

Paula Oja

SIGNIFICANCE OF CUSTOMER FEEDBACK

*AN ANALYSIS OF CUSTOMER FEEDBACK DATA
IN A UNIVERSITY HOSPITAL LABORATORY*

FACULTY OF MEDICINE,
INSTITUTE OF HEALTH SCIENCES, HEALTH ADMINISTRATION,
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**SIGNIFICANCE OF CUSTOMER
FEEDBACK**

An analysis of customer feedback data
in a university hospital laboratory

Academic dissertation to be presented with the
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Abstract

The aim of the study was to evaluate the usefulness of customer satisfaction surveys and spontaneous customer feedback procedure in a university hospital laboratory. Questionnaires containing closed-ended statements and an open-ended question were used in the customer satisfaction surveys targeted at the clinical units of the university hospital and regional health centres. Customer feedback documents including the subject matters of the reports, the investigations carried out and the actions taken were analysed using qualitative content analysis. The highest dissatisfaction rates in the clinical units were recorded for computerised test requesting and reporting, turnaround times of tests, missing test results and the schedule of phlebotomy rounds. In addition, additional instructions were needed. The most common causes of dissatisfaction among regional health centres were related to electronic data transfer of laboratory test requests and reports between health centres and the university hospital laboratory, need of additional instructions for handling of samples and preparation patients for laboratory tests, problems with decentralised phlebotomy services to hospital outpatients, and unawareness of the schedule of some less common laboratory tests. Further clarifications with selected customers were needed to specify the causes of dissatisfaction. Erroneous, delayed and lacking test results were the most common errors or defects revealed in the investigations of the spontaneous customer feedback reports from both the clinical units and the external customers. The most common underlying causes of errors were unintended errors and non-compliance with operating instructions. Systematic errors were found in one-sixth of the cases. Corrective actions were carried out in three-fourths of the cases. Satisfaction survey can be used as a screening tool to identify topics of dissatisfaction. However, further clarifications are often needed to find out the customer-specific causes of dissatisfaction and to undertake targeted corrective actions. Every reported case of customer feedback should be investigated to find out possible errors and their underlying causes so that appropriate corrective actions can be taken.

Keywords: complaints, customer feedback, laboratory errors, laboratory services, quality improvement, satisfaction survey

To my mother

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I have needed my supervisors’ lessons to unlearn erroneous impressions of research reporting: a) write what the results of previous studies were, do not primarily write what has been studied earlier, b) in the Methods section, write what was done in this study and do not write a new methodology book, c) discuss your own results taking into account other studies, and do not repeat your results as such or review the literature in the Discussion section, d) refer to essential research papers but do not think that other researchers use a measuring stick to measure your reference list when deciding whether your research report is worth reading.

I attended courses of health administration science while studying for Master’s degree in Health Sciences. I became interested in areas such as quality improvement and performance measurement. My Master’s thesis was about total quality management. I retained my interest in these topics, and the theme of the present thesis appeared as a natural continuum to my earlier studies. I am grateful to Professor Juhani Nikkilä for accepting me as a postgraduate student in Health Administration and his interest towards my research work.

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Oulu, 15th of June 2010

Paula Oja

List of original publications

This thesis is based on the following articles, which are referred to in the text as articles I-IV.

- I Oja PI, Kouri TT & Pakarinen AJ (2006) From customer satisfaction survey to corrective actions in laboratory services in a university hospital. *Int J Qual Health Care* 18: 422–428.
- II Oja PI, Kouri TT & Pakarinen AJ (2009) Utilisation of customer feedback in a university hospital laboratory. *Accred Qual Assur* 14: 193–197.
- III Oja P, Kouri T & Pakarinen A (2010) Health centres' view of the services provided by a university hospital laboratory: Use of satisfaction surveys. *Scand J Prim Health Care* 28: 24–28.
- IV Oja PI, Kouri TT & Pakarinen AJ (2010) Reacting to spontaneous feedback from external customers in a university hospital laboratory. *Accred Qual Assur* 15: 415–420.

In addition, some unpublished results are presented in this thesis.

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1 Introduction

Customer perceptions are considered important in different sectors of manufacturing industry, trade and service, including health care services (Blumenthal 1996, Berry & Parasuraman 1997, Edgman-Levitan 2008: 197–199). There are several ways to obtain customers' view on services, such as overall and focused satisfaction surveys, focus group interviews and customer complaints. Organisations are advised to use various methods to collect this information. (Berry & Parasuraman 1997, Ford *et al.* 1997, Garver 2001.)

Customer satisfaction survey is a widely used method in health care organisations (Cohen *et al.* 2008, Lombarts *et al.* 2009). However, it seems that customer satisfaction surveys have not resulted in quality improvement (Cleary 1999, Coulter 2006); this may be because the results of satisfaction surveys are only sparsely used systematically (Sluijs *et al.* 2001, Sumanen *et al.* 2007). Poorly defined aims (Evans *et al.* 2007), lack of specificity of questions (Reeves & Seccombe 2008), insufficient dissemination of results (Audet *et al.* 2005, Boyer *et al.* 2006) or difficulties in interpreting results (Wensing *et al.* 2003, Davies & Cleary 2005) have made it difficult to proceed to improvement actions. In addition, health care professionals may be sceptical towards the validity of results of customer satisfaction surveys (Tregunno *et al.* 2004, Davies & Cleary 2005).

Many health care organisations routinely collect and analyse customer complaints (Morgan *et al.* 2005, Lombarts *et al.* 2009). The features of a good complaint handling process have been described to support their use in quality improvement (Bendall-Lyon & Powers 2001, Johnston & Mehra 2002, Homburg & Fürst 2005). However, as evaluated by customers (Tax *et al.* 1998, Jones *et al.* 2006a, Friele *et al.* 2008), as admitted by organisations themselves (Morgan *et al.* 2005, Hsieh *et al.* 2005) and as explained by defensive behaviour on the part of organisations towards complaints (Homburg & Fürst 2007), it seems that customer complaints are not efficiently utilised for quality improvement.

Laboratory quality standards, such as EN ISO/IEC 17025 (2005: 23) and EN ISO 15189 (2007: 27), support the use of customers' perspective for service improvement. As an accredited laboratory, the laboratory of Oulu University Hospital has included customer satisfaction surveys and spontaneous customer feedback procedure in its quality system. The aim of this study was to evaluate the usefulness of these tools by analysing the data obtained from customer satisfaction surveys and spontaneous customer feedback to the laboratory.

2 Review of literature

2.1 Concept of quality

In the 1920s, Shewhart (1931: 53–54) defined that the quality of a thing or a product has two aspects: subjective and objective. *“For example, we are dealing with the subjective concept of quality when we attempt to measure the goodness of a thing, for it is impossible to think of a thing as having goodness independent of some human want.”* The objective aspect of quality means that an objective reality of a thing or a product is independent of the existence of man. Shewhart, a physicist and a statistician, developed statistical methods to control variation in production processes.

Some physicists and engineers, such as Deming and Juran, who had adopted Shewhart’s statistical methods, taught these methods for the manufacturing industry. In addition to statistical techniques, they paid attention to managers’ role. Deming (1982: 23–24, 88–89) emphasised that top managers have an important role in quality improvement. He applied Shewhart’s principles in quality improvement using the model called the Plan-Do-Check-Act cycle. Juran (1964: 2–4, 9, 12–14, 37–38) emphasised that top managers have to set the company’s policy and goals for quality improvement, instead of just controlling adherence to standards. Feigenbaum (1961: 12–17) suggested that a total view for quality is needed, meaning that a quality approach should be included in all functions of a company, not just in the production line, to enable producing a product or service that satisfies customers. He called this approach total quality control. The comprehensive approaches for quality were later named “total quality management” or “continuous quality improvement” (Juran & Gryna 1993: 12, 40).

There is no unambiguous definition for quality. The term is defined differently for products and services, for different industries, and for different levels of dimensionality. However, it is a widely accepted view that the main reason to pursue quality is to satisfy customers. (Evans & Dean 2000: 9, Wicks & Roethlein 2009.) EN ISO 9000 (2005: 23) defines quality as *“degree to which a set of inherent characteristics fulfils requirements”*. The term “quality” is not defined in the EFQM Excellence Model (European Foundation for Quality Management 1999, EFQM 2009: 28–30, Gemoets 2009). Laboratory quality standards such as EN ISO/IEC 17025 (2005: 15) and EN ISO 15189 (2007: 11)

refer to the EN ISO 9000 standard concerning the general definitions related to quality.

2.2 Quality in health care

The Institute of Medicine, United States, (2001: 39–54) has stated the aims for improvement in health care as six dimensions. Health care should be safe, effective, patient-centred, timely, efficient and equitable.

2.2.1 Early decades of quality assessment in health care

In 1917, the American College of Surgeons established the Hospital Standardization Program in the United States (Roberts *et al.* 1987). The College defined the factors that were considered to be essential for proper care and treatment of patients at any hospital. These factors, e.g. competence of doctors, content of the case records of patients, adequate clinical and pathological laboratory facilities, were named the Minimum Standard. The College assessed whether the Minimum Standard was met when voluntarily participating hospitals requested this evaluation. When a hospital was able to demonstrate compliance with the Standard, it was approved as providing quality care. Thus, an accreditation process of health care organisations had been created. These activities expanded and new standards were developed. Since 1953, these activities were continued by the Joint Commission on Accreditation of Hospitals.

Since the 1960s, Donabedian (1968, 1980: 80–85, 1988) developed the assessment of quality in health care. He proposed that the so-called “structure-process-outcome” framework could be useable for quality assessment in health care. He named characteristics, such as adequacy of facilities and equipment and qualifications of personnel, within which the medical care process takes place as “structure”. The “process” refers to the elements of the medical care process itself. Patient’s health status as a result of medical care forms the “outcome” component of quality assessment. He also pointed out that patient satisfaction is one of the desired outcomes of care (Donabedian 1980: 36–48, 71–73). This way different indicators of quality could be organised in a coherent way and quality assessment could be managed as a whole.

