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National Diet and Nutrition Surveys: the British experience

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Abstract

Objective: The National Diet and Nutrition Surveys (NDNS) are a series of government-funded surveys of food intake, nutrient intake and nutritional status of individuals, undertaken to support nutritional policy and risk assessment. This paper summarises a review that considered the extent to which NDNS met the needs of users and suggested options for the future. The Food Standards Agency has since progressed favoured options. This paper aims to help others wishing to obtain this type of information within their own populations.
Design: A detailed questionnaire was used to probe use of data and gather opinions from users, producers and managers of the NDNS. It asked about general information needs from NDNS and changes that might be made. This was followed by a two-day workshop which included discussion of the main issues and the generation of 19 possible future options for consideration by the Agency.
Results: Options to improve effectiveness included methods to prioritise breadth and depth of coverage and possible ways of improving response and compliance. Strategies to make surveys more efficient and timely, such as adopting a rolling programme, disaggregating survey components, integrating with other studies and improving data access, were also suggested. A rolling programme, in which data are collected continuously, was the favoured option to address some of the concerns and a strategy is now in place to achieve this.
Conclusions: There is widespread support for the NDNS from its users. There is no alternative source for such high-quality data on food and nutrient consumption and nutritional status and physical measurements in the same individuals. Useful information, such as the potential value of using a rolling programme from the outset, can be gained from this British experience by others wishing to measure food and nutrient intakes and status in their own populations.

Keywords
Diet
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Britain
Status
NDNS
Food Standards Agency
Nutrition
Food chemical exposure
Rolling programme
Lessons

Population-wide information on food and nutrient intakes and nutrient status is essential for nutritional monitoring and surveillance and food chemical exposure assessment. It is also used to inform food and nutrition policy and healthy eating advice.

The National Diet and Nutrition Surveys (NDNS) are jointly funded by the Food Standards Agency (the Agency) and the Department of Health. The major focus of the NDNS has been to gather information to monitor the food consumption, nutrient intakes and nutritional status of the British population and for assessing exposure to food chemicals.

Many countries regard the NDNS as one of the most comprehensive in Europe. Therefore a critical review of the current programme with a constructive look to the future can help to inform those who wish to start similar surveys or those who wish to review their own methodology.

Remit of the review

In 2002, the Agency commissioned a team of scientific consultants (M.A., S.B., S.G. and C.H.) to suggest options for change to the NDNS that would best meet the information needs of the Agency in relation to food consumption, nutrient intakes, nutritional status and food chemical exposure assessment. This paper is a summary of the methodology and key findings from the project (N10015; known as REVSURVE*).

NDNS and related surveys

The NDNS programme is jointly funded and managed by the Agency and the Department of Health. The NDNS

*The full report of this project can be accessed in the library of the Agency. This comprehensive review covered the Agency's complete Dietary Surveys Programme, of which the NDNS comprises the major part.

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programme provides cross-sectional information on the dietary habits and nutritional status of nationally representative samples of the British population (see http://www.food.gov.uk/science/101717/ndnsdocuments/):

- Dietary and Nutritional Survey of British Adults (survey performed in 1986/87)[1];
- National Diet and Nutrition Survey: Children aged 1.5 to 4.5 years (survey performed in 1992/93)[2,3];
- National Diet and Nutrition Survey: People aged 65 years and over (survey performed in 1994/95)[4,5];
- National Diet and Nutrition Survey: Young People aged 4 to 18 years (survey performed in 1997)[6,7];
- National Diet and Nutrition Survey: Adults aged 19 to 64 years (survey performed in 2000/01)[8–12].

Previous surveys have collected quantitative information on food consumption (weighed records over 7 days; or 4 days in refs 2 and 4), physical measurements (e.g. height, weight and blood pressure), a blood sample for analysis of nutritional status indices, a detailed interview to collect information on socio-economic, demographic and lifestyle characteristics, a physical activity record (refs 6 and 8), a urine sample (24-hour sample in refs 1 and 8), and an assessment of oral health/dental examination (refs 3, 5 and 7).

