

QALIBRA
Quality of Life – Integrated Benefit and Risk Analysis.
Web-based tool for assessing food safety and health benefit
(N° 022957)

Publishable final activity report

Helga Gunnlaugsdottir and Anna Kristin Danielsdottir (Matis)
Andy Hart (Fera)

Specific Targeted Research Project

Thematic Priority 5: Food Quality & Safety

Period covered: from 01.04.06 to 31.12.09

Date of preparation: 30.09.2010

Start date of project: 01.04. 2006

Duration: 2006 – 2009

Project coordinator: Helga Gunnlaugsdóttir

Project coordinator organisation name: Matis

Revision 1



ALTAGRA BUSINESS SERVICES
AND TRAVEL AGENCY



Table of contents

1. Project execution.....	2
Project objectives	2
Objectives in developing benefit-risk analysis methods.....	2
Objectives in dissemination	2
Participants.....	3
Coordinator contact details	3
Work performed and achievements of the project to the state-of-the-art	3
Example of benefit-risk assessment results produced by the QALIBRA software	7
Impact	11
2. Dissemination and use	13
Publishable results	13

Project acronym: QALIBRA

Project full title: Quality of life integrated benefit and risk analysis: Web – based tool for assessing food safety and health benefits

Contract no: 022957

Related to other Contract no: 022936 / Beneris

Project duration: 1 April 2006 - 31 December 2009

Reporting period: **1 April 2006 - 31 December 2009**

Project websites: <http://www.qalibra.eu>

1. Project execution

Project objectives

The strategic goals of QALIBRA are to **develop a suite of quantitative methods for assessing and integrating beneficial and adverse effects of foods and apply them to selected food groups**. To maximise dissemination and uptake of the project outputs, they will be implemented as web-enabled software.

Objectives in developing benefit-risk analysis methods

- Develop a generalised modular approach to benefit-risk analysis using menus of dose-response and valuation functions. The dose-response functions will cover different types of positive and negative health effects that are commonly encountered in food safety assessment. The valuation functions will integrate positive and negative health effects using common measures of net health impact (e.g. Disability-Adjusted Life Years (DALYs)). Implement the benefit-risk analysis methods developed in QALIBRA in web-enabled software that is available for use by all stakeholders via an integrated website, with different components adapted to different user groups
- Use the methods and software developed by QALIBRA to carry out detailed case studies on the benefits and risks of oily fish and functional foods

Objectives in dissemination

- To make the methods developed available to stakeholders in a web-based tool
- Develop targeted risk communication strategies for integrated benefit-risk analysis, adapted to the needs of different stakeholders
- To develop and test programs and materials for dissemination of the practical use of the QALIBRA software by technical end-users to promote a wide ranged uptake of the software
- Establish information-sharing and joint activities with BENERIS, another EU-funded project undertaking complementary research
- To seize opportunities to disseminate about the project and its outcomes

Participants

Partner name	Abbreviation	Country
Matis ohf	Matis	Iceland
The Food and Environment Research Agency	FERA	United Kingdom
National Institute of Public Health and The Environment	RIVM	The Netherlands
Wageningen University	WU	The Netherlands
University of Patras	UPATRAS	Greece
Altagra Business Service	ALTAGRA	Hungary
Instituto Nacional de Recursos Biológicos I.P./IPIMAR	IPIMAR	Portugal

Coordinator contact details

Dr. Helga Gunnlaugsdottir,
Matis ohf,
Vínlandsleið 12,
113 Reykjavik, Iceland.

