

Peer reviewed ORIGINAL ARTICLE

AN AUDIT OF THE COMPLETION OF BONE MARROW SPECIMEN REQUEST FORMS AT AN ACADEMIC LABORATORY

MJ Coetzee¹ MBChB, MMed(Path), FFPATH(SA), DTM&H | G Joubert² BA, MSc | M Swart³ MBChB | A Streicher³ MBChB | M Kruger³ MBChB | H Koekemoer³ MBChB

¹Department of Haematology & Cell Biology, University of the Free State & National Health Laboratory Service, Bloemfontein, South Africa

²Department of Biostatistics, University of the Free State, Bloemfontein, South Africa

³Previously medical students, School of Medicine, University of the Free State, Bloemfontein

Corresponding author: Marius J Coetzee | tel +27 51 405 3043 | email: coetzeemj@ufs.ac.za

SUMMARY

Background: Bone marrow request forms contain clinical information for the diagnosis of haematological conditions. Because these forms were not being completed adequately we introduced a structured request form in the Free State Province and performed an audit to see how it was completed.

Methods: During four months in 2013 we received 357 requests. We recorded the completion of the time and date, patient details, doctor's details, full blood count (FBC) results, clinical information, transfusion details, other laboratory tests requested, and details of the procedure completed by technologists.

Results: The patient's FBC results were absent on 57.7%, the transfusion history on 29.1%, the medication on 23.8%, and information about the clinical examination and HIV status on 9.2% of forms. The technologist had not signed on 27.4%, and details of additional tests were missing on 23.3%.

Conclusion: The lack of completion is similar to those reported for other laboratory request forms. We began to educate students and doctors about the importance of clinical information.

KEYWORDS

Bone marrow examination, laboratory request forms, hematology, clinical audit, clinical laboratory services

INTRODUCTION

The request for a laboratory test begins with a question in the mind of the treating doctor. The results of the laboratory test aims to answer the question or to lead to other questions, thus closing the brain-to-brain loop of laboratory testing.^[1] The laboratory haematologist integrates clinical information with laboratory findings in order to arrive at a clinically relevant diagnosis. However, approximately 70% of "laboratory errors" occur before the specimen is analysed.^[2] Incomplete test request forms continue to contribute to these errors.^[3]

Bone marrow aspirations and biopsies are invasive procedures that are only done if a diagnosis cannot be made on peripheral blood. Currently common indications at our institution include unexplained thrombocytopenia, anaemia, haematological malignancies, staging of non-haematological cancers, and HIV-associated cytopenias.^[4] The bone marrow sample is examined under the microscope, and depending on the context, it is also submitted for flow cytometry, various genetic tests, or for culture. The decision regarding additional tests is urgent, as fresh samples yield better information. Adequate clinical information is vital for the diagnosis of haematological malignancies,^[5,6] as details such as organomegaly and lymphadenopathy guide the selection of tests. Accurate demographic information prevents common pre-analytical errors.^[3]

The National Health Laboratory Service (NHLS) Haematology Laboratory at Universitas Academic Hospital receives bone marrow specimens from the eastern part of the Northern Cape, and the entire Free State. Most of the specimens come from the Pelonomi Regional Hospital and Universitas Academic Central Hospital, both in Bloemfontein. The laboratory provides tertiary paediatric and adult clinical haematology and oncology services for both diagnosis and monitoring. In 2013 we received 676 bone marrow aspirates and 882 trephine biopsy specimens. Most of the bone marrow procedures are done by clinical staff like registrars and medical officers. Our medical laboratory technologists assist them by making the aspirate smears and biopsy imprints.

The consequence of the incorrectly completed bone marrow request forms was that our registrars spent hours on the telephone obtaining missing clinical information that was important for the diagnoses. New genetic tests for haematological malignancies had been introduced, but these were often not ordered appropriately. This had a negative impact on the quality of diagnosis and turnaround time.

