

# Computerisation of endoscopy reports using standard reports and text blocks

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## ABSTRACT

**Background:** The widespread use of gastrointestinal endoscopy for diagnosis and treatment requires effective, standardised report systems. This need is further increased by the limited storage of images, and by the need for structured databases for surveillance and epidemiology. We therefore aimed for a report system which would be quick, easy to learn, and suitable for use in busy daily practice.

**Methods:** Endobase III<sup>®</sup> is an endoscopy information system offering three different ways of report writing, i.e. standard reports, text blocks and Minimal Standard Terminology (MST). A working group of two university and four general hospitals worked as a reference group for the development of standard reports and text blocks. Guidelines from various gastrointestinal endoscopy societies were followed to compose the reports.

**Results:** Standard reports were based on a list of distinct diagnoses; text blocks were based on anatomic landmarks and individual procedures. As such, 316 standard reports were developed for upper and lower gastrointestinal endoscopy, and endoscopic retrograde cholangiopancreatography (ERCP). In this way selecting one diagnosis produces a complete report. A total of 1571 different text blocks were additionally developed for each part of the gastrointestinal tract and for procedures during endoscopy. This module allowed generation of a full report on the combination of text blocks. Reports could be composed and printed within two minutes for 90% of cases.

**Conclusion:** Standard reports and text blocks are a quick, user-friendly way of report writing accepted and used by a number of gastroenterologists in the Netherlands.

## KEYWORDS

Computerisation, gastrointestinal endoscopy, standardised report system

## INTRODUCTION

Gastrointestinal endoscopy has become a standard, widely available technique for diagnosis and treatment of gastrointestinal disorders. The number of endoscopy procedures is ever increasing as a result of, among other things, the continuous development of newer techniques, introduction of screening and surveillance programmes for gastrointestinal disorders, and the increasing incidence of a range of gastrointestinal disorders. A recent survey among endoscopists in the Netherlands showed that 325,000 gastrointestinal endoscopies are performed annually in a population of 16 million.<sup>1</sup> As an imaging method with numerous repetitive manoeuvres as well as findings, gastrointestinal endoscopy reports are particularly suitable for electronic storage and processing.<sup>2</sup> Besides this, there is a need for structured databases for surveillance, epidemiology, quality control and research. This need is further increased by the limited storage of images during endoscopy, making the report essential.

For that purpose, several endoscopy information systems have been developed in the past decade to record endoscopy findings, store images and compose reports.<sup>3-13</sup>

Most of these systems are standalone report systems, not suitable for implementation in a hospital information system. The combination of report writing and digital image storing is not available in all the systems. The structure of the database of most of the systems is poorly accessible for research and export of data.

There are several crucial criteria for a report system that need to be fulfilled to get it generally used, suitable for every hospital and implemented in a hospital information system.

In the further development of healthcare informatics, it is necessary for such systems to be readily acceptable for most endoscopists in a hospital unit. Secondly, it should be possible to exchange and compare data and digital images

between different consultants and hospitals. Standardised protocols should be used to communicate between different systems within a hospital based on the Health Level-7 protocol (HL-7). For exchanging images a standard format such as DICOM (Digital Imaging and Communications in Medicine) is essential.

To get the system accepted in daily practice it is crucial that first of all, data entry is fast and accurate. Thus the system has to be accessible for the computer illiterate and the learning time should be limited.<sup>14</sup>

Programmes using the currently available structured data entry, such as Minimal Standard Terminology (MST),<sup>15-18</sup> do not fulfil all these crucial criteria. Firstly, composition of a report by means of MST is usually time consuming because of the different options available. Secondly, there is a risk of getting lost in the data entry module, caused by the numerous available choices that have to be made.

Our aim was to develop a report system that is quick, easy to learn and can be used in the busy daily practice by any endoscopist. Moreover, we considered it necessary that the programme would have the capacity to build up a database with endoscopy findings for various purposes including management of surveillance programmes, and epidemiological studies and quality control. Therefore, the findings should be linked to a specific comprehensive code system. This would allow anonymous evaluation of data.

