SIDARTHa

European Emergency Data-based Syndromic Surveillance System

Grant Agreement No. 2007208

SIDARTHa Syndromic Surveillance System: Test, Evaluation & Recommendations

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SIDARTHa Syndromic Surveillance System: Test, Evaluation & Recommendations

This report describes the test runs and evaluation of the SIDARTHa Syndromic Surveillance System for early public health threat detection and risk communication and presents recommendations for its future use and transferability – it forms deliverable D11 as defined in the Grant Agreement.

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Cover Figure

Evaluation of the SIDARTHa Syndromic Surveillance System Design (own creation)

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Abbreviations

14 - AKFAM – TR	SIDARTHa associated partner abbreviation for the University Hospital Antalya, Turkey
CDC	Centers for Disease Control and Prevention
CUSUM	Cumulative Sum
D11	Deliverable No. 11 of the SIDARTHa project
ECDC	European Centre for Disease Prevention and Control
ED	Emergency Department
EED	European Emergency Data
EMD	Emergency Medical Dispatch
EMS	Emergency Medical Service
EP	Emergency Physician
EU	European Union
8 – FOD Health DG 1 – BE	SIDARTHa associated partner abbreviation for the federal public service health, food chain safety and environment, Belgium
2 - GEOMED – DE	SIDARTHa associated partner abbreviation for the GEOMED Research Forschungsgesellschaft mbH, Germany
GIS	Geographic Information System
GP	General Practitioner
H1N1	Subtype of Influenza , here referring to the 2009 pandemic Influenza virus
16 – HSanMartino – IT	SIDARTHa associated partner abbreviation for the San Martino University Hospital Genoa, Italy
17 – HUS – NO	SIDARTHa associated partner abbreviation for the Haukeland University Hospital Bergen, Norway
ILI	Influenza-Like-Illness
IT	Information Technology
7 – KAE – DE	SIDARTHa associated partner abbreviation for the Klinik am Eichert (Clinics of the County of Goeppingen), Germany
9 – KUH – FI	SIDARTHa associated partner abbreviation for the University Hospital Kuopio, Finland
4 – LST Tirol – AU	SIDARTHa associated partner abbreviation for the Dispatch Centre Tyrol, Austria
M	Month of the SIDARTHa project
MedISys	Medical Intelligence System
NPV	Negative Predictive Value
5 – OMSZ – HU	SIDARTHa associated partner abbreviation for the National Emergency Medical Service Hungary
PPV	Positive Predictive Value
3 – RegH – DK	SIDARTHa associated partner abbreviation for the Capital Region Denmark
6 – SAMU – FR	SIDARTHa associated partner abbreviation for the System of Emergency Medical Assistance Garches, France
SCM	SIDARTHa project Steering Committee Meeting
SIDARTHa	European Emergency Data-based System for Information on, Detection and Analysis of Risks and Threats to Health
TechWS	SIDARTHa Technical Workshop
TESSy	The European Surveillance System
15 – UNIBI – DE	SIDARTHa associated partner abbreviation for the University of Bielefeld, Germany
1 – UNICAN – ES	SIDARTHa associated partner abbreviation for the University of Cantabria, Spain
USA	United States of America
WHO	World Health Organization
WP	Work Package of the SIDARTHa project
WS	Workshop of the SIDARTHa project group
13 – ZZSHMP – USZS – CZ	SIDARTHa associated partner abbreviation for the Emergency Medical Service Prague, Czech Republic

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1 Introduction: The SIDARTHa Project

Syndromic surveillance can detect public health threats earlier than traditional surveillance and reporting systems. Pre-hospital emergency medical services (EMS) and emergency medical dispatch centres (EMD), and in-hospital emergency departments (ED) across Europe routinely collect electronic data that provides the opportunity to be used for near real time syndromic surveillance of communicable and non-communicable health threats such as heat-related diseases or Influenza-Like-Illness (ILI). The European Commission co-funded project SIDARTHa (Grant Agreement No. 2007208) for the first time systematically explores the use of emergency data to provide a basis for syndromic surveillance in Europe. The project runs from June 2008 until December 2010. It is an initiative of emergency medical professionals organised in the *European Emergency Data (EED) – Research Network*[1].

Objectives

The objective of the European project SIDARTHa is to conceptualise, develop, implement/test and evaluate the European Emergency Data-based System for Information on, Detection and Analysis of Risks and Threats to Health (SIDARTHa).

Methodology

During the conceptualisation phase, information on international state-of-the-art in the early detection of health threats and on the current practice of health surveillance and alert systems in Europe are brought together with the possibilities of emergency data for detection of health threats and specific public health authority and emergency professional desires for SIDARTHa's system features. On this basis the surveillance system SIDARTHa is tested and evaluated during the implementation phase in different regions[2] (cf. Figure 1).

The project group constitutes a high-level expert panel of emergency professionals, public health experts and health authority representatives under guidance of an interdisciplinary steering committee. A sequence of focused methods such as group discussions, Strengths - Weaknesses - Opportunities - Threats analysis of existing procedures, half-standardised surveys to seek input from potential futures users, statistical analyses and modelling, and geo-processing methods are applied.

Expected Results & Products

The SIDARTHa project provides a methodology and software application for syndromic surveillance at the regional level[3] in Europe based on routinely collected emergency data. The SIDARTHa syndromic surveillance system automatically analyses the actual demand for emergency services and detects temporal and spatial aberrations from the expected demand. The system will automatically alert decision makers in the emergency medical institution and the regional public health authority. Via the established reporting ways the regional public health authority can inform national or supranational authorities on an event (cf. Figure 2).

It is expected that SIDARTHa improves the timeliness and cost-effectiveness of European and national health surveillance by providing a basis for systematic syndromic surveillance that supplements the existing surveillance structures.

The main outputs of the project are a syndromic surveillance application (software) publicly available free-of-charge and guidelines for future users on how to use the application and how to transform emergency data into syndromes and into the common SIDARTHa data set that the application can analyse, including recommendations on technical infrastructure, reporting procedures and interpretation of the results. Furthermore, the guidelines cover the utilisation of the interactive user display and risk communication platform.

[1] www.eed-network.eu

[2] SIDARTHa Implementation sites: District of Kufstein, Austria; Capital Region, Denmark, County of Goeppingen, Germany, Autonomous Region Cantabria, Spain

[3] In the SIDARTHa project the term *regional* is used referring to the smallest administrative level at which a health authority responsible for surveillance and reporting is established in a European country depending on the national definition and rules. This level can be a community, city, county, district or state. The implementation of the SIDARTHa syndromic surveillance system can be based on data collected for the same administrative level or also for a part of this area or based on the catchment areas of one or more participating emergency institutions.

