire design, and cost. The cost per sample person is about 4 times smaller in CAWI than in CATI-CAWI[1], which means that it is possible to choose a larger sample size in CAWI than in CATI-CAWI for the same total cost.

Consequently, we used a larger sample size for CAWI in the evaluation to make the data collection methods comparable. A suggested sample size for CATI-CAWI in the actual survey is 10 000 sample persons. In the evaluation, the sample size for CAWI was adjusted by the ratio of the response rates in the experiment to 14 685 sample persons. Then, the expected sizes of the response sets in the actual survey would be the same.

Response rates

Response rates were estimated for both groups in the experiment for all domains in the proposed shell table. The total response rate was 56 percent in mixed mode and 38 percent in web. The response rates for the five domains with the lowest response rates varied between 29 to 43 percent in mixed mode and between 19 to 26 percent in web. The distribution of response rates was similar within the two experimental groups.

Number of respondents

The number of respondents in a domain were calculated as the response rate multiplied with the expected sample size in the actual survey. Therefore, the results for the number of respondents often reflected the results for response rates.

It is of particular interest to look at domains where the number of respondents were small, i.e., domains which typically are small in the population and had a low response rate. Currently, estimates are suppressed for a domain in the Children's LCS if there are less than 100 respondents in the domain. Using the sample sizes for the actual

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[1] Including the cost of proxy interviews by telephone in CAWI; see section 4.

survey, this occurred for domains *girls who live mostly/only with their father* in CATI-CAWI and *girls whose parents neither work nor study* in CAWI.

Representativity

To measure the representativity of the response sets from the two groups, the R-indicator was used (Schouten, et al., 2009) (Schouten, et al., 2011). The R-indicator takes values between 0 and 1, and the higher the value is, the better the representativity. In

Table 2, we see that the R-indicator takes the value 0.75 for CATI-CAWI and 0.77 for CAWI. The difference is not significant.

Table 2 also shows the value of the unconditional partial R-indicator, which measures the contribution to the lack of representativity of the response set from a set of register variables used in the evaluation. The same two variables contribute most to the lack of representativeness for CATI-CAWI and CAWI, *parents' education level* and *family has low/medium/high income.* The difference between the indicators in CATI-CAWI and CAWI is not significant for any domain.

Table 2. R-indicator and the unconditional partial R-indicator in CATI-CAWI and CAWI multiplied by 100. 95 % confidence intervals are shown within the parentheses.

Indicator	CATI-CAWI	CAWI
R-indicator	0.75 (0.74–0.77)	0.77 (0.76–0.78)
Unconditional partial R-indicator		
Sex	3.0	3.8
Age	1.4	1.9
Grade	4.9	3.8
Parents' education level	9.2	8.2
Foreign/Swedish background (2 groups)	3.6	1.3
Foreign/Swedish background (4 groups)	4.6	4.1
Duration of stay in Sweden	4.4	1.3
Parents' occupation	1.0	3.7
Family has low/medium/high income	6.1	5.7
Family income above or below 60 % of median income	3.3	5.2
Housing	3.9	5.7
Region	2.0	1.9

Estimates of survey variables

Because the survey was subject to non-response, the calibration estimator (Särndal & Lundström, 2005) was used to produce estimates. The auxiliary variables were selected from registers and adapted to the smaller response set, i.e., the one from CATI-CAWI. Note that both response sets had similar distributions with respect to the auxiliary variables. Hence, the adjustment from calibration was similar in both groups. In addition, the distribution of the response sets was relatively similar to that of the population with respect to the auxiliary variables. This means that the adjustment from calibration was small.

We evaluated ratio estimates of six survey variables, which were selected to represent the different subject matter areas in the survey. The survey variables came from multiple choice questions but are used as indicators with two possible values as in the

statistical database of Sweden (SCB, 2022). The survey variables are shown in Table 3.

Table 3. Survey variables used in the evaluation.

Survey variable
Visited museum past six months
Read books at least one day a week
Spare time activity with adult leader at least one day a week
Meet friends at home at least one day a week
Have felt stressed at least once a week
Have a headache at least once a week

Estimates from all domains in the shell table were included in the comparison. If either survey variable category in a domain had less than 10 respondents in one response set, the domain estimate was left out from the comparison. This was also the case when the confidence interval for a domain estimate for either data collection method computed by standard normal approximation exceeded (0,100). Note that the calculation of the standard errors was done with the sample sizes corresponding to the actual survey as described in „Comparison of data collection methods".

Table 4 shows the results of sign tests of the difference between the standard error of estimates from CATI-CAWI and standard error of estimates from CAWI. The table shows the number of domains used, the value of the statistic, and the p-value of the statistic. The sign test was significant for four survey variables, of which three showed that the standard errors from CATI-CAWI were smaller than in CAWI. The absolute differences were however small.

Table 4. Results of sign test of the dfference between the standard errors of estimates from the two data collection methods.

Survey variable	Number of domains	Statistic	p-value
Visited museum past six months	84	0	100
Read books at least one day a week	67	-23	0
Spare time activity with adult leader at least one day a week	92	-22	0
Meet friends at home at least one day a week	93	-19	0
Have felt stressed at least once a week	88	-4	46
Have a headache at least once a week	86	14	0

Estimates of register variables

Ratio estimates of seven register variables were evaluated. The register variables were selected to represent the subject matter areas of the survey, although register variables used as domains or as auxiliary variables were not chosen. Table 5 shows the register variables used in the evaluation. Estimates of register variables are produced similarly as estimates of survey variables. If two domains include the same individuals for a register variable, one of them was excluded from the evaluation.