2.2.2 Introducing continuous quality improvement in health care

By the end of the 1980s, the limitations of the traditional approaches to quality in health care had become obvious. The traditional way of thinking about quality of health care did not seem to recognize the fact that, besides patients, health care organisations should also meet the needs of other customers, such as referring physicians, patients' families, managers of health care organisations, payers and society, even though priority must be given to patients' needs. Traditional approaches to quality emphasised the performance of individual physicians, but underestimated the influence of other steps of the work process. It was also seen that conventional approaches to quality were too static, because the main goal was to fulfil the requirements of standards, while attention was not paid to continuous improvement. (Berwick 1989, Laffel & Blumenthal 1989.)

It was suggested that the Continuous Quality Improvement or Total Quality Management programmes, which were used in manufacturing industry, could be implemented in health care organisations at local settings. It was argued that by applying the basic principles of these programmes – continuous improvement, customer focus, evaluation and improvement of work processes, strong leadership and teamwork – it would be possible to improve quality as a whole, and especially to meet the needs of customers as experienced in industry. (Berwick 1989, Laffel and Blumenthal 1989, Berwick *et al.* 1992a,b.)

The principles of continuous quality improvement or total quality management were included in the European Foundation for Quality Management EFQM quality management model in 1993 (Nabitz *et al.* 2000) and in the standards of the Joint Commission on Accreditation of Healthcare Organizations in 1994–1995 (Schyve 2000). The ISO 9000 standards for quality systems moved closer to the above-mentioned external quality evaluation approaches in respect to continuous improvement when these standards were revised in 2000 (Shaw 2000). Thus, the idea of continuous improvement was common for all these main quality evaluation approaches applied in health care.

2.2.3 Patient safety broadens the frame of quality

In spite of the growing interest in quality in health care and the increasing number of malpractice claims against physicians, there had been little research interest in errors. In the 1990s, research interest in errors and adverse events in health care was increasing. (Brennan *et al.* 1991, Leape *et al.* 1991.) A review of 30,000

medical records of hospital patients in the state of New York showed that 3.7% of the patients had injuries caused by care. Two-thirds of these injuries were caused by a reasonably avoidable error. (Brennan *et al.* 1991, Leape *et al.* 1991.) A similar study conducted in the United Kingdom (Vincent *et al.* 2001) and in Canada (Baker *et al.* 2004) revealed that 10.8% and 7.5% of hospital patients experienced an adverse event, respectively.

Vincent (1989) and Leape (1994) suggested that methods used in cognitive psychology and human factors research should be applied when investigating errors and their causes in health care in order to prevent errors. These methods had been systematically used in studies of errors in aviation, in road and rail travel, in mining and in nuclear power plants.

During the last 20 years, the number of original research articles, editorials, reviews and guidelines concerning medical errors and patient safety has strongly increased (Stelfox *et al.* 2006, Lilford *et al.* 2006). Classifications for errors have been developed for various areas of health care, e.g. anaesthesiology (Runciman *et al.* 1993) and transfusion medicine (Battles *et al.* 1998), or collectively for diverse health care settings (Chang *et al.* 2005). A common feature of the classifications is that errors are coded into active and latent errors. Active errors are errors or failures resulting from human behaviour. They are slips, lapses, mistakes or violations. Latent errors are errors that result from underlying system failures such as managerial decisions, defective processes and protocols or equipment failures (Reason 2000, Reason 2001: 9–18.) It has been suggested that investigation of errors should be carried out in such a way that a chain of events and underlying factors leading up to an error could be found out. (Vincent *et al.* 2000, Vincent 2003, Woolf *et al.* 2004.) System failures are relatively common as underlying causes of the events in health care: lacking information on drugs has led to prescribing errors (Leape *et al.* 1995), errors in communication, e.g. failure to follow physician's orders or wrong results on laboratory report have led to diagnostic or treatment errors (Woolf *et al.* 2004), a defective blood delivery routine has led to transfusion of the wrong blood unit to a patient (Ternov & Akselsson 2005), or failures of the work processes between surgical wards, the laboratory and the operating department have led to delays in the operating department (Waring *et al.* 2006).

2.2.4 Customer perspective in health care

Systematic satisfaction survey is a widely used method to obtain information on patients' views about quality in health care services (Cohen *et al.* 2008, Lombarts *et al.* 2009). It has been claimed that patient satisfaction surveys have not lead to quality improvement in health care because questionnaires were not designed to provide specific areas for improvement efforts (Cleary 1999, Coulter 2006). Poorly defined aims of surveys (Evans *et al.* 2007), poor formulation of questions (Cohen *et al.* 1996, Mair & Whitten 2000, Evans *et al.* 2007), low response rates (Mair & Whitten 2000) or failure to report response rates (Sitzia & Wood 1998) and difficulties in interpreting results (Wensing *et al.* 2003, Davies & Cleary 2005) have made it difficult to proceed to improvement actions. In addition, health care professionals may be sceptical towards the results of customer satisfaction surveys (Tregunno *et al.* 2004, Davies & Cleary 2005).

Generally, patients give high ratings on the overall satisfaction with their care (Jenkinson *et al.* 2002b, Jha *et al.* 2008, Allan *et al.* 2009). However, areas of dissatisfaction can be revealed using more specific questions concerning their care. The most common causes of dissatisfaction among hospital patients are communication with health care personnel and information received (Cleary *et al.* 1991, Coulter & Cleary 2001, Jenkinson *et al.* 2002b, Heidegger *et al.* 2006, Jha *et al.* 2008), especially discharge information received (Cleary *et al.* 1991, Coulter & Cleary 2001, Jha *et al.* 2008).

There are also reports about satisfaction surveys to professional customer groups of health care organisations. General practitioners and other referring physicians have been asked to evaluate hospital service quality (Hensen *et al.* 2008) and to assess communication with hospital physicians (Pantilat *et al.* 2001, O'Leary *et al.* 2006). Hospital physicians' medical expertise was highly ranked (Hensen *et al.* 2008). General practitioners value discharge information about medications, diagnosis, results of procedures, scheduled follow-up and results of laboratory tests as important (Pantilat *et al.* 2001, O'Leary *et al.* 2006). They proved to be dissatisfied with the too late arrival of discharge information after patients' hospital treatment (Pantilat *et al.* 2001, O'Leary *et al.* 2006, Hensen *et al.* 2008) and with the quality of that information (O'Leary *et al.* 2006, Hensen *et al.* 2008).

Patients' complaints are widely used in health care organisations (Lombarts *et al.* 2009). However, patients are often unwilling to complain even though they experience problems with health care services (Jones *et al.* 2006a, Gal & Doron

2007, Davis *et al.* 2008). Studies of patients' complaints have revealed that the main topics have been poor communication with health care personnel, inadequate or conflicting information obtained, long waiting times and problems with care and treatment. (Bark *et al.* 1994, Anderson *et al.* 2001, Wofford *et al.* 2004, Murff *et al.* 2006, Montini *et al.* 2008). Complaints have mostly resulted in verbal or written apologies (Bark *et al.* 1994, Anderson *et al.* 2001).

An analysis of complaints from hospital physicians and nurses to emergency department has also been reported. The complaints mostly concerned delays in or lack of consultations from emergency department physicians and lack of information to referring physicians. Nineteen percent of the cases led to corrective actions including re-education of emergency physicians and clarification of instructions. (Griffey & Bohan 2006.)

2.3 Quality in clinical laboratory services

Clinical laboratories play an essential role in patient care, and the quality of laboratory services has an important impact on patient safety. During the last 50 years, attention has been paid to the technical, i.e., analytical quality of laboratory tests, which has greatly increased, especially due to availability of more specific and accurate measurement procedures, instrumentation and implementation of quality assessment practices. (Howanitz 1990, Westgard 1992, Hamlin 1993, Stankovic 2004.) In addition to technical requirements, the laboratory accreditation standards include requirements for management of laboratories (EN ISO/IEC 17025:2005, EN ISO 15189:2007, Burnett 2006, Theodorou & Anastasakis 2009).

2.3.1 The laboratory testing process

The clinical laboratory process includes the following steps: test requisition, preparation of patient, specimen collection, specimen transportation, specimen preparation, examination/analysis, result validation and reporting. Specimens can be stored before examination/analysis or afterwards. The steps of the testing process before examination/analysis are called the pre-analytical phase, and the steps after the examination/analysis are known as the post-analytical phase of the laboratory process. (Burnett 2006, EN ISO 15189:2007: 13.) Point-of-care testing differs from the general laboratory testing process. Point-of-care tests are usually

performed outside the laboratory at or near the patient and the results are instantly available.

2.3.2 Errors in clinical laboratory services

Laboratory error has been defined to be a failure of a planned action to be completed as intended, or the use of a wrong plan to achieve an aim, occurring at any part of the laboratory process, from ordering examination to reporting result or interpreting and reacting to it (ISO/TS 22367:2008: 1).

Laboratory errors can be classified in several ways. (ISO/TS 22367:2008: 3–4). The most common way to classify errors is according to the phase in which they occur in the testing process: pre-analytical, analytical and post-analytical. Errors can be further sub-classified by the specific steps in which they occur (Plebani & Carraro 1997, Astion *et al.* 2003, Carraro & Plebani 2007, O’Kane *et al.* 2008.) Errors have also been classified by cause and seriousness (O’Kane *et al.* 2008), by impact for patient (Plebani & Carraro 1997, Astion *et al.* 2003), by preventability (Astion *et al.* 2003, Carraro & Plebani 2007) and by responsible party (Astion *et al.* 2003, Carraro & Plebani 2007). Based on cognitive and behavioural psychology, laboratory errors have been classified into active or latent and cognitive or non-cognitive errors (Astion *et al.* 2003, Carraro & Plebani 2007).