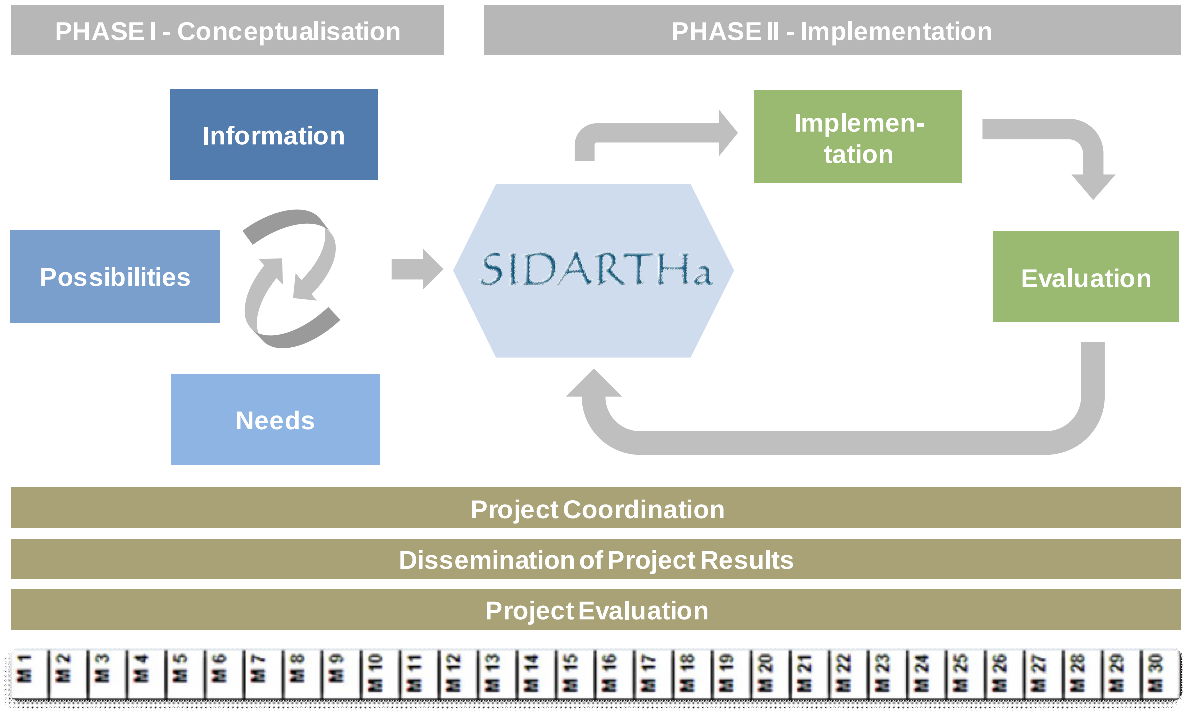

Figure 1: SIDARTHa Project Methodology

M = Month of the project time

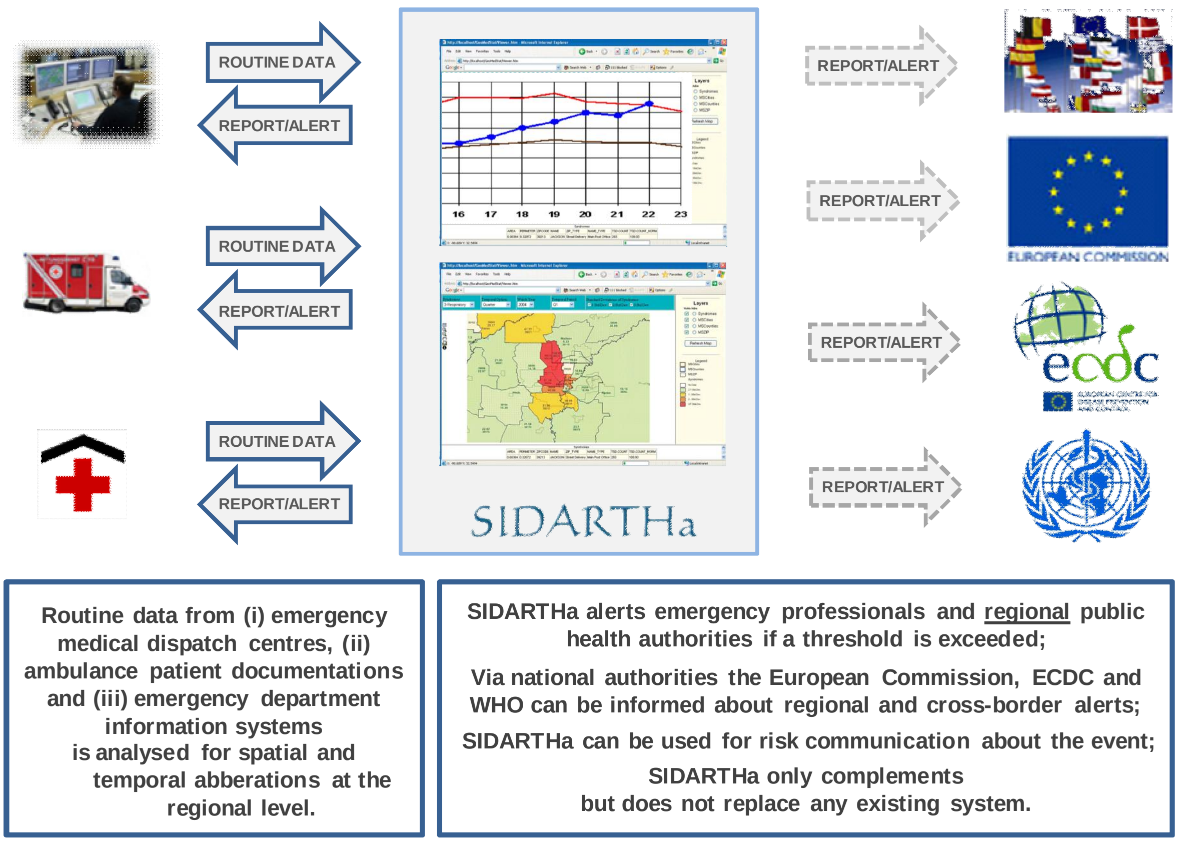

Figure 2: SIDARTHa Approach

ECDC = European Centre for Disease Prevention and Control, WHO = World Health Organization

2 Objectives & Methodology

2.1 Objectives

The main objective of this report is to present the results of the test and evaluation of the SIDARTHa syndromic surveillance system and approach (Task 13-15 of WP 7). It will also present recommendations of the project consortium to the future use and transferability of SIDARTHa (Task 16).

2.2 Methodology

The test runs during the implementation phase were providing the basis for evaluating SIDARTHa and encompassed different methods such as case studies, simulations, testing the technical setup of the SIDARTHa application and user evaluation surveys. The evaluation also drew on other results of the conceptualisation phase, e.g., historical data analysis. Test run and evaluation results were discussed among the implementation site representatives (technical workshops) and the project consortium (project workshop 4, 5). Implementation site visits were used to discuss test run and evaluation results with regional stakeholders in the implementation sites which was an important step also to foster the links between the stakeholders of emergency care and public health in the regions.

The Centers for Disease Control and Prevention (CDC) have published several guidelines on the evaluation of public health surveillance systems (Centers for Disease Control and Prevention 2001 (1)), including one guideline focusing on surveillance for early outbreak detection of health threats (Centers for Disease Control and Prevention 2004 (2), Sosin 2003 (3)). These guidelines provide a structured, semi-standardized method to evaluate syndromic surveillance systems and are considered to best fit to a comprehensive and in-depth evaluation. Other syndromic surveillance systems were evaluated using this framework (Doroshenko et al. 2005 (4), Jefferson et al. 2008 (5), Lombardo et al. 2004 (6), Sheline 2007 (7)). The evaluation of the SIDARTHa's performance was thus framed by the CDC guidelines.

Recommendations on the future use of SIDARTHa were phrased by the Advisory Board based on the results of the outcome evaluation.

2.2.1 Evaluation Indicators

The CDC guidelines target a wide range of different system features that should be analysed for the performance evaluation of a surveillance system:

- Usefulness
- Acceptability
- Stability
- Costs
- Simplicity
- Flexibility
- Sensitivity
- Timeliness
- Data quality
- Representativeness

The scientific-technical coordination office in cooperation with the coordinators adjusted the indicators and sub-indicators to assess the SIDARTHa syndromic surveillance approach and system for Annex I of the Grant Agreement before the project started (cf. chapter 2.3 of Annex I of the Grant Agreement):

Usefulness

- SIDARTHa is able to detect temporal and spatial clusters of health threats of public importance
- SIDARTHa is detecting health threats early in the course of an event enabling rapid intervention;
- SIDARTHa is able to detect health threats earlier than existing surveillance systems.

Acceptability

- Maintenance and level of utilisation after project time;
- no. of reporting partners and users during and after project time;
- no. of linkages to existing surveillance systems;
- transfer of SIDARTHa into other contexts or extension to cover additional health threats; importance of SIDARTHa's reports for public health;
- flexibility to respond to specific user enquiries;
- responsiveness of SIDARTHa to suggestions and comments;
- ease and cost of data reporting; timeliness of reporting;
- level of assurance of privacy and confidentiality;
- level of representativeness (i.e., coverage of population, no. of threats)

Stability

- Ability to collect, manage and provide data properly without failure;
- ability to adapt to changes (i.e., new coding);
- ability of SIDARTHa to be operational when necessary; no. of unscheduled outages and down times of the server;
- amount of costs involved in repair of SIDARTHa;
- percentage of time that SIDARTHa is fully operating;
- difference between desired and actual amount of time required for SIDARTHa to manage and release data

Costs

- Amount of costs (financial and non-financial, i.e., anxiety raised by false alarms, morbidity/mortality related to missing or late response) for system implementation and operation,
- for responding to system alarms and follow-up activities (i.e., diagnosis, community interventions), for responding to false alarms, for missing outbreaks or late recognition;
- costs occurring for running SIDARTHa compared to other surveillance systems;
- reduction of costs throughout SIDARTHa's operation through lessons learned of earlier events

Simplicity

- Level of integration with existing surveillance systems;
- time and resources spent to collect, transfer, analyse data, maintain and update the system and disseminate reports/alerts;
- staff training requirements;

- easily applicable case definitions and indicator rationales; interface that is easy to understand and easy to use

Flexibility

- Easy integration in existing surveillance systems;
- easy integration in new regions;
- easy adaptation of SIDARTHa to new case definitions/rationales and additional or new data sources and incorporation of other information technology;
- dependence on funding; dependence on reporting sources; flexibility of SIDARTHa to respond to specific user enquiries (local vs. European perspective, comparison of regions, different ways of reporting/dissemination)

Sensitivity

- Proportion of cases of a health threat reported to SIDARTHa until a threat is detected;
- ability to detect outbreaks; timeliness of reporting after onset of threat;
- ability to detect temporal and spatial or spatial-temporal clusters of a health threat;
- level of detail of information reported; sensitivity of one item of SIDARTHa (i.e., specific case definition/rationale, specific data source or combination of the data sources);
- level of sensitivity compared to other health surveillance systems;
- ability to monitor changes during an outbreak (temporal, spatial)

Timeliness

- Time intervals between different steps of SIDARTHa (i.e., between onset of a health threat event and reporting to SIDARTHa, between reporting to SIDARTHa and alert or between alert and response/intervention by health sector or public health officials)

Data quality

- Number of false alarms;
- data quality of reporting partners;
- completeness of data; quality of data management within SIDARTHa;
- accuracy of detecting a certain health threat;
- accuracy of details reported on specific health threats

Representativeness

- Level of reflection of characteristics of a health threat event by SIDARTHa;
- level of representativeness of general population by SIDARTHa's data sources;
- level of details in information reported

Validity/Specificity

- Predictive Value Positive (PVP),
- Predictive Value Negative (PVN),
- proportion of false alerts;
- proportion of health threats identified by SIDARTHa that are actual threats

2.2.2 Data Collection

The evaluation was based on information collected from the following sources. Appendix 1 provides an overview on the data sources used for assessment of the different indicators.

Workshops, steering committee meetings, visits

The SIDARTHa workshops and steering committee meetings can be understood as the cornerstones of the project and are thus considered an important source of information for the evaluation purposes. These meetings made interim outputs of the project visible and were also important to identify and tackle emerging needs/problems. All the meetings were very well prepared and managed and a detailed documentation of the workshop proceedings is available by use of the e-collaboration platform.

In total, five workshops, six steering committee meetings, three technical workshops, five implementation site visits and one open conference were realized during the project time.

- Workshop (WS) 1 + Steering Committee Meeting (SCM) 1: Copenhagen, Denmark; November 2008
- WS 2 + SCM 2: Prague, Czech Republic; January 2009
- (Technical Workshop) TechWS 1: Santillana, Spain; March 2009
- SCM 2a: Bonn, Germany; April 2009
- WS 3 + SCM 3: Innsbruck, Austria; June 2009
- TechWS 2: Bad Honnef, Germany; October 2009
- SCM 4: Genoa, Italy; December 2009
- TechWS 3: Maastricht, Netherlands; March 2010
- WS 4 + SCM 5 + Implementation Site Visit Spain: Santander, Spain; June 2010
- Implementation Site Visit Denmark: Copenhagen, Denmark; August 2010
- Implementation Site Visit Austria : Innsbruck, Austria ; August 2010
- Implementation Site Visit Germany: Goeppingen, Germany; September 2010
- Implementation Site Visit Belgium: Leuven, Belgium, November 2010
- WS 5 + SCM 6 + Open Conference: Brussels, Belgium November 2010

Presentations of interim/final results and minutes of the workshops are a relevant source contributing to the assessment of all evaluation indicators.

Surveys

Four different semi-quantitative surveys were developed and applied to gather information from different target groups and to assess the level of the implementation in the implementation sites at the end of the project. The surveys were used to include the perception of the project group members and external stakeholders on the SIDARTHa surveillance system and approach.

<u>Short Future User Survey</u>

A short survey was developed during the conceptualisation phase to get an idea about the general opinion of public health stakeholders towards needs for a syndromic surveillance system in Europe. The survey was accomplished during two European Public Health Conferences in 2009 and 2010. Information from 20 respondents was available (cf. Rosenkötter et al. 2010 (8)).