Table 5. Register variables used in the evaluation.

Register variable	Indicator	Population ratio (percent)
Number of siblings	Has one sibling	47.0
Number of caregivers	Has one caregiver	9.1
Country of birth	Is born in Europe	88.6
School organiser	School has independent organiser	21.3
Region	Lives in Stockholm region	23.6
Financial support	Lives in a household with financial support	8.5
Household income	Lives in a household whose equalized disposable income is lower than the median income.	51.5

Because the true population value is known for register variables, it is possible to calculate bias estimates. Table 6 shows the largest and smallest bias estimates, number of bias estimates significantly different from 0, and population ratio estimates

for all register variables and both data collection methods. The order of magnitude of the largest and smallest bias estimate, and the number of bias estimates significantly different from 0, were similar for both data collection methods. Note that there are differences between the population estimates from the data collection methods.

Table 6. Bias of estimates of register variables. Largest and smallest bias, number of bias estimates significantly different from 0, and population ratio estimates.

Register variable	Bias estimate, CATI-CAWI (percentage units)		Bias estimate, CAWI (percentage units)		Number of bias estimates significantly different from 0		Population ratio estimate (percent)	
	Largest	Smallest	Largest	Smallest	CATI-CAWI	CAWI	CATI-CAWI	CAWI
Has one sibling	10	0.1	13	0.01	40	22	48.6	47.2
Has one caregiver	7	0.01	6	0.6	27	32	7.1	6.8
Is born in Europe	24	0.1	11	0.1	36	11	89.2	88.5
School has independent organiser	14	0.02	15	0.06	33	50	22.3	24.9
Lives in Stockholm region	10	0.1	7	0.01	29	16	23.4	24.5
Lives in a household with financial support	14	0.5	11	0.03	17	10	6.6	7.8
Lives in a household whose equalized disposable income is lower than the median income.	20	0.02	11	0.04	34	33	50.7	51.2

Table 7 shows the result of sign tests of the difference in mean square error (MSE) between estimates from the two data collection methods. The MSE is similar for the two groups. Because the MSE is the sum of bias and variance, the standard error is not evaluated separately.

Table 7. Results of sign test of the dfference between the MSE of estimates from the two data collection methods.

Register variable	Number of domains	Statistic	p-value
Has one sibling	68	11	1
Has one caregiver	36	-6	7
Is born in Europe	57	10	2
School has independent organiser	64	-9	3
Lives in Stockholm region	61	3	61
Lives in a household with financial support	23	7	1
Lives in a household whose equalized disposable income is lower than the median income.	66	4	39

Summary

The overall response rate was higher in CATI-CAWI than in CAWI, 56 percent, and 38 percent, respectively. The response rates in domains were distributed similarly in both response sets.

The sample sizes 10 000 in CATI-CAWI and 14 685 in CAWI were used in the evaluation to make the response sets from the two methods equally large given the difference in overall response rates. When the sample sizes were adjusted, the number of respondents in domains were similar for both data collection methods.

The non-response indicators showed similar values for both CATI-CAWI and CAWI. In addition, the domains that contributed most to the lack of representativity were the same for both data collection methods.

The standard errors of estimates of survey variables were slightly smaller in CATI-CAWI for several domains. The bias and variance of estimates of register variables were similar for both data collection methods. Note that variance, i.e., standard error, and mean square error, is affected by sample size. In the evaluation, sample sizes were chosen to provide a fair comparison between the data collection methods, i.e., such that the sizes of the response sets were similar. However, if a larger sample size is chosen in CAWI, the standard errors and mean square errors will be smaller in CAWI than in CATI-CAWI.

4. Conclusions

The aim of the experiment was to assess the possibility to use CATI-CAWI and/or CAWI in a stand-alone Children's LCS. The results were evaluated with respect to the quality of statistics and the possibility to publish statistics according to the proposed shell table. In this assessment, several measures were used to evaluate the response sets from the two data collection methods with respect to, for example, number of respondents, representativity, and bias and variance of estimates.

The evaluation showed that the quality is adequate for statistics produced from data collected by either data collection method. In addition, the results show that the data collection methods are comparable in terms of quality. Hence, one may conclude that both data collection methods may be used in a stand-alone Children's LCS.

Proxy interviews

To reach sample persons who are unable to participate in the survey, for example due to disabilities, proxy interviews will be used. The proxy interviews will be conducted by telephone. If the data collection method of the survey is CAWI, proxy interviews will be conducted by telephone, i.e., as "interview-on-demand".

Recommended data collection method

The cost per sample person is lower in CAWI than in CATI-CAWI; this also holds if proxy interviews are conducted by telephone. In fact, it is possible to choose a sample size such that the number of respondents becomes larger in CAWI than in CATI-CAWI for a lower total cost. In this case, it is possible to produce statistics with higher accuracy and with less risk of suppression of estimates in CAWI than in CATI-CAWI. Hence, Statistics Sweden recommends using CAWI for the stand-alone Children's LCS.

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