There are several studies about the error rates in clinical laboratories. It is obvious that the error rates observed depend on local environment, the methods used and the type of errors investigated. However, the error rates in clinical laboratories have been reported to be about 0.5% of the number of tests or lower (Plebani & Carraro 1997, Bonini *et al.* 2002, Carraro & Plebani 2007). In various studies, 62–71% of laboratory errors occurred in the pre-analytical phase, 13–18% in the analytical phase and 11–23% in the post-analytical phase of the laboratory process (Plebani & Carraro 1997, Astion *et al.* 2003, Carraro & Plebani 2007). Plebani and Carraro (1997) estimated that most (74%) of the mistakes in a stat laboratory did not affect patients’ outcome. However, in 19% of the cases the mistakes led to further unnecessary investigations, and in 6% of the cases the mistakes caused inappropriate care. Based on retrospective analysis of incident reports in a clinical laboratory’s database, Astion *et al.* (2003) reported that delay in receiving test results was the most common (85%) impact on patients.

Recommendations and suggestions for clinical laboratories have been published to reduce their error rates and to improve patient safety (Howanitz 2005, Plebani 2006, ISO/TS 22367:2008, Sciacovelli & Plebani 2009). Error detection should be more effective in clinical laboratories. Laboratory information systems could be utilised to collect information of aspects such as turnaround times, lacking test results and corrected test results. (Wagar & Yuan 2007.) Laboratories should collect data on tests whose turnaround times exceed the agreed reporting targets for further investigation and possible actions (Hawkins 2007, Novis 2008). All laboratory employees should be able to report not only errors, but all kinds of incidents they observe. Management could use this information to decrease errors and to improve quality. (Wagar & Yuan 2007, Lippi *et al.* 2007, McCay *et al.* 2009, Szecsi & Ødum 2009.) Errors should be properly classified and the information obtained should be utilised to take appropriate corrective actions (ISO/TS 22367:2008: v).

2.3.3 Customer perspective in clinical laboratory services

Laboratory quality standards EN ISO/IEC 17025 (2005: 23, 25, 29) and EN ISO 15189 (2007: 27, 31) point out the use of customer feedback to improve services.

The College of American Pathologists has offered customer satisfaction surveys for hospital laboratories as part of its quality improvement program (Q-Probes) (Howanitz 1990, Bachner & Howanitz 1991). The College has developed surveys to cover certain aspects of laboratory services, such as test menu, phlebotomy services, courier services, reliability of test results, turnaround times, critical value reporting and interpersonal aspects of services. The College analyses the data and each participating laboratory gets its own results and comparisons with other laboratories. Through this service, the College encourages laboratories to use the results of these satisfaction surveys to identify opportunities for improvement. The results of the surveys have shown that customers have generally been satisfied with the laboratory services. However, the main causes of dissatisfaction relate to turnaround times, communication and phlebotomy services. (Zarbo *et al.* 2003, Jones *et al.* 2006b, Jones *et al.* 2009.)

Nationwide satisfaction surveys do not necessarily meet local needs, because the questions tend to be general in their nature. There are some survey reports about physician satisfaction with various aspects of their local laboratory services in clinical chemistry (Allen & Harris 1992, Boyde *et al.* 1997), microbiology (Pedler & Bint 1991) and pathology (Zarbo 2006). The overall satisfaction proved

to be high (Allen & Harris 1992, Zarbo 2006). Physicians were mostly satisfied with the quality of test results (Pedler & Bint 1991, Boyde *et al.* 1997, Zarbo 2006) and consultations from laboratory physicians (Pedler & Bint 1991, Zarbo 2006). General practitioners were generally satisfied with turnaround times of tests (Allen & Harris 1992, Boyde *et al.* 1997). Dissatisfaction was related to aspects such as out-of-hours services (Pedler & Bint 1991), timing and frequency of sample transportation (Boyde *et al.* 1997), turnaround times of tests (Zarbo 2006) and reporting practices of abnormal results (Boyde *et al.* 1997, Zarbo 2006).

Physicians' satisfaction with single topics concerning their local laboratory services has also been surveyed. Physicians were satisfied with interpretative comments of laboratory physicians on complex biochemistry results (Barlow 2008) and complex coagulation tests (Laposata *et al.* 2004). In addition, satisfaction with the statistical reports of their test ordering behaviour was also high (Smellie *et al.* 2000). Physicians expressed dissatisfaction with the use of a system that produced automated comments on the appropriateness of their test orders in their daily practice (Bindels *et al.* 2003). Physicians were also dissatisfied with the appropriateness of critical values for several common analytes. The current critical values for low ionised calcium, low total calcium, low phosphate and low pH were considered too high and the critical value for low glucose was considered too low. (Don-Wauchope & Chetty 2009.)

Patients mostly encounter clinical laboratory through phlebotomy services. Patient satisfaction surveys have covered items such as laboratory personnel's behaviour towards patients (Dale & Howanitz 1996, Seibert *et al.* 1996, Hendriks *et al.* 2002, Hepner *et al.* 2004), actual venipuncture procedure (Howanitz *et al.* 1991, Dale & Howanitz 1996, Hendriks *et al.* 2002) and waiting time at a phlebotomy station (Dale & Howanitz 1996, Hendriks *et al.* 2002). Generally, patients have been highly satisfied with the courtesy and respect shown by laboratory personnel (Dale & Howanitz 1996, Hepner *et al.* 2004) and with the venipuncture procedure (Howanitz *et al.* 1991, Dale & Howanitz 1996).

3 Aim of the study

The aim of the study was to evaluate the usefulness of customer feedback in a university hospital laboratory by

- analysing the data of customer satisfaction surveys including causes of dissatisfaction and the actions taken, and

- analysing the data of spontaneous customer feedback, including subject matter of the feedback, investigations carried out and the actions taken.

4 Methods

The studies were carried at Oulu University Hospital, Oulu, Finland, with nearly 1,000 beds and 1,000 daily outpatient visits within all main clinical specialties. The clinical chemistry laboratory provides services in clinical chemistry and haematology (including blood banking service) with a total of three million investigations annually. Sixty percent of test requests come from units within the same hospital and 40% from external customers representing other hospitals and health centres divided into 35% within the Northern Ostrobothnia Hospital District, 2% outside the district, and 3% private patients or institutions. The laboratory has EN ISO/IEC 17025 accreditation for the majority of routine tests.

4.1 Satisfaction surveys

The satisfaction surveys were targeted at the clinical units of the Oulu University Hospital (I) and the health centres in the Northern Ostrobothnia Hospital District (III) in 2001 and 2004, and in 2002 and 2006, respectively. The satisfaction surveys were carried out by using questionnaires designed by the chief physician, the associate chief physician, both specialists with long experience in clinical chemistry, and the planning officer of the laboratory (Streiner & Norman 2003: 18, Kelley *et al.* 2003). The statements were designed to reflect the essential aspects of the services the laboratory provides to the customers surveyed. Designs of the questionnaires were reviewed by the managing board of the laboratory and the customer service working group. No changes were made to the questionnaires when repeating the surveys.

The respondents were asked to rate their perceptions on a five-level Likert scale: strongly agree, agree, neither agree nor disagree, disagree and strongly disagree (Streiner & Norman 2003: 36–42), or “not applicable”, if appropriate. Respondents were also asked an open-ended question: “What is the most important problem in laboratory services between your clinical unit/health centre and the university hospital laboratory?” In addition, the respondents were asked to give their contact information to make them accountable for their responses, and to make it possible to identify units’ specific problems (Streiner & Norman 2003: 85). The purpose of the questionnaires was stated in the covering letters, which were signed by the chief physician of the laboratory (Bourque & Fielder 1995: 106, Gillham 2007: 45–46). Questionnaires on paper were sent to the senior physicians and nurses-in-charge of the in-patient and out-patient units of the

clinics of the university hospital and the medical directors of the health centres. 136 questionnaires were sent to 68 clinical units in 2001, and 144 questionnaires were sent to 72 units in 2004. Forty-two questionnaires were sent to the medical directors of health centres in 2002, and 38 questionnaires were sent to medical directors of independent health centres or joint municipal health centres in 2006.

Frequency distributions of the responses were calculated. A combined percentage of the two disagreement levels (disagree and strongly disagree) of 20% or higher was considered to represent a high level of dissatisfaction. The statistical significances of the differences in distributions between the 2001 and 2004 surveys of clinical units were calculated by the chi-squared test, and between the 2002 and 2006 surveys of health centres by Fisher's exact test. The responses to the open-ended question were classified into categories by content analysis with calculated frequencies (Pope *et al.* 2000).

4.2 Spontaneous customer feedback

Spontaneous customer feedback reports from the clinical units of the university hospital (II) and from health centres and other hospitals as external customers (IV) to the laboratory were handled according to the laboratory's standard customer feedback procedure. Any feedback received was compiled into forms that included date, receiver of the report, name and contact information of the customer, subject matter, investigations performed and actions carried out. Depending on the subject matter of the feedback, the original report was sent for investigation to a laboratory physician, a laboratory chemist or a leading medical laboratory technologist, depending on who knew best or who was in charge of the activities concerned. Copies of the forms were delivered to the chief physician of the laboratory and to the quality manager of the laboratory for follow-up. The investigator explored the case and suggested or carried out the actions needed. The chief physician endorsed every feedback after considering the investigations and actions as being adequate.

The feedback material documented during the years 2001–2006 from the clinical units and from the external customers was analysed. Qualitative content analysis (Miles & Huberman 1994: 10–12, Pope *et al.* 2000) of the feedback material was carried out by the planning officer, the associate chief physician and the chief physician of the laboratory. The original data were approached with three research questions: 1. What was the subject matter of the feedback? 2. What did the investigation of the case reveal? 3. What were the actions performed?

After this, the data were inductively condensed into preliminary categories, followed by re-checking of every case. (Miles & Huberman 1994: 22–25, 55–57, 61–62, 91–93.) Unclear cases were discussed and the final categories were formed through consensus formation (Greenhalgh 2006: 175). When re-checking the cases, the underlying causes for the errors or defects revealed were recognised, and they were further classified into active versus latent and cognitive versus non-cognitive ones (Reason 2001: 11–18, 28–29, ISO/TS 22367:2008: 1–4). Classification of the laboratory process into pre-analytical, analytical and post-analytical phases was performed as defined in the EN ISO 15189 (2007: 13) standard.