We introduced a new bone marrow request form in 2012 that we hoped would improve the quality of information received by the laboratory. The purpose of this audit was to establish how well these forms were being completed.

tests requested, and the laboratory details recorded after the procedure. A question about HIV infection was included because of its prevalence (16.6% in 2015),^[9] and its implications in the pathogenesis and management of haematological malignancies. HIV can for instance cause myelodysplastic changes that can be misinterpreted as evidence of the myelodysplastic syndrome, if the haematologist is not aware of the infection.

RESULTS

The results are summarised in Figure 2 in order of prevalence.

Some referring laboratories used old request forms, so that 32.2% (115/357) had no specific space for noting additional tests that were requested with the specimen.

The medical student researchers found 29.7% of the doctors' handwriting on the request forms to be illegible. The doctor's name was absent on 2.0% and telephone number on 5.6% of forms. This made it difficult to obtain missing information.

The full blood count (FBC) values that prompted the decision to request the bone marrow were absent in 57.7% of the forms. On 29.1% of the forms there was no transfusion history.

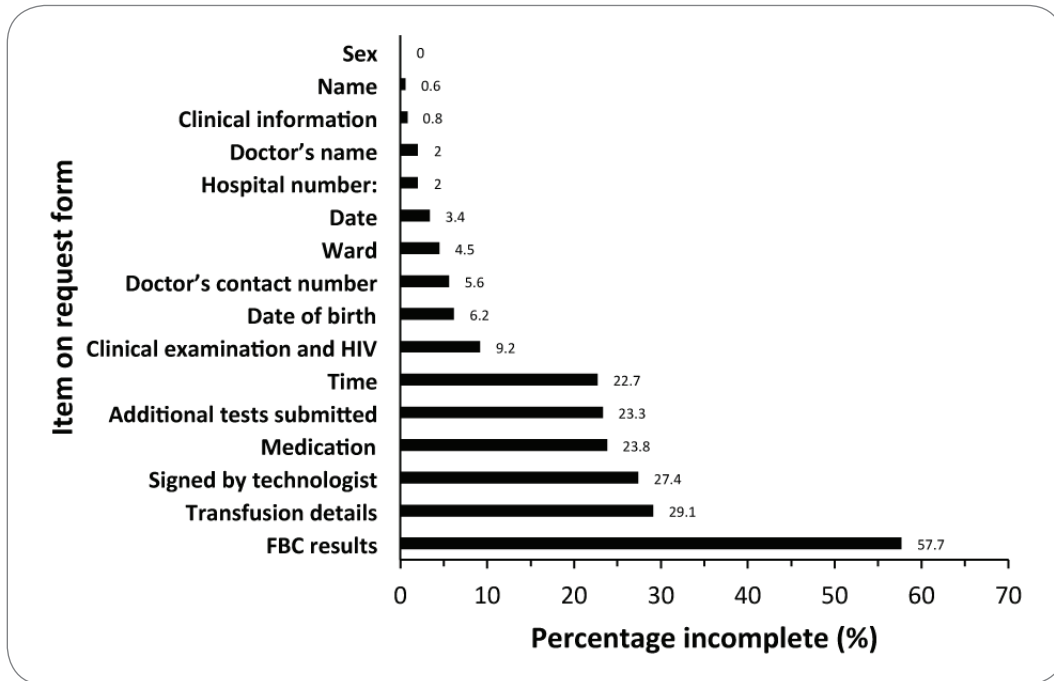


Figure 2. Percentage of incomplete items on the request forms.