E-mail: helga.gunnlaugsdottir@matis.is
Phone: +354-4225000
Fax: +354-4225001

Public website for the project: <http://www.qalibra.eu>

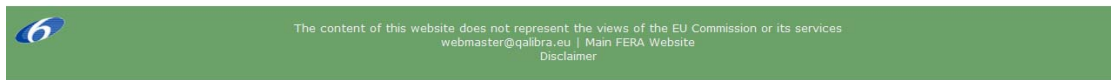
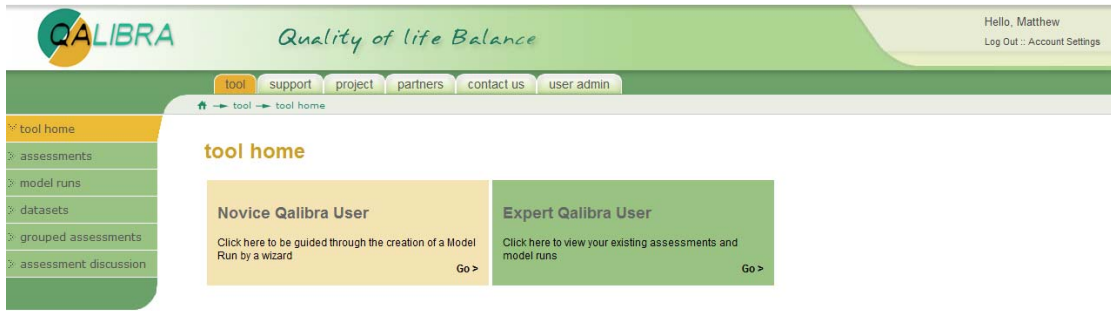
Work performed and achievements of the project to the state-of-the-art

When the QALIBRA project started (April 2006) approaches for benefit-risk analysis with respect to food safety were at an early stage of development. At this point in time information on risks and benefits of food was usually presented separately or integrated only in a qualitative way. Although general frameworks for benefit-risk analysis had been proposed in the literature, the few studies that had quantified net health impacts had been specific to particular problems. Uncertainties affecting risks and benefits were often given only fleeting consideration and very rarely quantified in any formal way. The few research studies, which had quantified net health impacts, had not attempted to quantify the uncertainties associated with them. Finally, only limited attention has so far been given to approaches for communicating net health impacts, or to approaches for communicating uncertainty.

Work performed and main achievements of QALIBRA to the state-of-the-art:

- Further development of an overall framework for benefit-risk analysis, using common currencies such as Disability-Adjusted Life Years (DALYs) to quantify the balance of risk and benefit, and providing the option to quantify uncertainty in every element of the calculation. The principal outputs of QALIBRA include comprehensive documentation and guidance on the framework and a user-friendly, web-based software that implements the QALIBRA framework and methods and makes them available for use by stakeholders.
- The QALIBRA consortium decided that as other software packages (e.g. Proast) already provide menus of dose-response models, it would be more efficient to equip the QALIBRA web-tool with a flexible interface to accept input from any form of dose-response model, rather than duplicate the existing functions. This flexible approach is an elegant and novel way that allows the end-user to be in charge of the final datasets that are going to be used for the calculations without any compromising in usage of standardized functions.
- Work on the overall framework has included evaluation of dose-response models and functions for integrating and valuing health impacts, selecting those most relevant to food safety questions and refining for use in the general framework. Obtaining critical pieces of information has been one of the challenges faced in this work as health metrics (e.g. DALYs) require the availability of detailed data on population intake, data on the food or nutrient on the type of health hazards and health benefits in terms of incidence and mortality of interest, dose-response information (not only from animal models but also in humans), information on the diseases related to the intake of the nutrient, and ‘disability weights’ to quantify the relative severity of health effects associated with intake of the nutrient under study. After discussing the options and the data demands within the consortium, disability-adjusted life years (DALYs) were regarded as the most suitable method to integrate the positive and negative effects of certain food intakes. However, the Qalibra framework and software also provide for use of the main alternative, quality-adjusted life years (QALYs).
- Identified suitable methods for characterising the main types of uncertainty affecting food benefit-risk assessments, and incorporating them in the framework.
- Investigated the benefit-risk information needs and reactions of technical users, and developed solutions for effective benefit-risk communication strategies. Considerable theoretical advances have been made in our understanding of consumer decision making associated with food consumption choices, in particular under circumstances where both risks and benefits are involved or may accrue to human health.
- Implemented the QALIBRA methods and approaches as web-based software for assessing and communicating net health impacts, and conducted detailed testing with end-users and refinement of the software in response to end-user tests to make it as user-friendly as possible. The QALIBRA web-based software for benefit and risk assessment of food is available at www.qalibra.eu , in Figure 1 examples of screens from the web-tool are given.

a)



