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Adult Cardiology Clinic

An evaluation of medical records documentation in the Adult Cardiology Clinic at the Nork Marash Medical Center: A cross-sectional study

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Prepared by Anna Oksuzyan

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Executive Summary

Purpose. The study was conducted to evaluate medical records documentation in the Adult Cardiology Clinic (ACC) at Nork Marash Medical Center (NMMC).

Introduction. Medical records are an important source of patient information used for quality assurance (QA), medical audit, reimbursement purposes, research, and education activities in developed countries. Patient records can serve as a defense against medical malpractice as well. However, before relying on medical records, the reliability and validity of their content should be evaluated. Several studies were conducted to assess the adequacy of medical records in various hospital and outpatient settings. Some indicated incomplete and inaccurate recording of elicited patient information. Medical records were more inadequate in outpatient health care settings. The initial hospital survey identified that NMMC has a variety of medical records and databases that can be used to assure quality of care and to monitor health care outcomes over time. However, the validity of patient records and databases has never been evaluated.

Methods. The study design was cross-sectional and data was collected prospectively. The accuracy and completeness of the first-visit structured encounter form (SEF) were assessed comparing the recorded information with the observation of the actual patient-cardiologist encounters, which was considered as the "gold standard". Survey participants were 18 and more years old females and males admitted to the ACC for the first time. The instrument was developed based on the content of the first-visit SEF and was pre-tested. SEFs were reviewed approximately 30 days after the completion of observations, assigning full, partial, and no credit to each item.

Sample. The sample size of the study was 66 patients. The hypothesized agreement between observations and records was agreement 85% and the least difference desirable to detect was 10%. There are five adult cardiologists at NMMC, four of whom participated in the study. The number of patients was represented in the sample proportionally to the volume of cardiologists' practices.

Ethical considerations. The research proposal was reviewed and approved by the Institutional Review Board (IRB) committee within the College of Health Sciences at the American University of Armenia (AUA).

Results. The mean observation time was 29 min and the average auditing time was 4 min. The overall mean agreement between observations of the actual encounters and SEFs was 69.8%. Data analysis was performed to identify the percent agreement for each domain and variable. Study indicated excellent agreement for tests performed and ordered for patient, good agreement for patient complaints and physical examination results, and poor agreement for medical history and patient habits. Recording pattern was examined to indicate inaccurate, under- and over-recording for each item in the instrument. Generally, there was significant under-recording of positive and/or negative findings for patient complaints, medical history, and patient smoking status. There was identified also over- and under-recording of physical examination findings. The examination of validity measurements pointed out that SEFs are valid source of patient information in terms of tests performed and ordered for patients.

Conclusions. Good overall agreement between observation of the actual cardiologist-patient encounter and SEF indicates that the first-visit SEF can be used as a source of patient data after appropriate improvements are designed and implemented. The study results emphasized the necessity of establishing guidelines for patient health assessment at the ACC, training on the completion of the first-visit SEF, and the establishment of the internal evaluation processes at NMMC.

Introduction

Medical records are an important source of patient information used for quality assurance (QA), medical audit, research, and education activities in developed countries. Based on the standards of Joint Commission on Accreditation of Healthcare Organizations (JCAHO) clinical records should contain sufficient information to identify a patient; to support a diagnosis: to justify treatment, its course, and results; and to promote continuity of care [1]. Nonetheless, health care organizations can determine the specific information documented in the clinical record for each patient assessed and treated on an ambulatory, emergency or inpatient basis [1] Good medical records ensure continuity of care and constitute a reliable means of communication among various health care providers delivering health care to patients [2]. Comprehensive medical records prove compliance with health care standards and justify deviation from these guidelines when necessary to assure quality of health care [2]. Patient records can be used for medicolegal purposes and serve as a defense against medical malpractice. Accurate, complete, and legible medical records are the evidence presented in court to refute professional negligence and medical malpractice [2]. The necessity for carefully prepared and thoughtful medical records have been heightened since the introduction of Quality Management and Improvement (QMI) programs to monitor and assess clinical outcomes [2]. In developed countries, the documentation in medical records assures reimbursement for the health care delivered to patients. Besides, adequate medical records are an irreplaceable source of patient information most frequently used for research purposes [3].

Before relying on medical records the reliability and validity of their content should be evaluated. A.Donabedian pointed out "…an important weakness in data: the medical record

does not show all that has been done for the patient, and certainly does not show all that should have been done" [4]. According to him, "The medical record kept by health care practitioners for each patient under their care is the most frequently used source of information about the process of care and about such outcomes as appear during care or soon afterward. Good records are essential for good care and for credible assessments of quality as well" [5].

Clinicians may argue that spending more time for medical records can lead to devoting less time to patients, so that the outstanding physician may keep inadequate records. S/he may believe the record review is the evaluation of record keeping rather than the evaluation of quality of care. Despite the possible logic and truth of this argument it has to be admitted that it is difficult to provide health care of high quality without adequate documentation to support decision-making and management of a patient [6]. Moreover, Lyons T.F. and Payne B.C. conducted secondary data analyses in 1974 using data on the quality of personal medical care and showed that "On the group level, on the individual physician level, and on the individual care level…1) good recording is related to good practice, and 2) the relationship is not perfect, but it is statistically significant" [7].

Several studies were conducted to assess the adequacy of medical records through comparison of verbatim transcripts of tape-recordings/direct observations of patient-provider encounters or computerized medical records with the information appeared in clinical records [7-11]. Research conducted by The Johns Hopkins Health Services Research and Development Center sought to determine the extent by which the evidence of coordination of care (recognition of such information as patient problems, therapies, tests, etc) was reflected in the medical record [9]. This study revealed that the observation and medical record agreed 70-85% of the time depending on the type of information [9]. Higher concordance between observations and records

was found for salient patient information: 82% agreement for symptoms, signs, and diagnosis, 81% agreement for prescribed therapies, while for the specific tests ordered the concordance was 70% [9]. The investigators concluded that medical records contain adequate patient information and supported the use of medical records to ensure continuity of care [9]. The study implemented by the Departments of Anesthesiology and Biomathematical Sciences of Mount Sinai School of Medicine, New York, indicated that extreme values of blood pressure were less frequently recorded in the handwritten than in the computerized anesthesia records [10]. The research suggested that some clinical information in the handwritten patient records could be inaccurate, which should be considered when using medical records as a source of information for research, quality assurance, and medicolegal purposes. It emphasizes the necessity to assess the reliability and validity of data abstracted from medical records prior to its use.

A.Donabedian mentioned that the medical record is less deficient for inpatients, more deficient in outpatient clinics that function within institutional health care organization, and much more incomplete in ambulatory settings that practice independently [5]. Zuckerman A.E., et. al, validated the content of pediatric outpatient medical records through comparison of tape-recordings of patient-provider encounters and the information documented in medical records [11]. The study findings indicated a good concordance between tape-recordings and medical records for patient chief complaints, 96%, diagnosis, 70%, non-drug therapies, 96%, and for follow-up appointments, 100% [11]. However, the agreement was poor for other type of patient information, such as 34% for drug name and 58% for drug dosage [11]. The authors speculated that medical records can serve as the source of patient information for various purposes after the adequacy assessment and appropriate revisions in records are made [11].

Research aimed to validate medical records of general medicine clinics of the North Carolina Memorial Hospital indicated that the actual concordance between medical records and interview transcripts ranged from 26 to 100%, where the chief complaints had the greatest agreement (92%), diagnosis or its impression, diagnostic tests, and therapy agreed by approximately by 70%, while the agreement of medical history was 29% [12]. The study showed that medical records are imperfect and documentation of patient information and patient education should be improved, particularly the discussion of diagnosis, tests, and proposed therapies [12]. In addition, the incomplete recording of patient-provider encounter was found in the study conducted in the teaching family medical centres of the Department of Family Medicine, University of Western Ontario, Canada [13]. A statistically significant difference ($p<0.001$) was found in the recording pattern between residents and observers and the under-recording of 1.03 problems per encounter [13].

Provider performance and recording may vary by the format of medical records [8, 14-15]. It was shown that the use of a structured encounter form increased the provider performance and recording compared with the use of a free text format [8, 14-15]. A study conducted in the Harriet Lane Primary Care Program (HLPCP) of the Johns Hopkins Hospital indicated also that there were over-recording for the physical examination in the SEF and under-recording of history of disease in the free text format records [8]. The investigators concluded that the record format may improve health care provider performance and documentation of patient information and delivered health care [8]. In addition, a clinical trial conducted in the general practitioner clinics of the capital city of Queensland, Australia, indicated that all clinical information was more frequently recorded and was more legible in the SEF compared to each item recorded in the free text medical records and favored the use of SEFs [15].

There is no available data on similar studies conducted in Armenia, so that determining the suitability of patient records use for quality assurance and research purposes in the Armenian health care organizations is a topic worthy of investigation.