The key benefits of the NDNS are:

- detailed and robust food consumption data for individuals (>5000 foods);
- information on current nutrient intakes (by combining food consumption data with the latest analyses in the Agency's nutrient databank);
- data on diet, nutritional status and related characteristics in the same individuals, to allow analysis of the links between them.

Issues for consideration in the review

The review of the dietary survey programme was prompted by four key elements.

- *A lack of timeliness in the current approach*. Each survey, from planning to publication, takes about 5 years. The time between collection of data on each age group does not reflect the speed of dietary changes (for example, data on adults were collected in 1986/87 and 2000/01 – a gap of some 13–15 years). This gap between data collection points limits the capacity to track changes over time and assess trends in detail.
- *A lack of flexibility to respond quickly to policy needs*. The long planning stage for each survey means it is not usually possible to adapt content or coverage at short notice.
- *Practical issues in encouraging involvement and ensuring quality of data*. Surveys are time-consuming and burdensome for respondents, and a decline in response rates has been observed for many surveys in recent years. As an illustration, the response rate to the NDNS for adults fell from 70% in 1986/87 to 47% in 2000/01[8]. This has led to concerns about the representativeness of the data generated. Misreporting of food consumption is a well-recognised problem in all dietary surveys including NDNS.
- *Cost-effectiveness*. The cost of individual NDNS is significant and costs have risen over time as the programme has gone forward. It is necessary to ensure that the approach adopted continues to be cost-effective.

Methodology of the review

The review was based on a detailed questionnaire* followed by a two-day workshop. The questionnaire was sent electronically to 273 recipients identified as either users of the NDNS or involved in the production/management of surveys. Completed responses were received from 103 recipients, of whom 43 were invited to the two-day workshop.

The review was assisted by an advisory panel representing NDNS users and producers from academia, industry and government, risk assessors/epidemiologists and ethicists. Their names are listed in our acknowledgements.

The Agency Board first discussed the results of the review in December 2003. Papers are available at http://www.food.gov.uk/multimedia/pdfs/fsa031202.pdf. Minutes of the meeting are at http://www.food.gov.uk/aboutus/ourboard/boardmeetings/board2003/boardmeeting121103/boardminutes111203.

Results and future directions

Response to REVSURVE questionnaire

One hundred and three questionnaires were completed, a response rate of 38%. Agency and other government staff comprised 16% and 13%, respectively, of the final sample, while 43% worked for academic institutions. A further 29% were affiliated to industry or were consultants.

The distribution of non-respondents by sector was not significantly different from respondents overall ($P > 0.05$) (non-respondent sample comprised 51% academics, 7% and 21% Agency and other government staff respectively, and 21% from industry). The main reason for non-response was that the respondent was a previous or minor user of the data or had passed the questionnaire to a colleague who was more familiar with it.

Ninety-seven per cent of questionnaire respondents agreed that NDNS is needed in Britain. Furthermore, the NDNS was considered particularly valuable in providing

*The full questionnaires can be found in the full version of the report in the Agency library.

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nationally representative data on intake and nutritional status in individuals.

Options for surveys

The review was asked to identify options for change to existing NDNS arrangements specifically to address the concerns above. Nineteen basic options were identified and 17 of these are summarised in Tables 1–3, setting out the pros, cons and risks of adoption, and an indication of those with significant resource implications.

It was considered that abandonment of the NDNS should be rejected, as the Agency has no other source of the information needed to support food policy and protect the consumer. The option of maintaining the status quo had the support of many users but would fail to seize the opportunity to maximise the effectiveness of this important programme. Tables 1, 2 and 3 summarise the 17 other options discussed, under the headings of 'Structure of NDNS', 'Improving data quality' and 'What to include'.