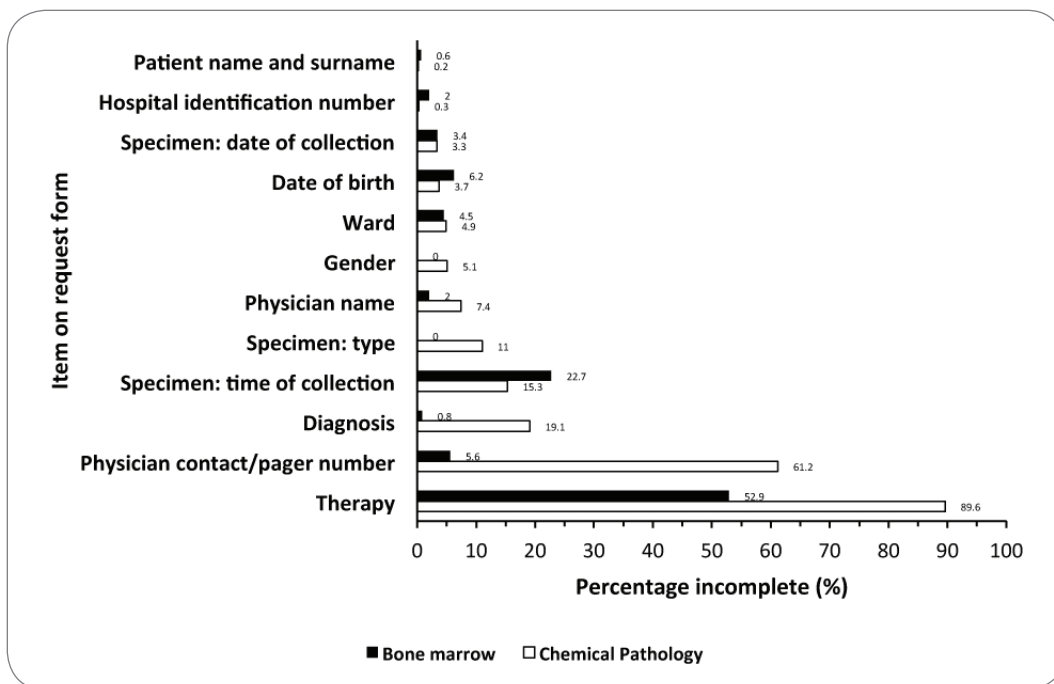


Figure 3. Comparison between the present study and that of Nutt et al. (2008)^[3] in the chemical pathology laboratory of an academic hospital.