The short survey was used for the evaluation of the usefulness and acceptability of syndromic surveillance from the public health perspective.

<u>Project Consortium Survey</u>

This survey was developed to assess the perception of the project members on the progress of the SIDARTHa project as well as on the relevance of the SIDARTHa system (cf. Appendix 2). The survey aimed at assessing the viewpoint mainly of the stakeholder group from the emergency care sector. The survey was applied on two occasions: During the third project workshop in Innsbruck, Austria in June 2009 and the final project workshop in Brussels, Belgium in November 2010. In detail, the survey aimed at assessing the project members' opinion about the importance and satisfaction of the project outcomes. Information is available from 13 respondents who participated on the two workshops.

The results from these surveys supported the evaluation to assess the level of usefulness of SIDARTHa as expressed by representatives from emergency care and to identify changes of attitudes in the course of the project.

Open Conference Survey

This survey was developed to assess mainly the public health perspective on syndromic surveillance in general and on the SIDARTHa syndromic surveillance system in particular (cf. Appendix 3). The survey was applied during the Open Conference in Brussels, Belgium in December 2010. This meeting aimed at presenting the SIDARTHa system to collaborating partners and external stakeholders mainly from public health and was attended by 24 participants. Information is available from 10 respondents. The first part of the qualitative and open-questioned survey asked about the use of and attitude towards syndromic surveillance in general. The second part was focused on the SIDARTHa system. Most of the respondents worked in national health authorities and were mainly involved in the areas of surveillance, crisis management and preparedness.

The findings support the evaluation of the system's performance by including the viewpoint of public health on usefulness, acceptability, and simplicity of the SIDARTHa system at the end of the implementation phase and the needs that are expressed when deciding about the integration of SIDARTHa into the local public health surveillance systems.

Implementation Site Survey

The performance of SIDARTHa in the four implementation sites was assessed by use of a questionnaire that was given to the implementation site representatives in December 2010 (cf. Appendix 4). The survey asked in a semi-quantitative way about several milestones of the implementation of the system: Technical implementation, level of integration of SIDARTHa into the routine emergency care data systems, the usefulness of outcomes from the conceptualisation of the project (e.g. coding manual), quality of routine data for creating the syndromes, use of the SIDARTHa approach and system, level of cross-linking of SIDARTHa with other routine public health surveillance systems in the respective region. The survey was applied to assess the state-of-art of SIDARTHa's implementation at the end of the project. Information was available from three implementation sites.

The data from this survey was used to assess all indicators except sensitivity.

Case Studies & Historical Data Analysis

Historical emergency data of the country consortia was analysed to determine the baseline and threshold values for the health threats under surveillance in the SIDARTHa system.

Several case studies were performed during the implementation phase of the project characterising the test run. The case studies aimed at testing the performance of the SIDARTHa system as well as at analysing the quality of emergency data for surveillance of potential health threats that had occurred before or did occur during the implementation. The case studies are highly qualified to contribute to the outcome evaluation and provide information on several features of the SIDARTHa surveillance system. Detailed results of the case studies are published in Rosenkötter et al. 2010 (8).

The findings and conclusions from the historical data analysis are considered to be another important source of information to assess all indicators except costs.

Simulations

The findings from the simulations are used to validate the performance of the early detection algorithms C1, C2, C3 and CUSUM for normal and Poisson distributed data during outbreaks of different lengths. Details are published in Rosenkötter et al. 2010 (8).

Results of the simulation study are supportive for the assessment of usefulness, validity (sensitivity, specificity, predictive values), data quality, flexibility and the timeliness of the SIDARTHa syndromic surveillance approach.

3 SIDARTHa Syndromic Surveillance System: Evaluation Results

3.1 Usefulness

At the end of the project, the SIDARTHa system was fully implemented in one of the four implementation sites. Full implementation is here understood as the ability of the SIDARTHa system to collect, edit and re-organise routine emergency care data, to create and analyse the syndromes under surveillance and to report the findings in real-time and automatic. The other implementation sites used the system in a pilot/test environment and provided data for the test runs and data analyses/case studies.

The results from the surveys demonstrate that there is a large consensus among experts from Public Health and from emergency health care about the potential usefulness of syndromic surveillance in general and the usefulness of the SIDARTHa approach in particular. When asked to rate the importance of the SIDARTHa system and the outcomes for the scientific community and decision-making processes from 1 (not at all) to 5 (very important), the project members answered an average value of 4.1 and 4.3, respectively, at the end of the project. These values did not change significantly from the ratings that had been given from project members at the end of the first phase of the project (4.3 and 4.6) in June 2009 and reflect on the one hand the high relevance that was constantly attributed to the SIDARTHa concept and on the other hand the fact that this attitude did not change during the implementation activities and the presentation of preliminary outcomes.

Respondents from public health during the Open Conference in December 2010 were informed about the SIDARTHa approach and system. Seven of the ten respondents were experienced in the use of syndromic surveillance systems, most of them for the surveillance of influenza like illness or particular events. When asked about health threats generally qualified for a syndromic surveillance approach such as SIDARTHa, the respondents considered mainly communicable diseases, intoxication, or environmental effects to fit best. Asked about the requirements that should be met in order to qualify a syndromic surveillance system for supplementing established surveillance systems, the respondents indicated three areas of importance: timeliness, several aspects dealing with data quality, and instructions for the handling of alerts. The respondents considered routine emergency care data to be a useful source of data for surveillance of health threats, especially when used for surveillance at a local level. This potential was balanced by some limitations that were mainly related to issues of data harmonisation and standardization, and to the low level of accuracy of pre-diagnostic information. Despite these concerns, the SIDARTHa syndromes were highly valued for reasons of being innovative, timely, and including spatial information. The results of the case studies however were viewed restrainedly. The respondents wondered about the added value of the case studies. The results of the H1N1 influenza case study were e.g. considered to be no real improvement of classical surveillance of H1N1. In the case of the volcanic ash cloud study case, it was also noted that it is difficult to evaluate the added value of a surveillance system for events that do not have any public health consequence. The SIDARTHa system was in general considered to be qualified for routine surveillance but provided that it demonstrates the quality of detection algorithms, data security and no extra costs. In summary, Public Health stakeholders who got an introduction to the SIDARTHa syndromic surveillance system considered the approach to be a promising tool for the timely detection of health threats, especially threats due to infectious conditions, intoxication or climate hazards, but valued the immediate integration of the system into routine Public Health surveillance programs with limitations. Concerns were mainly raised over the sensitivity of the system to produce alerts, data harmonisation and protection issues, and the uncertainties how to act in case of alerts.

SIDARTHa's ability to detect temporal and spatial clusters of health threats of public importance

The case studies and simulations showed that SIDARTHa is able to detect temporal (Case Studies H1N1, Gastroenteritis) and simulations and spatial clusters (Case Study Gastroenteritis Austria). The level of detection ability differs depending on the data source, the syndrome, the detection algorithm and the reference data used for comparison with SIDARTHa.

SIDARTHa's ability to detect health threats early in the course of an event enabling rapid intervention

The case studies also showed that SIDARTHa is able to detect health threats early in the course of the event or can provide earlier information (influenza case study) or is the only source of information on an event (volcanic ash plume case study).

SIDARTHa's ability to detect health threats earlier than existing surveillance systems

Especially the influenza case study showed that SIDARTHa provides earlier information on health threats compared to the existing sentinel surveillance system.

The following evaluation indicators will provide details with regard to the assessment of usefulness of SIDARTHa.

3.2 Acceptability

Maintenance and level of utilisation after project time

The SIDARTHa system is fully implemented in Spain where it will be maintained by the implementation site. The other implementation sites use the system in a pilot status and will fully implement the system after the project time. Only a long-term evaluation can show the maintenance and use of SIDARTHa in the longer run.

Number of reporting partners and users during and after project time

All twelve consortium partners contributed to the development of the SIDARTHa syndromes and the analysis of the feasibility to build the SIDARTHa syndromes based on their routine emergency care data.

At the end of the project time there is one fully reporting partner (Spain) and three partners reporting data for analysis (Austria, Germany, Belgium).

Only a long-term evaluation can reveal information on the number of reporting partners after the project time.

The main hurdle in fully implementing the system during the project time in the remaining implementation sites were technical difficulties to establish a link for the automatic data reporting. In the future, the necessary initial effort for setting up the system might hinder its acceptance.

Number of linkages to existing surveillance systems

Communication channels between the SIDARTHa data provider from the emergency care sector and the respective regional public health authority were established and intensified during the project time. Integrating the SIDARTHa system into routine surveillance systems could be realised in the Spanish implementation site where the system is regularly consulted by the regional health authority during their regular work as additional and timely information source.

Further, links were explored to the European Commission's surveillance system MedISys. A representative approached the coordinators during the Open Conference and concrete links were discussed in the form of a technical feed from SIDARTHa into MedISys. The link will be further explored after the project time.

Transfer of SIDARTHa into other contexts or extension to cover additional health threats

The flexibility of the SIDARTHa approach to cover different health threats and to function in different regions and with different emergency data sources is one of its big strengths and fosters acceptability. As the syndrome coding can be defined by the user the system can be applied for many different health threats fitting the regional specifications and data availability as shown for the four implementation sites.

The case study related to the volcanic ash cloud demonstrated that the SIDARTHa system can easily be adjusted to cover additional health threats, in this case the volcanic ash cloud with new syndromes such as traffic accidents and cardio vascular syndrome.

Importance of SIDARTHa's reports for public health

The results of the surveys among public health representatives (short survey, open conference survey) demonstrate that, in principal, there is the willingness to participate in the surveillance system. The surveys also showed that a final decision about the acceptability of the SIDARTHa system requires the provision of further evidence about the added value of the system.

Flexibility to respond to specific user enquiries

For the case study for the volcanic ash cloud the SIDARTHa consortium responded to specific user enquiries, in this case on the basis of a request from the European Centre for Disease Prevention and Control. The system was immediately adjusted to cover new syndromes.

In general, the SIDARTHa system is developed to suit the diverse regional user specifications in Europe. Syndrome definitions and included data fields for syndrome generation, baselines, thresholds and time periods can be changed/chosen by the user.

Responsiveness of SIDARTHa to suggestions and comments

During the project time the SIDARTHa system could be adjusted by the IT company *BeValley* to the suggestions and comments of the consortium and external experts. *BeValley* agreed to adjust and update the system in the future but the question remains how this can be sustained also with additional funding. This is a threat for future acceptance of SIDARTHa.

Ease and cost of data reporting

The implementation in the implementation site in Spain shows that after the full setup of the system with automatic data reporting no work and costs evolve for data reporting.