A collaborative project between the Center for Health Services Research and Development (CHSR) at the American University of Armenia (AUA) and Nork Marash Medical Center (NMMC) was jointly proposed in March 2000. NMMC is the leading hospital in the Caucasus region that provides cardiology and cardiovascular surgical services for adult and pediatric populations. It was founded on the base of former Children's Hospital #2 in 1992. Since 1994, cardiovascular surgical services have been provided to pediatric patients. In 1996 cardiology and cardiac surgery services became available for the adult population as well. Currently, NMMC is 60-bed hospital equipped with two 12-bed Intensive Care Units and performs 500-600 cardiac surgeries per year, although it is capable to perform as much as 1200 surgical procedures yearly [16].

AUA/NMMC joint project (ANP) was designed to improve managerial systems and quality of care in the hospital. NMMC is the first health care organization in Armenia that has participated in a quality of care assessment based on international standards. An initial hospital survey was carried out at NMMC to assess its compliance with the patient-centered and management-centered standards set by the Joint Commission International Accreditation (JCIA) [16]. JCIA is the division of Joint Commission on Accreditation of Healthcare Organizations (JCAHO), which is a non-profit American organization that provides accreditation to the health care organization in the United States.

The evaluation of Management of Information (MOI) and Quality Management and Improvement (QMI) functions revealed that NMMC has the ability to generate clinical, financial,

and utilization data to meet the needs of those who manage the organization and those outside of the hospital [16]. A patient record is initiated for each surgical patient and various structured encounter forms (SEFs) developed by most administrative and clinical departments, are filled in to collect adequate information about each patient and ensure continuity of care. All clinical records are retained due to the availability of the physical space and are available on a timely basis. The medical records and existing databases serve as the primary source of patient specific information used for decision-making, monitoring key clinical indicators, and improving the quality of care. However, the process of reviewing patient clinical records/SEFs has not been established at NMMC. Medical records are reviewed mainly in cases of referral to another health care organization and SEFs are reviewed in cases of follow-up visits to ensure continuity of care, the quality of patient records has not been assessed [16].

The next step undertaken was to describe the flow of patient-specific data and reveal strengths and weaknesses of data collection and analysis at NMMC. NMMC has rich databases of patient specific information (demographics, comorbidity conditions, pre-operative and post-operative complications) and a variety of medical records that can be used to ensure continuity of patient care and to monitor health care outcomes over time and with similar organizations [17]. However, the reliability and validity of patient records and hospital databases were never been evaluated.

Invasive cardiology and cardiac surgery health care organizations are those clinical medicine fields that are expected to adopt and implement quality management and improvement activities at relatively early stages considering the invasive nature, the associated risks, and rapid growth of these interventions [18-20]. Although the philosophy of Continuous Quality Improvement (CQI) is not formally established at NMMC, it is recognized that the accuracy and

completeness of routinely gathered information significantly influence the decision-making process and eventually the outcomes of care. Hence, before reliance on medical records for data collection it is important to assess the quality of information documented in patient records.

Patients 18 and over years old are admitted to the Adult Cardiology Clinic (ACC), the outpatient clinic, where patient health status is assessed and, when necessary, the appropriate treatment is proposed. At the outpatient clinic, a first-visit patient record is initiated for each patient. The record is presented in the structured form and only disease history is recorded in a free text format (see Appendix 1). Information recorded in the SEFs includes patient demographics, healthy lifestyle behavior, disease history, comorbid conditions, previous surgical operations, results of physical examination, electrocardiography (ECG), echocardiography (EChO), and X-ray examination, diagnosis, proposed invasive procedure, prescribed treatment, and the date of follow-up visit. The first-visit SEF captures the initial pre-operative information about patients that can be used to properly adjust for patient case mix enabling a fair comparison of indicators over time and across institutions of similar type. Considering the importance of valid and reliable data in medical records for future quality improvement and research activities it was proposed to evaluate the first-visit SEFs of the Adult Cardiology Department at NMMC.

The research question is as follows:

Are the first-visit structured encounter forms (SEFs) of the Adult Cardiology Clinic an adequate data source for quality assurance activities and research purposes at Nork Marash Medical Center?

The specific aims of the study were:

1. to investigate the completeness of the first-visit patient SEFs in the ACC at NMMC,
2. to investigate the accuracy of the first-visit patient SEFs in the ACC at NMMC

3. to elucidate the appropriate recommendations to improve patient specific data collection at NMMC.

The main objectives of the study are the following:

1. to reveal the agreement between observations ("gold standard") and the first-visit SEFs
2. to assess the validity of the first-visit SEFs (sensitivity, specificity, and positive predictive value).

The first-visit SEF review was part of the official Nork 2-Record Review (N2-RR) project considered as an internal evaluation endeavor proposed and undertaken by CHSR and NMMC. The aim of this project was to identify the possible use of NMMC medical records and the surgical summary database for quality assurance and research activities. After the adequacy of patient records and database at NMMC is established quality of care can be evaluated through retrospective review, which is preferable to the concurrent, as it avoids the cost of primary data collection. Based on the study results, appropriate recommendations for improvement of data collection can be made that finally may lead to the improvement of quality of health care and patient health outcomes. The study is addressed to NMMC clinical and administrative leaders for consideration in decision-making and implementation of quality assurance and research activities.

Methods

Study design

The study is descriptive cross-sectional and data collection was done prospectively. A cross-sectional study design was selected to have systematically collected data on the topic under

investigation and generate statistics on the adequacy of the first-visit SEF at the NMMC ambulatory clinic, as well as to provide some recommendations for its further improvement.

The accuracy and completeness of the first-visit SEF was assessed comparing the recorded information with the observation of the actual encounter, which was considered as a "gold standard". Completeness has two facets: the number of items recorded in the SEF and the number of items that should have been recorded in the SEF compared with the clinical guidelines set by the organization. The first aspect reflects the administrative quality, while the second one reflects the quality of care. Due to time limitations, the second definition of completeness was considered beyond the scope of this project and was not addressed. Accuracy is defined as the extent by which the recorded item matches the observed item. For example, normal heart sounds could be recorded in the SEF, while heart auscultation was not performed during the observed patient visit.

Study protocol

One visit was observed at any given time. If there was more than one patient visit scheduled for the same time, the investigator selected the one that had begun first until the number of observations for a particular cardiologist was fulfilled. Although the patient diagnosis was excluded from the instrument, it was recorded in order to enable retrieving patient SEFs for further data analysis.

Patients are admitted to the ACC on a previously assigned date based on the urgency of their needs. Exceptions are the patients from remote regions or outside of Armenia and emergency cases, who are admitted on the day of the visit. At the ambulatory clinic, there are three cardiology residents and five adult cardiologists, each of whom is responsible for the

primary patient admission one day a week. The residents perform patient health assessment and management independently, though under the supervision of cardiologists. ECG and blood pressure measurement are performed and patient demographic data and lifestyle habits are documented in the SEF by nurses, while physicians perform the physical examination, EChO, and other procedures and record clinical information (history of disease, patient complaints, diagnostic test results, etc).

SEFs were reviewed approximately 30 days after the completion of observations. This delay could minimize the likelihood that cardiologists and residents would modify their performance and recording pattern. The SEF and observation were considered concordant if both contained comparable information regarding a particular item. For each item a score from 0 to 1 was assigned complete, partial or no credit. Coding was generous, giving credit to partial entries that reflected patient-provider encounter. For example, a patient had reported no chest pain, shortness of breath, and orthopnea, but complained of an irregular heartbeat and frequent loss of consciousness. The SEF could note that a patient did not have any complaint, except the arrhythmia and frequent syncope episodes. In this case the exertional chest pain, exertional shortness of breath, and orthopnea were considered concordant and were given full credit (i.e., 1). Further, if a patient reported 3 comorbid conditions and only two of them were recorded, partial credit (i.e., 0.67) was given to this item. The same rule of scoring was applied if the number of stated and recorded comorbidities was the same, but 1 of the reported was different from the recorded comorbid condition. Both positive and negative findings observed during a patient visit should appear in the SEF, as the concordance of negative findings was considered in another study validating medical records [12].

Study instrument

The instrument was developed based on the content of the first-visit SEF and was limited to a 22-item questionnaire to verify the accuracy and completeness of the recording of each item. Items commonly audited were included in the instrument, such as diagnosis, medications (current treatment), ordered diagnostic tests, and allergies. Items not typically included in the medical audit were patient complaints and previous surgical operations. The investigator prepared the questionnaire in consultation with the cardiologist, who was considered a counterpart of N2-RR project. Selected the items were relevant and essential to the quality assurance and research purposes and the same weight was assigned to each item.

Considering the nature of the study, the instrument was designed in a way that would facilitate data collection rather than data entry and included both close-ended and open-ended questions (see Appendix 2). Open-ended questions were family history, comorbid conditions, previous surgical operations, current treatment, and blood tests prescribed. Responses to the questions also differed depending on the nature of the question. Items regarding the actual procedures performed by health care providers, such as physical examination, ECG, EChO, prescription of X-ray, blood test, treadmill, and cardiac catheterization had Yes/No responses. Other items, such as exertional chest pain, exertional shortness of breath, arrhythmia, orthopnea, family history, allergy, comorbidities, current treatment, previous surgical operations, and smoking status had 1/2/3 responses. When a question was raised during the first visit and patient had this complaint 1 was assigned to the item. When the question was raised, but the patient did not have this symptom 2 was assigned to the item, and 3 was given to the item when the question was not discussed during the first-visit. The same assignment of responses was applied to SEFs review, which allowed capturing both positive and negative patient responses. The investigator

developed the instructions for observation and audit (see Appendix 3 and 4 respectively), so that a person without medical background could collect data after a short-term training. The instructions were prepared in English as the researcher collected all data.