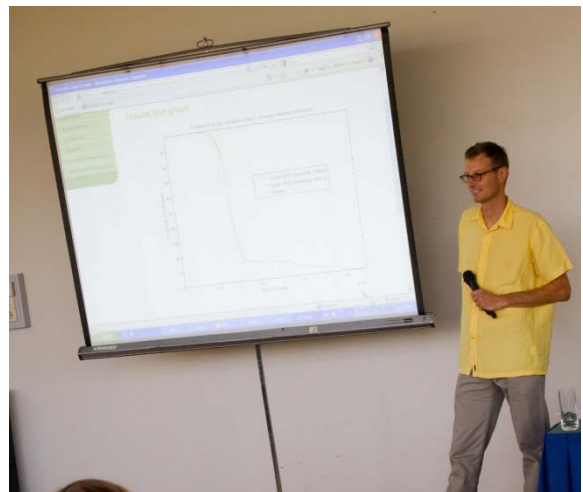
<http://www.qalibra.eu/tool/myAssessments/wizard.cfm>

b)



Figure 1. A screen shots from the QALIBRA web-tool for benefit-risk assessment of food at www.qalibra.eu/tool a) Tool home for novice user b) Step 1 of a Setup Run using a wizard

- The testing of the QALIBRA methods and the web-based software (i.e. the QALIBRA tool) included a technical end-user workshop held in September 2009 with 31 external participants from 15 countries. This proved to be a very useful test of the QALIBRA tool as it was demonstrated live and there was also an interactive practical hands-on training session for the participants using the QALIBRA web-tool. This ensured that the system was capable of handling large numbers of people (> 40) using it at one time, and properly queuing the requests in an appropriate way. Furthermore, the participants provided very useful feedback about the QALIBRA web-tool that was used in the final refinements and improvements of the tool to enhance the usefulness of this deliverable to stakeholders. Photos from the external end-user workshop are shown in Figure2.



- **Figure 2** Photos from the external end-user workshop held in September 2009 to introduce to the benefit-risk modelling approaches developed in QALIBRA and practical hands-on training with the benefit-risk software produced by QALIBRA
- End-user evaluations of following the technical end-user workshop in September 2009 were mostly positive, and it was concluded that a workshop format was a successful form for knowledge transfer to this group of stakeholders including people from food authorities, food industry, public health professionals and academia.
- Extensive testing and evaluation of the QALIBRA methodology and software in detailed case studies, including the important and topical example of seafood (with emphasis on oily fish) and functional food (i.e. margarine enriched with phytosterolesters). An example of benefit-risk assessment results produced by the QALIBRA software is provided below.
- The literature search carried out as an essential part of the work on the case study of functional foods revealed a convincing serum cholesterol lowering effect of margarines enriched with phytosterolesters. As we know from drug trials that the lowering of cholesterol levels is associated with a lower incidence rate for heart diseases we assumed that this would also account for the enriched margarines. For the negative effect, the literature was less pronounced and thus it was decided to take the lowering of beta-carotene levels as an example. This meant that we had to work with many uncertainties and assumptions in order to calculate a potential negative health effect i.e. an increase in the incidence of night blindness. Using the QALIBRA tool we are now able to quantify

net health benefits on a population level for different scenarios off margarine enriched with phytosterolesters.

- The case study on oily fish also included an extensive literature search on positive and negative health effects. Many studies have described health effects of oily fish but for many effects there is still no absolute proof. The results show the positive effects taken on board (fatal heart diseases and stroke) outweigh the effects of the contaminants included in Qalibra (dioxins, methylmercury). The case studies helped us to develop the overall framework and web-based software but need to be further refined in future projects.

Example of benefit-risk assessment results produced by the QALIBRA software

In this section an example of benefit-risk assessment results produced by the QALIBRA web tool available on the project website are presented.

The format used by the Qalibra software for displaying the primary numerical outputs is illustrated in Table 1. This shows results for 2 health effects from an assessment on consumption of oily fish done as a case study in the Qalibra project (the full assessment includes additional adverse and beneficial effects). The dietary change (increasing fish consumption to 200g/week for those individuals whose current consumption is lower) has a beneficial impact on both health effects so the individual and total changes in DALYs are negative. The assessment relates to 999 individuals (the number specified by the user who created the assessment), and the results are estimates of the annual average health impact for that population.

