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**AN 80-COLUMN PUNCHED CARD FOR MORTALITY
STATISTICAL PURPOSES AND THE PROCEDURE
FOLLOWED IN ITS PREPARATION**

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THE New York Life, like many other companies, was forced to curtail the normal operations of its Mortality Division during the war. Only recently has the help situation improved to such an extent that the Company has been able to resume the preparation of mortality cards on current issues of policies. In this connection the Company reviewed the procedures followed under its prewar system and came to the conclusion that substantial improvement could be made if 80-column punched cards and certain changes in procedure were adopted.

This paper describes the new 80-column punched card which has been adopted by the New York Life and the general procedure which is being followed in the preparation of such mortality card on new issues of policies.

In 1910 Mr. Arthur Hunter presented a monumental, pioneering paper on this subject entitled "Method of Making Mortality Investigations by Means of Perforated Cards, Sorting and Tabulating Machines, with Special Reference to the Medico-Actuarial Mortality Investigation," (*TASA*, XI), which included copies of certain 45-column mortality cards and also included a rather full description of the codes and procedures used. In 1924 a pamphlet was published by the Joint Committee on Mortality of the Association of Life Insurance Medical Directors and the Actuarial Society of America, entitled "Medical Impairment Code and Description of Mortality Cards," which included some details of coding together with copies of the uniform standard and substandard mortality cards, the so-called "Inter-Company" 45-column mortality cards which are believed to have been in general use until recent years.

The above two references apparently constitute the main information in actuarial literature with respect to mortality cards and procedure.

In 1939 Mr. Walter G. Bowerman presented a paper on Disability and Double Indemnity research which made brief reference to the possible use of 80-column mechanical equipment for mortality work. There have been no further papers appearing in our publications describing mortality

card procedure although several papers have been presented on the general use of punched card equipment. In a recent *Journal of the American Statistical Association* (September 1948), there appeared a paper on "Sampling Errors in Mortality and Other Statistics in Life Insurance" written by Mr. Donald D. Cody. A brief reference in general terms was made to mortality card procedure, and a copy of an 80-column mortality card used by the Equitable Life was included along with other punched cards. In another recent issue of the *Journal of the American Statistical Association* (June 1948), there was published a paper by Mr. Edward A. Lew on "Mortality Statistics for Life Insurance Underwriting," in which the subject of mortality statistics rather than detailed mortality card procedure was discussed. These two excellent papers cover important aspects of our work, of course, but do not give information on the preliminary phases of procedure which must be followed before one is in position to develop mortality statistics or to use sampling methods.

It can be seen, therefore, that apart from the pioneering paper of almost 40 years ago and the pamphlet published a quarter of a century ago there is little information as to mortality cards and procedure in current literature to guide the company endeavoring to adopt up-to-date methods for its mortality procedure.

In spite of the lack of published information on the subject it is known that in recent years a number of companies have adopted 80-column equipment for their mortality files, as well as for other uses. Although the processing of material to be used for developing mortality statistics is largely a routine operation, the role of the actuary being important primarily in the proper interpretation and application of the mechanical results, it seems desirable that we should have in our actuarial literature some up-to-date information on this subject. This is the main reason for presenting this paper but it is hoped also that other companies will round out the available knowledge on this subject by contributing information as to their procedures and thinking with respect to some of the many aspects on which differing opinions may be held. In this way the value of this paper will be greatly enhanced.

The basic information relating to mortality card procedure may be subdivided into three main sections, as follows:

1. General outline of procedure followed in the preparation of mortality cards.
2. Cases on which mortality cards are prepared.
3. The mortality card and outline of information appearing thereon.

Although our main problem thus far has been to develop an 80-column mortality card to fit our requirements and to set up the procedure to be followed in the preparation of such card, the filing system to be adopted

and the procedure to be followed in maintaining the files as to cancellations and changes are important aspects of the whole problem of mortality procedure. While we have not satisfactorily solved all our problems in this respect, some additional comments are included on these points.