Finally, consensus of gastroenterologists from different hospitals should be achieved for use of the new report system.

## MATERIALS AND METHODS

### Endoscopy information system

In the latest version of Endobase III<sup>®</sup>, developed by Olympus Software, it is possible to combine different text blocks to compose a complete report besides the use of standard reports and MST.

After selecting the different standard reports, text blocks or MST the composed report can be adapted in a word processor. An extensive relational database structure has been built into the programme, thus making it suitable for storing all the different data produced in an endoscopy unit, including digital images and videos, and retract it separately with all kinds of queries. A structured data entry is also available, the MST. The MST was translated into Dutch in 1998 by our group in cooperation with Dr Delvaux during a workshop on MST.

### TRANS.IT working group

At the end of 1999 a working group, the TRANS.IT project group, was founded as a peer reference group to design the standard reports and text blocks that were developed and used in the endoscopy units by the participating gastro-

enterologists. This group gathers on a regular basis to discuss the reports, a comprehensive coding system and new developments for endoscopy information systems.

The TRANS.IT working group consists of two university hospitals and six general hospitals and performs about 15% of all gastrointestinal endoscopies in the Netherlands. All the participants of the TRANS.IT group use the same version of standard reports, text blocks and translated MST. An alteration in the content of a standard report or text block will only be executed with the agreement of a majority of the working group members.

All the various standard reports and text blocks are directly linked to a specific code. The codes are based on the ICD-10 code system and are extended for specific endoscopy findings.<sup>19</sup>

### Structure of an endoscopy report

Several committees of societies for gastrointestinal endoscopy have proposed guidelines to obtain a standardised format for endoscopy reports. Considering the American Society of Gastrointestinal Endoscopy's proposal,<sup>20</sup> the European Society of Gastrointestinal Endoscopy's amendment,<sup>15</sup> the advice of the Netherlands Society of Gastroenterology and our experiences with an electronic report system we developed an extended structure to an endoscopy report suitable for our endoscopy units (*table 1*). A list of items proposed by the Netherlands Society of Gastroenterology was used for the description of the findings at the investigation (*table 2*). We used this structure and the proposed items as guidelines to compose the standard reports and text blocks in our system.

**Table 1.** Structure of an endoscopic report

Patient identification data
Date of procedure
Referring doctor
Endoscopist
Assisting doctor
Instruments used
Reasons for examination
Preparation
Type of endoscopic examination
Identification number of the endoscope
Medication (anaesthesia, analgesia, sedation)
Anatomical extent of examination
Limitation(s) of examination
Findings and specimens obtained
Therapeutic intervention(s) and result(s)
Notation of images captured
Complications (during endoscopy and within 24-48 hours)
Endoscopic diagnosis
Recommendations for referring doctor
Comments
Recall letter

**Table 2.** Items used to describe findings at upper gastrointestinal endoscopy

Use mm or cm in describing the dimensions of a lesion
Findings in oesophagus. Give distance in cm from lesions to teeth
Distance of Z-line to teeth
Distance of hiatal narrowing to teeth
Aspect of contents of stomach
Peristaltic and inflation of the stomach
Findings in antral region
Findings in corpus of the stomach
Findings in cardia and fundus in retroversion
Findings in angular region
Findings in pylorus and passing
Findings in duodenal bulb
Findings in proximal duodenum
Location of biopsies taken
Capture of images
Other procedures
Comment on proceedings of examination

The grading and severity of findings is classified by, for example, the Los Angeles (LA) Classification for reflux disease<sup>21</sup> and Forrest classification<sup>22</sup> for ulcers.

Prior to the examination most of the basic data of the patient necessary for the endoscopy report, such as indication, medication, endoscopist, endoscope identification number, referring doctor, general practitioner, medical history and risk factors, are already recorded in the system. The patient data can be extracted with the HL-7 protocol from the hospital information system by using the personal identification number (PIN) of the patient. Other features are recorded during or shortly after the examination date, such as *Helicobacter pylori* tests, histology or laboratory results, complications appearing after the examination and results of other gastrointestinal examinations such as ultrasonography, X-ray or manometry studies.