Three of the graphical outputs generated by Qalibra are illustrated in Figures 1-3, and the fourth is a variant of Figure 1 that uses a pie chart to show the proportions of individuals with zero and non-zero DALY changes. Figures 1-3 all relate to the same example assessment as Table 1.

Further information on these examples and discussion of their interpretation is presented in the final report on the Qalibra framework (Deliverable 29c).

Table 1. Example of tabular benefit-risk assessment results generated by Qalibra software for effects of oily fish consumption on incidence of stroke and fatal coronary heart disease (CHD). Reference scenario = current Dutch diet, alternative = oily fish consumption increased to 200g/week for those individuals whose current consumption is lower. Results are estimates of annual directly attributable health effects for a sample population of 999 individuals, expressed in DALYs. 95% uncertainty intervals are shown in brackets (produced for all results but shown only in top row here). See text for more explanation.

	Incidence of stroke	Incidence of fatal CHD	Total:
Change in TOTAL DALY from Reference scenario to Alternative scenario	-2.561087 (-5.293814, 0.051080)	-1.769932 (-3.245847, -0.284764)	-4.301226 (-7.429154, -1.273373)
TOTAL DALY, Reference scenario	34.799440	16.673234	51.473170
TOTAL DALY, Alternative scenario	32.238353	14.900700	47.172092
Incidence (per year) in 999 individuals, Ref scenario	3.298551	1.103577	
Incidence (per year) in 999 individuals, Alt scenario	3.065471	0.991378	
Average magnitude of effect, Reference scenario	0.000000	0.000000	
Average magnitude of effect, Alternative scenario	0.000000	0.000000	
Recover, Reference scenario	0.000000	0.000000	
Recover, Alternative scenario	0.000000	0.000000	
Total YLD if recover, Reference scenario	0.000000	0.000000	
Total YLD if recover, Alternative scenario	0.000000	0.000000	
TOTAL DALY if recover, Reference scenario	0.000000	0.000000	
TOTAL DALY if recover, Alternative scenario	0.000000	0.000000	
Survive (with effect), Reference scenario	3.298551	0.000000	
Survive (with effect), Alternative scenario	3.065471	0.000000	
Total YLD if survive (with effect), Ref scenario	57.048262	0.000000	
Total YLD if survive (with effect), Alt scenario	52.849759	0.000000	
TOTAL DALY if survive (with effect), Ref scenario	34.799440	0.000000	
TOTAL DALY if survive (with effect), Alt scenario	32.238353	0.000000	
Die (from effect), Reference scenario	0.000000	1.103577	
Die (from effect), Alternative scenario	0.000000	0.991378	
Total YLD if die (from effect), Reference scenario	0.000000	0.000000	
Total YLD if die (from effect), Alternative scenario	0.000000	0.000000	
Total YLL if die (from effect), Reference scenario	0.000000	16.673234	
Total YLL if die (from effect), Alternative scenario	0.000000	14.900700	
TOTAL DALY if die (from effect), Reference scenario	0.000000	16.673234	
TOTAL DALY if die (from effect), Alternative scenario	0.000000	14.900700	

