

6. Diaries



6.1 Overview of the Method

Diaries involve an individual or group of individuals maintaining a daily log of FLW and other information. The diary method is best suited for quantification of FLW where an entity does not have direct access to the FLW and where insights are needed about behaviors linked to amounts and types of food. The technique is widely used in social and market research to capture information about behaviors as they are carried out, and is well suited to habitual, routine behaviors carried out in a private setting.

Diaries can be kept by any individual or entity producing FLW (the “diarist”) but are most commonly used as a means of studying FLW in households and commercial kitchens. The quantities are recorded before the FLW is “thrown away.” If done well they can provide a rich description in real time not only of the types and amounts of FLW but also of the reasons why FLW occurs.

Various types of information can be recorded in diaries, including: weights of FLW captured through direct weighing (see Chapter 1); item counts (e.g., five apples—see Chapter 2); or volume-based measurements or approximations (e.g., using calibrated spoons, cups, jugs, or approximations such as handfuls—see Chapter 3). Sometimes, measurement devices are provided to research participants (e.g., a set of weighing scales). Other times, vessels are provided for volumetric assessment (e.g., a bag or small container to collect FLW).

Diaries have been used to collect information on FLW in the UK, Sweden, State of Oregon (United States), and City of Seattle (United States), often as one part of a larger study that encompasses other methods.⁹

ADVANTAGES AND DISADVANTAGES

The main advantage of using a diary-based method is that FLW is recorded in “real time” which circumvents issues of faulty recall in survey-based methods and physical degradation of FLW in methods that rely on measurement and approximation.

Diaries provide a way of recording FLW that is not collected in a formal waste collection system and so cannot otherwise be easily quantified (e.g., disposed of down the sewer, fed to pets or wild animals, composted at home). A photographic or video-based diary offers the added advantage of capturing the data but with no requirement for the diarist to write anything down. See Box 6.1 for more on photographic and video diaries.

Diaries also offer a means of capturing qualitative information such as participants’ views about FLW. This qualitative information can be linked to quantities of FLW (e.g., reasons for disposal of each food item or a diarist’s thoughts about FLW) to provide added insight. Reasons for FLW can also be collected through other methods such as surveys but, with surveys, the link between quantitative and qualitative information may be unclear or distorted. Because diaries collect quantitative information alongside qualitative information, they enable links to be easily made between self-reported attitudes and behaviors and the amounts of FLW.

There are, however, some significant disadvantages to the diary method, some of which can be overcome with good design and strong analysis. First, FLW data collected through a diary method are likely to be less accurate than FLW data collected using weight-based methods such as direct weighing or waste composition analysis. This is because quantities are most frequently captured through approximation (e.g., handfuls, platefuls) rather than measurement. Where measurement is used, it is carried out by non-experts, which may lead to inaccuracies.

Inaccuracies in data reported by diarists¹⁰ may also be affected by:

- ▶ **Novelty of the exercise** — there is some evidence to suggest that, on the first day of a diary exercise, participants are more vigilant about recording FLW than on subsequent days¹¹
- ▶ **Social desirability bias** — diarists complete the diary in a way perceived by them to be desirable to others—typically under-recording the amounts of FLW because wasting food is not a desirable practice. Evidence also suggests they may alter their food-consumption behavior in an attempt to do what they perceive to be desirable (e.g., prepare more healthy foods on the first day of the diary)¹²
- ▶ **Behavioral reactivity** — diarists react to the fact that they discard more food than expected by changing their behaviors in the middle of the diary collection period
- ▶ **Missed instances of FLW** — this particularly applies where units have more than one occupant and some instances of FLW are not captured by the diarist

Second, diarists are liable to drop out of the process, particularly if the demands placed on them are high. Commitment—which may have been high at the start of the process—can easily wane, leading to smaller sample sizes than expected and increased uncertainty in the results.

Third, a diary usually captures data over a short period of time and therefore does not capture variations in FLW over longer time periods. To overcome this shortcoming, repeated diary keeping is required, which increases the cost and leads to diarist fatigue and drop-out. Surveying different diarists over time, however, can help to offset the effects of fatigue. An entity could also repeat the diary study a year later to study changes over time.