#### Presentation and selection of different text blocks

The presentation of the different standard reports and text blocks was based on the experience that endoscopists translate their findings into a diagnosis at the end of an endoscopy. To shorten the time needed to search for the corresponding diagnosis, the text blocks are presented in different subsections. First of all different text blocks were divided into anatomical regions that are easily defined during endoscopy investigations, such as oesophagus, stomach, duodenum. Within an anatomical region the possible different diagnoses are grouped, for example oesophagitis contains reflux, caustic, viral. Within these groups a classification or grading is eventually added. All the text blocks are presented alphabetically in the programme. By typing the first characters of a diagnosis the selection of the group of diagnoses is presented.

## RESULTS

### Standard reports

Based on individual diagnoses, we constructed 316 different standard reports. Of these reports, 134 pertained to oesophagogastroduodenoscopy, 143 to lower digestive endoscopy, and 39 to endoscopic retrograde cholangiopancreatography (ERCP). In an open-access endoscopy unit at a district general hospital, no abnormalities are found during endoscopy in 32.3% of the endoscopy examinations.<sup>23</sup> Likewise in our own data, similar numbers of around 30% are found between two different referring groups.<sup>24</sup> The reports composed for these examinations are simple and fully standardised. Nevertheless, all the items listed in table 2 have to be included to obtain a complete report.

The reports of the remaining 67.7% of the endoscopy examinations, where at least one abnormality was found, must also contain all items to make them complete. In some of these examinations only one abnormality was found leaving the rest of the procedures without any abnormalities. These examinations can also be reported using standard reports.

Other examinations show more abnormalities, making standard reporting less applicable. In less common combinations of abnormal or rare findings, the use of the specific text blocks is recommended.

The composed standard reports are based on the endoscopy diagnoses or a combination of diagnoses made during endoscopy (table 3). After the examination the endoscopist has to select this endoscopy diagnosis out of the list of different standard reports.

For reflux oesophagitis, six different standard reports have been created for the LA classification that is generally used, grade A to D and an ulcer or stricture of the oesophagus. For the frequently seen combination of columnar mucosa (Barrett) and reflux oesophagitis four additional standard reports with this combination are available.

Gastric and duodenal ulcers are described according to the Forrest classification, resulting in 30 different standard reports for a number of different locations.

Infrequent findings or findings at rare locations can be described with the use of text blocks.

The reports are alphabetically arranged in Endobase and can be searched for by giving the first one or more characters of the diagnosis.

During a normal programme at our endoscopy unit the time needed to compose a report by selecting standard reports was measured. A number of endoscopists composed a total of 291 reports in this way. A student was positioned behind the endoscopist and timed different items during report writing. The average reporting time including selection of the standard report, addition of some details in the word processor and printing of the report was 1 minute 21 seconds (SD 51 seconds) for standard reports.

**Table 3.** Examples of some different standard reports for oesophagogastroduodenoscopy

<b>Barrett's mucosa</b>
1. Barrett's mucosa
2. Barrett's mucosa with reflux oesophagitis grade A
3. Barrett's mucosa with reflux oesophagitis grade B
4. Barrett's mucosa with reflux oesophagitis grade C
5. Barrett's mucosa with reflux oesophagitis grade D
6. Barrett's mucosa control endoscopy
7. Barrett's carcinoma
<b>Reflux oesophagitis</b>
8. Reflux oesophagitis grade A
9. Reflux oesophagitis grade B
10. Reflux oesophagitis grade C
11. Reflux oesophagitis grade D
12. Reflux oesophagitis grade D with ulcer
13. Reflux oesophagitis grade D with stricture
<b>Duodenal ulcer*</b>
14. Duodenal ulcer, spurting bleeding (Forrest Ia)
15. Duodenal ulcer, nonspurting active bleeding (Forrest Ib)
16. Duodenal ulcer, visible vessel, no active bleeding (Forrest IIa)
17. Duodenal ulcer, nonbleeding with overlying clot (Forrest IIb)
18. Duodenal ulcer, with haematin-covered basis (Forrest IIc)
19. Duodenal ulcer, clean ulcer ground, no clot, no vessel (Forrest III)
20. Normal oesophagogastroduodenoscopy
<b>Hiatal hernia</b>
21. Sliding hiatal hernia
22. Sliding hiatal hernia with Cameron lesions
23. Sliding hiatal hernia and gastritis
24. Sliding hiatal hernia and gastritis and duodenitis
<b>Varices</b>
25. Varices oesophagus grade I
26. Varices oesophagus grade II
27. Varices oesophagus grade III
28. Varices oesophagus grade IV
29. Varices bleeding banding
30. Varices bleeding injection
*Similar standard reports for gastric ulcer.