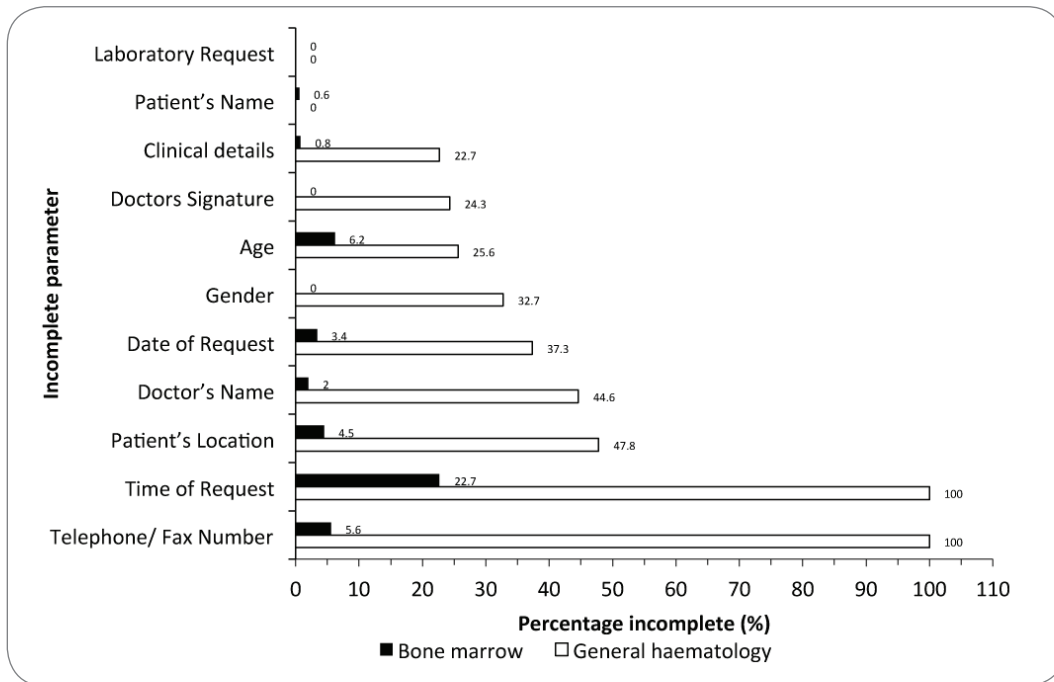


Figure 4. Comparison between incomplete items on the bone marrow request forms and general haematology request forms at academic laboratories.^[13]

There was no information about treatment on 23.8% of the forms. The absence of the time of collection on 22.7% and date on 3.4% of the forms is worrying.

Telephone calls to clinicians were seldom documented. Only 13 records of phone calls could be found on the laboratory information system.

DISCUSSION

The study is limited by the fact that we did not collect data about the completion of previous forms for comparison. The personnel unanimously felt that there was a huge improvement compared to previous years.

Incorrect completion of 2% of the specimen's forms required the laboratory to make phone calls to the requesting doctors. Incorrect completion of the forms, compounded by illegible handwriting can lead to serious laboratory transcription errors.^[10] Fortunately the NHLS subsequently enforced the rejection of any specimens that did not identify the patient and doctor clearly. This has increased compliance.

The FBC values that prompted the decision to request the bone marrow are important for the diagnostic triage of the bone marrow. By the time the bone marrow procedure is done, patients have often received transfusions. The lack of this information can obscure the laboratory's attempt to answer the clinician's question.

The specific clinical information was only absent on 0.8% of forms. This is better than the 20% found by Nutt *et al.*^[3] (see Figure 3). Clinical information is vital for the diagnosis of haematological malignancies.^[11] The absence of information regarding treatment on 23.8% of forms is worrying. The bone marrow can be suppressed by the disease process or its treatment. In both cases information about treatment is critical. The absence of

details of the clinical examination and possible HIV infection lead the laboratory staff to make many unnecessary phone calls and searches on the laboratory information system. In dermatopathology clinical information is just as important. Rademaker *et al.*^[12] report that 37% of the requests forms of 375 consecutive skin specimens contained no useful clinical information.

The laboratory personnel left out some details that they had to complete in up to 31.9% of forms. This was subsequently been addressed by emphasizing the importance of noting details such as that an aspiration was done without submitting a specimen for flow cytometry or a trephine biopsy.

The pattern of absence of information from our request forms is similar to that reported by Nutt *et al.*^[3] except that in our study the absence of time of collection was more prevalent (see Figure 3). Olayemi *et al.*^[13] studied the completion rate of general haematology request forms. As in our study, the most frequent data that was absent was the time of collection (see Figure 4). This is of importance as the age of the specimen is critical for flow cytometry^[14] and some genetic assays. Unfortunately the pattern of absence of information in our study mimics those of Nutt *et al.*,^[3] Olayemi *et al.*^[13] and Jegede *et al.*^[15]

If the requests for bone marrow investigations were completed online in an order entry the system would not accept incomplete requests. This would prevent any incomplete forms from being submitted.^[16] However, many of our referring hospitals are rural and do not have electronic information systems at this stage.