LEVEL OF EXPERTISE REQUIRED

It is important that an entity implementing the diary method has a good understanding of social or market research techniques. The data need to be handled by someone who not only understands data analysis generally, but also is capable of integrating quantitative and qualitative data. This is because diaries tend to contain comments and insights in addition to data on amounts of FLW generated. Expertise is important to maximize completion rates, tackle issues of social desirability bias and behavioral reactivity, and avoid possible inaccuracies related to estimates of FLW.

Box 6.1 | Diary Using Pictures of FLW

Nestlé has been using behavioral observation approaches in different contexts to reduce social desirability bias observed in interviews and diaries and to collect quantified information on behaviors related to food experiences. It is proposing to apply a similar approach to FLW quantification.

This approach involves capturing pictures or small videos of FLW and automatic dynamic weighing. The weight of each item of FLW is captured with no specific actions required from the household members. The pictures or videos are then coded by professionals who link the visual information (e.g., type of FLW) to the FLW weights.

The method is particularly useful where there is concern about the ability of diarists to keep accurate records. Because the burden is shifted from diarists to data processing teams, drop-out rates are reduced. This approach also avoids inaccuracies caused by poor recall and minimizes the impact of social desirability bias and behavioral reactivity. The tradeoff may be in the form of higher costs for paying and training professionals who assist with analyzing the data.

The entity implementing a diary study should therefore have expertise, or access to expertise, in:

- ▶ diary design;
- ▶ sampling theory and practice;
- ▶ operationalizing the approach, including recruiting participants, briefing and motivating them, and providing a helpline;
- ▶ coding and entering data; and
- ▶ statistical analysis of the results.

COSTS

Diaries can be expensive, whether they are carried out in-house or contracted to a specialist company. One reason is that the sample size often needs to be large so that the entity can scale up the data from the sample to the population without introducing too much uncertainty into the results. The likely level of drop-out needs to be taken into account because it can be substantial, and efforts will need to be made to minimize it. Costs associated with the following phases may include:

RECRUITMENT PHASE

- ▶ Purchasing lists of people or companies to be used for sampling
- ▶ Commissioning or carrying out questionnaire surveys to recruit participants

DESIGN PHASE

- ▶ Developing online or app-based diaries
- ▶ Printing hard-copy diaries
- ▶ Mailing/postage costs
- ▶ Purchasing and delivering measuring and recording equipment, if required
- ▶ Paying for external expertise in research sampling and diary design

OPERATIONAL PHASE

- ▶ Human resources required to brief diarists, maintain contact with them to keep up motivation levels, provide a helpline, and enter data and code the diaries
- ▶ Incentive payments or gifts for participants

ANALYSIS PHASE

- ▶ Paying for external expertise on statistical analysis

6.2 Guidance on Implementing the Method

An entity that implements an FLW study based on diaries will need to undertake a series of steps.

1. SCOPE THE STUDY

As Chapter 6 of the *FLW Standard* explains, a well-defined scope, aligned with the five accounting principles and an entity's goals, is important for ensuring that an FLW inventory meets an entity's needs. The scope of an entity's inventory (defined by the timeframe, material type, destination, and boundary) will dictate to a large extent the scope of the diary, although additional questions may be incorporated to meet wider goals. Chapter 6 also describes how the scope chosen by an entity for its FLW inventory should be aligned with its underlying goals for addressing FLW.

One particularly important scoping decision is whether to include or exclude times of the year that are known to affect the amount of FLW. FLW quantities can vary significantly during holiday and festival periods, as well as on weekends—versus weekdays—when less food may be eaten at home. The nature of food waste can also vary by time of the year. For example, during summer, households in the United States tend to eat a lot of corn on the cob and watermelons, leading to a seasonal increase in the weight of FLW and an increased share of associated inedible parts in the form of corn cobs, corn husks, and watermelon rinds.

Diaries are best suited for quantifying FLW in environments that are reasonably controlled and systematic, where the same process is carried out in roughly the same way and at the same time each day (e.g., a household, a catering kitchen).