### Text blocks

The text blocks were divided into different sections and presented in tabs according to different anatomical sections seen during the endoscopy and some specific parts. Reports created with text blocks were composed by selecting a diagnosis or finding from different sections of the text blocks.

For upper endoscopy eight different sections were made (table 4). First of all the preparation and progress of the examination was selected. Four sections were designed for the various anatomical regions: oesophagus, stomach, duodenal bulb and descending duodenum. A separate section was made for aberrant anatomy after gastrointestinal surgery. One section consisted of 'therapeutic' interventions, e.g. taking biopsies and placing endoprotheses. Another section was composed of different

**Table 4.** Different sections for text blocks

Oesophagogastro- duodenoscopy	Colonoscopy	ERCP
Preparation and progress of examination	Digital rectal examination	Introduction and proceedings
Oesophagus	Preparation and progress of examination	Papilla major
Stomach	Ileum	Papilla minor
Duodenal bulb	Caecum	Cannulation and pre-cut
Descending duodenum	Ascending colon	Common bile duct
Post-surgery	Transverse colon	Cystic duct and gall bladder
Therapeutic interventions	Descending colon	Bifurcation and hepatic ducts
Conclusions	Sigmoid colon	Pancreatic duct
Advice	Rectal and anal region	Sphincterotomy and balloon dilatation
	Post-surgery	Therapeutic interventions bile duct
	Therapeutic interventions	Therapeutic interventions pancreatic duct
	Conclusions	Conclusions
	Advice	Advice

ERCP = endoscopic retrograde cholangiopancreatography.

kinds of recommendations for the referring doctor. Finally, there was a section with conclusions which is automatically built up by the different selected text blocks.

It is possible to select one or more text blocks from each section, but also to select none and omit a section. A total of 252 text blocks were created for upper endoscopy.

Lower gastrointestinal endoscopy consists of 13 different sections (table 4). Again it starts with the preparation and progress of the examination. There are even different sections for anatomical regions: ileum, caecum, ascending colon, transverse colon, descending colon, sigmoid colon, rectal and anal region. A separate section was made for digital rectal examination. There is also one section for postsurgery anatomy and a section for therapeutic interventions. Recommendations for the referring doctor are in the last section. A total of 607 text blocks were created for lower endoscopy.

Reports of ERCP mainly comprised text blocks and consisted of different anatomical and therapeutic parts (table 4).

Each text block consists of one or more sentences describing a diagnosis or finding of that particular text block. For this purpose a total of 1571 different text blocks have been written and are being used at this moment (table 5).

**Table 5.** Number of standard reports and text blocks

Examination	Number of standard reports	Number of text blocks
Oesophagogastro-duodenoscopy	134	252
Sigmoidoscopy	47	420
Colonoscopy	96	697
ERCP	39	202
<i>Total</i>	316	1571

ERCP = endoscopic retrograde cholangiopancreatography.

In the same way as with standard reports, the time needed to compose a report with text blocks was timed. In total 133 examinations were reported by different endoscopists and the needed time was measured. The mean time for selecting different text blocks, making some adaptations in the word processor and printing of the report was 1 minute 37 seconds (SD 55 seconds).