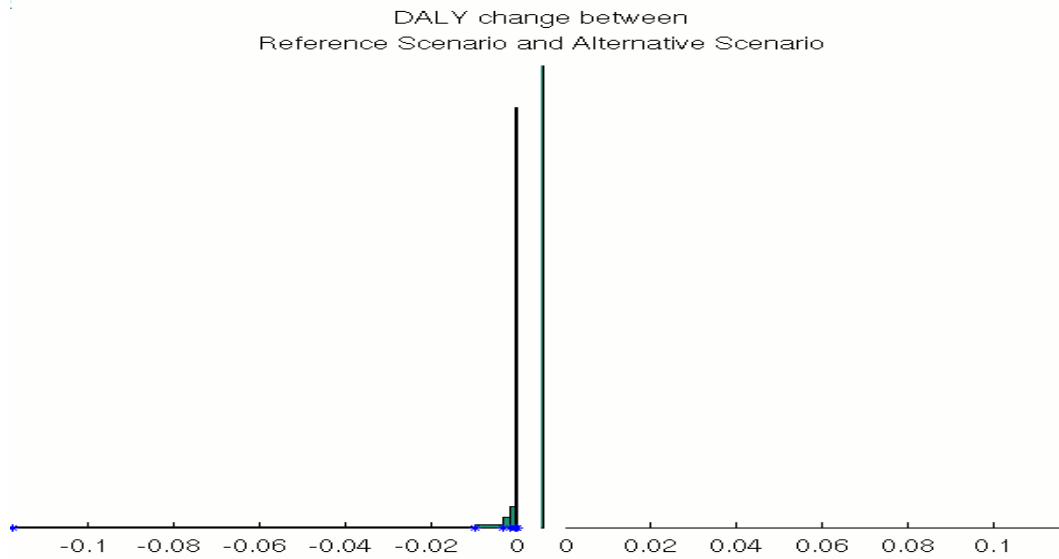


Figure 3. Histogram of individual contributions to the change in annual population DALYs between reference and alternative scenarios, for the assessment shown in Table 1. See text for details.

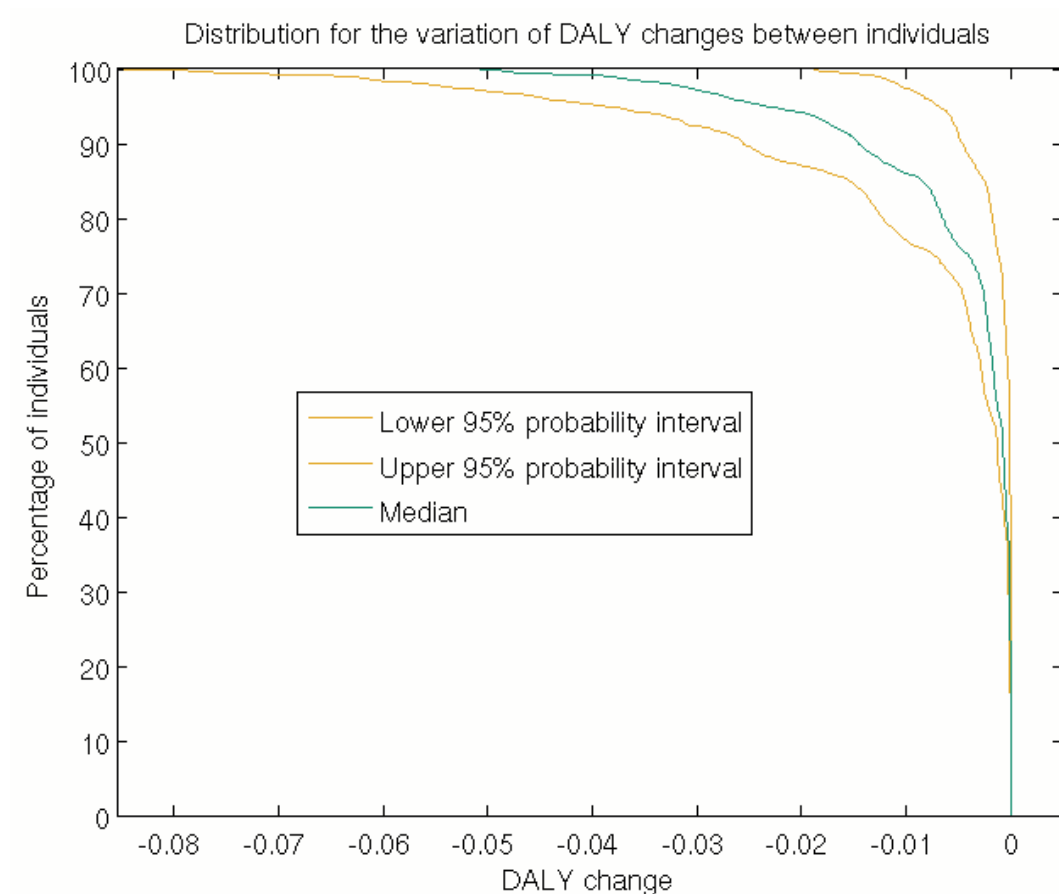


Figure 4. Complementary cumulative distribution of individual contribution to annual change in population DALYs between reference and alternative scenarios, for the assessment shown in Table 1. See text for details. The curve shows the percentage of the population (on the vertical axis) with annual DALY changes more positive than each point on the horizontal axis.