The diagnosis, proposed treatment, and health education are communicated to patients and family members after the results of ancillary tests are available to cardiologists. The completion of these tests requires 30-45 minutes. Observation of continuing patient-provider encounter was considered infeasible due to time constrains, so only the initial part of the first visit was observed.

The instrument was pre-tested on 9 patients who were admitted to the outpatient clinic for the first time. Several problems were noticed in "current treatment" and "blood pressure measurement" items. At the time of admission to the ACC, some patients were already receiving antihypertensive and/or anti-anginal treatment. Some physicians recorded the medications that a patient was receiving in the SEF under the assigned treatment in instances when the cardiologist would prescribe the same medications. This did not allow differentiating the drugs that were newly prescribed by the cardiologist from those that the patient was receiving before admission to the ambulatory clinic. Thus, if question about the current treatment was raised during the observation and was positive, but it was not recorded separately from the prescribed treatment, the item was considered discordant.

The pre-test revealed that nurses may measure either sitting or lying blood pressure (BP), while BP level may differ depending on the patient position, which should be considered by physicians while interpreting results. Thus, the instrument was redesigned to capture the information not only whether this procedure was actually performed and the results were recorded, but also whether the patient position while measuring BP was noted in the SEF. The

pre-test also pointed out that comorbid conditions imply both those diseases that a patient currently has and those that s/he endured previously. Although the latter illnesses represent the history of disease, data was collected on both groups of diseases.

Pre-test results indicated that some patients could be prescribed a treadmill test and cardiac catheterization for diagnostic purposes. The treadmill test is performed outside of NMMC and patients are given referrals to those health organizations where this test is available. Cardiac catheterization and treadmill examination are costly procedures and some patients are unable to pay for them, so that the test results are not always available. However, the prescription of these procedures is recorded in the SEF and the investigator evaluated the completeness of physician recordings in SEFs regarding the prescription of cardiac catheterization and treadmill test.

Smoking status is asked and recorded by nurses at admission. The SEF format is designed in a way that it captures only positive and rarely negative (for example, when patient quit smoking within the past month) findings are recorded. The value 3 (nothing recorded) was assigned in cases when the item was left blank, as it is impossible to separate negative findings from missing values.

Study population

The eligibility criteria for the participation in the first-visit SEF evaluation project at the ACC are the following:

- primary patients admitted to the ACC
- 18 and more years old
- females and males

The exclusion criteria are as follows:

- patients admitted to NMMC for the first time on an emergency basis
- patients admitted to ACC for a follow-up visit.

The sample size of the study was determined using one-sample proportion formula in the STATA statistical software. The standard agreement is 0.95, the hypothesized agreement between observations and records is 0.85 (based on expert opinion), and the least difference desirable to detect is 0.10. With 80% power and alpha error of 0.05, the sample size is equal to 53 patients. The sample size was increased up to 66 patients, considering possible problems that might naturally rise during the study implementation.

A quota sampling procedure was used in the survey. The patients represented the sample proportion as the volume of cardiologists' practices. There are five adult cardiologists at NMMC, four of whom participated in the study. The volume of the cardiologist practice was calculated using 3-month data on first-visit patients from April to May, when none of them had vacations, so that the calculated percentages reflected reality. The percentage of patients examined by each cardiologist was calculated and applied to the sample of 66 patients to find the number of study participants drawn per cardiologist. This required 17, 22, 12, and 15 patients of four cardiologists participated in the study. The respective number of study participants assessed by cardiology residents was impossible to calculate due to the absence of available data on the volume of resident practices.

Ethical Considerations

The research proposal was reviewed and approved by the Institutional Review Board (IRB) committee within the College of Health Sciences at the AUA (see Appendix 5). The consent form was not provided to patients and cardiologists. The study possessed minimal risk

for patients, as the probability and extent of anticipated harm and discomfort were equal and not greater than that of routine physical and psychological examinations or tests performed in ordinary daily life. The first-visit SEF review was a part of the official ANP and was considered as a part of an internal evaluation process. Moreover, the presence of staff members (e.g. residents or other employees) during the examination is uncommon at NMMC or any other health care organization in Armenia. In those cases when a patient was confused or discontent by the presence of the investigator, the willingness of patient was respected. The study involved only those cardiologists who were willing to participate and were supportive of the ANP. The cardiologists' agreement to participate in the study was obtained prior to its initiation.

The study involves the use of patient names, as the SEFs of study participants were later reviewed. The medical records were reviewed in the hospital that ensured patient confidentiality. In addition, the patient names were coded and entered into the computer in a separate file, which was destroyed after data had been analyzed. The Consultants of the ANP, the advisors of student investigator, MPH department, and student researcher had access to the data.

Study limitations

The study involves direct observations of patient visits that can influence provider performance and recording. However, the reactive effect of the direct observation and consent statement on provider recording were assessed in the Harriet Lane Primary Care Program of the Johns Hopkins Hospital and found to be not statistically significant for study participants [8]. In addition, data collection on Hospital survey at NMMC conducted through interviews with key informants, observations, and, rarely, through record review, convinced the assessment team that the report was an objective and accurate portrayal of NMMC [16]. Taking into account the

absence of the reactive effect of direct observations on study results [8] and self-assessment nature of proposed project, additional SEFs review of unobserved visits of participating cardiologists was considered unnecessary.

The main factor that can jeopardize external validity of the results is the absence of patient randomisation, which was impossible to apply in the survey. As described earlier, both primary and surgical patients are admitted to the ambulatory clinic at an assigned time. Although a list of patients who will be admitted to the outpatient department is available for approximately one-month period ahead, the note about the type of the visit, i.e. the primary or the follow-up visit, is not recorded. However, it is believed that patient primary diagnoses included in the study represents the variety of patients admitted to the ACC, as the proportion of patient diagnoses in the sample was similar to that of patients admitted to the clinic during another 3-month period of time.

The study has limited generalizability as the results may be restricted to the structured encounter forms of the Adult Cardiology Clinic of NMMC. In addition, small sample size may not allow detecting the difference in percent agreement within patient diagnoses, gender, and among cardiologist, as well as between cardiologists and residents. Nevertheless, a pilot study revealed preliminary results regarding the adequacy of the first-visit SEF, so that conclusions and recommendations can be valuable for further research activities.

Data analysis

Data was entered into SPSS 10.0 statistical software and data analysis was performed in SPSS 10.0, STATA 7.0, and MS Excel statistical software. As noted earlier, the instrument was designed in a way to facilitate data collection rather than data entry, so that the physical structure

of the instrument and data entry format for some items, particularly for blood pressure, peripheral hemodynamics, and open-ended questions were modified. To eliminate the possibility of additional errors data cleaning and double entry with error checking were performed.

Sixty-six patients participated in the study: 17 (25.8%), 22 (33.3%), 12 (18.2%), and 15 (22.7%) of 2, 3, 4, and 5 cardiologists respectively. The first-visit SEFs of all patients were available. Cardiologists performed 57.6% of patient assessments, while cardiac residents admitted 43.4% of patients. Males constitute 56.1% of the study participants and females compose 43.9% of the sample. The mean observation time was 29 minutes ranging from 10 minutes to 1 hour 40 minutes (sd=12 minutes). The mean auditing time was 4 minutes with range from 2 to 10 minutes (sd=1 minute).

Percent agreement

The overall mean score was 16.7 (sd=1.83, min=13, max=20) (table #1), which corresponds to 69.8% agreement considering 24 as a perfect score.

Table #1. Mean score and percent agreement per case

Minimum	Maximum	Mean	Std. Deviation	% Agreement
13	20	16.74	1.83	69.8

The hypothesis that the percent agreement between observations and SEFs is 85% was tested using one-sample t-test. The investigator rejected the hypothesis that the true average agreement between the observation and the first-visit SEF is 85% ($p<0.000$) (table #2).

Table #2. The actual and hypothesized percent agreement and their mean difference with the 95% CI*

# of patients	Actual mean (X)	Hypothesized mean (Y)	Mean difference (X-Y)	Std. deviation	Sig. level (2-tailed)	95% confidence interval	
						Lower bound	Upper bound
66	69.78%	85%	-15.23%	7.62	.000	-17.11%	-13.36%

* CI- confidence interval

The actual mean agreement between observations and SEFs was 15.23 (95% CI: 13.36, 17.11) lower than the hypothesized value of the average agreement. The study has 85.97% power to detect 10% difference between perfect agreement and the hypothesized percent agreement between observations and the first-visit SEFs.

The items were collapsed to reveal the percent agreement for patient complaints, medical history, physical examination, tests performed, tests assigned, and patient smoking status (see Appendix 6). It was found that patient complaints had 70.83% agreement, medical history had 52.73% agreement, physical examination had 60.61% agreement, tests performed and tests ordered had 100% and 97.35% agreement respectively. Patient habits had the lowest percent agreement, 45.45% (table #3).