4.3 Ethical aspects

In the customer satisfaction surveys to the clinical units of the university hospital and to the regional health centres, no personal data of patients appeared in the responses.

Spontaneous customer feedback was received from physicians and nurses of the customer units. These reports contained personal data of patients, such as patient's name, identity number and other information that was essential for investigation of the cases. This is why it was essential that the original feedback report contained the information needed to identify and investigate the case. This information could be seen by the receiver of the report, the chief physician and the quality manager of the laboratory as well as the persons responsible for the investigation of the cases. When clinical units of the university hospital or health centres gave feedback to solve problems in patient cases the procedure was interpreted to belong to the patient's care regime to which the patient had given his/her permission. When the handling of data for research purposes was started, the original customer feedback reports were coded to eliminate personal data of patients.

The laboratory physicians, hospital chemists and leading medical laboratory technologists who had been responsible for the investigations of customer feedback are not recognizable in the original articles of this study. However, the personnel of the laboratory of the Oulu University Hospital may recognise some of these professionals, because they know the functions of the laboratory and the persons in the above-mentioned professional roles. This is why an attempt was made in the original articles to report possible critical results analytically, in a respectful tone.

5 Results

5.1 Satisfaction surveys to the clinical units of the university hospital

5.1.1 Response rates

The response rate of the clinical units was 79% in 2001 and 89% in 2004.

5.1.2 Satisfaction survey in 2001

The distribution of the responses from the clinical units to the statements on laboratory services is presented in Table 1 of article I. In 2001, the highest level of dissatisfaction was related to missing test results. In addition, there was high dissatisfaction with the laboratory information system when reviewing the laboratory results, and with the turnaround times of both stat tests and routine tests for inpatients. The respondents needed additional instructions on the preparation of patients for laboratory tests and on the collection and handling of samples. Additional consultations by laboratory physician were also needed. Dissatisfaction was also shown with Laboratory Users' Handbook and the schedule of phlebotomy rounds.

Classification of the most important problems in laboratory services as reported by the clinical units in response to the open-ended question in 2001 is presented in Table 2 of article I. The most frequent problems concerned computerised test requesting and reporting, phlebotomy services and turnaround times of tests.

5.1.3 Corrective actions

In the negotiations with the selected clinics, the respondents were asked to explain what they meant by missing test results. Most often the results were considered "missing" if they were received later than expected for the intended purpose. These clinics were informed about the turnaround times of laboratory tests and they were asked to use stat requests in urgent cases. The causes for the long turnaround times of tests perceived by the respondents were also identified in the negotiations. In a typical case, tests were ordered as routine despite

emergency needs. These clinical units were advised to order stat tests in urgent cases. Instructions for blood collection, including pictures of the tubes used for venipuncture and for paediatric samples as well as instructions for patient preparations for laboratory tests were produced and delivered to the clinical units in 2002–2003. After consulting the in-patient units, the schedules of the phlebotomy rounds were modified. Before this rescheduling, 13 rounds in 24 hours were available for the clinics. When the rounds were rescheduled to meet the needs of the clinics, it turned out that the total number of rounds could be reduced to 11. It appeared in the negotiations that consultations were needed for the appropriate diagnostic strategies in certain emergency situations, in bleeding disorders, in disorders of amino-acid metabolism, and in endocrinological surgery. These needs were reported to the laboratory physicians responsible for possible actions.

5.1.4 Satisfaction survey in 2004

Compared with the disagreement levels obtained in 2001, the only statistically significant differences in 2004 were seen in the responses concerning scheduled phlebotomy rounds in the daytime and the instructions on the collection and handling of samples. The dissatisfaction with the phlebotomy rounds decreased from 21.1% to 1.7% ($p=0.005$), and the dissatisfaction with the instructions on collection and handling of samples increased from 27.8% to 41.8% ($p=0.010$) (Table 1, article I). The dissatisfied respondents were contacted and they were asked to specify their needs. Most of them could not specify what instructions they needed. No significant changes were obtained in the dissatisfaction levels concerning missing test results, laboratory information system, turnaround times, instructions on the preparation of patients, and the Laboratory Users' Handbook, all of which showed high ($\geq 20\%$) levels of dissatisfaction in 2004 as well.

The most important problems in laboratory services based on the responses to the open-ended question in 2001 and in 2004 are summarised in Table 1. The problems in laboratory information system reported in 2001 were also seen in the 2004 survey. Problems concerning phlebotomy services had not decreased essentially in 2004. In 2004, availability of scheduled rounds and out-of-hours services for paediatrics were no longer seen among the most important problems. However, delays in morning phlebotomy rounds, especially at weekends, seemed to be an increasing problem. The number of the most important problems reported in 2004 concerning test turnaround times was the same as in 2001. Long

turnaround times in urgent cases and in routine morning tests appeared as important problems in the 2004 survey.

Table 1. Number of most important problems in laboratory services as reported by the clinical units in response to the open-ended question in 2001 and 2004. The three main categories and their subcategories are shown.

Category	2001	2004
Laboratory information system (test requests and reports)	32	29
Information to support requesting, reporting and interpretation is insufficient	15	5
Requesting and reporting formats are too complicated	13	21
Electronic requests and reports are not available in some special cases	4	3
Phlebotomy services	32	25
Lack of non-scheduled service in urgent cases ¹	7	7
Single defects in phlebotomy skills and customer service attitude	6	-
Distant location of phlebotomy stations ²	5	1
Not enough scheduled rounds ¹	4	-
Not enough out-of-hours services for paediatrics ¹	4	-
Long waiting times at phlebotomy stations ²	3	5
Lack of services for functional/tolerance tests ¹	2	-
Delays at the scheduled round at 07:00 hours especially at weekends ¹	1	5
Test turnaround time	24	25
Long turnaround time of certain single test or patient groups at day-time (mainly clinic of oncology in 2001)	11	1
Long turnaround time (clinic of psychiatry)	6	6
Long turnaround time because of transportation	4	-
Long turnaround time during emergency hours	3	-
Long turnaround time in urgent cases	-	10
Long turnaround time of routine morning test results ¹	-	8

¹ inpatients; ² outpatients

5.2 Satisfaction surveys to the regional health centres

5.2.1 Response rates

The response rate of the regional health centres was 83% in 2002 and 100% in 2006.

5.2.2 Satisfaction surveys in 2002 and 2006

The distribution of regional health centres' responses to the statements on laboratory services is presented in Table 1 of article III. In 2002, the highest level of dissatisfaction was related to electronic data transfer of test requests and reports between health centres and the university hospital laboratory. Seven health centres made a statement on this. In 2002, only five health centres had electronic data transfer connections with the university hospital laboratory. In 2006, the dissatisfaction with electronic data transfer was still high. In 2006, 18 health centres had data transfer connections with the university hospital laboratory. Both in 2002 and 2006, the personnel in health centres needed additional instructions on the preparation of patients for laboratory tests and on the collection and handling of samples. In 2002, and also in 2006, many respondents were not aware of the frequency of analysis of different laboratory tests at the university hospital laboratory. The only statistically significant changes (reduced satisfaction) between the two surveys were obtained in the responses regarding sent-out information on changes in laboratory services ($p=0.006$) and usability of the reference value booklet ($p=0.009$), both, at least partly, caused by increases in neutral judgments.

The most important problems in laboratory services based on the responses to the open-ended question in 2002 and 2006 are summarised in Table 2 of article III. Both in 2002 and 2006, the most frequently reported problem was related to data transfer between health centres and the university hospital laboratory. These problems included lack of electronic data transfer connections, problems in existing connections, or differences in the number codes of laboratory tests between health centres and the hospital laboratory. Health centres also reported various problems in the practice of decentralised phlebotomy services for university hospital outpatients. For example, laboratory test orders were lacking or incomplete, or patients had not received instructions in preparation for the tests.

5.2.3 Corrective actions

In 2002, only five health centres had an electronic data transfer connection with the university hospital laboratory. Before the 2006 survey, electronic data transfer connections were established with an additional 13 health centres. The construction and remodelling of the connections continued until 2008. In 2004, the number codes of the laboratory tests in the laboratory information system of

the university hospital were changed to conform with the standardised national codes that were already in use in the health centres. To reduce problems in the decentralised phlebotomy services, instructions were produced in 2003 and delivered to the laboratories of the health centres and to the requesting clinics at the university hospital. In addition, information on the frequency of analysis of laboratory tests was added to the Laboratory Users' Handbook.

Further enquiries after the 2006 survey specified that the health centres needed instructions for specimen handling for certain laboratory tests and also general instructions for patient preparation and specimen collection and handling. These customers were informed that the instructions they needed could be found in the Laboratory Users' Handbook.

5.3 Spontaneous customer feedback from clinical units of the university hospital and from external customers

5.3.1 Subject matters of spontaneous customer feedback

During the years 2001–2006, the laboratory received 115 spontaneous feedback reports from the clinical units of the university hospital and 95 reports from external customers.

The classifications of subject matters of feedback reports from the clinical units of the university hospital and external customers are presented in Table 1 of article II and Table 1 of article IV, respectively. The three main categories of the subject matters of the reports from the clinical units were suspicion of validity of test results, delay in service and lacking test results, which covered a total of 82% of the subject matters. In the reports from the external customers, lacking test results, validity of test results suspected, returning of samples to customers in transportation boxes and delay in service constituted 87% of the subject matters.

A comparison of the main categories of the subject matters of the feedback reports is shown in Table 2. Lacking test results as a subject matter was more common among external customers than among clinical units, whereas delay in service was less common. Returning of samples in transportation boxes was common in reports from external customers. It is clear that in these cases, the customers had not received the test results, which means that lacking test results was actually a problem in more than half of the feedback reports from external customers.