Strategic options identified were: shifting the timescale of data collection to a rolling programme (Option 1), as used in the National Health and Nutrition Examination Survey (NHANES) in the USA, or using other methods to acquire food intake data (consumer panels, novel technologies) (Option 2). Reducing the volume of data collected by disaggregating the elements (Option 3) and adopting a modular survey methodology, requiring different levels of information from different people (Option 4), were also explored. These would have the advantage of reducing respondent burden and hence non-response bias, but would lose what some nutritionists regard as a key strength – namely the linkage of diet and nutritional status data in a high proportion of individuals. Other options explored include partial integration with the Health Survey for England (Option 5), although this might require the (NDNS-type) dietary survey to be conducted as a separate (*post hoc*) element.

Misreporting of food intake was acknowledged to be a widespread problem in the NDNS (as in other surveys) and threatens the reliability of the data and estimates derived from it. It was considered essential that research be conducted into both prevention (i.e. ways of minimising) (Option 9) and cure (i.e. *post hoc* treatments such as modelling and the use of biomarkers) (Option 10). Whilst no method is likely to eliminate misreporting entirely, this could at least allow some quantification of the errors and hence uncertainty surrounding estimates of nutrition and exposure.

The breadth (i.e. population coverage) and depth (i.e. detail) of the surveys were generally considered adequate, although suggestions were made for improvements and possible methods for prioritising needs (Options 12–16). There was general agreement that respondent burden was high, leading to poor response rates, and this was probed by discussing some of the underlying issues such as incentives (Option 6), ethical approval process (Option 7), survey methodology (Option 8) and improved promotion of the importance of taking part in NDNS (Option 11). In fact, dissemination is likely to be fundamental to the future of the NDNS, essential to encourage greater public awareness and respondent participation and to maximise the fruitful exploitation of the data.

Future directions for the NDNS

Of the options, it was clear that the rolling programme (Option 1) was the only one that addressed the issues of timeliness and flexibility that prompted the review. A rolling programme would address the issue of lack of timeliness in the current arrangements as, once established, it would generate data on a continuous basis, strengthening the ability to track changes over time and avoiding long gaps between data collection points. As data would be collected every year there would be the added flexibility to add targeted studies (such as adjunct surveys and 'bolt-ons') at relatively short notice, making the programme more responsive to immediate policy needs. None of the other options addressed these issues. The continuous nature of the rolling programme approach might also raise the profile of the survey, which might improve response rates. Survey management would be more cost-effective, eliminating the need for repeated planning, set-up costs and feasibility studies, and allowing evaluation at any stage.

The Agency's Board agreed in principle in December 2003 to move to a rolling programme format for future dietary surveys, subject to seeing more detailed proposals. Proposals were drawn up during 2004 following informal discussions with a range of stakeholders. The Board approved the proposals for the core rolling programme, subject to availability of funding, at its meeting in February 2005. The proposals for structure, content and funding for the new programme have now been published on the Agency website at http://www.food.gov.uk/multimedia/pdfs/fsa050203.pdf. Key stakeholder organisations have indicated support for a move towards a good-quality rolling programme approach that builds on the track record of the NDNS and gives scope for monitoring trends.

The proposed rolling programme will provide data for risk assessment and be the primary method for monitoring progress against nutrition targets in the Agency's Strategic Plan 2005–2010. It could also be used to monitor progress on diet and nutrition objectives set out in the White Paper 'Choosing Health'. The programme will be designed to be representative of the total UK population, now including Northern Ireland. People living in institutions such as residential homes for the elderly, prisons and hospitals are not covered by the proposed programme. The rolling programme offers opportunities for enhancement by sample boosts in specific regions or groups, and by bolt-on surveys and additional components to provide in-depth focus on special issues.