We have tried to address the completion rate by introducing a lecture on the optimal use of a laboratory in our undergraduate medical curriculum, as well as offering tutorials on bone marrow sampling for interns. The Royal College of Pathologists mentions the topic in the *Knowledge, skills and behaviours essential for working with Pathologists* section of the Pathology Undergradu-

ate Curriculum.^[17] It is probably by developing and improving such interaction between clinicians and laboratories that the completion of bone marrow request forms will improve.^[18]

It is our impression that the formatting of the form might contribute to poor completion of the lower sections. Some of the wording might be ambiguous. Subsequent to the audit it became apparent that the junior doctors often requested inappropriate or incorrect genetic tests, or unnecessary flow cytometry. This leads to waste of resources. In collaboration with Human Genetics we have decided to remove the options for additional genetic tests, and have the haematology registrars and pathologists request these based on their microscopic findings and the quality of the specimen. It is our impression that the completion has improved after the results of this audit were communicated locally. Our bone marrow request form will be improved and evaluated continually. Similar simple improvements in laboratory request forms have recently yielded positive results.^[19]

ACKNOWLEDGEMENTS

We would like to thank all the staff of the Haematology Laboratory and Laboratory Support Services of the Universitas Academic Business Unit, National Health Laboratory Service for their endless support. In particular, the staff of the Division of Clinical Haematology and the Division of Human Genetics need to be thanked. Dr Jaco Joubert and Dr Riana van der Linde are thanked for their reviews of the manuscript.

AUTHORS' CONTRIBUTIONS

MJC had the research idea and MS, AS, MK, and HK wrote the protocol and performed the research under his guidance. He wrote the manuscript. GJ provided input on the protocol as leader of the undergraduate research module, performed the statistical calculations, and edited the manuscript.

DISCLOSURE

No competing financial interests or other conflicts of interest exist for any of the authors.