Table 2. Subject matters of feedback reports received from clinics of the university hospital and from external customers

Categories	Clinics of the university hospital	External customers
	Number of cases (%)	Number of cases (%)
Validity of test result suspected	42 (37%)	23 (24%)
Delay in service	38 (33%)	8 (8%)
Lacking test results	14 (12%)	35 (37%)
Samples returned to customer in transportation box		17 (18%)
Other	21 (18%)	12 (12%)
Total	115 (100%)	95 (100%)

5.3.2 Errors or defects found in the laboratory services

The investigations revealed errors or defects in laboratory services in 81 cases (70% of the feedback reports) of the clinical units of the university hospital, and in 78 cases (82%) of the external customers.

Erroneous test results, delayed test results and lacking test results made up 91% of the errors and defects found among cases of the clinical units (II) and 93% of those of the external customers (IV).

Table 3. Distribution of cases with erroneous, delayed or lacking test results in different phases of laboratory process

Phases of laboratory process	Clinics of the university hospital	External customers
	Number of cases (%)	Number of cases (%)
Test ordering	1 (1%)	1 (1%)
Sample collection	15 (20%)	
Sample transfer	6 (8%)	20 (28%)
Order entry in the university hospital laboratory		16 (22%)
Sample processing	8 (11%)	12 (17%)
Analysis	8 (11%)	10 (14%)
Result reviewing and reporting	21 (28%)	13 (18%)
Error or defect could not be located	15 (20%)	
Total	74 (100%)	72 (100%)

Table 3 shows the distribution of cases with erroneous, delayed or lacking test results in different phases of the laboratory process. Most of the errors or defects observed in the laboratory services to the clinics of the university hospital occurred in sample collection and in result reviewing and reporting. Sample

transfer from external customers to the university hospital laboratory, including unpacking of the transportation boxes, and entering of external customers' orders into the laboratory information system of the university hospital were especially prone to errors.

5.3.3 Underlying causes of errors and defects

Classifications of the underlying causes of errors or defects found among the cases of the clinical units and the external customers are shown in Table 3 of article II and in Table 2 of article IV, respectively. The latter table also shows the distribution of the underlying causes into different phases of the laboratory process.

Active non-cognitive errors included cases, for example, where a departmental secretary had made a typing error when entering external customers' requests into the laboratory information system of the university hospital, or when a medical laboratory technologist forgot samples on a phlebotomy tray or in a freezer, or forgot to review and release a test result or failed to notice an impossible result. Most of the active cognitive errors were cases in which operating instructions were not followed. Latent errors were identified in 17% of the cases of the clinical customers and in 14% of the cases of the external customers. Latent errors were defects in operating instructions, errors in computer programs or failures of analysers.

5.3.4 Corrective actions

The laboratory performed corrective actions in 76% of the cases reported by the clinical units and in 79% of the cases reported by the external customers. When needed, new operating instructions were created, existing instructions were amended or operating instructions were run through with the personnel. The errors in the laboratory information system programs were corrected. Corrections were made in the Laboratory Users' Handbook. When necessary, the cases were discussed at departmental meetings or with the employees concerned. In addition, customers were informed and guided, e.g. in ordering laboratory tests, the use of stat requesting and handling and transporting of samples. Errors in unpacking of the transportation boxes were common and continued in spite of instructions. It proved to be necessary to change the work process, and an instruction was given

that the boxes be double-checked by two persons to ensure that all samples were removed.

6 Discussion

The purpose of listening to customers' perceptions is to improve quality. Before the actions needed for quality improvement can be taken, the service provider has to obtain customers' perceptions and investigate and interpret the information obtained.

The requirement of obtaining customers' views and their use for quality improvement has been included in several standards in health care including clinical laboratories (Auras & Geraedts 2010, EN ISO/IEC 17025:2005: 23, 25, 29, EN ISO 15189:2007: 27, 31). The scientific literature concerning customer satisfaction in health care is abundant, and most of the reports deal with patient satisfaction surveys. Reports rarely include information on whether the survey results have led to corrective actions, which are a prerequisite for quality improvement (Quinn *et al.* 2004, Davies *et al.* 2008).

The purpose of the satisfaction surveys targeted at the clinical units of the university hospital and the health centres in the hospital district was to find out topics of dissatisfaction for possible corrective actions in the laboratory services, not to measure satisfaction level of the customers as a whole.

The closed-ended statements of the questionnaires were planned so as to be specific enough and to cover subjects that are important in the service process and that the customers can observe, as well as subjects that may be prone to problems. A combined percentage of the two disagreement levels (disagree and strongly disagree with a statement) was regarded to represent dissatisfaction. Ratings in the negative end of the response scale describing dissatisfaction may be more useful for managers when deciding on actions for quality improvement (Jenkinson *et al.* 2002a, Elliott *et al.* 2007, Fullam *et al.* 2009).

An open-ended question was included in the questionnaire to find out the most important problems perceived by the customers. Responses to the open-ended question strengthened the view of the main problems based on the responses to the closed-ended statements. Responses to the open-ended question could also reveal problems not covered by the closed-ended statements. In our surveys targeted at health centres, problems of decentralised phlebotomy services for university hospital outpatients were revealed in the responses to the open-ended question. Open-ended questions have been recognised as useful in other studies as well, because the responses may contain detailed information (Boyer *et al.* 2006, Reeves & Seccombe 2008). However, if open-ended questions are used,

the responses should be analysed with adequate time resources and expertise (Boynton & Greenhalgh 2004).

The response rates of the surveys targeted both at the hospital units and the health centres were very good. Follow-up letters sent to non-respondents may have contributed to the high response rates. In addition, customers were aware that the laboratory has an accredited quality system with structured collection of customer feedback. Thus, they may have anticipated that the laboratory takes notice of the comments for the improvement of its services.

In satisfaction surveys, responses do not necessarily reveal the causes of the dissatisfaction perceived. It appeared in the present study that after surveys, additional contacts were needed with many customers to find out their specific problems. This is why it was important to ask customers' contact information in the customer satisfaction surveys.

When comparing the dissatisfaction levels of the surveys aimed at the clinical units of the university hospital in 2001 and 2004, the only statistically significant changes were found in responses concerning the need of additional instructions and schedules of phlebotomy rounds. The interpretations of the results concerning the need of additional instructions were somewhat problematic. Although instructions were delivered to the hospital clinics after the 2001 survey the dissatisfaction level did not decrease; instead, it increased significantly. Further clarifications after the 2004 survey among the dissatisfied customers revealed that most of them were not able to specify their needs. On the other hand, the instructions that the customers did specify could be found in the Laboratory Users' Handbook. In this situation, the laboratory considered that, despite the high dissatisfaction level, the laboratory could not carry out any targeted corrective actions. It seems that the Laboratory Users' Handbook is not used to the extent it should be. The Handbook is probably difficult to use, or customers are not familiar with its content. It has been found in other studies that only 18% of the personnel performing blood specimen collection at hospital wards (Wallin *et al.* 2008) and 60% of the personnel in primary health care (Söderberg *et al.* 2009) used Laboratory Users' Handbook when searching for instructions on sample collection and handling.

The corrective actions concerning phlebotomy rounds led to a very significant decrease in dissatisfaction. The phlebotomy rounds were re-scheduled in collaboration with clinical units. In addition to the actions of the laboratory, some clinical units revised their own work patterns to integrate them better with the laboratory services. As a result of this collaboration, phlebotomy services

improved, even though the number of rounds decreased. This supports the view that major corrective actions that may have an impact on the processes of both parties should be carried out in collaboration with the customers.

Corrective actions targeted at one or a few customers may not be reflected as a change in satisfaction rating. As seen in the present study (III), not even corrective actions targeted at all customers are necessarily manifested as a decrease in dissatisfaction level. In the satisfaction survey to the health centres in 2002, one third of the respondents were not familiar with the frequency of analysis of laboratory tests. Although this information was added to the Laboratory Users' Handbook there was no change in dissatisfaction in the 2006 survey.

To evaluate the usefulness of the spontaneous feedback procedure the spontaneous feedback data collected during the years 2001–2006 concerning the clinical units of the university hospital and external customers (health centres and other hospitals) were analysed.

It was found that clinical units of the university hospital and external customers gave feedback when they suspected the validity of the test results, when test results were lacking or when there were delays in service. In addition, health centres gave feedback when samples had been returned to them in transportation boxes, thus leading into lack of corresponding test results. From customers' point of view, all of these are important problems that may have an impact on patient care and safety.

Based on their consequences, the errors and defects revealed in the investigations could be classified into lacking, erroneous or delayed test results and others. These kinds of errors form an unwanted outcome of the laboratory process and may have harmful consequences for clinical processes. In the present study, the available data did not make it possible to classify errors according to potential risk or harm caused to the patients. In the investigations, the sites of the errors or defects in the laboratory process could be indicated. Classification of errors according to the various sites in the laboratory process in which they occur may reveal problematic areas that are prone to errors.

It is important to find out the underlying causes for errors because it offers a possibility to target corrective or preventive actions properly (EN ISO/IEC 17025:2005: 25, ISO/TS 22367:2008: 4–5). The cause analysis is often the key and the most difficult part in the corrective actions procedure. Underlying causes are not often obvious, and careful analysis is therefore needed. (EN ISO/IEC 17025:2005: 25.)

In the present study, the latent (systematic) errors or defects that occurred in operating instructions, computer programs and analysers could be corrected, leading to permanent improvement as far as these errors were concerned. Nearly all of the active cognitive errors were cases where operating instructions had not been followed. It is worth trying to decrease these errors since they can be due to ignorance or negligence, or even due to defects in the instructions themselves. It was found in the study of spontaneous customer feedback from external customers (IV) that most of the errors were unintended errors occurring during manual steps of the working process. It is generally difficult to prevent unintended errors. Their elimination calls for a change in the work process. In the laboratory, attempts were made to prevent common unintended errors in unpacking of transportation boxes and in the order entry of test requests of external customers by applying double-checking in those work steps. The problems in order entry were later eliminated for the part of regional health centre customers as electronic data connections were set up.