Other studies (Carrico and Goss (2005) (9), Das et al. (2003) (10), Jefferson et al. (2008) (5) or Travers, Barnett et al. (2006) (11)) showed that additional workload for data collection/reporting of data provider is a major hindering factor for the sustainability of a syndromic surveillance system. Therefore, the automatic data collection/reporting of SIDARTHa is a major asset when it comes to acceptability.

Timeliness of reporting

Although the data collection is working in real-time as soon as a case is closed by the emergency care provider, the SIDARTHa consortium decided to have a daily update in data reporting which provides sufficient timeliness for public health purposes. The process of data reporting to SIDARTHa, data analysis and output generation (alert, graphs, maps) is automated and takes seconds. The automated or simple production of online reports from the SIDARTHa system to be sent for example by email to stakeholders is not yet available and would increase the timeliness of SIDARTHa even more. Timeliness of reporting in the SIDARTHa system is another big asset towards acceptance.

Level of assurance of privacy and confidentiality

The level of assurance of privacy and confidentiality is an issue that was causing concerns among the public health stakeholders who participated in the surveys.

SIDARTHa uses only anonymised data only. Further, SIDARTHa is running at the data providing institutions so that raw data never leaves the institution. This was an important point from the beginning of the project for the data providers and shall foster acceptance of the system in the future. The data provider can choose who shall have how much access to the results of SIDARTHa and to the data behind the alerts. The system is protected using usual security measures for web-based systems using confidential data (e.g., passwords, secured server).

Representativeness

Representativeness was also a topic raised by public health representatives during the Open Conference. Though emergency data covers a unique service area it seldom is complying with administrative boundaries for which statistical or other surveillance data is available. Further, emergency data basically represents severe cases and therefore, SIDARTHa could not be used for surveillance of mild disease symptoms. This is an inherent weakness of the system hindering acceptance.

On the other hand routine surveillance systems are not able to fully display the occurrence of severe cases. An emergency data-based syndromic surveillance system could deliver this piece of additional information in terms of an estimation of e.g. severe influenza cases.

3.3 Stability

Ability to collect, manage and provide data properly without failure

For the fully installed system in the Spanish implementation site the data handling is working in an automated and standardised fashion. The automatic character of the SIDARTHa syndromic surveillance is the biggest asset towards stability. If data have to be collected or managed manually stability of a system can be challenged as shown in the evaluation by Jefferson et al. 2008 (5).

Ability to adapt to changes (i.e., new coding)

For the case study for the volcanic ash cloud the SIDARTHa consortium responded to specific user enquiries, in this case on the basis of a request from the European Centre for Disease Prevention and Control. The system was immediately adjusted to cover new syndromes.

In general, the SIDARTHa system is developed to suit the diverse regional user specifications in Europe. Syndrome definitions and included data fields for syndrome generation, baselines, thresholds and time periods can be changed/chosen by the user.

During the test run in the implementation site in Spain no impact on system stability by changes were observed.

Ability of SIDARTHa to be operational when necessary

In the Spanish implementation site the system was ready to provide information on the influenza season beginning in winter 2010 earlier than the sentinel system which was the first real test-run during a health event that was expected.

Number of unscheduled outages and down times of the server

The Spanish implementation site reported having had an average of one downfall per month during the test run.

Amount of costs involved in repair of SIDARTHa

This indicator cannot yet be generated as SIDARTHa not yet needed major repair. The outages of the system were fixed with very little work effort of the IT company *BeValley*.

For the time after the project ends the question is open how future repairs and maintenance can be assured in a decentralised system such as SIDARTHa. If the regional system cannot easily be repaired by the future users how does that affect the usefulness and acceptance of the system?

Percentage of time that SIDARTHa is fully operating

The fully implemented system in the Spanish implementation site was fully operating during the test run in 95% of the time.

Difference between desired and actual amount of time required for SIDARTHa to manage and release data

As the system is automated there is no difference between desired and actual amount of time to treat the data.

3.4 Costs

Amount of costs (financial and non-financial, i.e., anxiety raised by false alarms, morbidity/mortality related to missing or late response) for system implementation and operation

Resource estimation for the SIDARTHa system is an issue that was considered important in the survey given to Public Health representatives during the open conference.

A full assessment of the costs was not possible during the project time and would not have been representative also as the system was adjusted while it was implemented and tested. This has to be a matter of follow-up evaluation activities.

Amount of costs for responding to system alarms and follow-up activities (i.e., diagnosis, community interventions)

It was not part of the SIDARTHa project to develop or monitor response strategies after the SIDARTHa system had issued an alert.

Especially costs for false alarms and follow-up activities such as interpretation of the output of a syndromic surveillance system and organisation of a response to an alert are the biggest driver for concern about costs in most syndromic surveillance systems (Balter et al. 2005 (12)). This was also a concern raised by the public health representatives participating in the open conference.

Amount of costs for responding to false alarms, for missing outbreaks or late recognition

It was not part of the SIDARTHa project to develop or monitor responses and their costs after the SIDARTHa system had issued an alert.

Amount of costs occurring for running SIDARTHa compared to other surveillance systems

The costs are anticipated to be very low as the system is fully developed and available free of charge. Further it runs fully automated once implemented and no costs occur for data collection, analysis and output. The cost-effectiveness is supposed to be one major asset for the usefulness of the system.

Reduction of costs throughout SIDARTHa's operation through lessons learned of earlier events

This indicator cannot be generated based on the information gathered during the test run.

3.5 Simplicity

Level of integration with existing surveillance systems

Integrating the SIDARTHa system into routine surveillance systems could be realised in the Spanish implementation site where the system is regularly consulted by the regional health authority during their regular work as additional and timely information source. The step of sharing SIDARTHa results is simple as it is web-based by granting access to the SIDARTHa software for public health officials.

Further links as currently explored for example to the European Commission's surveillance system MedISys are technically very simple as the MedISys system would get a simple feed from the SIDARTHa system informing about an alert in a certain region that would be incorporated into the reports of MedISys as all sources scanned by the system.

Time and resources spent to collect, transfer, analyse data, maintain and update the system and disseminate reports/alerts

The implementation in the Spanish implementation site has indicated that once the automated SIDARTHa system is running no relevant time and resources have to be spent for collection, transfer and analysis of results. This is one major asset towards simplicity of the system.

The SIDARTHa system's output is accessible to selected stakeholders or the public (to be decided by the user) via the web-based interface which is a very easy way to disseminate results instantly and without additional effort.

Interpretation of the output of SIDARTHa and organisation of a response to an alert will engage additional resources. This part cannot be taken over by software but can only be done by astute public health professionals and clinicians.

The installation process and coding of own data sets into the SIDARTHa standard data set is also a time consuming part of the process.

For the time after the project ends the question is open how future repairs and maintenance can be assured in a decentralised system such as SIDARTHa. If the regional system cannot easily be repaired by the future users how does that affect the usefulness and acceptance of the system?

Staff training requirements

There are no staff training requirements for using SIDARTHa.

Though it is anticipated that future users in emergency care institutions have IT staff available who can install the SIDARTHa software and program the automated data transfer from their own databases into SIDARTHa, this will cause an effort of some days for these people hindering the easy installation of the system.

There is one step in the preparatory phase of coding regional data sets when the data should be checked for seasonality which has an impact on the performance of some detection algorithms. For this step some statistical knowledge is necessary which might not be available in emergency care institutions hindering easy installation of the system.

Easily applicable case definitions and indicator rationales

The test of using the Coding Manual (workshop, historical data analysis, case study) revealed that the case definitions and coding recommendations are applicable to regional data sets.

The real-world test implementing SIDARTHa in further implementation sites not involved in the project and the conceptualisation of the coding will reveal further information on the simplicity of the coding manual.

Interface that is easy to understand and easy to use

The test/evaluation of the interface among the project participants showed that the current interface is not intuitive and needs further explanation for the first time use (as given in the User Manual). The interface entails too much information that is not relevant and too much information at once (on one page). The change of the analyses or output design (graphical representation, thresholds) is not intuitive either. This is the biggest threat regarding simplicity of the system.

The evaluation of another system showed that a not easy to use interface is a threat for the acceptance of the system (Jefferson et al. 2008 (5)).

3.6 Flexibility

Easy integration into existing surveillance systems

Integrating the SIDARTHa system into routine surveillance systems could be realised in the Spanish implementation site. The setup of the SIDARTHa software enabling user-specific graphic representation or changes in analyses is an asset towards integration of the system in existing surveillance systems.

The simple web-based way of sharing results with stakeholders who are using other surveillance systems and the technically simple feed of results into superior surveillance systems such as for example MedISys supports SIDARTHa's integration into the established surveillance landscape.

Easy integration into new regions

The SIDARTHa approach so far is not fully adopted in other regions than the Spanish implementation site as the system and the approach were further developed during the implementation phase. It is not yet clear how easy the system can be implemented now it is in its final version.

SIDARTHa can be installed across Europe as emergency data is available in most countries electronically and the SIDARTHa Standard Data Set reflects the minimum requirements that can be fulfilled by every emergency institution in Europe. Though emergency care across Europe follows diverse system approaches the care (and therefore data collection process) has common characteristics (Baer et al. 2009 (13)). These points are an immanent strength of SIDARTHa compared also to other successful syndromic surveillance systems based on data sources not available across Europe such as for example telephone helplines or not so standardised systems such as out-of-hours care.

The SIDARTHa system is developed to suit the diverse regional user specifications in Europe. Syndrome definitions and included data fields for syndrome generation, baselines, thresholds and time periods can be changed/chosen by the user. The test of using the Coding Manual (workshop, historical data analysis, case study) revealed that the case definitions and coding recommendations are applicable to the consortium's regional data sets. This is the biggest asset regarding flexibility for a Europe-wide applicable system.

Easy adaptation of SIDARTHa to new case definitions/rationales and additional or new data sources and incorporation of other information technology

The flexibility of the SIDARTHa approach to cover different health threats and with different emergency data sources is one of the big strengths. As the syndrome definitions can be defined by the user the system can be applied for many different health threats fitting the regional specifications and data availability as shown for the four implementation sites.

The case study related to the volcanic ash cloud demonstrated that the SIDARTHa system can easily be adjusted to cover additional health threats, in this case the volcanic ash cloud with new syndromes such as traffic accidents and cardio vascular syndrome.

The integration of SaTScan for automated spatial-temporal analysis has not yet been accomplished in the software application. Further IT support is necessary to accomplish this task after the projec time.