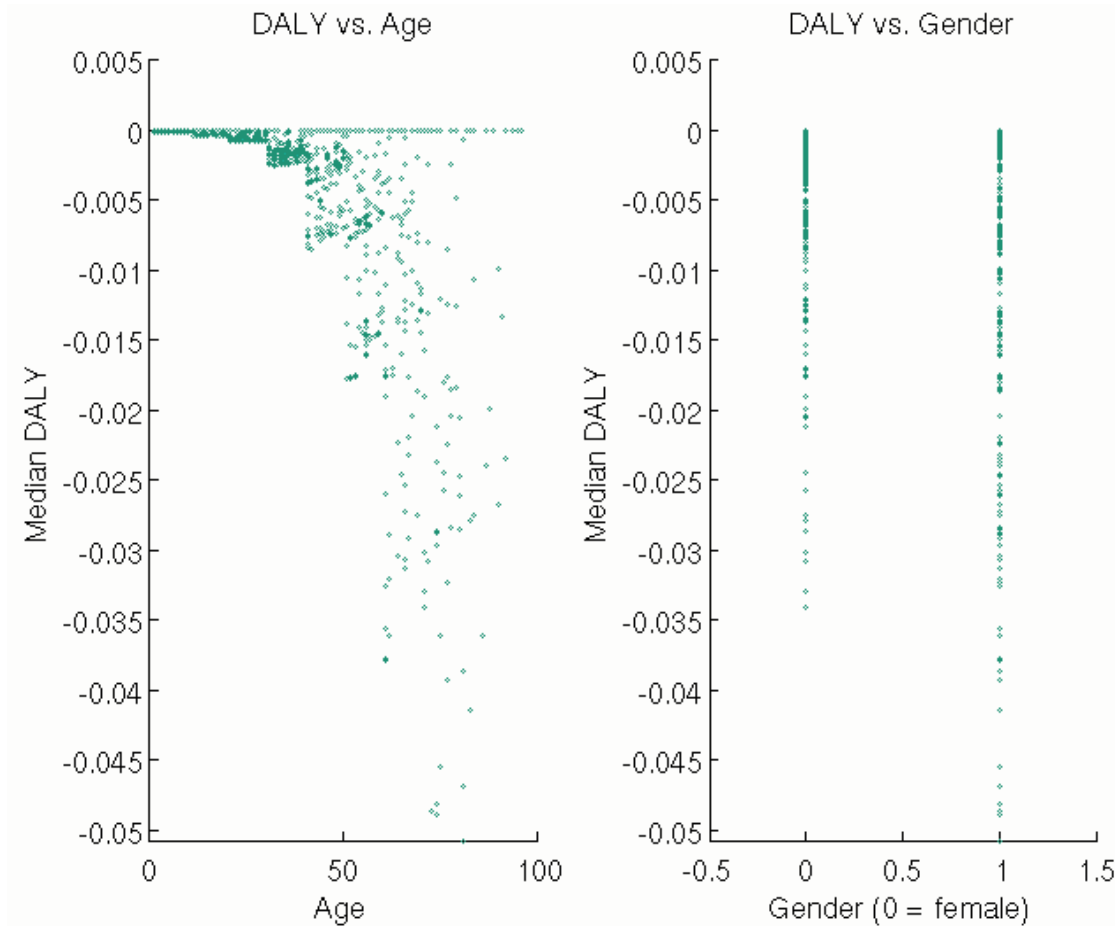


Figure 5. Individual contributions to annual change in population DALYs between reference and alternative scenarios shown in relation to age (left hand graph) and gender (right hand graph) for the assessment shown in Table 1. See text for details.