GENERAL OUTLINE OF PROCEDURE

The general procedure followed by the New York Life in the preparation of mortality cards on new issues may be outlined as shown below:

1. Our Medical Department indicates all impairments on the "Home Office" sheet of the application file and shows the numerical rating debit for each impairment.
2. Our Underwriters are advised as to the few special types of standard issues on which mortality cards should be prepared and which cannot be identified from the regular valuation card. The Underwriters indicate such cases by a special mark on the "Home Office" sheet of the application file. On such cases the division which prepares the valuation card includes a special perforation on the valuation card. This perforation indicates that if the first premium is paid, the case is of a type for which the Mortality Division should have a mortality card.
3. The Valuation Division of the Actuarial Department each month selects from its paid issues
 - (i) cases with the special perforation indicated above, and
 - (ii) other cases on which mortality cards are to be prepared and which may be identified from the information regularly appearing on the valuation card—for example, policies issued on a substandard basis.

On all such cases the Valuation Division reproduces in the first twenty-four columns of the mortality card information which is common to the valuation card and the mortality card.

4. The Mortality Division receives such mortality cards monthly from the Valuation Division and then secures the application files on these cases to complete these mortality cards. The additional information which the Mortality Division needs to complete the mortality card is taken from the application file and is handwritten in code directly in coding blocks provided for such information at the left hand portion of the card (see sample card in Appendix A). The handwritten coded information is then perforated on the card.
5. A duplicate mortality card of different color and with an identifying punch is reproduced from the mortality card prepared as indicated above and the cards are then filed.

It can be seen that the above general procedure limits the preparation of mortality cards and the handling of application files to paid issues on cases for which mortality cards should be prepared and that intermediate steps involving handwritten cards are not used.

CASES ON WHICH MORTALITY CARDS ARE PREPARED

Mortality cards are prepared on new issues at all ages which fall into one or more of the following categories:

- (a) standard issues with policy numbers ending in either 0 or 5
- (b) substandard issues
- (c) issues with substandard double indemnity benefits
- (d) issues with substandard waiver of premium benefits
- (e) issues on the lives of persons of certain races
- (f) cases with a medical test such as X-ray, electrocardiogram, glucose, serum, etc.
- (g) wholesale, mortgage redemption or other "groups" where special underwriting rules may be followed
- (h) large amount issues
- (i) issues with aviation clause or on the lives of members of the Air Forces, active Air Reserves or Air National Guard, even if issued without aviation clause.

It will be noted that mortality cards are not prepared on nonmedical issues unless such issues fall into one of the special categories (such as cases with policy numbers ending in 0 or 5). At the present time almost half of our issues by number of policies are on a nonmedical basis and it is believed that the system outlined will provide sufficient data to enable us to study our nonmedical experience.

The large amount cases referred to include those determined according to the rules set forth by the Joint Committee for the Large Amount Study. However, for our own mortality purposes we also include in our large amount files policies issued below age 10 or on a substandard basis although the Inter-Company Large Amount Study is based only on standard issues at ages 10 and over.

THE MORTALITY CARD AND OUTLINE OF INFORMATION
APPEARING THEREON

A copy of the mortality card is shown in Appendix A.

All mortality cards on new issues are prepared on the same 80-column form, the one form being used for standard issues and for substandard issues, with special information on aviation cases, large amount issues, and nonmedical issues.

The mortality card described herein is devised primarily for use in connection with studies of occupation and medical impairments. However, the card is constructed so that it will include the information generally available to the Company from its application files which has heretofore been required for the handwritten aviation card required in the Inter-Company Aviation Study, as well as supplying details which seem desir-

able because of our underwriting practices. Nonmedical studies may also be made from such cards. Disability and Double Indemnity studies are usually made from valuation records but special studies of these benefits may also be made by means of this card combined with special disabled life and accidental death cards which are prepared on all disability claims and all double indemnity deaths.

We are aware that it has been stated that to secure maximum flexibility under punch card systems, an extra set of cards should be prepared for each special purpose in preference to attempting to have one card used for several purposes. In mortality work, it might be felt that if a case were for a large amount and also presented an aviation hazard, for example, a card should appear in each file. However, it is our opinion that the cost of clerical handling of such extra sets of cards, with particular respect to maintenance of files as to changes, etc., definitely indicates the use of a single card form adapted so as to permit its inclusion by mechanical means whenever it should properly be included in any group of policies being studied.