In comparison, the time needed to use MST was also measured in 250 reports made by an experienced user. The mean time for this way of report writing is 2 minutes and 50 seconds (SD 1 minute 10 seconds).

### Coding

All endoscopy reports are coded automatically with an extension of the ICD-10. The different report systems in use all produce the same code for identical findings. In this way extensive research possibilities are created. For example, a search on 13,081 upper endoscopies for a specific ICD-10 code for duodenal ulcers (K26) results in 511 (3.9%) duodenal ulcers. This incidence is declining from 4.1% in 1996 to 2.8% in 2005. Twenty-one of these duodenal ulcers (4.1%) showed active bleeding and were classified as Forrest I, while six were Forrest Ia. Signs of recent bleeding were found with a visible vessel in 45 patients (8.8%), an overlying clot, Forrest Iib, in 31 (6.1%) and a haematin-covered basis, Forrest Iic, in 28 patients (5.5%).

### DISCUSSION

Structured computerised report systems are essential for modern gastrointestinal practice. They should enable systematic, rapid, informative, comprehensive reporting of endoscopy findings and at the same time allow database handling for various purposes. Potentially, they should also be used for safety and quality control, as well as other issues including maintenance of equipment, management of stocks, and billing. In this study we have shown that a structure report system, in our setting the Endobase III® system developed by Olympus, allows incorporation of standard reports as well as text blocks. With 316 reports

and 1571 text blocks, 90% of endoscopy examinations could be reported within two minutes. This makes it useful for the busy daily practice of many endoscopy units. All endoscopists in the participating hospitals use this system for report writing in every case.

Standard reports can be used to report examinations without abnormalities and examinations with frequently seen abnormalities. With rarer findings and/or a combination of diagnoses the use of text blocks is more suitable. This still makes it possible to compose a comprehensive report of the examinations performed in a short time. For those examinations (about 5 to 10%) where it is hard to compose a report with standard reports or text blocks, we propose using a standard structured data entry such as the MST. In our experience MST is more complex, takes more time and there is a risk of getting lost in the data tree. The advantage is that you can describe the findings point by point and build up a structured database.

In comparison, when using MST to compose a complete report, about 40 different choices have to be made for the description of an examination with only a few abnormalities. The possibility for the endoscopist to choose the type of report writing after the examination makes the programme user-friendly and well accepted. With standard reports and text blocks it is possible to register a standard list of all the requirements on medical records and endoscopy reports in particular.<sup>25</sup> With all the legal consequences nowadays, registration of endoscopy information should be as complete as possible. With this system all this information can be stored and easily retrieved.

All the standard reports and text blocks are directly linked to an extended ICD-10 code system in the database. Also other data in the system such as reason of examination, medication, and complications are coded. With these codes an anonymous database can be built with endoscopy data from different hospitals.

The standard reports and text blocks are written in Dutch, and will be translated. They are used in the Endobase system, but can be applied to any system that can work with text blocks and a code system.

All the reports and text blocks are tested and if necessary adapted by the TRANS.IT working group. The TRANS.IT working group will stay operational for at least three years, in order to improve the functionality and quality of the reports and to create a large anonymous central database. After three years we will have the possibility to answer specific research questions from the results of a database with approximately 60,000 upper endoscopies performed in a uniform way.

Nowadays the system with the standard reports and text blocks is accepted and used in about 30% of the Dutch Hospitals.

## NOTES

- Members of the TRANS.IT Project group, in alphabetical order, are: G.P. van Berge Henegouwen, M. Bruno, J.A.G. Drapers, P. Fockens, M.J.M. Groenen, G. den Hartog, G.H.J. van der Hoorn, P.J. Kingma, A.W.M. van Milligen de Wit, S.A. Mulder, P. Niermeijer, R.J.Th. Ouwendijk, P.J. van der Schaar, T. Schwartz, R. Soekhoe, W.N.H.M. Stuifbergen, A.A. Tanis, P.J. Wahab.
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