Impact

QALIBRA has established a collaboration effort through clustering with another EU project in the same call, Beneris (www.beneris.eu), and both projects share the same Scientific Advisory Panel. Both projects deal with risks and benefits of food, using complementary methods and approaches. The projects have liaised with each other about method development. To progress this, scientists have visited each other's institutes to learn about methods and approaches (e.g. methods for quantifying uncertainty). This collaboration has spun off into further expert elicitation activities. Altogether QALIBRA and Beneris held three joint cluster meetings to share ideas, approaches and results, and developed a common dissemination strategy, Figure 6 shows a photograph taken at the last cluster activity in June 2009. Reports containing the output from these cluster meetings have been written and submitted to the European Commission. In addition, a Gordon conference was organised and planned by the KTL/Beneris in co-operation with QALIBRA, ERAC and Sytyke. In order to promote post-project activities of the two consortia QALIBRA and Beneris aim to publish several scientific articles together in a relevant scientific journal. The tentative journal for this joint dissemination is Food and Chemical Toxicology.



Figure 6 Photo of the participants of the final cluster meetings between QALIBRA & Beneris in Budapest 10-11th June 2009

In addition, QALIBRA formed a very productive relationship with another EU project, BRAFO, which is coordinated by ILSI-Europe (www.ilsis.org/Europe/Pages/BRAFO.aspx). BRAFO is developing a tiered framework for benefit-risk assessment, and the QALIBRA methods and software fit very well with the higher tiers. A joint workshop was held in September 2009 to explore the applicability of the QALIBRA tool to a range of case studies being undertaken by BRAFO. At a subsequent BRAFO meeting in October, Ib Knudsen reported back on the joint workshop, saying “The QALIBRA model and software was very impressive in practical use when demonstrated at the workshop.” further he said “It will be important to run educational courses to make scientists in the field familiar with and

confident with the use of the QALIBRA model on practical cases in order to ensure that the QALIBRA model will become commonly used, further development and attract refinements as it deserves.”

To promote end-user uptake of the web-based software developed in QALIBRA a special external end-user workshop was held in September 2009. Effort was made to attract food safety experts with a direct interest in benefit-risk analysis of food, and give them a detailed introduction to the benefit-risk modelling approaches developed in the project and practical hands-on training with the benefit-risk software produced by QALIBRA (Figure 2).

This end-user workshop was among others attended members of the Qalibra/Beneris Science Advisory Panel, by two active members of the EFSA working group on Risk/Benefit procedures (Dr A. Knaap, chair of the working group, and Dr B. Bottex, secretary of the working group) and by twelve experts from BRAFO. As a result of this the project received valuable feedback and both BRAFO and EFSA have recognised the additional value of the Qalibra tool in the quantitative stages of benefit-risk assessments and referred to Qalibra in their publications.

The methodology and tools developed in QALIBRA are also being introduced to other projects and groups working with benefit-risk assessments e.g. Bepraribean (SAFEFOODERA EraNet project on risks and benefits of food) and an FAO/WHO Expert Consultation on benefit-risk assessment of fish consumption.

The QALIBRA software is primarily designed for risk assessors, working for regulatory authorities or in the food industry or in consultancy businesses, who need to consider the potential risks and benefits to health when setting food policy, developing a new food product, or advising consumers on dietary choices. The software is web-based and presently free to users.

It is expected that this will:

- Provide decision-makers with a better basis for policy and regulatory decisions and contribute to improving the safety and health benefits of the food chain
- Help consumers to make better-informed dietary choices
- Contribute to reinforcing competitiveness of European food industries by providing companies with better information on the overall health impacts of different foods and production practices. This will help them to compete more effectively by meeting consumer demands for healthy foods.

Of course uptake and knowledge transfer to potential end-users about the QALIBRA web-tool and methodologies does not occur on its own. QALIBRA has therefore developed and tested the end-user workshop format to promote uptake of the QALIBRA web-tool and methodologies. The training and dissemination material developed for the end-user workshop were written to be sufficiently generic so that they can be used for further training activities which may be organised after the end of the QALIBRA project. In fact at least one workshop has been held after the finalisation of the QALIBRA project, at the UK Food Standards Agency, and plans for another are under discussion. These workshops will raise awareness and interest in the QALIBRA assessment tool in their organisations, and thus initiate the development of a wider user network.

The QALIBRA web-tool and methodologies have great potential, but have yet to prove themselves in real-life decision-making and verify that they are able to add value to traditional assessments. If they succeed in this critical test, it may lead to a substantial advance in the scientific basis for food policy and contribute to achieving a healthy diet for European consumers.