At the left of the mortality card form used for all types of issues, coding blocks are provided in which are handwritten in code directly from the application file all the information necessary to complete the perforation of the card.

The arrangement of the various fields of the mortality card is shown below. Certain fields of the mortality card are of particular interest and details of the coding of these fields are shown in Appendix B attached.

The arrangement of the mortality card is as follows:

Column No.	Field	Remarks
1- 8	Policy Number and Sex	M and F (= Y and X) appear in column 7 for "Male" and "Female," respectively. R and S (= Y and X) appear in column 8 for "Rated" and "Standard," respectively.
9-10	Insurance Age	
11-13	Face Amount	Face amount is perforated to "complete" thousands only on all cases, regardless of whether policy provides for a level or varying amount of insurance.
14-16	Insurance Begins	
17	Gross Premium Mode	
18	Waiver of Premium Multiple	
19	Double Indemnity Multiple	
20-22	Plan of Insurance	
23-24	State	(See Appendix B.)

The preceding information is reproduced directly from the Valuation Card as is a special perforation ("1" in column 50) included on all non-medical cases.

The information required for the remainder of the card is obtained from the application file by the Mortality Division and the balance of the card is completed by that Division, as follows:

Column No.	Field	Remarks
25-26	File Number	A mortality "File Number" is assigned to each card (see Appendix B).
27	Classification Amount	For use on Large Amount Cases only (see Appendix B).
28-30	Occupation	A special Occupation Code is used on Military Aviation cases (see Appendix B).
31-35	Impairment	(See Appendix B.)
36-40	Impairment	On all aviation cases special aviation information is entered (see Appendix B).
41-45	Impairment	
46-48	Systolic Blood Pressure	
49-50	Diastolic Blood Pressure	(See Appendix B.) On nonmedical cases Size of City is coded and a special perforation is used to indicate a nonmedical issue.
51	Build	(See Appendix B.)
52-53	Height	(See Appendix B.)
54-56	Weight	(See Appendix B.)
57	Special Class	(See Appendix B.)
58	Race	
59	Family History	
60-61	True Age	
62-63	Rating	
64	Cause of Rating	(See Appendix B.)
65-67	Extra Premium	(See Appendix B.)
68-69	Number of years for which Extra Premiums are payable	
70-75	Blanks	Electrocardiogram code to be shown on cases where this medical test has been made (see Appendix B).
76-77	Duration	(See Appendix B.)
78	Mode of Termination	(See Appendix B.)
79-80	Cause of Death	(See Appendix B.)

FILING SYSTEM AND MAINTENANCE OF FILES AS TO CANCELLATIONS AND CHANGES

All mortality cards are assigned a "File Number" as part of the coding of such cards (see Appendix B).

As stated previously, mortality cards are prepared in duplicate. One set of cards is filed in numerical order, the so-called "numerical file." The other set, the so-called "status file," is subdivided by File Number, with certain File Numbers being filed together as indicated in the Appendix B table, and each subdivision is separated into two groups according to whether the case is (1) Dead, or (2) Existing or Lapsed. Each group in the "status file" is maintained in numerical order.

While our new procedure for the preparation of mortality cards on cur-

rent issues of policies has already been put into operation, the problem of maintaining the files as to cancellations and changes presents certain practical problems which have not yet been entirely solved.

It is our understanding that some companies prefer to prepare mortality cards at time of issue and to make no changes on such cards until a study is contemplated, at which time the file is processed and brought up-to-date. It is our feeling that in order to be in position to produce statistics which may be required quickly we should keep our file current as to cancellations and changes. This we propose to do monthly by a mechanical handling of the valuation increase and decrease cards.

The detailed handling of changes on mortality cards requires further study and it is hoped that additional information on this point will be available for discussion at the meeting.