Investigations of single instances of customer feedback do not necessarily uncover the critical steps of the laboratory process that are prone to errors. On the other hand, reviewing collected feedback data once a year or more seldom leaves possible errors and defects uncovered for too long. The feedback data, including the original reports, investigations and the corrective actions performed, should be analysed regularly at shorter intervals. Regular analysis of collected data makes it possible to find out the distribution of different errors in the various steps of the process for consideration of actions. In addition, a great advantage of spontaneous customer feedback is that it gives a possibility to investigate cases in nearly real time.

Compared with the number of laboratory tests performed, the number of feedback reports from both the clinical units of the university hospital and the external customers was very low. Thus, it is not possible to use this method to calculate error-rates in the laboratory. Health care professionals do not report problems or errors to the extent they should for quality improvement (Tucker & Edmondson 2003, Nuckols *et al.* 2007). The reasons for underreporting seem to be pragmatic: health care professionals are too busy, they think that they will not get feedback or they do not know whether a possible error or problem is worth reporting (Evans *et al.* 2006, Kreckler *et al.* 2009). The most common reason why customers do not complain is that they think nothing will change (Johnston & Clark 2001: 325–326, Goodman 2006, Jones *et al.* 2006a). In addition, all complaints and other reports are not registered by service providers (Stauss &

Seidel 2008, Luria *et al.* 2009). Thus, it seems that underreporting on the part of health care professionals also concerns feedback on laboratory services.

7 Conclusions

1. Customer satisfaction survey can be used as a screening tool to identify topics of dissatisfaction.
2. After the survey, further clarifications are often needed to find out customer-specific causes of dissatisfaction and to undertake proper corrective actions.
3. Most of the spontaneous feedback received by the university hospital laboratory concerned important subjects that may have had impact on patient care and safety.
4. In comparison to satisfaction surveys, an advantage of the spontaneous customer feedback system is that it gives a possibility to investigate concrete cases as soon as possible.
5. Every reported case should be investigated to find out possible errors and their underlying causes so that appropriate corrective actions can be taken.
6. Errors or defects revealed in satisfaction surveys or spontaneous customer feedback procedure should lead to corrective or preventive actions, since customer feedback cannot result in quality improvement if proper actions are not carried out.

References

- Allan J, Schattner P, Stocks N & Ramsay E (2009) Does patient satisfaction of general practice change over a decade? *BMC Fam Pract* 10: 13.
- Allen KR & Harris CM (1992) Measure of satisfaction of general practitioners with the chemical pathology services in Leeds Western Health District. *Ann Clin Biochem* 29: 331–336.
- Anderson K, Allan D & Finucane P (2001) A 30-month study of patient complaints at a major Australian hospital. *J Qual Clin Pract* 21: 109–111.
- Astion ML, Shojania KG, Hamill TR, Kim S & Ng VL (2003) Classifying laboratory incident reports to identify problems that jeopardize patient safety. *Am J Clin Pathol* 120: 18–26.
- Audet A-MJ, Doty MM, Shamasdin J & Schoenbaum SC (2005) Measure, learn, and improve: physicians' involvement in quality improvement. *Health Aff* 24: 843–853.
- Auras S & Geraedts M (2010) Patient experience data in practice accreditation – an international comparison. *Int J Qual Health Care* 22: 132–139.
- Bachner P & Howanitz PJ (1991) Using Q-Probes to improve the quality of laboratory medicine: A quality improvement program of the College of American Pathologists. *Qual Assur Health Care* 3: 167–177.
- Baker GR, Norton PG, Flintoft V, Blais R, Brown A, Cox J, Etchells E, Ghali WA, Hébert P, Majumdar SR, O'Beirne M, Palacios-Derflingher L, Reid RJ, Sheps S & Tamblyn R (2004) The Canadian adverse event study: the incidence of adverse events among hospital patients in Canada. *CMAJ* 170: 1678–1686.
- Bark P, Vincent C, Jones A & Savory J (1994) Clinical complaints: a means of improving quality of care. *Qual Health Care* 3: 123–132.
- Barlow IM (2008) Are biochemistry interpretive comments helpful? Results of a general practitioner and nurse practitioner survey. *Ann Clin Biochem* 45: 88–90.
- Battles JB, Kaplan HS, Van der Schaaf TW & Shea CE (1998) The attributes of medical event-reporting systems. Experience with a prototype medical event-reporting system for transfusion medicine. *Arch Pathol Lab Med* 122: 231–238.
- Bendall-Lyon D & Powers TL (2001) The role of complaint management in the service recovery process. *Jt Comm J Qual Improv* 27: 278–286.
- Berry LL & Parasuraman A (1997) Listening to the customer – the concept of a service-quality information system. *Sloan Manage Rev* 38: 65–76.
- Berwick DM (1989) Continuous improvement as an ideal in health care. *N Engl J Med* 320: 53–56.
- Berwick DM, Enthoven A & Bunker JP (1992a) Quality management in the NHS: the doctor's role – I. *Br Med J* 304: 235–239.
- Berwick DM, Enthoven A & Bunker JP (1992b) Quality management in the NHS: the doctor's role – II. *Br Med J* 304: 304–308.
- Bindels R, Hasman A, Derickx M, Van Wersch JWJ & Winkens RAG (2003) User satisfaction with a real-time automated feedback system for general practitioners: a quantitative and qualitative study. *Int J Qual Health Care* 15: 501–508.

- Blumenthal D (1996) Quality of health care. Part 1: Quality of care – what is it? *New Engl J Med* 335: 891–894.
- Bonini P, Plebani M, Ceriotti F & Rubboli F (2002) Errors in laboratory medicine. *Clin Chem* 48: 691–698.
- Bourque LB & Fielder EP (1995) How to conduct self-administered and mail surveys. Thousand Oaks, Sage Publications.
- Boyde AM, Earl R, Fardell S, Yeo N, Burrin JM & Price CP (1997) Lessons for the laboratory from a general practitioner survey. *J Clin Pathol* 50: 283–287.
- Boyer L, Francois P, Doutre E, Weil G & Labarere J (2006) Perception and use of the results of patient satisfaction surveys by care providers in a French teaching hospital. *Int J Qual Health Care* 18: 359–364.
- Boynton PM & Greenhalgh T (2004) Hands on guide to questionnaire research. Selecting, designing and developing your questionnaire. *Br Med J* 328: 1312–1315.
- Brennan TA, Leape LL, Laird NM, Hebert L, Localio AR, Lawthers AG, Newhouse JP, Weiler PC & Hiatt HH (1991) Incidence of adverse events and negligence in hospitalized patients. Results of the Harvard Medical Practice Study I. *N Engl J Med* 324: 370–376.
- Burnett D (2006) ISO 15189:2003 – Quality management, evaluation and continual improvement. *Clin Chem Lab Med* 44: 733–739.
- Carraro P & Plebani M (2007) Errors in a stat laboratory: types and frequencies 10 years later. *Clin Chem* 53: 1338–1342.
- Chang A, Schyve PM, Croteau RJ, O’Leary DS & Loeb JM (2005) The JCAHO patient safety event taxonomy: a standardized terminology and classification schema for near misses and adverse events. *Int J Qual Health Care* 17:95–105.
- Cleary PD (1999) The increasing importance of patient surveys. *Br Med J* 319: 720–721.
- Cleary PD, Edgman-Levitan S, Roberts M, Moloney TW, McMullen W, Walker JD & Delbanco TL (1991) Patients evaluate their hospital care: a national survey. *Health Aff* 10: 254–267.
- Cohen AB, Restuccia JD, Shwartz M, Drake JE, Kang R, Kralovec P, Holmes SK, Margolin F & Bohr D (2008) A survey of hospital quality improvement activities. *Med Care Res Rev* 65: 571–595.
- Cohen G, Forbes J & Garraway M (1996) Can different patient satisfaction survey methods yield consistent results? Comparison of three surveys. *Br Med J* 313: 841–844.
- Coulter A (2006) Can patients assess the quality of health care? *Br Med J* 333: 1–2.
- Coulter A & Cleary PD (2001) Patients’ experiences with hospital care in five countries. *Health Aff* 20: 244–252.
- Dale JC & Howanitz PJ (1996) Patient satisfaction in phlebotomy. A College of American Pathologists’ Q-Probes Study. *Lab Med* 27: 188–192.
- Davies E & Cleary PD (2005) Hearing the patient’s voice? Factors affecting the use of patient survey data in quality improvement. *Qual Saf Health Care* 14: 428–432.

- Davies E, Shaller D, Edgman-Levitan S, Safran DG, Oftedahl G, Sakowski J & Cleary PD (2008) Evaluating the use of a modified CAHPS® survey to support improvements in patient-centred care: lessons from a quality improvement collaborative. *Health Expect* 11: 160–176.
- Davis RE, Koutantji M & Vincent CA (2008) How willing are patients to question healthcare staff on issues related to the quality and safety of their healthcare? An exploratory study. *Qual Saf Health Care* 17: 90–96.
- Deming WE (1982) *Out of the crisis. Quality, productivity and competitive position.* Cambridge, Cambridge University Press.
- Donabedian A (1968) Promoting quality through evaluating the process of patient care. *Med Care* 6: 181–202.
- Donabedian A (1980) *Explorations in quality assessment and monitoring. Volume 1. The definition of quality and approaches to its assessment.* Ann Arbor, Michigan, Health Administration Press.
- Donabedian A (1988) The quality of care. How can it be assessed? *JAMA* 260: 1743–1748.
- Don-Wauchope AC & Chetty VT (2009) Laboratory defined critical value limits: How do hospital physicians perceive laboratory based critical values? *Clin Biochem* 42: 766–770.
- Edgman-Levitan S (2008) Measuring and improving patient experiences of care. In: Ransom ER, Joshi MS, Nash DB & Ransom SB (eds) *The healthcare quality book. Vision, strategy, and tools.* 2nd ed. Chicago, Health Administration Press: 187–215.
- EFQM (2009) *EFQM excellence model.* Brussels, EFQM Publications.
- Elliott MN, Beckett MK, Kanouse DE, Hambarsoomians K & Bernard S (2007) Problem-oriented reporting of CAHPS consumer evaluations of health care. *Med Care Res Rev* 64: 600–614.
- EN ISO 9000 (2005) *Quality management systems. Fundamentals and vocabulary (ISO 9000:2005).* Helsinki, Finnish Standards Association SFS.
- EN ISO 15189 (2007) *Medical laboratories – Particular requirements for quality and competence.* Geneva, International Organization for Standardization.
- EN ISO/IEC 17025 (2005) *General requirements for the competence of testing and calibration laboratories (ISO/IEC 17025:2005).* Geneva, International Organization for Standardization.
- European Foundation for Quality Management (1999) *Assessing for excellence. A practical guide for self-assessment.* Brussels, EFQM.
- Evans JR & Dean JW, Jr (2000) *Total quality. Management, organization and strategy.* 2nd ed. Cincinnati, South-Western College Publishing.
- Evans RG, Edwards A, Evans S, Elwyn B & Elwyn G (2007) Assessing the practising physician using patient surveys: a systematic review of instruments and feedback methods. *Fam Pract* 24: 117–127.
- Evans SM, Berry JG, Smith BJ, Esterman A, Selim P, O’Shaughnessy J & DeWit M (2006) Attitudes and barriers to incident reporting: a collaborative hospital study. *Qual Saf Health Care* 15: 39–43.