Dependence on funding

The SIDARTHa software and all related material such as the coding and user manual are available free-of-charge which is a big asset when it comes to funding. The implementation of the system costs some work effort but does not need additional funding or staff. The automated character of the system prevents dependence on funding. If maintenance, repair, and update of the system are costing further funding for external IT support is not yet clear.

Dependence on reporting sources

As the system is implemented at the reporting sources and is automated in collecting data the dependence on acceptance by reporting sources (e.g., data privacy, workload) is minimal.

The system is created in a way it can be installed running on one data source. The system does not depend on all data sources in a region to participate or data sets from different emergency sources to be merged. This is a big asset when it comes to flexibility.

Flexibility of SIDARTHa to respond to specific user enquiries (local vs. European perspective, comparison of regions, different ways of reporting/dissemination)

For the case study for the volcanic ash cloud the SIDARTHa consortium responded to specific user enquiries, in this case on the basis of a request from the European Centre for Disease Prevention and Control. The system was immediately adjusted to cover new syndromes.

In general, the SIDARTHa system is developed to suit the diverse regional user specifications in Europe. Syndrome definitions and included data fields for syndrome generation, baselines, thresholds and time periods can be changed/chosen by the user.

The SIDARTHa system's output is accessible to selected stakeholders or the public (to be decided by the user) via the web-based interface which is a very easy way to disseminate results instantly at a local, regional, national or European level and across borders within or beyond a country. In this way, a comparison of the situations in different regions is possible. This is big advantage towards flexibility.

Reporting and disseminating the results beyond the web-based interface, e.g., by standardised reports or automated email alerting are not yet installed. More flexible ways of reporting meeting different user's needs would increase the usefulness of SIDARTHa.

3.7 Validity: Sensitivity & Specificity

Proportion of cases of a health threat reported to SIDARTHa until a threat is detected

Due to the data source 'emergency medical care data' – it is not possible to cover all outbreak cases reported since only severe (or emergency) cases are part of the SIDARTHa system.

The necessary number of cases until a threat is detected varies per syndrome and detection algorithm. The simulation study showed that based on ED-ES data one day outbreaks of the unspecific syndrome were hardly detectable whereas a 13 day outbreak of ILI patients which peaked at day six and decreased afterwards was almost 100% detected at day six (C3, CUSUM Poisson distributed data).

Timeliness of reporting after onset of threat

The SIDARTHa surveillance system is based on the daily reporting of cases. It is a continuous system where daily reporting of SIDARTHa syndromes takes place routinely and is independent from the occurrence of a health threat. Thus SIDARTHa provides a timelier reporting compared to routine surveillance systems that often report on a weekly basis.

In the situation of an unexpected health threat for which new syndromes are needed, timeliness of reporting can be limited as the syndrome coding has to be newly defined or adjusted which can include coordination steps between public health and emergency care

Temporal ability to detect outbreaks

In general the ability to detect outbreaks is depending on the case severity. As it can be seen in the case studies the system was able to identify the ILI pandemic in 2009. The detection of gastrointestinal syndrome outbreaks in contrast was problematic. Since gastrointestinal problems do mainly not lead to the need of emergency medical care treatments these outbreaks can only be identified by a syndromic surveillance system if the outbreak occurs under special circumstances (i.e., symptoms in a group from abroad).

Ability to detect spatial or spatial-temporal clusters of a health threat

A spatial-temporal analysis in order to detect clusters of a health threat is depending on the ability of a syndrome to cluster. The analysis was successful for gastrointestinal health threats that happened under special circumstances (e.g. school class with gastrointestinal symptoms during holiday in a hotel or large traffic accident during the period of the volcanic ash cloud.

Level of detail of information reported

For most data sets information on all SIDARTHa variables was available (date/time, geographic reference, syndrome (underlying codes (AMPDS, ICD-10), age, gender, severity). This enabled the data holder to extend information on identified aberrations from baseline numbers with background data (e.g. case studies on gastrointestinal syndrome, volcanic ash plume) in order to identify risk groups (e.g. age groups).

Sensitivity of one item of SIDARTHa (i.e., specific case definition/rationale, specific data source or combination of the data sources)

In general it can be stipulated that the sensitivity of the SIDARTHa syndromic surveillance approach must be assessed per data source, per syndrome and per detection algorithm.

The case studies gave indications that it is worth to identify special coding characteristics and that a common syndrome coding is not advisable for all data sources (e.g. syndrome coding (ICD-10) in the German EP data set (EP-DE) which did not match the specific coding habits of the physicians).

A second observation was made in the case study on gastrointestinal syndrome in Austria (EMD-AT and EP-AT) data. For this data source a clear signal was identified on 14 February 2007 in EP data whereas no signal was seen in EMD data. This was mainly due to a less specific coding in EMD data which did not led to the detection of gastrointestinal syndrome. This observation underlines the importance to monitor different data sources parallel in order to have different pieces of information available.

Level of sensitivity compared to other health surveillance systems

The sensitivity was compared to different reference data sources during the case studies, e.g., absenteeism data, sentinel surveillance system resulting in sensitivity values of between 7.1 (EP-AT) and 75.0% (ED-ES) for weekly aggregated data. Sensitivity varied from 1.3% (EP-AT) to 41.4% (ED-ES) for daily aggregation. The assessment of sensitivity is varying for the chosen syndrome, detection algorithm and especially the reference data/surveillance system.

Ability to monitor changes during an outbreak (temporal, spatial)

The graphical visualisation and mapping tool incorporated in the SIDARTHa software allows the daily monitoring of changes in time and space.

Positive Predictive Value (PPV) and Negative Predictive Value (NPV)

The predictive values were determined within the simulation study. PPVs of about 40% were reached by C1, C2 and CUSUM on a one day event of simulated Poisson distributed respiratory syndrome (ED-ES) and by CUSUM on a simulated three day event of Poisson distributed intoxication syndrome on day +1 (ED-ES). NPVs of about 90% were detected by the simulations of one day and a three day event for all early detection algorithms (ED-ES).

Predictive values are different for the different syndromes, data sources and detection algorithms.

Proportion of health threats identified by SIDARTHa that are actual threats (sensitivity) and proportion of false alerts (specificity)

Sensitivity and specificity were assessed within the influenza case study and the simulation study.

The H1N1 case study provided heterogeneous results as to the sensitivity and other features of the SIDARTHa system. Further, the level of information provided by reference data sets varied substantially with some sources not providing detailed information to generate timelines and others not providing information on the threshold for the start of outbreaks.

The routine emergency care data sets were analyzed by the SIDARTHa system on a daily basis while the reference surveillance data was available in weekly intervals. Sensitivity and specificity was calculated for ILI signals by two approaches. The weekly approach flagged weeks as positively detected when at least one daily signal occurred in a calendar week in which the reference data exceeded the predefined threshold. The daily approach was more conservative, it was hypothesised that as soon as the reference data exceeded the predefined weekly threshold the SIDARTHa system should deliver seven signals, one for each weekday.

Sensitivity and specificity calculations were done by use of a contingency table. The sensitivity of the tested routine emergency care data sets ranged in the weekly approach between 7.1 (EP-AT) and 75.0% (ED-ES) while specificity was in a range between 76.3% (EMD-AT) and 100% (EP-BE, ED-ES). As assumed the sensitivity was less when using the daily approach. Sensitivity varied from 1.3% (EP-AT) to 41.4% (ED-ES) and specificity ranged from 95.8 (EMD-AT) to 100% (EP-BE, ED-ES). It must be added that the sensitivity for EP-AT data was an outlier: In the weekly approach the second lowest sensitivity was 50.0% (ED-BE) and for the daily approach it was 8.5% (EP-BE). The specificity was in every of the tested data sets higher than the sensitivity.

The finding that the SIDARTHa system provided a specificity that was higher than the sensitivity is reasonable because of the fact that ILI syndromes that are reported by emergency care data reflect the proportion of cases that are assumed to be the severe ones. Also, one might assume that the reference surveillance systems that were used within this case study allowed for the detection of milder forms of the ILI syndrome. Thus, the severity of a health threat can be concluded as one determining factor when the sensitivity of the SIDARTHa system is calculated with reference data sets (more severe cases occur less often than mild forms). The analysis also indicates that other factors have to be taken into account for the interpretation and evaluation of the sensitivity and specificity of the SIDARTHa system. Apart from the general characteristics of the health threat that is under surveillance, the quality of the reference data impacts the sensitivity calculations. For the influenza case study e.g. sick leave data due to acute respiratory infections and notified lab-confirmed influenza cases were used as references. Also, the reference data were weekly aggregated while emergency data were daily available, thus giving the wide range of sensitivity values when comparing the weekly and daily approach.

The influenza case study allowed for concluding that some of the emergency data sets where useful for the identification of the H1N1 influenza patterns in 2009 while others not. The use of ED or EMD data tended to better detect an increase of ILI cases than EP data. Time series analysis of the Austrian EMD and EP data for example correlated moderately with reference data from the major regional health insurance (EMD: $r=0.47$ ($p<0.001$), EP: $r=0.42$ ($p<0.05$). Higher coefficients were calculated for the time series analysis of ED data sets from the Spanish implementation sites when correlated with local reference data from a sentinel system ($r=0.75$ ($p<0.001$)).

Further, the sensitivity results indicate that the choice of the methodology for the detection of signals (EARS or CUSUM) influences the sensitivity of the system. In general CUSUM for normal or Poisson distributed data was the method of choice. The simulation study confirmed this result. The CUSUM algorithm showed in each scenario the highest sensitivity. Specificity didn't vary between the EARS or CUSUM approach.

Another point determining the sensitivity of the SIDARTHa system but not directly related to the system is the structure of the local health care systems and the general treatment seeking behaviour of the population that is under surveillance. Especially, the general decision of the population when and how to approach the emergency care services is crucial for the sensitivity of a surveillance system that is based on data from the emergency care field.

3.8 Timeliness

The timeliness of the SIDARTHa system in the sense of receiving earlier information on a health threat compared to other surveillance sources was assessed by the case studies of the volcanic ash cloud 2010 and the H1N1 influenza pandemic 2009.

Timeliness was approached in the volcanic ash cloud case study by the ability of the SIDARTHa system to contribute to the ad hoc surveillance of a health threat with an unclear impact on health. By the SIDARTHa approach information is made available for a situation in which routine health statistics are not able to deliver information.