CONCLUSION

There is no reason to believe that all companies would decide to have exactly the same kind of information on their mortality cards, prepare them for the same types of cases, or use the same procedure in gathering the data and preparing the cards. Nor is it likely that the same codes would be chosen by all companies. This brief paper was presented not with such objectives in view but rather with the thought that, by describing the card and procedures adopted by our Company, it might stimulate discussion which would bring forth ideas and suggestions from other companies that would be helpful to everyone who has to deal directly with this problem.

The mortality card and procedure which have been described in this paper include many valuable ideas and suggestions made by my associates at the New York Life and I am grateful to them for their assistance.

APPENDIX B

DETAILS OF CODING OF CERTAIN FIELDS

STATE

(Columns 23-24)

The State Code used does not distinguish the counties in certain Southern States, as has been done heretofore under the Inter-Company Code previously used.

FILE NUMBER

(Columns 25-26)

A file number is assigned to each case in accordance with the following code, the order of listing indicating the order of preference to be used, and certain groups of file numbers are filed together as indicated:

Group	File Number	
Ages 0-9.....	00	
Large Amount—Aviation.....	10	} filed together
Large Amount—Medical Test.....	11	
Large Amount—Others.....	12	} filed together
Aviation—Medical Test.....	20	
Aviation—Others.....	21	
Medical Test—Others.....	30	} filed together
Wholesale or Group.....	31	
Race.....	32	
Nonmedical.....	40	
Substandard W.P.....	41	
Substandard D.I.....	42	
"0 & 5" Policy Numbers (Standard).....	50	
Temporary Extra Premiums (with or without Permanent Extra Premium or Rated Age)..	60	
Rated Age with Permanent Extra Premium..	70	
Substandard Issues not included above.....	80	

The application file must be reviewed to determine what File Number should be used. If a case would qualify under two or more of the classes listed above, the File Number to use is the one which comes earliest in the code; of course, if it is desired to study such case with cases included in a later File Number it may be included by a mechanical sorting of the appropriate field of the card.

CLASSIFICATION AMOUNT

(Column 27)

For "Large Amount" cases (File Numbers 10, 11, 12 and those "Large Amount" cases included in the "Ages 0-9" file—File Number 00) the "Classification Amount" is indicated by the Underwriter on the Home Office sheet and is perforated in accordance with the Inter-Company code.

For cases other than such "Large Amount" cases this column is left blank.

Both standard and substandard cases are included in the Large Amount files.

On "Large Amount" cases certain data are handwritten for purposes of identification as recently outlined by the Joint Committee.

OCCUPATION
(Columns 28-30)

Except for military aviation risks—that is, persons who are in military service and who are included in the File Numbers 10, 20 or 21—the occupation is coded in accordance with the 1925 Occupation Code. For military aviation risks—that is, persons who are in military service and are included in File Numbers 10, 20 or 21—the occupation is coded in accordance with a special code which includes the insured's branch of service and rank and which we have prepared because it is believed that the 1925 Occupation Code is not sufficiently up-to-date as regards military aviation. It is our understanding that a revision of the 1925 Occupation Code with respect to military personnel is under consideration at the time this paper is being written.

The mortality rating corresponding to the advance in age or extra premium for occupation is handwritten in the coding block as, for example, "+70."

Where the Occupation Code does not adequately describe the occupation, details are handwritten in the coding block.

IMPAIRMENTS
(Columns 31-45)

Fields of 5 columns each are provided for three impairments.

Impairments are coded in accordance with the 1935 Impairment Code, the first three columns of each impairment field covering the code number, the fourth column covering the degree or any factor other than "Time," and the fifth column covering the "Time" symbol.

All impairment factors present in the case are coded and perforated in the order of their importance in terms of the rating applied. If there are four impairments or more, the three most important are punched, and the others handwritten on the card. A "Y" is perforated in column 41 (first column in third impairment field) to indicate that additional impairments are handwritten in code below the "3" line in the third impairment field. The numerical debit for each impairment is handwritten in the coding block. Where a debit is given for a combined impairment, the combined impairments in the coding blocks are bracketed and the debit shown opposite the combined impairments.