Table 1 Summary of options – structure of the National Diet and Nutrition Surveys (NDNS)

Option	Significant resource implications	Others involved	Pros	Cons	Risks
1. Use a 'rolling programme'	• Long lead time to settle design • Needs careful planning/ management of transition phase		• Timely, flexible data • Potential efficiency savings	• Transition phase • Continuous planning needed	• Overall cost unclear (see also 3, 5)
2. Use market research methods for dietary intake data	• Time and cost in adapting market research methods	Operators of market research panels	• New opportunities to link with other data • Lower collection costs	• Coverage: potentially no status or individual data • Omissions of other surveys • Will not give information on food actually eaten	• Access to market research data unavailable or refused
3. Carry out separate surveys for nutrition and risk assessment needs	• Expense of running two separate surveys		• Specific to needs • Improved targeting • Avoids 'unnecessary' data	• Management/set-up cost • Duplication	
4. Measure intake and status seperately, with a overlap group for validation	• Potential increase in cost from using a larger sample size • Pilot work needed		• May improve response rate • Flexible: could collect different levels of detail. • Could produce data more quickly	• Larger sample – increased cost • Potential for duplication	• Possible sample bias, depending on format
5. Integrate NDNS with the health surveys for England, Scotland, Wales and Northern Ireland	• Long lead time to allow piloting • Potential cost changes depend on degree of integration and changes in fieldwork	UK health depts, 'owners' of health surveys	• Access to larger sample • Possible higher response	• Less detailed dietary data – not quantitative	• Could reduce response rate to the four health surveys • FSA/DH unable to agree acceptable protocol

FSA – Food Standards Agency; DH – Department of Health.

Table 2 Summary of options – improving data quality

	Option	Significant resource implications	Others involved	Pros	Cons	Risks
6.	Use better incentives and reduced respondent burden to increase response rates	• Possible, depending on incentive • Research on reasons for non-response		• More representative data	• Cost of additional incentive payments • Long time scale for research	• Ethical committees object to increased incentives • Some methods to increase response rates could reduce the value of the data
7.	Improve process for gaining ethical approval	• Long-term negotiation	Health depts, research ethics committees and their central office	• Process specific to survey work rather than clinical trials	• Long time scale for negotiation	• Feasibility
8.	Use a less burdensome method for assessing diet	• Will need research to review and evaluate alternatives		• Fast • Flexible • Potential savings • Potential to increase response	• Less accurate • Less reliable	• Data may not meet exposure assessment needs
9.	Reduce misreporting with new technology	• Will need research to review and evaluate alternatives		• Could improve data quality if successful • Potential for additional information (e.g. context)	• Equipment costs	• Research may fail to identify successful methods
10.	Research on biomarkers to correct for misreporting	• Will need long-term research to review and evaluate needs and develop methods		• Help to quantify uncertainty • Addresses problems with other methods	• Looks at nutrients only not foods • High cost of methods • Relies on biological specimens	• Limitations/uncertainty of technique
11.	Promote NDNS to improve response rate	• Dependent on form of promotion		• Open • Promotes awareness/debate with users and participants	• Cost	• May appear coercive

NDNS – National Diet and Nutrition Surveys.

Table 3 Summary of options – what to include

	Option	Significant resource implications	Others involved	Pros	Cons	Risks
12.	Prioritise target groups using an advisory group or interrogating current databases	• Potential costs if using an advisory group • A potential role for SACN?	Users of NDNS data	Advisory group: • Open • Multidisciplinary • Watching brief Databases: • High potential coverage	Advisory group: • Cost • Decision time Databases: • Cost • Confidentiality	
13.	Prioritise core components of survey		Users of NDNS data	• Improve focus of main survey		• Lose detail (see also 3, 5, 8, 15)
14.	Use adjunct surveys or modelling to increase breadth	• Set-up costs for individual surveys	Users of NDNS data	• Wider scope/better focus • Possible use to offset low response • Possible cost/time savings from smaller survey	• Set-up cost	• May miss detail • Increased 'survey fatigue'
15.	Additional analysis of existing data and 'bolt-on' studies to extend breadth	• Potential costs of expanding existing surveys		Analysis: • Focus • Access for others Bolt-ons: • Specific • Rapid • Lower set-up cost for main survey	Analysis: • Confidentiality • Need to predict future needs for data • Cost Bolt-ons: • Cost per section • Reactive	• Increased 'survey fatigue'
16.	Use blood samples from health screening	• Long-term	Health professionals, UK health depts	• Possible reduction in collection costs • Potential sample size	• Lose context • Sample bias	• May not get ethics committee agreement
17.	Dissemination: improve accessibility and use of raw data		Data 'owners'	• Better access/wider use of data • Possible revenue generator if user base greatly extended	• Cost of in-house analysis/preparation	• Unable to secure assistance from UK Data Archive