- Feigenbaum AV (1961) Total quality control. Engineering and management. The technical and managerial field for improving product quality, including its reliability, and for reducing operating costs and losses. New York, McGraw-Hill Book Company.
- Ford RC, Bach SA & Fottler MD (1997) Methods of measuring patient satisfaction in health care organizations. *Health Care Manage Rev* 22: 74–89.
- Friele RD, Sluijs EM & Legemaate J (2008) Complaints handling in hospitals: an empirical study of discrepancies between patients' expectations and their experiences. *BMC Health Serv Res* 8: 199.
- Fullam F, Garman AN, Johnson TJ & Hedberg EC (2009) The use of patient satisfaction surveys and alternative coding procedures to predict malpractice risk. *Med Care* 47: 553–559.
- Gal I & Doron I (2007) Informal complaints on health services: hidden patterns, hidden potentials. *Int J Qual Health Care* 19: 158–163.
- Garver MS (2001) Listening to customers. *Mid Am J Bus* 16: 41–54.
- Gemoets P (2009) EFQM transition guide. How to upgrade to the EFQM Excellence Model 2010. Brussels, EFQM Publications. URI: http://www.efqm.org/en/PdfResources/Transition_Guide.pdf. Cited 2009/12/19.
- Gillham B (2007) Developing a questionnaire. 2nd ed. London, Continuum International Publishing Group.
- Goodman J (2006) Manage complaints to enhance loyalty. *Qual Prog* 39: 28–34.
- Greenhalgh T (2006) How to read a paper. The basics of evidence-based medicine. 3rd ed. Oxford, Blackwell Publishing.
- Grieffy RT & Bohan JS (2006) Healthcare provider complaints to the emergency department: a preliminary report on a new quality improvement instrument. *Qual Saf Health Care* 15: 344–346.
- Hamlin WB (1993) The history of evaluation criteria for CAP surveys. *Clin Chem* 39: 1456–1457.
- Hawkins RC (2007) Laboratory turnaround times. *Clin Biochem Rev* 28: 179–194.
- Heidegger T, Saal D & Nuebling M (2006) Patient satisfaction with anaesthesia care: What is patient satisfaction, how should it be measured, and what is the evidence for assuring high patient satisfaction? *Best Pract Res Clin Anaesthesiol* 20: 331–346.
- Hendriks AAJ, Oort FJ, Vrielink MR & Smets EMA (2002) Reliability and validity of the Satisfaction with Hospital Care Questionnaire. *Int J Qual Health Care* 14: 471–482.
- Hensen P, Schiller M, Metz D & Luger T (2008). Evaluating hospital service quality from a physician viewpoint. *Int J Health Care Qual Assur* 21: 75–86.
- Hepner DL, Bader AM, Hurwitz S, Gustafson M & Tsen LC (2004) Patient satisfaction with preoperative assessment in a preoperative assessment testing clinic. *Anesth Analg* 98: 1099–1105.
- Homburg C & Fürst A (2005) How organizational complaint handling drives customer loyalty: an analysis of the mechanistic and the organic approach. *J Mark* 69: 95–114.
- Homburg C & Fürst A (2007) See no evil, hear no evil, speak no evil: a study of defensive organizational behavior towards customer complaints. *J Acad Mark Sci* 35: 523–536.

- Howanitz PJ (1990) Quality assurance measurements in departments of pathology and laboratory medicine. *Arch Pathol Lab Med* 114: 1131–1135.
- Howanitz PJ (2005) Errors in laboratory medicine. Practical lessons to improve patient safety. *Arch Pathol Lab Med* 129: 1252–1261.
- Howanitz PJ, Cembrowski GS & Bachner P (1991) Laboratory phlebotomy. College of American Pathologists Q-Probe study of patient satisfaction and complications in 23783 patients. *Arch Pathol Lab Med* 115: 867–872.
- Hsieh SY, Thomas D & Rotem A (2005) The organisational response to patient complaints: a case study in Taiwan. *Int J Health Care Qual Assur* 18: 308–320.
- Institute of Medicine. Committee on Quality of Health Care in America (2001) *Crossing the quality chasm: a new health system for the 21st century*. Washington DC, National Academy Press.
- ISO/TS 22367 (2008) *Medical laboratories – Reduction of errors through risk management and continual improvement*. Geneva, International Organization for Standardization.
- Jenkinson C, Coulter A & Bruster S (2002a) The Picker Patient Experience Questionnaire: development and validation using data from in-patient surveys in five countries. *Int J Qual Health Care* 14: 353–358.
- Jenkinson C, Coulter A, Bruster S, Richards N & Chandola T (2002b) Patients' experiences and satisfaction with health care: results of a questionnaire study of specific aspects of care. *Qual Saf Health Care* 11: 335–339.
- Jha AK, Orav EJ, Zheng J & Epstein AM (2008) Patients' perception of hospital care in the United States. *New Engl J Med* 359: 1921–1931.
- Johnston R & Clark G (2001) *Service operations management*. Harlow, Prentice Hall.
- Johnston R & Mehra S (2002) Best-practice complaint management. *Acad Manag Exec* 16: 145–154.
- Jones BA, Bekeris LG, Nakhleh RE, Walsh MK & Valenstein PN (2009) Physician satisfaction with clinical laboratory services. A College of American Pathologists Q-Probes Study of 138 institutions. *Arch Pathol Lab Med* 133: 38–43.
- Jones BA, Walsh MK & Ruby SG (2006b) Hospital nursing satisfaction with clinical laboratory services. A College of American Pathologists Q-Probes Study of 162 institutions. *Arch Pathol Lab Med* 130: 1756–1761.
- Jones JA, Meehan-Andrews TA, Smith KB, Humphreys JS, Griffin L & Wilson B (2006a) "There's no point in complaining, nothing changes": rural disaffection with complaints as an improvement method. *Aust Health Rev* 30: 322–332.
- Juran JM (1964) *Managerial breakthrough. A new concept of the manager's job*. New York, McGraw-Hill Book Company.
- Juran JM & Gryna FM (1993) *Quality planning and analysis. From product development through use*. 3rd ed. New York, McGraw-Hill.
- Kelley K, Clark B, Brown V & Sitzia J (2003) Good practice in the conduct and reporting of survey research. *Int J Qual Health Care* 15: 261–266.
- Kreckler S, Catchpole K, McCulloch P & Handa A (2009) Factors influencing incident reporting in surgical care. *Qual Saf Health Care* 18: 116–120.

- Laffel G & Blumenthal D (1989) The case for using industrial quality management science in health care organizations. *JAMA* 262: 2869–2873.
- Laposata ME, Laposata M, Van Cott EM, Buchner DS, Kashalo MS & Dighe AS (2004) Physician survey of a laboratory medicine interpretive service and evaluation of the influence of interpretations on laboratory test ordering. *Arch Pathol Lab Med* 128: 1424–1427.
- Leape LL (1994) Error in medicine. *JAMA* 272: 1851–1857.
- Leape LL, Bates DW, Cullen DJ, Cooper J, Demonaco HJ, Gallivan T, Hallisey R, Ives J, Laird N, Laffel G, Nemeskal R, Petersen LA, Porter K, Servi D, Shea BF, Small SD, Sweitzer BJ, Thompson BT & Vander Vliet M (1995) Systems analysis of adverse drug events. *JAMA* 274: 35–43.
- Leape LL, Brennan TA, Laird N, Lawthers AG, Localio AR, Barnes BA, Hebert L, Newhouse JP, Weiler PC & Hiatt H (1991) The nature of adverse events in hospitalized patients. Results of the Harvard Medical Practice Study II. *N Engl J Med* 324: 377–384.
- Lilford R, Stirling S & Maillard N (2006) Citation classics in patient safety research: an invitation to contribute to an online bibliography. *Qual Saf Health Care* 15: 311–313.
- Lippi G, Banfi G, Buttarello M, Ceriotti F, Daves M, Dolci A, Caputo M, Giavarina D, Montagnana M, Miconi V, Milanese B, Mosca A, Morandini M & Luca G (2007) Recommendations for detection and management of unsuitable samples in clinical laboratories. *Clin Chem Lab Med* 45: 728–736.
- Lombarts MJMH, Rupp I, Vallejo P, Suñol R & Klazinga NS (2009) Application of quality improvement strategies in 389 European hospitals: results of the MARQuIS project. *Qual Saf Health Care* 18: i28–i37.
- Luria G, Gal I & Yagil D (2009) Employees' willingness to report service complaints. *J Serv Res* 12: 156–174.
- Mair F & Whitten P (2000) Systematic review of studies of patient satisfaction with telemedicine. *Br Med J* 320: 1517–1520.
- McCay L, Lemer C & Wu AW (2009) Laboratory safety and the WHO World Alliance for Patient Safety. *Clin Chim Acta* 404: 6–11.
- Miles MB & Huberman AM (1994) An expanded sourcebook. *Qualitative data analysis*. 2nd ed. Thousand Oaks, Sage Publications.
- Montini T, Noble AA & Stelfox HT (2008) Content analysis of patient complaints. *Int J Qual Health Care* 20: 412–420.
- Morgan NA, Anderson EW & Mittal V (2005) Understanding firms' customer satisfaction usage. *J Mark* 69: 131–151.
- Murff HJ, France DJ, Blackford J, Grogan EL, Yu C, Speroff T, Pichert JW & Hickson GB (2006) Relationship between patient complaints and surgical complications. *Qual Saf Health Care* 15: 13–16.
- Nabitz U, Klazinga N & Walburg J (2000) The EFQM excellence model: European and Dutch experiences with the EFQM approach in health care. *Int J Qual Health Care* 12: 191–201.