Table #3. Sum of the scores and percent agreement for domain

Variable name	Sum of scores	Percent agreement (%)	Agreement value (%)	Strength of agreement
Patient complaints	186	70.83	61-80	good
Medical history	176.6	52.73	41-60	poor
Physical examination	324.5	60.61	61-80	good
Tests performed*	132	100	81-100	excellent
Tests ordered†	202	97.35	81-100	excellent
Patient smoking status	30	45.45	41-60	poor

*Tests performed are electrocardiography and echocardiography examinations

†Tests ordered are X-ray examination, blood tests, treadmill test, and cardiac catheterization

The percent agreement per variable was also calculated considering 66 as a perfect score and is presented in Appendix 7. Concern was indicated for exertional shortness of breath, comorbidities, previous surgical operations, carotid artery auscultation, patient smoking status, family history, current treatment, patient position while measuring blood pressure, and position of peripheral pulses assessed. Low percent agreement for these variables can be due to significant under-recorded findings. They are important patient information that should be

adequately recorded to consider in planning of patient management and fair comparison of health care outcomes over time.

Recording pattern

Recording pattern was analysed to reveal under- and over-recording of positive and negative findings and improper recording for patient complaints, medical history, and patient habits. Recording pattern was examined for physical examination and tests performed and assigned for patients.

Under-recoding of both positive and negative findings for patient complaints, medical history, and patient habits was calculated as the percentage of responses not recorded in the SEF among all reported responses. Under-recording of positive findings was defined as the percentage of positive responses recorded in the SEF among all reported positive responses. Similarly, under-recording of negative findings was considered as the percentage of negative responses recorded in the SEF among all reported negative responses. Over-recording for these domains was calculated as the percentage of responses not obtained during the first visit among all recorded.

For physical examination, tests performed, and tests ordered under-recording was calculated as the percentage of results not recorded in the SEF among all performed procedures. Similarly, over-recording was computed as the percentage of procedures not performed among all results recorded in the SEF.

Generally, it was revealed that patient complaints and medical history were accurately recorded, but patient smoking status was improperly recorded in 7.32%. Under-recorded findings, both positive and negative, were found for patient complaints by 42.16%, medical history by 77.56%, and patient smoking status by 68.29% (table #4).

Table #4. Recording pattern for patient complaints, medical history, and patient smoking status *

Domain	Under-recording of negative and positive findings	Under-recording of positive findings	Under-recording of negative findings	Inaccurate recording	Over-recording
Patient complaints	42.16	18.75	60	0	0
Medical history	77.56	72.22	92.31	0	8.33
Patient habits	68.29	26.67	92.31	7.32	27.78

* Recording pattern is presented in percentages

Detailed examination of each variable collapsed into these domains revealed that the major problems in under-recording of positive findings were indicated for arrhythmia, orthopnea, allergy, and, especially, family history and current treatment. Under-recording of negative findings was found for exertional chest pain, arrhythmia, orthopnea, current treatment, comorbid conditions, previous surgical operations, and patient smoking status (see Appendix 8).

X^2 test of independence was carried out to reveal the association between raising the question about smoking status and gender. This revealed that discussion of smoking status with patients is related to gender and the odds of raising this issue for men is 3.8 times higher than for women (table #6).

Table #6. Rasing the question on patient smoking status by gender

	Raised	Not Raised	# of patients	Percentage*
Males	28	9	37	75.68
Females	13	16	29	44.83
Total	41	25		
Odds ratio = 3.82906			95% confidence interval	
			Lower bound	Upper bound
Pr>chi2 = 0.0103			1.194321	12.55209

* The percentage of cases when the question was raised by gender

Analysis of recording pattern of physical examination and tests performed and ordered to patients indicated under-recording for tests ordered (29.32%) and over-recording for physical examination (28.13%) (table #5). Tests carried out and assigned to patients were never over-recorded.

Table #5. Recording pattern for physical examination, tests performed, and tests assigned to patients *

Domain	Under-recording	Over-recording
Physical examination	29.32	28.13
Tests performed	0	0
Tests ordered	9.72	0

* Recording pattern is presented in percentages

Analysis of each variable separately indicated that the results of blood pressure measurement and the assignment of blood tests and cardiac catheterization were perfectly recorded (0% of under- and over-recording). Significant under-recording was revealed for patient position (either lying or sitting) while measuring blood pressure, for assessment of peripheral pulses, carotid artery auscultation, and the prescription of chest X-ray examination. Over-recording problems were indicated for lungs auscultation, abdominal palpation, assessment of peripheral pulses, position of peripheral pulses assessed, and carotid artery auscultation (see Appendix 9).

Difference of the mean concordance score among patient primary diagnoses, cardiologists, and cardiology residents

A set of independent variables was examined to reveal possible difference in the mean concordance score. The hypothesis that the mean concordance score per case is identical within patient diagnoses and among cardiologists was tested by one–way analysis of variance

(ANOVA). F-test was performed to test whether the mean scores are identical among cardiologists. At the ACC, patient diagnoses are divided into six categories, one of which (Acquired heart disease/Non-rheumatic) happened to be in the sample only once. To be able to detect possible difference in the mean percent agreement, this case was excluded from data analysis.

The ANOVA revealed that there was insignificant statistical difference in the mean concordance score in the sample depending on patient diagnosis (p=0.373) and cardiologist (p=0.156). One-way analysis of variance was performed to test the hypothesis that the mean concordance score of cardiologist is identical to that of resident performing under the supervision of this cardiologist. Due to the presence of a single patient assessment by the resident 1 under the supervision of the cardiologist 5, the ANOVA was carried out after the exclusion of this case from the data. Data analysis showed that there was a statistically significant difference in the mean overall score between the cardiologist 2 and resident 2 together and the cardiologist 3 and 4 alone (table #7).

Table #7. The difference in the mean concordance score between cardiologist and resident performing under the supervision of cardiologist

Cardiologist + resident id (X)	Cardiologist + resident id (Y)	Mean difference (X-Y)	Std. Error	Sig. Level	95% Confidence Interval	
					Upper bound	Lower bound
30	22	3.2813	.8821	.032	.1280	6.4345
40	22	3.9786	.9890	.012	.4431	7.5141

The mean difference is significant at the .05 level.

One-way analysis of variance was applied to test the difference in the mean score for each variable among cardiologists. When statistically a significant difference was found in the concordance score per variable among cardiologists, a post-hoc test with Bonferroni correction

was applied to indicate the mean difference between each pair of cardiologists. The Bonferroni correction was used to set the overall probability of type I error at the 0.05 level, as the combined probability of type I error for multiple tests is much greater than 0.05.

The ANOVA and the post hoc test revealed that there is a statistically significant difference between cardiologists in the mean concordance score for arrhythmia, lungs auscultation, abdominal palpation, and assessment of peripheral pulses (table # 8).

Table #8. The difference in the mean concordance scores for arrhythmia, lungs auscultation, abdominal palpation, and peripheral pulses assessment by cardiologists

Item	Cardiologist id (X)	Cardiologist id (Y)	Mean difference (X-Y)	Std. Error	Sig. Level	95% Confidence Interval	
						Upper bound	Lower bound
Arrhythmia	3	4	.5379	.1512	.004	.1259	.9499
Lungs auscultation	2	5	.5412	.1374	.001	.1668	.9156
	3	5	.3727	.1298	.034	.0189	.7266
	4	5	.5167	.1502	.006	.1074	.9260
Abdominal palpation	3	2	.4198	.1512	.044	.0763	.8319
Assessment of peripheral pulses	3	5	.4902	.1348	.003	.1226	.8577
	4	5	.5583	.1560	.004	.1333	.9834

The mean difference is significant at the .05 level.

Validity measurements

Validity measurements, important indicators of medical record adequacy, were calculated to test the potential use of the first-visit SEFs as source of retrospective data collection at NMMC. Sensitivity and specificity were calculated to have the percentage of true positives and true negatives respectively in the SEFs carrying a certain variable. Positive predictive value (PPV) was computed to indicate the percentage of true positives among all recorded positive.

Equal to or higher than 70% sensitivity, specificity, and PPV were found for tests performed and tests ordered to patients. Patient complaints, medical history, and patient habits had less then 70% sensitivity, but ≥ 70% specificity and PPV, except for patient smoking status that had < 70% PPV. On the contrary, physical examination had ≥ 70% sensitivity and PPV, but < 70% specificity (table #9). Validity of SEFs was examined for each variable separately as well, and details are presented in Appendix 10.