When one impairment is the cause of another, the former is entered on the Home Office sheet of the application file in parentheses and is followed by the other. Similarly, for impairments related to Tumors the site of Tumor is noted in parentheses. In other cases, an impairment may be entered in parentheses as explanatory to another impairment. In all such cases both impairment codes are perforated whenever possible.

The impairment code relating to extreme overweight or underweight is ignored in perforating the impairment field, as information on "build" is shown in the "Build" field.

Information as to degree, results of tests, etc., which is not included in the impairment code but is recorded parenthetically after the Code Number, is handwritten in the impairment field.

AVIATION INFORMATION
(Columns 36-45)

On aviation cases (File Numbers 10, 20 and 21) the aviation "impairment" codes are not perforated in the impairment field but are handwritten below the "6" line in the third impairment field. Since special aviation information is perforated in the second and third impairment fields this means that on aviation cases the first impairment field is coded for a medical impairment, if any, and additional medical impairments are handwritten below the "1" line in Column 31 and to the right with "Y" perforated in Column 31 to indicate that there are additional medical impairments.

On aviation cases (File Numbers 10, 20 and 21) special aviation information is coded in the second and third impairment fields as shown below. Additional information is, of course, included in the "Extra Premium" and "Cause of Rating" fields. This special aviation information has been designed to enable us to check our experience in the light of our underwriting rules and to enable us to supply the information normally available to us which may be requested for Inter-Company aviation studies which in the past have been made by means of handwritten cards.

Column	Information
36-37	Aviation Classification
38	Flying Capacity (<i>i.e.</i> , Pilot, Crew Member or Passenger)
39	Total Flying Time
40	Flying Time in the last 12 months
41	Probable Flying Time in the next 12 months
42	Type of Plane or Place of Flying
43	Aviation Clause

The coding used for this special aviation information is shown on the following pages.

AVIATION CLASSIFICATION

The Aviation Classification represents the type of aviation hazard which best characterizes the risk. The coding is as follows:

(Columns 36-37)

Military Aviation	
Pilots (other than Aviation Cadets, Student Pilots, Administrative Officers with "Wings," Glider Pilots, Test Pilots or "Lighter than Air" Pilots)	00
Aviation Cadets and Student Pilots	01
Administrative Officers with "Wings"	02
Navigators, Flight Engineers and Radio Operators*	03
Bombardiers, Gunners and Observers*	04
Flight Surgeons	05
Other crew members*	06
Administrative Officers without "Wings"	07
"Nonrated" Officers (not coded 07)*	08
Ground Maintenance crew*	09
Other nonflying (ground) personnel*	10
Glider Pilots and crew members*	11

* Details to be handwritten in coding block for third impairment.

(Columns 36-37)—*continued*Military Aviation—*continued*

Test Pilots and crew members*	12
"Lighter than Air" Pilots or crew members*	13
Paratroopers	14
Airborne Infantry	15
Miscellaneous (not above)*	19

Air Reserves and Air National Guard

Military Air Reservists not on Extended Active Duty	
Air Force	30
Army	31
Navy	32
Marine	33
Coast Guard	34
Miscellaneous*	35
Air National Guard	36

Civilian Aviation

Air Carriers, Governmentally Certificated Scheduled	40
Air Carriers, Noncertificated	41
Business Establishment Planes	42
Charter or freight flying	43
Civil Air Patrol	44
Commercial flying (no other details)	45
Crop dusting, seeding or spraying	46
Exhibition or stunt flying	47
Feeder line operations	48
Fixed base operations	49
Glider flying	50
Instruction of civilian students	51
Military Air Transport Service	52
Photography flying	53
Private flying	54
Sightseeing flying	55
Student flying	56
Survey flying	57
Taxi flying	58
Test flying	59
Ex-Military flying (do not include here anyone who fits in one of other civilian categories)*	60
Miscellaneous*	69

* Details to be handwritten in coding block for third impairment.

The Aviation Classification on all cases is the one which best characterizes the risk. If there are or have been any other aviation activities of a different nature, "Y" is perforated in column 36 in addition to perforating the Aviation Classification. The details of the additional activities are handwritten below the "5" line.