- Novis DA (2008) The quality of customer service in anatomic pathology. *Diagn Histopathol* 14: 308–315.
- Nuckols TK, Bell DS, Liu H, Paddock SM & Hilborne LH (2007) Rates and types of events reported to established incident reporting systems in two US hospitals. *Qual Saf Health Care* 16: 164–168.
- O’Kane MJ, Lynch PLM & McGowan N (2008) The development of a system for the reporting, classification and grading of quality failures in the clinical biochemistry laboratory. *Ann Clin Biochem* 45: 129–134.
- O’Leary KJ, Liebovitz DM, Feinglass J, Liss DT & Baker DW (2006) Outpatient physicians’ satisfaction with discharge summaries and perceived need for an electronic discharge summary. *J Hosp Med* 1: 317–320.
- Pantilat SZ, Lindenauer PK, Katz PP & Wachter RM (2001) Primary care physician attitudes regarding communication with hospitalists. *Am J Med* 111: 15S–20S.
- Pedler SJ & Bint AJ (1991) Survey of users’ attitudes to their local microbiology laboratory. *J Clin Pathol* 44: 6–9.
- Plebani M (2006) Errors in clinical laboratories or errors in laboratory medicine? *Clin Chem Lab Med* 44: 750–759.
- Plebani M & Carraro P (1997) Mistakes in a stat laboratory: types and frequency. *Clin Chem* 43: 1348–1351.
- Pope C, Ziebland S & Mays N (2000) Qualitative research in health care. Analysing qualitative data. *Br Med J* 320: 114–116.
- Quinn GP, Jacobsen PB, Albrecht TL, Bell Ellison BA, Newman NW, Bell M & Ruckdeschel JC (2004) Real-time patient satisfaction survey and improvement process. *Hosp Top* 82: 26–32.
- Reason J (2000) Human error: models and management. *Br Med J* 320: 768–770.
- Reason JT (2001) Understanding adverse events: the human factor. In: Vincent C (ed) *Clinical risk management: enhancing patient safety*. London, BMJ Publishing Group: 9–30.
- Reeves R & Seccombe I (2008) Do patient surveys work? The influence of a national survey programme on local quality-improvement initiatives. *Qual Saf Health Care* 17: 437–441.
- Roberts JS, Coale JG & Redman RR (1987) A history of the Joint Commission on Accreditation of Hospitals. *JAMA* 258: 936–940.
- Runciman WB, Sellen A, Webb RK, Williamson JA, Currie M & Morgan C (1993) Errors, incidents and accidents in anaesthetic practice. *Anaesth Intensive Care* 21: 506–519.
- Schuye PM (2000) The evolution of external quality evaluation: observations from the Joint Commission on Accreditation of Healthcare Organizations. *Int J Qual Health Care* 12: 255–258.
- Sciakovelli L & Plebani M (2009) The IFCC Working Group on laboratory errors and patient safety. *Clin Chim Acta* 404: 79–85.
- Seibert JH, Strohmeier JM & Garey RG (1996) Evaluating the physician office visit: in pursuit of a valid and reliable measure of quality improvement efforts. *J Ambul Care Manage* 19: 17–37.

- Shaw CD (2000) External quality mechanisms for health care: summary of the ExPeRT project on visitatie, accreditation, EFQM and ISO assessment in European Union countries. *Int J Qual Health Care* 12: 169–175.
- Shewhart WA (1931) *Economic control of quality of manufactured product*. New York, D. Van Nostrand Company.
- Sitzia J & Wood N (1998) Response rates in patient satisfaction research: an analysis of 210 published studies. *Int J Qual Health Care* 10: 311–317.
- Sluijs EM, Outinen M, Wagner C, Liukko M & de Bakker DH (2001) The impact of legislative versus non-legislative quality policy in health care: a comparison between two countries. *Health Policy* 58: 99–119.
- Smellie WSA, Galloway MJ & Chinn D (2000) Benchmarking general practice use of pathology services: a model for monitoring change. *J Clin Pathol* 53: 476–480.
- Stankovic AK (2004) The laboratory is a key partner in assuring patient safety. *Clin Lab Med* 24: 1023–1035.
- Stauss B & Seidel W (2008) Discovering the “customer annoyance iceberg” through evidence controlling. *Serv Bus* 2: 33–45.
- Stelfox HT, Palmisani S, Scurlock C, Orav EJ & Bates DW (2006) The “To Err is Human” report and the patient safety literature. *Qual Saf Health Care* 15: 174–178.
- Streiner DL & Norman GR (2003) *Health measurement scales. A practical guide to their development and use*. 3rd. ed. Oxford, Oxford University Press.
- Sumanen M, Virjo I, Hyppölä H, Halila H, Kumpusalo E, Kujala S, Isokoski M, Vänskä J & Mattila K (2007) Use of quality improvement methods in Finnish health centres in 1998 and 2003. *Scand J Prim Health Care* 26: 12–16.
- Szecei PB & Ødum L (2009) Error tracking in a clinical biochemistry laboratory. *Clin Chem Lab Med* 47: 1253–1257.
- Söderberg J, Brulin C, Grankvist K & Wallin O (2009) Preanalytical errors in primary healthcare: a questionnaire study of information search procedures, test request management and test tube labelling. *Clin Chem Lab Med* 47: 195–201.
- Tax SS, Brown SW & Chandrashekar M (1998) Customer evaluations of service complaint experiences: implications for relationship marketing. *J Mark* 62: 60–76.
- Ternov S & Akselsson R (2005) System weaknesses as contributing causes of accidents in health care. *Int J Qual Health Care* 17: 5–13.
- Theodorou DG & Anastasakis PC (2009) Management review checklist for ISO/IEC 17025 and ISO 15189 quality-management systems. *Accred Qual Assur* 14: 107–110.
- Tregunno D, Baker GR, Barnsley J & Murray M (2004) Competing values of emergency department performance: balancing multiple stakeholder perspectives. *Health Serv Res* 39: 771–791.
- Tucker AL & Edmondson AC (2003) Why hospitals don’t learn from failures: organizational and psychological dynamics that inhibit system change. *Calif Manage Rev* 45: 55–72.
- Vincent C (2003) Understanding and responding to adverse events. *N Engl J Med* 348: 1051–1056.

- Vincent CA (1989) Research into medical accidents: a case of negligence? *Br Med J* 299: 1150–1153.
- Vincent C, Neale G & Woloshynowych (2001) Adverse events in British hospitals: preliminary retrospective record review. *Br Med J* 322: 517–519.
- Vincent C, Taylor-Adams S, Chapman EJ, Hewett D, Prior S, Strange P & Tizzard A (2000) How to investigate and analyse clinical incidents: Clinical Risk Unit and Association of Litigation and Risk Management protocol. *Br Med J* 320: 777–781.
- Wagar EA & Yuan S (2007) The laboratory and patient safety. *Clin Lab Med* 27: 909–930.
- Wallin O, Söderberg J, Van Guelpen B, Stenlund H, Grankvist K & Brulin C (2008) Preanalytical venous blood sampling practices demand improvement – a survey of test-request management, test-tube labelling and information search procedures. *Clin Chim Acta* 391: 91–97.
- Waring J, McDonald R & Harrison S (2006) Safety and complexity. Inter-departmental relationships as a threat to patient safety in the operating department. *J Health Organ Manag* 20: 227–242.
- Wensing M, Vingerhoets E & Grol R (2003) Feedback based on patient evaluations: a tool for quality improvement? *Patient Educ Couns* 51: 149–153.
- Westgard JO (1992) Assuring analytical quality through process planning and quality control. *Arch Pathol Lab Med* 116: 765–769.
- Wicks AM & Roethlein CJ (2009) A satisfaction-based definition of quality. *J Bus Econ Stud* 15: 82–111.
- Wofford MM, Woffors JL, Bothra J, Kendrick SB, Smith A & Lichstein PR (2004) Patients complaints about physician behaviors: A qualitative study. *Acad Med* 79: 134–138.
- Woolf SH, Kuzel AJ, Dovey SM & Phillips RL (2004) A string of mistakes: the importance of cascade analysis in describing, counting, and preventing medical errors. *Ann Fam Med* 2: 317–326.
- Zarbo RJ (2006) Determining customer satisfaction in anatomic pathology. *Arch Pathol Lab Med* 130: 645–649.
- Zarbo RJ, Nakhleh RE & Walsh M (2003) Customer satisfaction in anatomic pathology. A College of American Pathologists Q-Probes Study of 3065 physician surveys from 94 laboratories. *Arch Pathol Lab Med* 127: 23–29.

Original publications

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- II Oja PI, Kouri TT & Pakarinen AJ (2009) Utilisation of customer feedback in a university hospital laboratory. *Accred Qual Assur* 14: 193–197.
- III Oja P, Kouri T & Pakarinen A (2010) Health centres' view of the services provided by a university hospital laboratory: Use of satisfaction surveys. *Scand J Prim Health Care* 28: 24–28.
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