The influenza case study 2009 tested the usefulness of different data sets from emergency care for the detection of ILI in contrast to reference data sets. SIDARTHa was able to report on ILI events earlier than other available surveillance systems. In the Spanish case the timeliness ranged from seven to ten days. However, the timeliness analysed in this case study is rather an estimation, since the analysis was done retrospectively and information on the latency period (reporting delay) of weekly reported reference systems during this period were not available.

The analysis of the timeliness of the SIDARTHa system on the one hand confirms the general ability of the system to early and timely detect events. The comparison of the performance of the SIDARTHa system with reference surveillance systems indicates that the SIDARTHa system at least for ILI / influenza surveillance might be an added value. However, it remains unclear for the other syndromes / health threats under surveillance how timely SIDARTHa performs. Timeliness differs depending on the syndrome, health threat/purpose, data source, detection algorithm, region, treatment seeking behaviour, and reference data.

Time intervals between different steps of SIDARTHa…

…between onset of a health threat event and reporting to SIDARTHa

Depending on the data sets that were examined timeliness was best in EMD-AT (1-5 days after onset) and ED-ES data (1-20 days after onset). A range is given since timeliness was assessed for different ILI outbreak periods during the second half of 2009. In ED-ES data the CUSUM algorithm needed 20 days until the first outbreak wave was detected, for the second wave it was detected already on the first day. The estimation of the timeliness can be judged optimistically since the analysis of the reference data is not available till the patient visited e.g. the GP, the GP diagnosed influenza (and confirmed the diagnosis by a lab test) and reported the case to the public health authority. For the 2009 influenza pandemic it is reasonable that emergency care data showed a delay in detecting ILI because most of the cases showed low level of severity and thus medical care was sought from e.g. general practitioners rather than from emergency care professionals.

The simulation study gave also some indications for the timeliness. 99.8% of the 13 days lasting simulated ILI outbreaks were detected on day 6.

Emergency data is as such timely in the process of a health event. It is a medical information source including located between the unspecific but earlier data sources of web searches and the most specific of laboratory confirmed diagnoses. Compared to other traditional surveillance systems such as sentinel GPs it is covering the more severe cases of an illness but is available throughout the year and covering a larger part of the population. In order to have information more severe cases early during a health event emergency data is a timely source. WP 5 showed that data collection is electronically available for one or all of the emergency data sources in most parts of Europe making it a timely and regularly available data source.

…between reporting to SIDARTHa and alert

The process of data reporting to SIDARTHa, data analysis and output generation (alert, graphs, maps) is automated and costs seconds. Although the data collection is working in real-time as soon as a case is closed by the emergency care provider, the SIDARTHa consortium decided to have a daily update in data reporting which provides enough timeliness for public health purposes.

The SIDARTHa system's output is accessible to selected stakeholders or the public (to be decided by the user) via the web-based interface which is a very easy way to disseminate results instantly and without additional effort. The automated or simple production of online reports from the SIDARTHa system to be sent for example by email to stakeholders is not yet available and would increase the timeliness of SIDARTHa even more.

Timeliness in this step of the SIDARTHa system is a big asset towards usefulness. As other evaluations show with semi-automated systems (collection automated, analysis and reporting manual), there will be no information during weekends or public holidays (Doroshenko et al. 2005). In the Spanish implementation, the seasonal influenza started over the Christmas period 2010 and an alert was issued by the SIDARTHa system alerting the emergency department and the public health authority in time to increase their resources.

…between alert and response/intervention by health sector or public health officials

It was not part of the SIDARTHa project to develop or monitor response strategies after the SIDARTHa system had issued an alert. Interpretation of the output of SIDARTHa and organisation of a response to an alert will need additional time. This part cannot be taken over by software but can only be done by astute public health professionals and clinicians. There are no experiences yet on this step of the SIDARTHa syndromic surveillance process.

3.9 Data quality

Number of false alarms

In the influenza case study the false detection rate was calculated[4]. The rate was 0% in EP-BE and ED-ES data and highest in EP-AT data (80.0%). A medium false detection rate was seen in EMD-AT data (40.0%) and ED-BE data (22.2%). These results underline the usefulness of ED and EMD data for influenza surveillance.

Data quality of reporting partners

At the end of the project the Spanish implementation site is the only one automatically reporting data to the SIDARTHa system. Here, the data quality is continuously good as the data collection is standardised, and electronically and automatically transferred into SIDARTHa.

Completeness of data

As it was seen within the descriptive historical data analysis all test sites were able to deliver almost complete data sets on SIDARTHa Standard Data Set variables (date/time, geographic reference, syndrome (underlying codes (AMPDS, ICD-10), age, gender, severity). Data contained more than 10% of missing values on gender (EMD-AT), age (EP-BE), zip-code (ED-AT), ICD-10 (EP-DE, ED-AT), chief complaint (ED-ES), severity (ED-AT, EP-BE, ED-BE, ED-ES).

As data collection and transfer to SIDARTHa is standardised, electronic and automatic completeness of data is continuously guaranteed. Jefferson et al. 2008 (5) showed that manual data collection hampers data quality.

Quality of data management within SIDARTHa

As this part is automated within SIDARTHa the quality of data management is continuously good. The automated process of analysis and reporting of results is a big asset towards continuous data quality.

Accuracy of detecting a certain health threat

The accuracy of detecting health threats depends on the data source and the syndrome. More details on this evaluation criterion were given in the validity section.

[4] The proportion of all signals which are not related to a pandemic period in the reference data.

Accuracy of details reported on specific health threats

The accuracy of the data is stable as the data collection is electronic and standardised and transfer to SIDARTHa is automated.

3.10 Representativeness

Level of reflection of characteristics of a health threat event by SIDARTHa

When developing a syndromic surveillance system based on routine emergency medical care data the boundaries of the system are set. The system is working with symptoms or working diagnoses at EP or ED level. The information on the "disease" is not validated by a lab test and is therefore less detailed or specific.

Furthermore, an emergency data-based syndromic surveillance system focuses on severe cases. Mild cases which consult a GP are not caught by the system. However, as it can be seen in the influenza case study or while monitoring a previously unknown, suddenly occurring health threat like the volcanic ash plume the system delivers a piece of information which is probably timelier (ILI case study) or which is not available from routine health statistics (volcanic ash plume) and is therefore a worth addition to routine surveillance information.

Compared to other syndromic surveillance systems which are for example based on web queries or GP consultations, an emergency medical care-based system is in between these data sources regarding the level of characterisation of the health threat or has distinct advantages. The specificity of health information is better compared to web queries. Furthermore, background data (e.g. on age, gender) are available which enables the determination of specificially affected sub-groups. Compared to syndromic surveillance based on GP data SIDARTHa covers information of severe cases which are probably not seen by a GP.

Level of representativeness of general population by SIDARTHa's data sources

Representativeness was also a topic raised by public health representatives during the Open Conference. Though emergency data covers a unique service area it seldom is complying with administrative boundaries for which statistical or other surveillance data is available. Further, emergency data basically represents severe cases and therefore, SIDARTHa could not be used for surveillance of mild disease symptoms. This is an inherent limitation of the system hindering acceptance.

On the other hand are routine surveillance systems not able to display fully the occurrence of severe cases. An emergency data-based syndromic surveillance system could deliver this piece of additional information in terms that an estimation of e.g. severe influenza cases.

Level of details in information reported

A certain level of detail is defined in the SIDARTHa Standard Data Set providing information on age, gender, severity, and location. The SIDARTHa system offers further details on case information depending on the data transferred to SIDARTHa which is chosen by the user, e.g., free-text description on case history or treatment by call taker/emergency physicians/paramedics/nurse.

The SIDARTHa system provides information if the alert level is reached for a certain syndrome and detection algorithm, a graphic representation of the development of a syndrome over time with the option to choose different time periods and reference data (e.g., same period last year) with the option to filter by other information, e.g., age, gender, severity. Further, a geographic representation of cases is possible.

4 Synthesis: Strengths, Weaknesses, Opportunities, Threats of SIDARTHa

In order to synthesise the evaluation results an overview by strengths, weaknesses, opportunities, threats was chosen (for a overview cf. Figure 3). As the SIDARTHa system did not run long and fully only in one implementation site strengths and weaknesses refer to issues that will not change and opportunities and threats concern those issues regarded as changeable in the near future.

Indicator	Strength	Weakness	Opportunity	Threat
Acceptability	✓		✓	✓
Stability				✓
Costs	✓		✓	
Simplicity				✓
Flexibility	✓			
Validity			✓	
Timeliness	✓			
Data Quality	✓		✓	
Representativeness		✓		

Figure 3: Synthesis of SIDARTHa's outcome evaluation: strengths, weaknesses, opportunites, threats by evaluation indicator

4.1 Strengths

Timeliness

- Emergency data available in real-time
- Automated analysis and online reporting software

Data quality

- Electronic, standardized data collection in emergency care (common data elements across Europe)

Flexibility

- SIDARTHa approach takes different contexts across Europe into account and can be applied across Europe following minimum standards
- New syndromes can be easily generated and syndromes can be easily adjusted in the SIDARTHa software by users to local/regional circumstances or other health problems
- SIDARTHa software (alert thresholds, output) can be flexibly adjusted to user requirements

Acceptability

- Web-based reporting and interactive data analysis supports acceptance of users in different contexts
- SIDARTHa approach takes different contexts across Europe into account and can be applied across Europe following minimum standards
- Uses routinely collected data and automated system minimizing workload to implementation
- SIDARTHa uses anonymised data and data does not have to leave the data providing institution (as SIDARTHa software is installed there)

Costs

- SIDARTHa software is available free-of-charge

4.2 Weaknesses

Representativeness

- No clear population is represented by emergency data (service areas do not necessarily correlate with administrative boundaries)
- Emergency data does not reflect the full disease spectrum in a population

4.3 Opportunities

Validity (Sensitivity, Specificity)

- Case studies and simulations suggest that SIDARTHa has good sensitivity, specificity or validity but the support for this depends on location context, syndrome, data source, algorithm, area of application/objective/health threat, and reference data)
- Application of different detection algorithms and data sources in one locality in parallel allowing for comparative surveillance in one locality (cross-checking) support the validity of the SIDARTHa system as a whole
- Newly incorporated, more specific items for data collection derive out of collaboration of emergency care and public health in syndromic surveillance

Data quality

- Emergency data offer utility for development of further syndromes, covering various communicable and non-communicable health threats, and long-term monitoring of major chronic diseases in the population (data is collected in a standardized way)

Acceptability

- SIDARTHa conceptualized by emergeny medical professionals fosters acceptability among emergency professionals
- Use of syndromic surveillance for management in emergency medical services