FLYING CAPACITY

(Column 38)

The flying capacity under the Aviation Classification of the two previous columns is coded as follows:

Pilot	0
Crew Member	1
Passenger	2

TOTAL FLYING TIME
(Column 39)

No past flying activities (<i>i.e.</i> , rated for contemplated aviation activities).....	Y
1- 100 hours total flying time.....	0
101- 300 hours total flying time.....	1
301- 800 hours total flying time.....	2
801-1200 hours total flying time.....	3
1201-2000 hours total flying time.....	4
2001-5000 hours total flying time.....	5
over 5000 hours total flying time.....	6
Not specified.....	9

The total flying time in column 39 corresponds to the Aviation Classification and Flying Capacity but also includes the flying time for any similar aviation activities, *e.g.*, if the insured is now a private pilot but was formerly an Army pilot, perforate total flying time as a pilot; if the insured is now a private pilot but was formerly an air-crewman, perforate only private pilot hours and handwrite air-crew hours below the "6" line. The "Y" perforation in column 36 will identify these latter cases.

FLYING TIME IN LAST 12 MONTHS
(Column 40)

No past flying activities within 12 months (<i>i.e.</i> , rated for contemplated aviation activities or for flying more than 12 months ago).....	Y
1- 100 hours flying time within last 12 months.....	0
101- 150 hours flying time within last 12 months.....	1
151- 200 hours flying time within last 12 months.....	2
201- 300 hours flying time within last 12 months.....	3
301- 500 hours flying time within last 12 months.....	4
501- 750 hours flying time within last 12 months.....	5
751-1000 hours flying time within last 12 months.....	6
over 1000 hours flying time within last 12 months.....	7
Not specified.....	9

The flying time perforated corresponds to the Aviation Classification and Flying Capacity but also includes the flying time for any similar aviation activities. Any flying time for dissimilar aviation activities is handwritten below the "7" line. The "Y" perforation in column 36 identifies such cases.

PROBABLE FLYING TIME IN NEXT 12 MONTHS
(Column 41)

No contemplated future flying (<i>i.e.</i> , rated for past aviation activities) Y	
1- 100 hours probable flying time in next 12 months.....	0
101- 150 hours probable flying time in next 12 months.....	1
151- 200 hours probable flying time in next 12 months.....	2
201- 300 hours probable flying time in next 12 months.....	3
301- 500 hours probable flying time in next 12 months.....	4
501- 750 hours probable flying time in next 12 months.....	5
751-1000 hours probable flying time in next 12 months.....	6
over 1000 hours probable flying time in next 12 months.....	7
Not specified.....	9

The flying time perforated corresponds to the Aviation Classification and Flying Capacity but also includes the flying time for any similar aviation activities. Any flying time for dissimilar aviation activities is handwritten below the "8" line. The "Y" perforation in column 36 identifies such cases.

TYPE OF PLANE OR PLACE OF FLYING
(Column 42)

For Military Personnel, Air Reserves and Air National Guard the following code for type of plane flown is used.

Military Planes	
Unspecified.	Y
Type other than specified below.	0
Training.	1
Single Engine Fighter.	2
Twin Engine Fighter.	3
Jet Fighter.	4
Reconnaissance.	5
Light Bomber.	6
Medium Bomber.	7
Heavy Bomber.	8
Transport.	9

Codes 1-9, inclusive, for military planes are identical with the codes used in the Inter-Company studies of aviation mortality experience. At the present time little, if any, information as to type of plane is secured by our Company in the ordinary aviation case.

For Civilians, other than Air Reserves and Air National Guard, the Place of Flying is coded as follows:

Place of Flying	
United States.	0
Canada.	1
Alaska.	2
Hawaii.	3
Other than above.	9

For Civilians, other than Air Reserves and Air National Guard, a "Y" is punched in all cases where insured is a pilot and is known to fly in dual control planes (this means a double punch).