An entity should decide whether information other than quantities of FLW will be sought through the diary study. In a household study, such information might include whether shopping has been undertaken on that day, or how many people were eating meals in the home that day. Analysis of this supplementary information may provide insights into when and why FLW occurs, which might be useful in tackling the generation of FLW.

2. DEVELOP A SAMPLING STRATEGY

An important design consideration is the way in which the diarists will be sampled because poor sampling technique can affect the accuracy of the results. An entity should determine the approach to sampling (e.g., probability versus non-probability sampling).

Probability sampling involves creating a listing of all eligible sampling units, known as the sampling frame. Non-probability sampling involves identifying potential diarists through a research process, which can be more or less formal. Additional guidance on both probability and non-probability sampling is provided in Appendix A of the *FLW Standard*.

3. RECRUIT PARTICIPANTS

The way in which potential diarists are approached will depend on the contact information available in the sampling frame. For diaries, it is useful to have personal contact so that the process can be explained and potential diarists persuaded to take part. An anonymous letter or email may not be effective.

The approach to recruitment will depend on whether probability or non-probability sampling has been selected. If an entity uses probability sampling, it should make a random selection of potential recruits and seek their participation, but should not replace those who decline. One disadvantage of probability sampling is that, because no replacements are made, the sample size can rapidly shrink. This is especially likely in the case of diaries that require a high level of commitment. Additional guidance about selecting samples is provided in Appendix A of the *FLW Standard*.

An entity should consider how to maximize recruitment. An incentive could be offered to diarists. Incentives should be culturally appropriate, and may include modest cash payments, gift vouchers, or merchandise. If this is given on completion of the task, it can also minimize drop-out rates. Other ways to maximize participation at the recruitment stage include wording letters or introductory text persuasively, perhaps stressing the social benefits of the study, or offering information on the diarists' own FLW so they can reduce it (this can work well for business diarists).

An entity should avoid introducing bias in recruiting the diarists to ensure that the results are representative of the population. One risk is that only people interested in FLW issues will volunteer for the diary study. Ways to address this risk should be carefully considered because including only "interested people" will create an unrepresentative sample, leading to inaccurate results. As another example, if a researcher is based in a store recruiting diarists, and that store tends to attract only wealthy shoppers, then the sample will be biased toward more affluent people who may have very different FLW behaviors from less affluent people.

Because studies in the UK, the United States, and Australia have shown that a proportion of the diarists will not finish the research process, it is good practice for an entity using non-probability sampling to recruit extra diarists to ensure that it gets the required number of completed diaries.¹³

At the time of recruitment, an entity should ask the diarists about their preferred means of communication (e.g., telephone, email, text) during the diary process. Observing their stated communication preferences will maximize the likelihood of full participation.

4. DECIDE HOW DIARISTS WILL QUANTIFY FLW

A key aspect of design is to decide how the diarists will undertake quantification. There are several options, which may be combined:

- ▶ **Weighing** — requires weighing equipment, which should be provided to the diarist
- ▶ **Measurement of volume** — involves the provision of measuring equipment such as calibrated jugs, cups, or spoons (see Box 6.2 for examples). It works best for liquid FLW and requires conversion to weight
- ▶ **Approximation of volume** — involves diarists making estimates of the volume of FLW, in units such as handfuls and platefuls. Volumes must later be converted to weight

Experience in the UK has shown that diarists should be asked to quantify FLW in whatever way is easiest for them, and should not be asked to make complex conversions (e.g., from platefuls to grams, amounts of FLW to cost), or to make distinctions between (edible) food and associated inedible parts. Such conversions and categorizations are best carried out by those analyzing the data after the diary has been completed. Diaries have traditionally been kept in written form on paper. However, electronic media are increasingly being used to record information for the diary (e.g., using smart phones or tablet devices). Non-written forms of diary-keeping (such as photographic and video-based records) are useful where there are low levels of literacy, where there is a high population of non-native language speakers, or where it is anticipated that diarists will not report accurately on their FLW. These methods can also be less onerous for the diarists.

Where equipment is provided to diarists, it will need to be sourced and dispatched. If the diarist is permitted to keep the equipment at the end of the study, the “gift” of those items can serve as an added incentive to take part.