Costs

- costs for implementing the system (workload) cannot be evaluated at this point in time due to limited information
- SIDARTHa can is cost-effectiveas costs mainly apply at implementation, afterwards (if the system is stable), costs (in terms of workload) are limited

4.4 Threats

Simplicity

- Software is currently not user-friendly and not simple to use which threatens the usefulness of SIDARTHa

Stability

- Software currently has take-outs, malfunctions and bugs threatening the usefulness of SIDARTHa
- Periodic changes in data collection in emergency services might lead to necessary changes in syndrome definition or threatens the application of certain detection algorithms which need longer periods of historical data
- Maintenance of SIDARTHa software (i.e., service, trouble shooting, updates) is not defined yet

Acceptability

- Partnership between emergency care and public health in SIDARTHa implementation sites is currently very weak – without good practice and reference implementations SIDARTHa's acceptability among both emergency care and public health is threatened
- Until now no response procedures after SIDARTHa issues an alert are defined or applied which limits the incorporation of SIDARTHa into the existing surveillance fabric in the implementation sites
- Data preparation before first use (i.e., application of statistical tests) might threaten implementation as necessary expertise is not represented in emergency institutions

5 Recommendations for the Future

The SIDARTHa International Scientific Advisory Board especially acknowledges the value of the SIDARTHa approach for:

- Being based on international state-of-the-art research and practice in the field of syndromic surveillance and further developing the state-of-the-art by developing a Europe-wide applicable syndromic surveillance approach;
- Respecting the diversity between and within EU member states by its flexible and broad concept that allows its utilisation at various regional levels, for several health threats/problems, with different technical/infrastructural levels of emergency medical data collection, and different components and formats of routine emergency medical data sets;
- Supporting the evidence for the utility of routine emergency medical data in Europe for public health purposes;
- Having the potential to enhance generic preparedness of the emergency care sector for health threats and the intersectoral collaboration of the emergency care and public health sectors;
- Having the potential to enhance generic preparedness of EU member states for health threats in support of the achievement of the International Health Regulations.

Based on the outcome evaluation of the SIDARTHa approach and system, the SIDARTHa International Scientific Advisory Board recommends the following future actions to enhance the usefulness, acceptance and distribution of SIDARTHa (sorted by relevance):

1) Full implementation of the SIDARTHa software in all implementation sites and at further SIDARTHa consortium partners, and later in further regions across Europe;

2) Publication of the SIDARTHa project results in international peer-reviewed journals;

3) Online publication of the SIDARTHa deliverables with public access;

4) Further development of user friendliness, simplicity and stability of the SIDARTHa software and ease of its implementation process;

5) Implementation of spatial and spatial-temporal detection algorithms and improvement of geographic representation of results in SIDARTHa software;

6) Implementation of standardised report generation and automatic alerting and reporting functions in the SIDARTHa software;

7) Strengthening the integration of SIDARTHa in existing local/regional surveillance systems in the implementation sites and linking SIDARTHa at the European level to other activities and systems such as ECDC's The European Surveillance System (TESSy) and/or the European Commission's Medical Intelligence System (MedISys);

8) Exchanging the vast knowledge on conceptualising, implementing and evaluating a syndromic surveillance system/approach in different European countries with other parties experienced in syndromic surveillance or interested to setup syndromic surveillance systems;

9) Prospective evaluation of SIDARTHa at implementation sites, and later long-term evaluation

10) Development of a concept/framework for response plans for SIDARTHa implementation sites (what happens after SIDARTHa issues an alert);

11) Development of guidelines/hand-books how to adjust SIDARTHa to local circumstances, especially preparatory analyses (e.g., identifying data trends), finding optimal alert thresholds, and how to interpret output of the SIDARTHa software;

12) Implementing measures to strengthen the collaboration between emergency care services and public health authorities in implementation sites, by for example:

   a. incorporation of emergency care services in established public health communication procedures,

   b. incorporation of SIDARTHa results into established public health surveillance procedures,

   c. setup of joint response plans during health events applying SIDARTHa,

   d. regular joint teleconferences or meetings to exchange information on SIDARTHa use and further development,

   e. joint studies and trainings;

13) Studies to assess validity/sensitivity/specificity and cost-effectiveness of SIDARTHa (by location, area of application/objective/health threat, syndrome, detection algorithm, data source and compared to different reference data sets);

14) Studies to explore the utility of SIDARTHa approach/system for other areas of application, especially

   a. cross-border syndromic surveillance between regions in the same country;

   b. cross-border syndromic surveillance between countries,

   c. applicability in low-/middle income settings (e.g., East Europe, developing settings),

   d. using emergency data as source of information for regular health monitoring (e.g., chronic conditions such as cardio-vascular, cerebro-vascular or respiratory diseases and injuries);

15) Solutions for maintaining SIDARTHa in the implementation sites and for the SIDARTHa software (including updates, maintenance and trouble-shooting service) including funding;

16) Institutionalisation of SIDARTHa scientific/technical support and network (e.g., in an international society or non-profit organisation).

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Appendix

Appendix 1 Data sources used for assessment of different evaluation indicators

	Information Source					
Indicator	**Project Workshops, Technical Workshops**	**Open Conference survey**	**Impl. Site Survey/ Visits**	**Case Studies**	**Simulations**	**Short Survey**
Usefulness						
SIDARTHa is able to detect temporal and spatial clusters of health threats of public importance and is detecting health event threats early in the course of an event enabling rapid intervention;			x	x	x	
SIDARTHa is able to detect health threats earlier than existing surveillance systems.			x	x	x	
Acceptability						
Maintenance and level of utilisation after project time;			x			
no. of reporting partners and users during and after project time;			x			
no. of linkages to existing surveillance systems;			x			
transfer of SIDARTHa into other contexts or extension to cover additional health threats	x	x	x			x
importance of SIDARTHa's reports for public health		x				x
flexibility to respond to specific user enquiries	x		x	x		
responsiveness of SIDARTHa to suggestions and comments	x		x	x		
ease and cost of data reporting			x			
timeliness of reporting			x	x		
level of assurance of privacy and confidentiality			x	x		
level of representativeness (i.e., coverage of population, no. of threats)				x		
Stability						
Ability to collect, manage and provide data properly without failure;			x			
ability to adapt to changes (i.e., new coding);			x	x		
ability of SIDARTHa to be operational when necessary;			x			
no. of unscheduled outages and down times of the server;			x			
amount of costs involved in repair of SIDARTHa;			x			
percentage of time that SIDARTHa is fully operating;			x			
difference between desired and actual amount of time required for SIDARTHa to manage and release data			x			
Costs						
Amount of costs (financial and non-financial, i.e., anxiety raised by false alarms, morbidity/mortality related to missing or late response)			x			
for system implementation and operation,			x			
for responding to system alarms and follow-up activities (i.e., diagnosis, community interventions),			x			
for responding to false alarms,			x			
for missing outbreaks or late recognition;						
costs occurring for running SIDARTHa compared to other surveillance systems;			x			
reduction of costs throughout SIDARTHa's operation through lessons learned of earlier events						
Simplicity						
Level of integration with existing surveillance systems;			x			
time and resources spent to collect, transfer, analyse data, maintain and update the system and disseminate reports/alerts;			x			
staff training requirements;			x			
easily applicable case definitions and indicator rationales;	x	x	x	x		
interface that is easy to understand and easy to use	x	x	x			

	Information Source					
Indicator	**Project Workshops, Technical Workshops**	**Open Conference survey**	**Impl. Site Survey/ Visits**	**Case Studies**	**Simulations**	**Short Survey**
Flexibility						
Easy integration in existing surveillance systems;	x					
easy integration in new regions	x			x		
easy adaptation of SIDARTHa to new case definitions/rationales and additional or new data sources and incorporation of other information technology	x			x		
dependence on funding			x			
dependence on reporting sources				x	x	
flexibility of SIDARTHa to respond to specific user enquiries (local vs. European perspective, comparison of regions, different ways of reporting/dissemination)	x		x			
Validity (Sensitivity, Specificity)						
Proportion of cases of a health threat reported to SIDARTHa until a threat is detected				x	x	
ability to detect outbreaks				x	x	
timeliness of reporting after onset of threat				x		
ability to detect temporal and spatial or spatial-temporal clusters of a health threat				x	x	
level of detail of information reported				x		
sensitivity of one item of SIDARTHa (i.e., specific case definition/rationale, specific data source or combination of the data sources)				x	x	
level of sensitivity compared to other health surveillance systems				x		
ability to monitor changes during an outbreak (temporal, spatial)				x	x	
Predictive Value Positive (PVP)				x	x	
Predictive Value Negative (PVN)				x	x	
proportion of false alerts			x	x		
proportion of health threats identified by SIDARTHa that are actual threats				x	x	
Timeliness						
Time intervals between different steps of SIDARTHa						
between onset of a health threat event and reporting to SIDARTHa				x		
between reporting to SIDARTHa and alert			x			
between alert and response/intervention by health sector or public health officials			x			
Data quality						
Number of false alarms				x		
data quality of reporting partners			x	x		
completeness of data			x	x		
quality of data management within SIDARTHa			x			
accuracy of detecting a certain health threat				x	x	
accuracy of details reported on specific health				x		
Representativeness						
Level of reflection of characteristics of a health threat event by SIDARTHa				x		
level of representativeness of general population by SIDARTHa's data sources			x			
level of details in information reported				x		

Appendix 2 Project Consortium Survey

WP3 – Evaluation of SIDARTHa; A. Krämer & P. Pinheiro, University of Bielefeld, Germany

SIDARTHa Evaluation Form – Implementation Phase, as of Nov. 2010

Dear colleagues,
To evaluate the second phase of the SIDARTHa project, we would like to integrate your impressions of the project's activities during the last months. We therefore kindly ask you to complete the form as indicated below. Many thanks for your cooperation.

To which stakeholder group do you belong?

