Punch card data processing in haematology

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SYNOPSIS  A method of processing haematological laboratory data based on the IBM 870 system is described. As the cards are being punched with the identification particulars of the patient and source of the sample, a worksheet is automatically generated on which the tests are indicated. The results of the laboratory tests are recorded by the technician on the worksheet and reproduced on the punch cards which are subsequently used for the automatic printout of the results on self-adhesive preprinted labels. The resulting report is clear and legible and is transferred onto the request/report document.

The data processing is carried out by clerk/typists who have been trained as punch card operators. The present workload of approximately 2,000 items of information obtained from some 170 samples per day is handled by one punch card operator in less than three hours. The punch cards are manipulated in a sorter for quality control purposes and are stored for subsequent retrieval of information.

Since our first report on data processing in haematology at the Irish Branch meeting of the Association of Clinical Pathologists which was held in Dublin in 1967, we have changed both the system and the equipment in order to make the process more efficient. We do not claim that the present arrangement is original but we have found it to be successful in routine use for more than a year.

The system has been designed to deal in the first instance with routine haematological data. By this is meant the information which is obtained from certain basic morphological studies which include determination of the haemoglobin, the erythrocyte, leucocyte, and platelet counts, the packed cell volume, the derived indices, and the results of the microscopical examination of a stained blood smear. It is intended that the data processing system should be gradually extended to other laboratory investigations in haematology.

BASIC PRINCIPLES

We have laid down certain basic principles to which any hospital laboratory documentary or data processing system should conform. (1) It must be capable of being married to the existing hospital request/report form. (2) It must maintain control of specimen identity. (3) It must permit grouping of tests into appropriate batches suitable for laboratory analysis. (4) It must produce a legible typed report slip capable of incorporation into the existing report form and subsequent inclusion in the patient’s hospital record. (5) It must maintain a retrievable record of the results suitable for subsequent analysis. (6) It must allow queries about results to be handled readily. (7) It must not impede the technical work, add an undue burden to the existing secretarial staff, or delay reports reaching the clinician.

EQUIPMENT

The equipment is that required for the IBM 870 system, namely, an IBM 836 control unit and an IBM 866 non-transmitting typewriter. The addition of an IBM 082 card sorter will increase the versatility of the system.

DOCUMENTS

These are preexisting request/report forms; standard 80-column punch cards; preprinted 20-line worksheets; and preprinted self-adhesive continuous report stationery.

THE DATA PROCESSING SYSTEM

After discussion with the systems analyst and others, the following system has been put into operation (Fig. 1): 1 The wards and departments submit venous blood samples and request/report forms to the laboratory. 2 The request/report form must contain the identification particulars of the patient, the source of the specimen,
some clinical information, and the tests which are requested of the laboratory.

3 In the laboratory the technician adds the laboratory accession number to the specimen container and both the laboratory accession number and the test code to the request/report form.

4 The specimens are arranged in batches and moved to the bench for testing.

5 The suitably coded request/report forms are passed to the data processing staff, who, using the automatic punch, transfer the identification particulars, together with the test code, to the punch card.

6 The punch is linked to the automatic typewriter which is suitably programmed to produce a worksheet of 20 lines containing the name and identification particulars of the patient and the source of the specimen. The worksheet is also marked with the coded test information.

7 When the necessary information has been transferred the worksheet is then passed to the work area where the various tests are performed.

8 As the results become available they are recorded by the technician on the worksheet.

9 When the worksheet is complete it is returned to the data processing area where the results of the tests are punched on the original cards.

10 The cards are then passed through the automatic reader and typewriter where the patient identification details and the results of the tests are transferred to preprinted adhesive labels on continuous stationery.

11 The preprinted adhesive labels containing the type of laboratory data are detached from the continuous stationery, attached to the appropriate request portion of the request/report form, and checked for identity. The request portion of the form is then detached and discarded.

12 The 20-line worksheet and its appropriate completed batch of laboratory reports are then edited and signed by the pathologist or his deputy.

13 The report forms with attached labels are then returned to the ward or clinical units where they are filed, shingle fashion, in the appropriate section of the patient's hospital folder.

14 The worksheets are retained in a looseleaf book which is kept near the telephone, where the results of the laboratory tests are immediately available in answer to telephoned requests.

15 The punched cards are stored for further sorting, retrieval, or manipulation.

DISCUSSION

This data processing system was introduced without disruption of the existing method of laboratory documentation and was compatible with the hospital records. Within the laboratory the use of duplicate laboratory accession numbers on replicated self...

![Diagram showing the system of data processing.](http://jcp.bmj.com/)
adhesive labels has made it possible to retain the identity of both the specimen and the report form.

The specimens are moved to the work area in the laboratory and the report/request forms to the data processing area. At the time that the identification particulars of the patient are being punched onto the cards, a worksheet is also produced on which the individual tests are indicated. The generation of a 20-line worksheet and the corresponding 20 punch cards takes less than five minutes to produce. As each worksheet is completed it is transferred into the work area where the laboratory technician can immediately enter the results of his analysis.

Once the worksheet is completed it is moved back into the data processing area for transcription of the results onto the punch cards. When all the results have been punched then the worksheet becomes the laboratory record which is used to answer telephoned requests for results from wards and outpatient departments.

### TABLE

<table>
<thead>
<tr>
<th>PATIENT, SPECIMEN, AND HAEMATOLOGICAL DATA ON AN 80-COLUMN PUNCH CARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient and Specimen Data</td>
</tr>
<tr>
<td>---------------------------</td>
</tr>
<tr>
<td>1-33</td>
</tr>
<tr>
<td>Haemoglobin</td>
</tr>
<tr>
<td>Red cell count</td>
</tr>
<tr>
<td>PCV</td>
</tr>
<tr>
<td>MCHC</td>
</tr>
<tr>
<td>White cell count</td>
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<tr>
<td>Platelet count</td>
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<tr>
<td>Reticulocyte count</td>
</tr>
</tbody>
</table>

The information on the punch cards is automatically transferred via the control unit and non-transmitting typewriter to report slips. The resulting clear and legibly typed report slip goes on to the original request/report form. This report form is then sent back to the ward for entry into the patient's record. The total time for the second and third stages of the punch card operation, namely the punching of the results from the 20-line worksheet and the automatic typing of these results, takes approximately 10 minutes for each 20-line sheet of information.

The completed punch cards are stored in their original cardboard boxes. They can be manipulated in a sorter for statistical purposes and once a suitable programme has been written they can be used as the input to a computer.

Before the introduction of punch card data processing two clerk/typists were required to deal with the documentation, recording and issuing of written or typed reports. The same two clerk/typists have been trained as punch card operators and the transfer to a punch card system was made without any increase or change in grading of the secretarial staff. The two clerk/typists are alternately responsible for the reception and for office duties including data processing. Thus this punch card system neither impedes the technical work nor adds an undue burden on the secretarial staff.

As the punch is noisy, it has been found necessary, so as not to interfere with normal telephone communication, to remove the equipment from the main reception area. The space for the equipment and the associated bench for the receipt of documents and the storage of stationery in its underbench units requires something of the order of 100 sq feet of floor space.

We believe that this present punch card system of handling haematological laboratory data has been successful in all the aims which we set out when we introduced it. Furthermore, if certain manual steps made by both technical and data processing staff were eliminated then the whole system could become free from the possibility of errors of transcription. This could be achieved if the analytical equipment was linked to an analogue digital converter and an automatic punching machine. In conjunction with an electronic engineering department we are currently investigating this latter possibility.