SACN – Scientific Advisory Committee on Nutrition; NDNS – National Diet and Nutrition Surveys.

Proposals are based on a sample size of 1000 people per year for the core programme, covering both adults and children (aged 1.5 years upwards). This would allow a group of 1500 adults or children to build up over two years for analysis. This sample size and structure would generate data on food and nutrient intakes sufficient for analysis every 1–3 years and on nutritional status and salt intakes every 4–5 years. Dietary survey assessment would be included for all participants on an annual basis, blood samples and 24-hour urine collections less frequently or in a sub-sample. The dietary assessment method proposed is based on the multiple-pass 24-hour dietary recall repeated on four non-consecutive days. This is considered to produce data of comparable quality to the weighed record but be much less burdensome for participants. It will be tested alongside the existing weighed intake method to ensure that the method can be compared with data generated in earlier surveys. The Agency is also developing proposals to address the problem of underreporting and is considering methods to improve response rates such as increasing the token of appreciation. The Agency is pursuing discussions with health departments, devolved administrations and external organisations to identify co-funding for the core programme and for proposed enhancements to boost sample sizes in ethnic minority groups and in the devolved countries.

Provided funding is secured, pilot study fieldwork will commence in 2006 with the first phase of the new rolling programme to commence in 2007.

Conclusions

There is a very high level of support for the NDNS from a wide range of users, who would have no alternative source for such high-quality nationally representative data on food and nutrient intakes, or data on nutritional and physical status in the same individuals.

Nineteen options to improve effectiveness were suggested to the Agency. These included methods to prioritise breadth and depth of coverage and possible means of improving response and compliance. Strategies to make surveys more efficient and timely such as adopting a rolling programme, disaggregating survey components, integrating with other studies and improving data access are also suggested. A move to a 'rolling programme' for the NDNS was the favoured option to address some of the concerns and a strategy is now in place to achieve this.

Value of NDNS review for other countries

Although this review was conducted on the British NDNS programme, this is widely acknowledged to be the most advanced within Europe. This view was confirmed by the international respondents to the questionnaire ($n = 19$, representing 13 countries). The central skill base in Britain was one of the key reasons identified as leading to the high quality of the NDNS compared with surveys conducted outside Britain. Many Britain surveys are conducted at household level which does not allow for the precision required for analysis of nutritional status and risk assessment.

Many of the international respondents considered that their national surveys gave insufficient information on food consumption, while most felt they did not provide adequate information on nutritional status from blood and urine analytes.

Lack of timeliness and difficulty in monitoring trends are problems in several countries. Only the US NHANES and the Danish food consumption study use a rolling programme approach to monitor trends. Comparison between cross-sectional surveys conducted several years apart is made in other countries, but comparability of methods is key. Efforts in the future could be directed to collecting data that could be maintained as part of a harmonised European database (as proposed by the EFCOSUM initiative).

Other countries may be able to benefit from this review: not only from how the NDNS have been conducted in the past, but also on some possible solutions to the problems currently facing the British programme, e.g. methods to prioritise breadth and depth of coverage and possible ways of improving response and compliance. New British strategies to make surveys more efficient and timely such as adopting a rolling programme, disaggregating survey components, integrating with other studies and improving data access could be included in new programmes right from the outset.

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