Table #9. Sensitivity, specificity, and positive predictive value for each domain

Variable name	Sensitivity	Specificity	PPV*
Patient complaints	58.15	100	100
Medical history	22.45	97.01	91.67
Physical examination	70.68	38.04	71.87
Tests performed†	100	100	100
Tests ordered‡	89.39	100	100
Patient smoking status	24.39	80	66.67

*PPV is the positive predictive value

†Tests performed are electrocardiography and echocardiography examinations

‡Tests ordered are X-ray examination, blood tests, treadmill test, and cardiac catheterization

Discussion

Percent agreement

Prior to implementing this study it was hypothesized that the mean percent agreement between observations and the first-visit SEFs is 85%, while the actual agreement was found to be 69.8%. Actual agreement was on average 15.23% (95% CI: 13.36, 17.11) lower than the hypothesized agreement. Further, analysis of the percent agreement for each domain revealed that tests performed and tests assigned to patients had perfect agreement, while patient complaints and physical examination had good agreement. The weakest area of data collection at ACC is medical history and patient habits.

This study's results are similar to that of another study aimed at validating medical records, which revealed poor agreement for patient habits, allergies, current medications, family history, and social history (29%) [12]. The survey conducted at the ACC revealed excellent agreement for ordered tests and lower agreement for chief complaints, while other studies indicated the opposite results [9, 11]. This can be explained by tendency to under-record positive and negative findings for patient complaints by cardiologists.

Analysis of each variable revealed excellent agreement of allergy. This can be due to the fact the question regarding allergy was raised only during 5 observations (8.2%) that may artificially increase the apparent percent agreement. Obtaining careful history of previous allergies, including drug allergies, is an important prerequisite to reduce the probability of hypersensitive reactions before administrating any medication to patients [21].

The analysis of percent agreement was carried out including those cases when a question was not raised during the first visit or a procedure was not performed, which may lead to the artificial increase of the overall percent agreement, as well as the percent agreement per variable. Thus, it can be expected that the concordance between observations and SEFs could be lower if analysis is performed without these cases.

Recording pattern

One of the strengths of data collection at the ACC is the accurate and complete recording of tests performed and ordered for patients, except chest X-ray examination. Under-recording of chest X-ray prescription can be explained by cardiologists' reliance on the availability of existing X-ray films. However, these films are not attached to ambulatory folder, where patient SEFs are

kept, and stored separately. Thus, the auditor or investigator would be unable to detect from the SEF whether chest X-ray test was prescribed to patient or not if it is not recorded in the SEF.

The results showed that there was proper recording of patient complaints and medical history. However, there was significant under-recording of both positive and negative findings regarding patient complaints, patient habits, and, especially, medical history. Family history of myocardial infarction, hypertension, sudden death, and stroke was generally raised during the first visit, but it was almost never recorded. Family history is one of the risk factors for heart disease, although unmodifiable, and should be carefully addressed by physicians [22-23, 26]. It should be noted that the sample included patients who had a family history of cardiovascular diseases. If this issue was not discussed it was impossible to find out under-recording of negative findings regarding patient family history. Over-recording of medical history can be explained by the fact that in some cases comorbidities and previous surgical operations were noted in the SEF as negatives, but these issues were not discussed during the first visit.

Current treatment is another area of data collection at ACC that is weak and needs improvements. Medications that were prescribed to a patient in another health care organization were rarely recorded in the SEF, which may pose some difficulties for assessing continuity and quality of care [26].

It was mentioned previously that the detail given to record comorbidities and previous surgical operations items varies among cardiologists and residents. Therefore, some cardiologists may record only those diseases that a patient currently has and/or are important for planning of patient management, which can be considered as a subjective judgement. Furthermore, the absence of comorbid conditions and previous surgical operations should be marked in the SEF. In most such cases the items were left blank, which does not allow differentiating negative

responses from missing ones. Some comorbid conditions and previous surgical operations are those preoperative variables that should be considered for risk adjustment of health outcomes after cardiac surgery [24-25]. They are indicators of disease severity and should be taken into account when planning alternative treatments [24-25].

The same problem was found in patient habits, as only positive findings were recorded; negatives, e.g. when patient quitted smoking in a recent past, were rarely recorded. Moreover, there was improper recording of patient smoking status, though only in small percent of cases. Examining the difference in proportion of cases when the question about smoking status was raised showed that the odds of being asked about smoking status is 3.8 times higher for males than for females. This can be explained by the cultural image of non-smoking Armenian woman. Patient habits are risk factors for cardiovascular diseases [22-23]. Under-recording and improper recording of these findings 1) may impose difficulties on conducting patient education stressing a particular patient lifestyle behavior and 2) can create obstacles for retrospective data collection for further QA and research activities.

It can be concluded that the under-recording of positive and negative findings indicates the absence of the established policy and procedures for taking medical history and risk factors for cardiovascular diseases and problems with training in documenting medical records. It may underestimate cardiologist performance, as without recording of negative findings it is impossible to prove that a question was raised [2, 12].

Data analysis revealed that there were notable under-recording and over-recording of physical examination results. Examination of each item separately indicated that the major problems were found for patient position while measuring BP, position of pulses assessed, and

carotid artery auscultation. Patient BP was measured in either sitting or lying position, but it was never recorded in the SEF.

While collecting the data it was revealed that the detailed given to record peripheral hemodynamics and major arteries varies among cardiologists and cardiac residents. The number of pulses assessed was identified from the item peripheral hemodynamic/major arteries (depending on the implication of cardiologists and residents), while the pulse item of SEF showed which artery pulse had been assessed. The results of carotid artery auscultation were recorded under the item major arteries or as a separate item in the remarks. The assessment of peripheral pulses (left and right radial and left and right pedal pulses) and carotid artery auscultation should be routinely performed in each patient admitted to the clinic. Data analysis indicated significant under-recording of these procedures, which in turn identifies a problem with the lack of standards on physical examination and documenting its results.

An over-recording pattern was indicated for lungs auscultation, abdominal palpation, assessment of peripheral pulses, and carotid artery auscultation. Physical examination was found to be most prone to over-recording in another study aimed to evaluate the impact of SEFs on provider performance and recording pattern in comparison with free text format patient records. The format of SEF for physical examination predisposed providers unintentionally to check off all physical examination results even if it was partially performed. This identifies a problem with training on documentation of medical records and the absence of established guidelines on conducting patient physical examinations. Partial performance of physical examination may lead to overlooking of patient health problems and inappropriate patient management, possibly causing quality of care to suffer.

Difference of the mean concordance score among patient primary diagnoses, cardiologists, and cardiology residents

The study revealed that there was no statistically significant difference in the mean concordance score within patient primary diagnoses and among cardiologists, but there was a statistically significant difference between cardiologists alone and residents performing under the supervision of cardiologists. Further, analyzing the difference in the average concordance score per each variable among cardiologists detected statistically significant differences in the mean concordance score for arrhythmia, lungs auscultation, abdominal palpation, and peripheral pulses. Although a larger sample size was needed to deduce conclusions and appropriate recommendations, the study may present pilot results that can be used for further research.

Validity measurements

Before reliance on medical records as a source of patient data for research or other purposes, it is necessary to examine their validity. Data analysis was carried out to detect how sensitive, specific and predictive the first-visit SEFs are to various types of patient information. When both sensitivity and specificity were equal or exceeded 70%, the medical records were considered appropriate for use as a valid source of patient information for retrospective data collection.

Data analysis indicated that the first-visit SEFs are sensitive to performance or prescription of ancillary tests and are specific enough to properly identify when these tests actually were not performed or assigned. These medical records are also able to correctly predict true performance/prescription of these tests by 100%. More detailed analysis indicated that the SEF reflected true positive findings on exertional chest and BP measurement by 76-100% and true negative findings by 100%. The other items had high sensitivity, but low specificity or low

sensitivity, but high specificity (see Appendix 14) that should be considered when collecting patient information for research purposes.

Conclusions and recommendations

A comprehensive clinical record is a key source of specific patient information used for various purposes. Considering the importance of accurate and complete patient records, the study was conducted to evaluate the medical records documentation at the ACC at NMMC. Study indicated the following strengths and weaknesses of data collection at ACC:

- Good agreement between observations of the actual patient-provider encounter and medical records
- Significant under-recording of positive findings regarding family history and current treatment
- Significant under-recording of negative findings regarding patient complaints, medical history, and patient habits
- Considerable under-recording of patient position while measuring BP and results of particular peripheral artery assessments
- Substantial over-recording of lungs auscultation, abdominal palpation, assessment of peripheral pulses, and carotid artery auscultation
- Valid patient specific information with respect to BP measurement, tests performed and ordered to patients
- Absence of established standards on history taking, physical examination, and documentation of medical records

Good agreement between direct observations of patient-cardiologist encounters and the first-visit SEFs supports the use of the first-visit SEFs as a source of patient information for further QA activities and research purposes only after some improvements are designed and implemented. The first-visit SEF was found to be valid source of patient data only with regard to BP measurement, ECG and EChO examinations, prescriptions of blood tests, treadmill test, and cardiac catheterization that had a high percent agreement, sensitivity, specificity, and PPV.

Under-recording of patient complaints, medical history, and patient smoking status resulted in decreased percent agreement and lowered the adequacy of patient records. It is necessary to emphasize the need for recording not only positive, but also negative findings, differentiating them from the missing ones. It is quite important to record patient family history and allergy and the SEF should be redesigned to include this information. Comorbid conditions and previous surgical operations had poor agreement that highlights the need to establish the standards on history taking regarding these items and to separate comorbidities from the previously endured diseases. Besides, to fairly compare indicators of health care quality at NMMC over time and with similar health care organizations in developed countries, it is necessary to standardize coding of patient diagnosis and comorbid conditions according to international standards (e.g. ICD).