5. DECIDE WHETHER A PRE-/POST-DIARY QUESTIONNAIRE IS REQUIRED

For some types of research question, it may be important to issue a pre-diary questionnaire. This will be useful if an entity is interested in assessing levels of awareness of FLW-related issues before the diary exercise. A post-diary questionnaire may provide useful insight into whether or not the diarist changed his or her behavior as a result of

being a study participant or became more aware of FLW as a result of the study. The benefits of pre- and post-diary questionnaires need to be weighed against the additional cost. See Chapter 7 of this document for more information.

6. DETERMINE THE LENGTH OF THE DIARY PERIOD

An entity should give careful thought to the length of the diary-keeping period. In theory, the longer the period over which the diary is kept, the more accurate the data will be. However, the longer the period, the fewer diarists will agree to take part, and the more diarists will drop out part way through. This is a tradeoff that needs to be carefully considered.

Typically, diarists have been asked to record their waste-age patterns over one week, although some diaries for food consumption (rather than FLW) have recently moved to shorter recording periods to reduce the reporting burden and thereby increase accuracy.¹⁴ The chosen time period should reflect likely differences in food consumption and likely FLW. This will be culturally determined by factors like shopping patterns, growing and harvesting patterns, and schooling and working patterns.

7. DETERMINE HOW THE DIARY WILL BE KEPT

Diaries can be online, app-based, hard copy, or visual (i.e., photographic or video). The choice will depend on the nature of an entity’s sample and the extent to which diarists are able to access technology in their kitchen or normal place of food disposal. The choice may also be driven by budget, for example, the cost of supplying expensive equipment could be prohibitive.

8. DESIGN THE DIARY

Whichever format for the diary is selected, a motivating introduction, perhaps provided as a separate letter, is important. This will encourage the diarist at least to start the diary process. Details of any support that is available to diarists throughout the process should be set out here (e.g., a telephone helpline number or email address).

A well-designed, user-friendly diary plays an important role in ensuring that information obtained is as accurate as possible. The diary should be clearly written and engaging, showing which information needs to go where, and using images where possible (e.g., providing illustrations of different food groups and the way to approximate quantities). The diary must be clear about the meaning of key terms such as “waste,” “losses,” and “food.” An entity may wish to specify which destinations of FLW the diarists are to record, and explain that it would like information to be provided about these even though some diarists may not consider the material going to them as FLW (e.g., where FLW is home-composted or fed to animals).

The required information should be very clearly set out (e.g., in a table with obvious headings, and providing space for comments by the diarists).¹⁵ Reminders may be included throughout the diary about the importance of ensuring that all instances of FLW are captured. It is useful to emphasize that even small amounts of FLW should be recorded, given that they will be scaled to the population and therefore could be important in accurate quantification. Reminders should also stress the importance of being honest about FLW generation.

9. TEST THE DIARY

It is good practice to pilot or test a diary and other tools to ensure that users will actually record the information desired. When significant changes are made as a result of a pilot, it is good practice to run another pilot until there is certainty that the diary will be effective. Using a diary that has proven successful in another study is one way to reduce the time spent piloting, but the fact that diaries may not be transferable across cultures and languages should be kept in mind.

10. BRIEF THE DIARISTS

It is good practice to brief the diarists directly about what is required. This is typically done by telephone or in person, but could also be done using an online video. Information to share with diarists includes:

- ▶ why the diary is being undertaken;
- ▶ when to start keeping the diary;
- ▶ how to fill in the diary;

- ▶ what to include and what not to include, including how “food,” “waste,” and “losses” are defined (if these terms are used);
- ▶ what sources of FLW to include (should a household diary, for example, include all household members’ FLW and what should be done about visitors; should a restaurant diary cover only kitchen FLW or should it also include FLW generated by customers eating on the premises);
- ▶ how to weigh or approximate quantities of FLW;
- ▶ what to do if the diarist is away from home;
- ▶ what to do if a diarist skips a day;
- ▶ when to finish the diary and where to send it when complete;
- ▶ what the diarist can expect to receive as a thank you for participating, when it will be received, and how it will be provided.

The briefing is also an opportunity to reiterate the confidentiality of responses to the diary. Box 6.2 outlines an effective means of briefing diarists.