AVIATION CLAUSE
(Column 43)

Clause	Code No.
No Clause.	0
Partial exclusion clause providing full passenger coverage.	1
Partial exclusion clause providing passenger coverage only on Governmentally Certificated Scheduled Air Carriers.	3
Total exclusion clause.	4

The "No Clause" cases include policies issued with an aviation extra premium and without an aviation clause.

SYSTOLIC BLOOD PRESSURE

(Columns 46-48)

DIASTOLIC BLOOD PRESSURE

(Columns 49-50)

Except for nonmedical cases, which are coded "1" in column 50, systolic and diastolic blood pressures are perforated.

The blood pressure perforated on all cases other than nonmedical issues is the average of all the systolic pressures on examination and the average of all the diastolic pressures on examination.

Where blood pressure is an impairment found on examination the Medical Department indicates on the application the "synthetic blood pressure" which has been used as a basis for underwriting the policy and this blood pressure is handwritten in the coding block. In addition, the highest systolic pressure on examination with its accompanying diastolic pressure and the highest diastolic pressure on examination with its accompanying systolic pressure are handwritten below the "1" and "2" lines, respectively.

Where a history of high blood pressure is reported as an impairment the Medical Department indicates on the application the "synthetic blood pressure" and this blood pressure is handwritten in the coding block. In addition, the highest systolic pressure in the history with its accompanying diastolic pressure and the highest diastolic pressure in the history with its accompanying systolic pressure are handwritten below the "1" and "2" lines, respectively. Histories more than 5 years old are ignored.

The "synthetic blood pressure" as currently used by the New York Life is the average of the two highest readings in the last 5 years.

Where the diastolic reading is 100 or more, the first digit (1) is omitted so that, for example, 104 is perforated 04.

The fifth phase of diastolic blood pressure is perforated except where the fourth phase diastolic pressure is recorded as an impairment. In the majority of cases both the fourth and the fifth phase readings appear in the application. 6 mm. may be deducted from a diastolic reading at fourth phase to obtain the assumed corresponding diastolic pressure at the fifth phase but diastolic pressures at different phases should not be combined in obtaining an average.

NONMEDICAL INFORMATION

(Columns 46-50)

On nonmedical cases (cases with "1" in column 50) there are no blood pressure readings and special nonmedical information is coded in the blood pressure fields. The Branch Office is coded in columns 46-48 and the Size of City in which insured resides is coded in column 49.

80-COLUMN PUNCHED MORTALITY CARD

The code for Size of City is based on the 1940 census and is as follows:

Size of City Where Insured Resides	Code No.
Under 50,000.....	0
50,000- 99,999.....	1
100,000-249,999.....	2
250,000-999,999.....	3
1,000,000 and over.....	4

BUILD
(Column 51)

The Build is coded as follows, with a double punch as indicated.

	Col. 51 Position
Overweight.....	O=Y
Underweight.....	U=X
0- 4%.....	0
5- 9.....	1
10-14.....	2
15-19.....	3
20-24.....	4
25-29.....	5
30-39.....	6
40-49.....	7
50-59.....	8
60% or more.....	9

If Build is not given, X9 is perforated since this build never occurs in practice.

HEIGHT
(Columns 52-53)

The Height is perforated in feet and inches, with a half-inch taken to the nearest even inch. Thus 5' 2½" becomes 5' 2" and 5' 3½" becomes 5' 4".

WEIGHT
(Columns 54-56)

The Weight in pounds is perforated with a half-pound taken to the nearest even pound.

SPECIAL CLASS
(Column 57)

This field is used to record information as to the marital status of women and whether or not they are gainfully employed. The information refers to the status at date of issue of the policy and is included only in order to have this additional information available on female lives.

RATING
(Columns 62-63)

All policies are given a percentage numerical rating and this rating is perforated according to a code which, in effect, is similar to simply dropping the last digit of the rating. In rating a case the basic rating is 100% and debits and cred-

its are given for Family History, Build, Medical Impairments and Occupation or for some other cause or combination of causes. Ratings up to and including 125% are usually considered standard for insurance while ratings substandard for insurance usually range from 130% upward.