Patient position while measuring BP was either sitting or lying. This identifies the necessity to its standardization and BP measurement in a single position or its notation in the SEF. Further, under-recording of physical examination results and the prescription of chest X-ray examination may undervalue provider performance and lessens the adequacy of medical records, so that it is essential to improve recording of all patient information trough medical staff training.

Over-recording of lungs auscultation, abdominal palpation, assessment of peripheral pulses, position of peripheral pulses assessed, and carotid artery auscultation possesses problem with training on documentation of medical records. In addition, incomplete patient health assessment may lead to disregarding of disease symptoms and signs, which in its turn may result in under-diagnosis, incomplete treatment and worsening of patient health outcomes. Thus, it is extremely important for NMMC to develop clinical guidelines on history taking, physical examination, and data collection on patient lifestyle behavior, train the medical staff members on accurate and complete documentation of patient information, and to establish internal evaluation processes at NMMC ensuring compliance with these standards and continuous quality improvement.

Patient weight and height are excluded from the first-visit SEF, while overweight is one of the modifiable risk factors for heart disease [22-23]. The equipment to measure patient weight and height is available at NMMC and can be performed by nurses while patient are waiting for cardiologist admission. In addition, it is recommended to note the type of patient visit, i.e. primary or follow-up, in the nurses notebook when assigning a date and time for patient visit to facilitate further data collection and patient randomization, if necessary.

It is recommended to conduct further research with a larger sample size to investigate the variation of the mean score by patient primary diagnosis, cardiologists, and residents. Although preliminary results showed identical mean concordance score within patient diagnosis, this can be due to small number of patients with acquired rheumatic heart disease and congenital heart disease in the sample. Therefore, a larger sample size could be needed to detect a statistically significant difference in the mean concordance score by patient diagnoses. In addition, while initial findings revealed identical mean concordance score among cardiologists, study detected

statistically significant difference among cardiologists regarding arrhythmia, lungs auscultation, abdominal palpation, and peripheral pulses assessment, as well as between cardiologist assessing patients alone and cardiologists supervising resident performance. However, a study with larger sample size is desirable to conduct to confirm the statistically significant difference with high power. Preliminary difference in recording pattern among cardiologists for certain variables defines the necessity of stressing these issues when training the ACC staff members on medical records documentation.

It is proposed to investigate on the completeness and accuracy of the first-visit SEFs in comparison with clinical guidelines used by similar health care organizations and to evaluate cardiologist performance according to these standards. Besides, intrusive nature of the study that involved the direct observation of patient-cardiologist encounters may lead to modifying their behavior and recording pattern. Although it is believed that the study results reflect the real picture of NMMC, it is desirable to assess the adequacy of medial records when using less intrusive methods.

In conclusion, the study confirmed that the accuracy and completeness of medical records should be evaluated prior to their use as a source of patient data for QA and research activities. This study can serve as a basis for designing and implementing improvements in other aspects of patient data collection at NMMC. This may result in the improvement of health care quality and, consequently, patient health outcomes. Moreover, in a broader view, the NMMC may serve as a model of successful introduction and implementation of QA activities in the Armenian health care system. NMMC experience in this sphere can be used by other hospitals in Armenia to accept the “philosophy” of QA as an indispensable function of any health care organization to provide high quality health care.

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Appendices

Appendix 1

The first-visit structured encounter form of the Adult Cardiology Clinic

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• **Hypertension** • **Arrhythmia** • **Cardiomyopathy** • **NS** • **Other**

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Խոշոր անոթներ _____

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դիաստոլիկ աղմուկ՝ , բնույթը՝_____մաքսիմալ լսում է՝_____

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Կրկին քննություն ___/ ____ / 200 թ.

Այլ հետազոտություններ

1.tredmil
2.holter
3. CT
4. MRI

Դեղորայք՝

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

Appendix 2

AMERICAN UNIVERSITY OF ARMENIA / NORK MARASH MEDICAL CENTER

INSTRUMENT FOR THE EVALUATION OF MEDICAL RECORDS DOCUMENTATION AT THE ACC

1 = raised/positive	1 = recorded/positive
2 = raised/negative	2= recorded/negative
3 = none	3 = none

1-3 responses for A and D sections

Yes = test performed/ordered	Yes = results recorded/prescription recorded
No = test not performed/not ordered	No = results not recorded/prescription not recorded

Yes/No responses for B and C sections

Date: ____/____/2001

Observation Start time: _____: _____
Observation End time: _____: _____

Patient ID:
Resident ID:

Auditing Start time: _____: _____
Auditing End time: _____: _____

#	Item	**Observation**	**1st visit SEF**	**Score**
		Response	**Response**	**0-1**
A.	**Anamnesis Morbi:**	**1/2/3**	**1/2/3**	
1.	Exertional chest pain			
2.	Exertional shortness of breath			
3.	Arrhythmia			
4.	Orthopnea			
5.	**Family history** (e.g. for myocardial infarction			
	hypertension			
	stroke			
	diabetes			

	renal failure					
	others)					
6.	Allergy					
7.	Current treatment					
8.	**Comorbidities** (e.g. myocardial infarction,					
	stroke					
	diabetes					
	gastric ulcer					
	rheumatic fever					
	others)					
9.	**Previous surgical operation(s)** (e.g. cardiac surgery,					
	gastric ulcer resection,					
	others)					
B.	**Physical examination**	**Yes**	**No**	**Yes**	**No**	
10a.	Blood pressure measurement					
10b.	Sitting/lying position while measuring BP					
11.	Heart auscultation					

12.	Lungs auscultation					
13.	Abdominal palpation					
14a.	**Peripheral hemodynamics** (left radial pulse,					
	right radial pulse					
	left pedal pulse					
	right pedal pulse)					
14b.	Position of pulse assessed					
15.	Carotid artery auscultation					
C.	**Other tests**					
16.	Electrocardiography (ECG)					
17.	Echocardiography (EchO)					
18.	Chest X-ray examination					
19.	**Blood tests**					
	(prothrombin index,					
	electrolytes [Na, Ca, K],					
	creatinine,					
	glucose,					
	cholesterol,					
	triglycerides,					
	HDL,					
	LDL,					
	bun,					
	others)					
20.	Treadmill					
21.	Cardiac catheterization					
D.	**Risk factor**	**1/2/3**		**1/2/3**		
22.	Smoking status					

Patient name:
Patient primary diagnosis:
Patient secondary diagnosis:

Appendix 3

AMERICAN UNIVERSITY OF ARMENIA /NORK MARASH MEDICAL CENTER

INSTRUCTIONS FOR OBSERVATIONS OF PATIENT-PROVIDER ENCOUNTERS AT THE ADULT CARDIOLOGY CLINIC

1= raised/positive*	The question was raised during the first visit and a patient answer was positive
2= raised/negative	The question was raised during the first visit and a patient answer was negative
3= none	The question was not raised during the first visit

* 1-3 responses for sections A and D
Yes/No responses for B and C sections

Section A / Anamnesis Morbi

1. Did a cardiologist ask a patient about exertional havi ng chest pain? [1 -3]

1 If a question about having exertional chest pain was raised and a patient had the exertional chest pain
2 If a question about having exertional chest pain was raised and a patient had not the exertional chest pain
3 If a question about having exertional chest pain was not raised

Note: Chest pain sensation can be described by a patient as an unpleasant feeling (e.g. pressing, squeezing, strangling, constricting, bursting, burning, etc). The exertional chest pain is defined as chest pain related to the physical activity.

2. Did a cardiologist ask a patient about having exetional shortness of breath? [1-3]

1 If a question about having exertional shortness of breath was raised and a patient had the exertional chest pain
2 If a question about having exertional shortness of breath was raised and a patient had not the exertional chest pain
3 If a question about exertional chest pain was not raised during the first visit

Note: A patient can describe the shortness of breath as a feeling of urgent need to take another breath. The exertional shortness of breath is defined as shortness of breath related to the physical activity.

3. Did a cardiologist ask a patient whether s/he has arrhythmia? [1-3]

1 If a question about having arrhythmia was raised and a patient had the arrhythmia
2 If a question about having arrhythmia was raised and a patient had not the arrhythmia
3 If a question about having arrhythmia was not raised during the first visit

Note: The arrhythmia can defined by a patient or cardiologist as “pounding”, “stopping”, “jumping” or “racing”.

4. Did a cardiologist ask a patient about having orthopnea? [1-3]

1 If a question about having orthopnea was raised and a patient had the orthopnea
2 If a question about having orthopnea was raised and a patient had not the orthopnea
3 If a question about having orthopnea was not observed during the first visit

Note: Orthopnea is defined as having difficulties with breathing that occur in lying position and is relieved promptly by sitting or standing position.

5. Did a cardiologist ask a patient about having family history of any disease? [1 -3]

1 If a question about having family history of any disease was raised and a patient mentioned one/some disease(s)

2 If a question about having family history of any disease was raised and a patient had not family history of any disease
3 If a question about having family history of any disease was not raised during the first visit

Note: If a patient had a family history of any disease, write down the diseases that the patient had reported.