11. PROVIDE HELP FOR THE DIARISTS

It is good practice to set up a telephone, email, or online hotline where diarists can go for help. This is an important tool for maximizing the accuracy of the diary. It can be used to motivate participants to report all FLW and not misreport anything to make their household appear less wasteful—this can be achieved by stressing (again) that the data will be aggregated and no judgments will be made about individual households.

12. ENCOURAGE THE DIARISTS TO COMPLETE THE PROCESS

Encouragement to keep filling in the diary or sending the images is very important. It is good practice to contact every diarist at least once during the diary process. This serves two purposes—to deal with any questions they may have and also to encourage them to keep going. An entity can also remind the diarists of what they need to do when they have completed the diary, including completing a post-diary questionnaire.

Box 6.2 | An Effective Diary “Pack”

In a UK study, diarists were sent a “pack” containing everything they needed to complete the diary, which arrived at least five days prior to the beginning of participation in the project. The pack contained the diary itself, which included full instructions, as well as a pen and magnet for the fridge or collection bin, printed with prompts to encourage completion of the diary. Measuring jugs and spoons were also sent to aid accurate measurement of the food and drink. Finally, a self-addressed, freepost envelope was included for the return of the completed diary.

Source: WRAP (The Waste and Resources Action Programme). 2009. Down the Drain. Banbury, UK: WRAP.

A diary might include encouraging words, or reminders of any incentive being offered for diaries that are fully completed. It is useful to provide items that serve as a reminder to keep filling in the diary (e.g., a magnet if refrigerators are metal-fronted, or pens printed with reminders about the diary).

13. COLLECT, COMBINE, AND ANALYZE THE DATA

The data from diaries should be collated and converted into electronic form. There are a number of possible tasks involved in data analysis. The most common tasks are set out below:

► **CATEGORIZE FLW**

This may include determining whether material is food or inedible parts associated with food, and assigning items to the appropriate food categories. The food classification can be made at a number of levels (e.g., classifying an item as “fruit” at the highest level and then as “apple” at a more detailed level of classification). Section 6.6 of the *FLW Standard* provides guidance on classification systems that can be used to describe food categories.

► **CALCULATE ANY DERIVED INFORMATION**

Where diarists have provided non-weight-based measures or approximations of FLW (e.g. five apples, a handful of raisins) quantities must be converted into weight. Weights can then be converted into other

measures (e.g., costs or environmental impacts) as required. Guidance on converting into other measures is provided in Appendix D of the *FLW Standard*.

► **LINK DIARY DATA TO OTHER DATA**

Socio-demographic information may have been collected when recruiting the households, or as part of pre- and post-completion surveys (e.g., information on FLW attitudes and behaviors). This information should be combined with the diary data, taking care to match data correctly, to add richness to the dataset.

► **ADJUST THE DATA THROUGH WEIGHTING, IF REQUIRED**

Weighting may be advisable where an unrepresentative sample has been obtained. A weighted sample complicates the analysis so an entity should consider whether weighting is necessary to obtain accurate results. Where weighting is required, decisions should be taken about which variables to use to weight the data (e.g., quantities of FLW generated or socio-demographics variables). Seasonality is also a factor (e.g., if the diary is carried out in the summer, the data may need to be adjusted to allow for winter patterns of FLW).

► **SCALE UP THE DATA TO REPRESENT THE POPULATION**

The data should be scaled up to apply to the whole population. More information about scaling up is provided in Appendix A of the *FLW Standard*.

Endnotes

9. WRAP (2013a); WRAP (2009); Sörme et al. (2014); Van Garde and Woodburn (1987); van Graas (2014).
10. Unpublished research by WRAP found that diarists in households with multiple occupants reported just 60 percent of the amount recorded through waste composition analysis.
11. See section 2.6 of WRAP (2014).
12. See section 2.6 of WRAP (2014).
13. WRAP (2013a).
14. For example, for the UK's National Diet and Nutrition Survey: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/216486/dh_128546.pdf
15. An example of a diary can be found at: <http://www.wrap.org.uk/sites/files/wrap/Kitchen-Diary-2012-Final-Low-Res.pdf>