- O Emergency Medical System (including dispatch centre) - EMS
- O Emergency Department - ED
- O Health Authority

A: SIDARTHa in general: Information on and involvement in the project

Please mark a number from 1 (=very poor; very little) to 5 (=very well; very much), or n/a (= not applicable)

	1	2	3	4	5		n/a
I feel informed about the overall and specific objectives of the project.	O	O	O	O	O		O
I feel informed about the background of the project.	O	O	O	O	O		O
I am familiar with the project's workflow (milestones, tasks, and deliverables).	O	O	O	O	O		O
I am familiar with the project's responsibilities (overall, work packages) and their distribution among the team members.	O	O	O	O	O		O
I feel involved in the different tasks of the project.	O	O	O	O	O		O

Additional Comments:

____

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____

B: SIDARTHa in particular: Your responsibilities and tasks

Please mark a number from 1 (=very poor; very little) to 5 (=very well; very much), or n/a (= not applicable)

	1	2	3	4	5		n/a
I am aware of my responsibilities and the tasks involved.	O	O	O	O	O		O
I am (or was) able to accomplish the tasks for which I am (or was) responsible.	O	O	O	O	O		O
To accomplish the tasks, I feel (or felt) qualified as to:							
My personal and my staff's professional qualification.	O	O	O	O	O		O
The human resources of the institution I am working in.	O	O	O	O	O		O
The technical resources of the institution I am working in.	O	O	O	O	O		O
I feel (or felt) instructed about how to fulfil my tasks.	O	O	O	O	O		O
The workload of my tasks is (or was) balanced with the human and financial resources available.	O	O	O	O	O		O

1

WP3 – Evaluation of SIDARTHa; A. Krämer & P. Pinheiro, University of Bielefeld, Germany

Additional Comments:

C: Coordination of the project and dissemination of information

Please mark a number from 1 (=very poor; very little) to 5 (=very well; very much), or n/a (= not applicable)

	1	2	3	4	5		n/a
Do you feel updated about the project's ongoing development?	O	O	O	O	O		O
How do you rate the flow of information during the last months?	O	O	O	O	O		O
How do you rate the quality of disseminated information?	O	O	O	O	O		O
How helpful has the disseminated information been to accomplish your tasks?	O	O	O	O	O		O

Additional Comments:

	1	2	3	4	5		n/a
How do you rate the impact of the following tools on the development of the SIDARTHa project:							
The website	O	O	O	O	O		O
The e-collaboration platform	O	O	O	O	O		O
The homework phases	O	O	O	O	O		O
The meetings and workshops	O	O	O	O	O		O

	1	2	3	4	5		n/a
How useful have the following tools been for you to accomplish your tasks:							
The website	O	O	O	O	O		O
The e-collaboration platform	O	O	O	O	O		O
The homework phases	O	O	O	O	O		O
The meetings and workshops	O	O	O	O	O		O

Additional Comments:

2

	1	2	3	4	5		n/a
How do you rate the management of the project in general?	O	O	O	O	O		O
How do you rate the effectiveness of the work that has so far been done by the following groups on the project's progress:							
The technical and scientific coordination	O	O	O	O	O		O
The steering committee and advisory board	O	O	O	O	O		O
The country consortia	O	O	O	O	O		O

Additional Comments:

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D: General information

How do you rate the general importance of the project and its anticipated outcomes?

Please mark a number from 1 (=not important) to 5 (=very important), or n/a (= not applicable)

	1	2	3	4	5		n/a
Importance for the scientific community	O	O	O	O	O		O
Importance for decision- or policy-making processes	O	O	O	O	O		O

Has your rating changed since the beginning of the project?

O no.

O yes, more important than before.

O yes, less important than before.

How do you rate your SIDARTHa satisfaction?

Please mark a number from 1 (=not satisfied) to 5 (=very satisfied), or n/a (= not applicable)

	1	2	3	4	5		n/a
Satisfaction with the project's management	O	O	O	O	O		O
Satisfaction with the project's outcomes	O	O	O	O	O		O
Satisfaction with my contribution to the project	O	O	O	O	O		O
Overall SIDARTHa satisfaction	O	O	O	O	O		O

Additional Comments and Suggestions:

____

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____

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Appendix 3 Open Conference Survey

SIDARTHa Questionnaire

Use of SIDARTHa – The Public Health perspective

SIDARTHa (**S**ystem for **I**nformation on, **D**etection and **A**nalysis of **R**isks and **T**hreats to **Hea**lth) is a European Commission co-funded project that aims at establishing a syndromic surveillance system in Europe by use of routine emergency care data. Currently, the SIDARTHa project is running the implementation phase. A SIDARTHa pilot is being tested and evaluated in four test sites across Europe. Assessing the Public Health perspective on syndromic surveillance in general and on SIDARTHa in particular is of major relevance to comprehensively evaluate the project's activities and achievements related to the conceptualisation and implementation of the SIDARTHa system.
We, therefore, kindly ask for your support and for answers on a few questions. We highly appreciate your comments and ask for information as detailed as possible. This will help us to build up the evidence on the project's usefulness and to adapt the SIDARTHa system to the requirements of the user group from Public Health.

A: General questions

The health authority you are working in is responsible for which region?

What is the population size that is covered by your health authority?

What is your main job in the health authority you are working in?

B: Syndromic surveillance

Have you ever used syndromic surveillance, occasionally or routinely? If yes, what were the health threats under surveillance and what data was used? If no, have you ever considered or discussed the use of syndromic surveillance systems?

Is the health authority you are working in currently using a syndromic surveillance system?

SIDARTHa questionnaire – Public Health perspective

Which health threats are in general qualified from your point of view for surveillance by use of syndromic approaches?

From your point of view, which requirements should be met in order to qualify a syndromic surveillance system for supplementing established surveillance systems?

Are there any specific health threats in your region that you consider to be candidates for syndromic surveillance systems?

C: SIDARTHa system

The SIDARTHa surveillance system is based on routine data from emergency care. What are the potential and limitations when using this source of information for surveillance?

The SIDARTHa project has been able to identify six syndromes that are qualified for a European syndromic surveillance approach based on emergency care data. The syndromes include influenza-like-illness, gastrointestinal syndrome, intoxication syndrome, environmental syndrome, respiratory distress, and unspecific syndrome (volume of cases). How would you estimate the added value of these syndromes for Public Health surveillance?

SIDARTHa questionnaire – Public Health perspective

The SIDARTHa pilot system was used for two case studies on the H1N1 pandemic influenza 2009 and the volcanic ash cloud 2010. In case that you are aware of the results from these analyses, how would you rate the value of the case studies for Public Health surveillance?

Do you consider the SIDARTHa approach to be qualified for routine surveillance? Why?

What information on the quality of the SIDARTHa system do you consider the most relevant when deciding about the integration of SIDARTHa into the running surveillance systems?

What are the questions that you would like to have answered at the end of the SIDARTHa pilot?

Are there any specifications or adjustments for the population under surveillance in your region that should additionally be covered by the SIDARTHa system?

Thank you for your support,
The SIDARTHA project group

Appendix 4 Implementation Site Survey

Implementation and use of the SIDARTHa syndrome surveillance system - Test Site Questionnaire

Dear colleagues,

To evaluate the performance of the SIDARTHa system after the implementation phase, we would like to assess the outcome of the project's activities in the four test sites. We therefore kindly ask you to complete the form as indicated below. Many thanks for your cooperation.

Implementation site:

____

Technical implementation of the SIDARTHa system

1: The SIDARTHa system has successfully been installed.

- O Yes
- O No, not yet

If no, please specify.

---

2. The SIDARTHa system has been running…

- O without any problems
- O with some problems (e.g. fall downs) that were manageable
- O with serious problems, i.e. difficult to manage or even not manageable

If there were any problems, please specify.

3. Emergency care data is routinely entered into and organized in a data base and can be generated from the data base for the SIDARTHa system.

O Yes

O No, not yet

If yes, data entry usually occurs

O on a daily basis

O on a weekly basis

O other: ________________

If no, please specify.

4. Historical emergency care data has been analysed for the purposes of the SIDARTHa project.

O Yes

O No, not yet

If no, please specify.

5. The SIDARTHa system has successfully been linked with the routine data collection systems.

O Yes, without any limitations

O Yes, with some limitations

O No, not yet

If no or with limitations, please specify

6. The SIDARTHa system is able to automatically generate syndromes from the routine data systems.

O Yes

O No, not yet

If yes, please indicate the syndromes that are currently under SIDARTHa's surveillance.

If no, please specify.

7. The Coding Manual has been used to translate the routine emergency data into to the SIDARTHa syndromes.

O Yes

O No

If yes, how helpful was the Coding Manual to create the SIDARTHa syndromes?

O Very helpful

O Fairly helpful

O Slightly helpful

O No help at all

If the coding manual was of limited use, please specify the main limitations.

8. The SIDARTHa system is able to produce alerts when incident numbers exceed an expected threshold.

- O Yes
- O No, not yet

If yes, alerts are reported…

- O actively (e.g. as pop-up window, via E-Mail or SMS)
- O passively (e.g. when SIDARTHa system is started by user)

If yes, please indicate the syndromes for which alerts can be generated.

9. The SIDARTHa system is able to automatically generate reports or summaries.

- O Yes
- O No, not yet

If yes, reports/summaries are generated…

- O daily
- O weekly
- O monthly
- O by request

10. The SIDARTHa system has been integrated into routine surveillance systems of the local/regional health authorities

- O Yes
- O No, not yet

Use of the SIDARTHa system

11. The SIDARTHa system has been used during the implementation phase...

- O for scientific purposes (e.g. SIDARTHa or other projects)
- O for case studies
- O for resource planning in emergency care
- O for routine surveillance
- O to validate alerts from other surveillance systems
- O to validate own alerts by other surveillance systems
- O for other purposes

Please specify your answers.

12. Emergency care data has been analysed by use of the SIDARTHa system

O on a daily basis

O on a weekly basis

O by request

13. The SIDARTHa system has been used for the surveillance of health threats.

O Yes, routinely

O Yes, occasionally

O No, not yet

If yes, please indicate the health threats that are/were under surveillance.

14. The SIDARTHa system has helped to detect health threats of importance during the implementation phase.

O Yes

O No

O There were no health threats during the implementation phase

If no, please specify.

If yes, please specify the health threats.

15. SIDARTHa has been able to detect health threats earlier than existing surveillance systems.

O Yes

O No

If yes, please give some information about the timeliness.

16. Have results from the SIDARTHa system been shared with public health authorities?

O Yes

O No, not yet

Please specify the communication channels between your institution and your health authorities.

17. Have results from the SIDARTHa surveillance system been involved in decision-making processes?

O Yes

O No, not yet

If yes, please specify.

18. How useful do you rate in general the SIDARTHa system for the detection of health threats as it is right now in your test site?

Please mark a number from 1 (=no use at all) to 5 (very useful)

1	2	3	4	5
O	O	O	O	O

19. How useful do you rate the SIDARTHa system for the detection of health threats in case that it is fully running?

Please mark a number from 1 (=no use at all) to 5 (very useful)

1	2	3	4	5
O	O	O	O	O

Thank you very much for your cooperation!

Date ______________ Signature ______________