6. Did a cardiologist ask a patient about having an allergy/ [1-3]

1 If a question about having an allergy was raised and a patient responded positively
2 If a question about having an allergy was raised and a patient responded negatively
3 If a question about having an allergy was not raised during the first visit

7. Did a cardiologist ask a patient whether s/he is receiving treatment for a heart disease? [1-3]

1 If a question about being currently treated for a heart disease was raised and a patient responded positively
2 If a question about being currently treated for a heart disease was raised and a patient responded negatively
3 If a question about being currently treated for a heart disease was not raised

Note: If answer is positive, write down the names of the drugs that the patient mentioned.

8. Did a cardiologist ask a patient about having comorbidities (illnesses other than heart disease)? [1 -3]

1 If a question about having comorbidities was raised and a patient responded positively
2 If a question about having comorbidities was raised and a patient responded negatively
3 If a question about having comorbidities was not raised during the first visit

Note: If a patient answer was positive, write down those diseases that the patient had noted, both those that s/he currently has and that s/he had in the past.

9. Did a cardiologist ask a patient about having surgeries in the past? [1-3]

1 If a question about having surgical operations in the past was raised and a patient answered positively
2 If a question about having surgical operations in the past was raised and a patient responded negatively
3 If a question about having surgical operations in the past was not raised during the first visit

Note: If a patient response was positive write down those operations that the patient listed.

Section B / Physical examination

10a. Did a cardiologist perform blood pressure measurement in patient? [Yes/No]

Yes If a cardiologist/nurse applied the cuff of the sphygmomanometer to a patient bare upper arm, placed the disk of the stethoscope face down under the cuff and immediately above a patient elbow, squeezed the had bulb rapidly, and delatated the cuff slowly

No If a cardiologist/nurse did not either apply the cuff of the sphygmomanometer to a patient bare upper arm, or did not place the disk of the stethoscope face down under the cuff and immediately above a patient elbow, or did not squeeze the had bulb

10b. What was a patient position while measuring blood pressure? [Yes/No]

Yes A patient blood pressure was measured either in sitting or lying position

No A patient position was not measured (see 10a No)

11. Did a cardiologist perform heart auscultation? [Yes/No]

Yes If a cardiologist applied the disk of the stethoscope on a patient chest in the area of the h eart projection: second right interspace and the left third interspace adjacent to the sternum, second left interspace, fourth and fifth interspaces adjacent to the left sternal border, and cardiac apex

No If a cardiologist did not apply the disk of the stethoscope on a patient chest in the area of the heart projection

12. Did a cardiologist perform lung auscultation? [Yes/No]

Yes If a cardiologist applied the disk of the stethoscope face down on the anterior and posterior sides of a patient chest

No If a cardiologist did not apply the disk of the stethoscope on a patient anterior and posterior sides of chest

13. Did a cardiologist perform abdominal palpation? [Yes/No]

Yes If a cardiologist palpated a patient abdomen

No If a cardiologist did not palpated a patient abdomen

14a/b. Did a cardiologist assessed a patient peripheral pulses? [Yes/No]

Yes If a cardiologist took a patient radial and pedal pulses on both left and right hands and legs (e.g.: using tips of index and third fingers a cardiologist located the area between a patient wrist bone and tendon on the thumb side of either wrist

No If a cardiologist did not check radial and pedal pulses of a patient

Note: If a cardiologist assessed a patient peripheral pulses, write down for which arteries the pulse was taken.

15. Did a cardiologist perform the auscultation of carotid arteries? [Yes/No]

Yes If a cardiologist applied the disk of the stethoscope face down on the right and left lateral sides of a patient neck

No If a cardiologist did not apply the disk of the stethoscope face down on the right and left lateral sides of a patient neck

Section C / Other tests

16. Did a cardiologist/nurse perform electrocardiography? [Yes/No]

Yes If a patient was asked to lie on a bed or examining table and electrodes were attached to the skin of a patient legs, arms, and chest. After the recording process had begun, a graphic representation of a heart at work appeared on the paper

No If electrodes were not attached to the skin of a patient legs, arms, and chest. After the recording process had begun, a graphic representation of a heart at work did not appeared on the paper

17. Did a cardiologist perform echocardiography? [Yes/No]

Yes If a patient was asked to lie on the table or the examination table, special jelly was applied to a patient chest, and as a cardiologist maneuvered the transducer on a patient chest, the reflection image of heart appeared on the screen

No If a cardiologist did not maneuvered the transducer on a patient chest and the reflection image of heart did not appear on the screen

18. Was a patient prescribed the chest X-ray examination? [Yes/No]

Yes If a patient was prescribed chest X-ray examination

No If a patient was not prescribed chest x-ray examination

19. Was a patient prescribed blood tests? [Yes/No]

Yes If a patient was prescribed blood tests

No If a patient was not prescribed blood tests

Note: If a patient was prescribed blood tests mark those tests that a cardiologist reported.

20. Was a patient prescribed treadmill examination? [Yes/No]

Yes If a patient was prescribed treadmill examination and was referred to the appropriate health care organization

No If a patient was not prescribed treadmill examination

21. Was the cardiac catheterization proposed to a patient? [Yes/No]

Yes If a patient was proposed the cardiac catheterization

No If nothing was mentioned about the cardiac catheterization

Section F / Risk factor

22. Did a cardiologist ask a patient about smoking habit? [1-3]

1 If a question about being a smoker was raised and a patient responded positively
2 If a question about being smoker was raised and a patient responded negatively
3 If a question about being smoker was not raised during the first visit

Appendix 4

AMERICAN UNIVERSITY OF ARMENIA /NORK MARASH MEDICAL CENTER

INSTRUCTIONS FOR AUDITING THE MEDICAL RECORDS DOCUMENTATION IN THE ADULT CARDIOLOGY CLINIC

1= recorded/positive	A patient respond was recorded and the findings were positive
2= recorded/negative	A patient respond was recorded and the findings were negative
3= none	The item on the SEF is left blank

Responses 1-3 for the sections A and D
Responses Yes/No for the sections B and C

Section A / Anamnesis Morbi

1. Was a patient complaint about having exertional chest pain recorded in the SEF? [1 -3]

1 If a patient complaint about having or exertional chest pain was recorded in the SEF under the item "Anamnesis Morbi"
2 If a patient note about not having the exertional chest pain was recorded in the SEF
3 If nothing was recorded in the SEF regarding the exertional chest pain

Note: The exertional chest pain can be defined as the chest pain related to the physical and emotional activities.

2. Was a patient complaint about having exertional shortness of breath recorded in the SEF? [1 -3]

1 If a patient complaint about having exertional shortness of breath was recorded in the SEF under the item "Anamnesis Morbi"
2 If a patient note about not having exertional shortness of breath was recorded in the SEF
3 If nothing was recorded in the SEF regarding the exertional shortness of breath

3. Was a patient complaint about having arrhythmia recorded in the SEF? [1-3]

1 If a patient complaint about having arrhythmia was recorded in the SEF under the item "Anamnesis Morbi"
2 If a patient note about not having arrhythmia was recorded in the SEF
3 If nothing was recorded in the SEF regarding arrhythmia

4. Was a patient complaint about having shortness of orthopnea recorded in the SEF? [Yes/No]

1 If a patient complaint about having orthopnea was recorded in the SEF under the item "Anamnesis Morbi"
2 If a patient note about not having orthopnea was recorded in the SEF
3 If nothing was recorded in the SEF regarding orthopnea

5. Was a family history of any disease recorded in the SEF? [1 -3]

1 If a family history of any disease (i.e. mother or father or both parents had/have a particular disease) was recorded in the SEF
2 If a patient note about not having family history of any disease was recorded in the SEF
3 If nothing was recorded in the SEF regarding family predisposition

Note: If a response was positive, copy those diseases that were recorded in the SEF

6. Was a patient complaint about having allergy was recorded in the SEF? [1-3]

1 If a patient complaint about having an allergy was recorded in the SEF
2 If a patient note about note having an allergy was recorded in the SEF
3 If nothing was recorded in the SEF regarding an allergy

7. Did the SEF mention about patient receiving current treatment for a heart disease? [1-3]

1 If a note that a patient is receiving treatment for a heart disease was recorded in the SEF
2 If a note that a patient is not receiving treatment for a heart disease was recorded in the SEF
3 If SEF mentioned nothing about a patient receiving treatment for a heart disease

Note: If a patient answer was positive, copy the names of the drugs that were recorded in the SEF under the current treatment

8. Were patient comorbidities (illnesses other than heart diseases) recorded in the SEF? [1-3]

1 If the SEF mentioned about comorbidities that a patient has under the item "Other diseases"
2 If SEF mentioned that a patient does not have comorbidities
2 If the SEF mentioned nothing about comorbidities that a patient has

Note: If response is positive, copy those diseases that were recorded in the SEF.