2. Dissemination and use

The main products from QALIBRA are:

- 1) Improved methodology, e.g. for comparing benefits and risks using a composite metric, for benefit-risk assessments of food.
- 2) The QALIBRA web-based software for benefit and risk assessment of food, available at www.qalibra.eu (Figure 1)
- 3) Detailed case studies on oily fish and functional foods, demonstrating the application and usefulness of the Qalibra framework and software. (Example provided above)
- 4) Interested food safety experts and assessors have been identified and trained using an end-user workshop format. (Figure 2)
- 5) Collaboration with other EU projects dealing with risks and benefits of food e.g. Beneris, BRAFO and the SAFEFOODERA EraNet project Bepraribbean
- 6) Training and dissemination materials for use in further promotion, uptake and exploitation of the project results.
- 7) Scientific articles

Publishable results

The most likely exploitable result from QALIBRA includes;

- i) Web-enabled QALIBRA software for benefit and risk assessment of food
- ii) Training materials for use in workshops and other activities to promote end-user uptake of the web-based software developed in QALIBRA

Web-enabled QALIBRA software for benefit and risk assessment of food

Result description: The software is web-based and free to users after completing a short online training session, as foreseen in the proposal and contract. At the webpage for the project, www.qalibra.eu, potential users can register and obtain information about the principles of the QALIBRA approach to risk-benefit assessment, including the types of data and expertise required, the limitations of the methods used, and guidance on the interpretation of results. The software provides methods that integrate the risks and benefits of dietary change into a single measure of net health impact, and allow quantification of associated uncertainties.

Possible market applications: The QALIBRA software is primarily designed for risk assessors, working for regulatory authorities or in the food industry or in consultancy

businesses, who need to consider the potential risks and benefits to health when setting food policy, developing a new food product, or advising consumers on dietary choices. The software is web-based and presently free to users. The partner hosting the server for the software is committed to maintain the website and software for a minimum of 3 years after December 31st 2009. In the future charges may be required to recover costs if use is intensive.

Stage of development: The development of the software is finalised and it has been used to carry out detailed case studies on the benefits and risks of oily fish and functional foods (i.e. margarine enriched with phytosterolesters).

Collaboration sought or offered: QALIBRA partners have collaborated with the EU coordination project BRAFO, providing training in the use of the software and offering assistance to support case studies conducted by BRAFO.

Collaboration detail: BRAFO is a specific support action to investigate the risk benefit analysis of foods, partly financed by the EU 6th framework programme. *Homepage:* <http://www.brafo.org>

Intellectual property rights (IPR) status: Not IPR protected to date.

Contact details: Dr. Andy Hart, The Food and Environment Research Agency (FERA), Sand Hutton, York, YO41 1LZ, UK, *Homepage:* www.fera.defra.gov.uk

Training materials

Result description:

This result consists of training material for dissemination of the practical use of the QALIBRA software by technical end-users to promote a wide ranged uptake of the software. The material includes presentations, worked examples based on the QALIBRA case studies, and scenarios and input data for use in hands-on training sessions. Training is also available in the form of a web tutorial, which users must complete before being given access to the software.

Possible market applications: End-users e.g. risk assessors, working for regulatory authorities or in the food industry or in consultancy businesses, who need to consider the potential risks and benefits to health when setting food policy, developing a new food product, or advising consumers on dietary choices.

Stage of development: The development of the training material has been finalised. The material has been tested and applied on two different occasions' using an end-user workshop format. It is intended for use in further training activities which the partners are seeking to organise after the end of the Qalibra project.

Collaboration sought or offered: Not relevant to date.

Intellectual property rights (IPR) status: Not IPR protected to date.

Contact details: Dr. Helga Gunnlaugsdottir, Matis, Vínlandsleið 12, 113 Reykjavík, Iceland, *Homepage:* www.matis.is

In addition to the above mentioned main products and publishable results from the project, the QALIBRA project has so far been presented on > 50 different occasions with oral presentations, posters and brochures. The countries addressed are all over the world, although the majority of the presentations have been carried out in Europe. The project web site is used for collaborative work within the project and for dissemination activities. Further, it is the webgate and support for the community of users for the Web-enabled QALIBRA software for benefit and risk assessment of food (QALIBRA tool).