REFERENCES

- Plebani M, Laposata M, Lundberg GD. The Brain-to-Brain Loop Concept for Laboratory Testing 40 Years After Its Introduction. *American Journal of Clinical Pathology* 2011; 136:829-33. <http://www.degruyter.com/view/j/cclm.2011.49.issue-7/cclm.2011.617/cclm.2011.617.xml?rskey=qZEW5q> (accessed 2016-07-11).
- Plebani M, Carraro P. Mistakes in a stat laboratory: types and frequency. *Clinical Chemistry* 1997; 43:1348-51. <http://www.clinchem.org/content/43/8/1348.abstract?sid=efb29083-1286-4a77-b62d-e306cbe477c2> (accessed 2016-07-11).
- Nutt L, Zemlin AE, Erasmus RT. Incomplete laboratory request forms: the extent and impact on critical results at a tertiary hospital in South Africa. *Annals of Clinical Biochemistry* 2008; 45:463-6. <http://acb.sagepub.com/content/45/5/463.full> (accessed 2016-07-11).
- Van Schalkwyk WA, Opie J, Novitzky N. The diagnostic utility of bone marrow biopsies performed for the investigation of fever and/or cytopenias in HIV-infected adults at Grootte Schuur Hospital, Western Cape, South Africa. *International Journal of Laboratory Hematology* 2011; 33:258-66. <http://onlinelibrary.wiley.com/doi/10.1111/j.1751-553X.2010.01280.x/abstract?jessioid=B28F7E6FA49C4EAF887E69459C9E4D08.f03t04> (accessed 2016-07-11).
- Wilkins BS. Pitfalls in bone marrow pathology: avoiding errors in bone marrow trephine biopsy diagnosis. *Journal of Clinical Pathology* 2011; 64:380-6. <http://jcp.bmj.com/content/64/5/380.abstract?sid=e4d77431-7f81-4903-9c93-cabb68ec5b0d> (accessed 2016-07-11).
- Sharif MA, Mushtaq S, Mamoon N, Jamal S, Luqman M. Clinician's responsibility in pre-analytical quality assurance of histopathology. *Pakistan Journal of Medical Sciences* 2007; 23:720-3. <http://pjms.com.pk/issues/octdec107/abstract/article14.html> (accessed 2016-07-11).
- International Organization for Standardization. *Medical laboratories – Requirements for quality and competence ISO 15189:2012*. Geneva: International Organization for Standardization; 2012. http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=56115 (accessed 2016-07-11).
- Lee SH, Erber WN, Porwit A, Tomonaga M, Peterson LC, International Council for Standardization in Hematology. ICSH guidelines for the standardization of bone marrow specimens and reports. *International Journal of Laboratory Hematology* 2008; 30:349-64. <http://onlinelibrary.wiley.com/doi/10.1111/j.1751-553X.2008.01100.x/abstract> (accessed 2016-07-11).
- Statistics South Africa. *Mid-year population estimates 2015*. Pretoria: Statistics South Africa; 2015 23 July 2015. http://www.statssa.gov.za/?page_id=1854&PPN=P0302&SCH=6334 (accessed 2016-07-11).
- Vecellio E, Malley MW, Toouli G, Georgiou A, Westbrook JL. Data quality associated with handwritten laboratory test requests: classification and frequency of data-entry errors for outpatient serology tests. *The Health Information Management Journal* 2015; 44:4-6. <http://journals.sagepub.com/action/doSearch?SeriesKey=&AllField=Vecellio&SeriesKey=himd> (accessed 2017-07-21).
- Parker A, Bain B, Devereux S, et al. Best practice in lymphoma diagnosis and reporting: British Committee for Standards in Haematology, Royal College of Pathologists; 2010. <http://www.bloodmed.com/content/image/guidelines/3455.pdf> (accessed 2017-07-21).
- Rademaker M, Thorburn M. Pathology referrals for skin lesions - are we giving the pathologist sufficient clinical information? *The New Zealand Medical Journal* 2010; 123:53-8. <https://www.nzma.org.nz/journal/read-the-journal/all-issues/2010-2019/2010/vol-123-no-1325/article-rademaker> (accessed 2016-07-11).
- Olayemi E, Asiamah-Broni R. Evaluation of request forms submitted to the haematology laboratory in a Ghanaian tertiary hospital. *The Pan African Medical Journal* 2011; 8:33. <http://www.panafrican-med-journal.com/content/article/8/33/full/> (accessed 2016-07-11)
- Van der Linde R. Verification Report for the BD FACS Canto II, Universitas Academic Laboratory, National Health Laboratory Service and Department of Haematology and Cell Biology, University of Free State. Bloemfontein, South Africa: NHL; 2015.
- Jegede F, Mbah HA, Dakata A, Gwarzo DH, Abdulrahman SA, Kuliya-Gwarzo A. Evaluating laboratory request forms submitted to haematology and blood transfusion departments at a hospital in Northwest Nigeria. 2016; 5(1) <http://www.ajlmonline.org/index.php/ajlm/article/view/381> (accessed 2017-04-29).
- Georgiou A, Williamson M, Westbrook JL, Ray S. The impact of computerised physician order entry systems on pathology services: A systematic review. *International Journal of Medical Informatics* 2007; 76:514-29. <http://www.sciencedirect.com/science/article/pii/S1386505606000426> (accessed 2017-07-21).
- Royal College of Pathologists. *Pathology Undergraduate Curriculum*. London: Royal College of Pathologists, 2014. <https://www.rcpath.org/discover-pathology/are-you-an-undergraduate-/undergraduate-pathology-curriculum.html> (accessed 2016-07-11).
- Osege ID, Afolabi O, Onyenekwu CP. The Effectiveness of Clinician Education on the Adequate Completion of

Laboratory Test Request Forms at a Tertiary Hospital. *Annals of Medical and Health Sciences Research* 2016; 6:90-4. <http://www.amhsr.org/article.asp?issn=2141-9248;year=2016;volume=6;issue=2;spage=90;epage=94;aualast=Osege> (accessed 2016-07-11).

19. Cassim N, Coetzee LM, Glencross DK. Piloting a national laboratory electronic programme status reporting system in Ekurhuleni health district, South Africa. *South African Medical Journal* 2016; 106:53-4. <http://www.samj.org.za/index.php/samj/article/view/10066> (accessed 2016-07-11).

© The Society of Medical Laboratory Technologists of South Africa