9. Were previous surgical operations that a patient underwent in the past recorded in the SEF? [1-3]

1 If previous surgical operations were recorded in the SEF under the item "Other diseases"
2 If a patient statement about not having previous surgical operations was recorded in the SEF
3 If nothing was recorded in the SEF regarding previous surgical operations

Note: If a patient response was positive, copy those surgeries that were recorded in the SEF.

Section B / Physical examination

10a. Was a patient blood pressure recorded in the SEF? [Yes/No]

Yes If two numbers (for systolic and diastolic blood pressure) are recorded in the SEF under the item "Blood pressure"

No If both numbers (for systolic and diastolic blood pressure) were not recorded in the SEF

10b. Was a patient position while measuring blood pressure recorded in the SEF? [Yes/No]

Yes Either sitting or lying position of a patient while measuring blood pressure was recorded in the SEF

No If a patient position while measuring blood pressure was not recorded in the SEF

Note: If a patient position while measuring blood pressure was noted in the SEF, write it down.

11. Were the results of heart auscultation recorded in the SEF? [Yes/No]

Yes If marks (+ or N) were made or negative findings were recorded in the SEF under the item "Heart sounds and murmurs"

No If nothing was recorded in the SEF under the item "Heart sounds and murmurs"

12. Were the results of lung auscultation recorded in the SEF? [Yes/No]

Yes If vesicular respiration was marked or abnormal findings were recorded in the SEF under the item "Lungs"

No If the item “Lungs” is left blank

13. Were the results of abdominal palpation recorded in the SEF? [Yes/No]

Yes If a mark (+ or -) was made or negative findings were recorded in the SEF under the item “Abdomen”

No If nothing was recorded in the SEF under the item “Abdomen” on the SEF

14a Were the results of peripheral pulses assessment recorded in the SEF? [Yes/No]

Yes If marks (+ or N) were made or negative findings were recorded in the SEF under the item “Peripheral hemodynamics” or “Major arteries”

No If the item “Peripheral hemodynamics” or “Major arteries” was left blank

14b. Was the position of pulses assessed recorded in the SEF? [Yes/No]

Yes If marks (+ or N) were made or negative findings were recorded in the SEF under the item “Pulse”

No If item “Pulse” is left blank

15. Were the results of carotid artery auscultation recorded in the SEF? [Yes/No]

Yes If a mark (+ or N) was made or negative findings were recorded in the SEF under the items “Great arteries” in the SEF

No If the item “Great arteries” in the SEF is left blank

Section C / Other tests

16. Were the results of electrocardiography (ECG) recorded in the SEF? [Yes/No]

Yes If ECG results were recorded in the SEF or the ECG list was attached to a patient ambulatory record

No If ECG results were not recorded in the SEF or the ECG list was not available in the ambulatory folder

17. Were the results of echocardiography recorded in the SEF? [Yes/No]

Yes If EChO results were recorded in the SEF under the item “Echocardiography”

No If the item “Echocardiography” is left blank

18. Were the results of chest X-ray examination recorded in the SEF? [Yes/No]

Yes If prescription of X-ray examination was recorded in the SEF or X-ray film was attached to the patient ambulatory record

No If nothing was recorded regarding the prescription of X-ray examination or X-ray film was not attached to the patient ambulatory record

19. Were the blood test results recorded in the SEF? [Yes/No]

Yes If the blood tests form with the recorded results was attached to the patient ambulatory record

No If blood tests form with the recorded results was not available in a patient ambulatory record

Note: If blood tests were prescribed to a patient write down the results of those tests that were recorded

20. Was treadmill test prescribed to a patient? [Yes/No]

Yes If treadmill test was circled in the SEF

No If treadmill test was not circled in the SEF

21. Was the cardiac catheterization proposed to a patient? [Yes/No]

Yes If a note that a patient was proposed the cardiac catheterization was recorded in the SEF under the item "Remarks"

No If nothing was recorded in the SEF regarding cardiac catheterization

Section D / Patient risk factor

22. Was a patient smoking habit recorded in the SEF? [1-3]

1 If a note that a patient is a smoker was recorded in the SEF
2 If a note that a patient is not a smoker was recorded in the SEF
3 If the item "Smoking" on the ACD SEF is left blank

Appendix 5

Study approval by the Institutional Review Board committee within the College of Health Sciences

Appendix 6

Outline of items included in each main domain

Domain	Items
Patient complaints	Exertional chest pain, exertional shortness of breath, arrhythmia, orthopnea
Medical history	Family history, allergy, current treatment, comorbidities, previous surgical operations
Physical examination	BP * measurement, patient position while measuring BP, heart auscultation, lungs auscultation, abdominal palpation, assessment of peripheral pulses, position of peripheral pulses assessed, carotid artery auscultation
Tests performed	ECG† and EChO‡
Tests ordered	Chest X-ray examination, blood tests, treadmill test, cardiac catheterization
Patient habits	Patient smoking status

*BP – blood pressure
†ECG – electrocardiography
‡EChO - echocardiography

Appendix 7

Sum of the scores and percent agreement for each variable

Variable name	Sum of scores	Percent agreement (%)	Agreement value (%)	Strength of agreement
exertional chest pain	51	77.27	61-80	good
exertional shortness of breath	35	53.03	41-60	poor
arrhythmia	47	71.21	61-80	good
orthopnea	53	80.30	61-80	good
family history	19	28.79	< 40	very poor
allergy	63	95.45	81-100	excellent
current treatment	28	42.42	41-60	poor
comorbidities	32.1	48.64	41-60	poor
previous surgical operations	34.5	52.27	41-60	poor
BP* measurement	66	100	81-100	excellent
patient position while measuring BP	0	0	< 40	very poor
heart auscultation	65	98.48	81-100	excellent
lungs auscultation	50	75.76	61-80	good
abdominal palpation	41	62.12	61-80	good
assessment of peripheral pulses	42.5	64.39	61-80	good
position of peripheral pulses assessed	27	40.91	< 40	very poor
carotid artery auscultation	33	50	41-60	poor
ECG†	66	100	81-100	excellent
EChO‡	66	100	81-100	excellent
chest X-ray examination	60	90.91	81-100	excellent
blood tests	65	98.48	81-100	excellent
treadmill test	65	98.48	81-100	excellent
cardiac catheterization	66	100	81-100	excellent
patient smoking status	30	45.45	41-60	poor

*BP – blood pressure

†ECG – electrocardiography

‡EChO - echocardiography

Appendix 8

Recording pattern for each variable of patient complaints, medical history, and patient habits *

Patient complain	Under-recording of negative and positive findings †	Under-recording of positive findings ‡	Under-recording of negative findings §
exertional chest pain	24.19	0	24.19
exertional shortness of breath	49.21	5	69.77
arrhythmia	43.18	37.14	66.67
orthopnea	81.25	25	100
allergy	60	60	0
family history	97.92	92.97	0
current treatment	95	96.67	90
comorbidities	60.34	40	91.30
previous surgical operations	64.44	42	94.74
patient smoking status	68.29	33.33	92.31

* the recording pattern is presented in percentages

† the percentage of responses not recorded in the SEF among all cases when the question was raised

‡ the percentage of positive responses not recorded in the SEF among all reported positive responses

§ the percentage of negative responses not recorded in the SEF among all reported negative responses

Appendix 9

Recording pattern for each variable of physical examination, tests performed and assigned to patients *

Item	Under-recording §	Over-recording ¶
BP* measurement	0	0
patient position while measuring BP	100	0
heart auscultation	0	1.51
lungs auscultation	0	75.76
abdominal palpation	2.38	36.92
assessment of peripheral pulses	3.33	48.21
position of peripheral pulses assessed	92.5	40
carotid artery auscultation	33.33	88.57
ECG†	0	0
EChO‡	0	0
chest X-ray test	60	0
prescription of blood tests	0	0
assignment of treadmill	7.69	0
assignment of cardiac catheterization	0	0

*BP – blood pressure

†ECG – electrocardiography

‡EChO - echocardiography

§ the percentage of responses not recorded in the SEF among all performed procedures

¶ the percentage of procedures not performed among all responses recorded in the SEF among

Appendix 10

Sensitivity, specificity, and positive predictive value for each variable

Variable name	Sensitivity	Specificity	PPV*
exertional chest pain	75.81	100	100
exertional shortness of breath	51.61	100	100
arrhythmia	56.82	100	100
orthopnea	18.75	100	100
family history	2.08	100	100
allergy	40	100	100
current treatment	5	100	100
comorbidities	39.65	87.50	95.83
previous surgical operations	35.56	85.71	84.21
BP† measurement	100	100	100
patient position while measuring BP	0	0	0
heart auscultation	100	0	98.48
lungs auscultation	100	0	75.76
abdominal palpation	97.62	0	63.08
assessment of peripheral pulses	96.67	25	51.79
position of peripheral pulses assessed	7.5	92.31	60
carotid artery auscultation	66.67	48.33	11.43
ECG‡	100	100	100
EChO§	100		100
chest X-ray examination	40	100	100
blood tests	100	100	100
treadmill test	92.31	100	100
cardiac catheterization	100	100	100
patient smoking status	24.39	80	66.67

* PPV – positive predictive value
† BP – blood pressure
‡ ECG – electrocardiography
§ EChO - echocardiography