CAUSE OF RATING

(Column 64)

On substandard cases the cause of rating is coded as, for example, medical impairment, occupation, build, aviation, etc., as well as combinations of causes of rating, such as more than one medical impairment, a medical impairment and occupation, etc. Medical impairments for which debits of +25% or less are imposed, and which of themselves would not be sufficient to make a case substandard, are ignored in coding this column.

The purpose of this column is to permit a mechanical selection of all cases rated for a medical impairment, or for occupation, or for some other reason covered by the code, or to permit the mechanical selection of cases rated for a combination of reasons. These latter cases are frequently either excluded from regular mortality studies or are studied as a special group.

EXTRA PREMIUM

(Columns 65-67)

If a case is either (a) standard or (b) substandard with rated age only, an "X" is perforated in column 65 to indicate a skip.

The extra premiums shown in this field are based on the total amount of insurance excluding premiums for disability, double indemnity and Child's Protection benefits. Except where there are two or more extra premiums payable for different periods the extra premium perforated is the total gross annual extra premium for the face amount.

In those relatively few cases where there are both continuous and temporary extra premiums, only the amount of the continuous extra premium is perforated. In such cases the amount of the temporary extra is handwritten.

In the rare cases where there are two temporary extra premiums payable for different periods, the extra perforated is that which runs for the longer period. The extra premium payable for the shorter period is handwritten.

ELECTROCARDIOGRAM CASES

(Columns 70-75)

These columns will be blank on all cases except those where an electrocardiogram has been furnished in connection with the issuance of insurance. On such cases, a special electrocardiographic code appears in these columns.

DURATION

(Columns 76-77)

Duration on death losses is the policy year within which death occurs, so that $2\frac{1}{4}$ appears as 3. Duration on all terminations other than by death is the excess of calendar year of exit over calendar year in which insurance begins, that is, "mean

duration." In order to have available some additional information as to duration and yet not change from the "mean duration" system which has been used in the Company's mortality studies for many years, a double punch is used in certain instances, as follows:

(a) if termination other than by death occurs prior to the anniversary in the calendar year of termination, an "X" is also punched in column 77.

(b) if termination other than by death occurs after the anniversary in the calendar year of termination, a "Y" is also punched in column 77.

For a case terminated other than by death on the anniversary or for any termination by death there is no double punch.

Mortality cards which lapse in the calendar year in which insurance begins are treated as lapses with duration "0".

MODE OF TERMINATION

(Column 78)

For cases terminated by death, "Y" is punched in column 78. For all other terminations "X" is punched in this column. There is no perforation for duration on "existing cards."

The above simple code for mode of termination is the Inter-Company code.

CAUSE OF DEATH

(Columns 79-80)

The 1935 Inter-Company code is to be used. At the time this paper is being written it is our understanding that a new Inter-Company code is in the process of preparation and will be recommended for adoption beginning January 1, 1950.

DISCUSSION OF PRECEDING PAPER

JAMES S. ELSTON:

Mr. Ryan's paper should be of immense value to actuaries having to meet the problems he discusses of installing a punch card system for mortality purposes and other similar uses. Mr. Ryan clearly analyzes most of the problems involved and the solution derived to meet the special purposes and circumstances of his company. Our system and purposes in general are the same but with significant differences which have led to different solutions in some important respects. His system is designed to give exact results for very specific analyses. While we hope that our system will give the most essential analyses as, for instance, to enable us to contribute to a joint impairment mortality investigation, much of our emphasis is on getting rather general analyses of our total business. For instance, we cannot work our Additional Indemnity Experience by amount of substandard rating but we can obtain our total Nonmedical Experience.

The origin of our 80-column Hollerith card was in the depression rather than in the aftermath of the second World War. From the time of the Medico-Actuarial investigation, we had a 45-column mortality card on all our business and for years we had had a new business statistical card from which a group method reserve listing as well as many other statistics were derived. During the depression, the Company had quite a number of clerks who were not actually needed but it was the Company's policy not to dismiss them. In 1932, about three dozen of these were assembled from all over the Company as a force which established our 80-column attained age valuation card and our corresponding mortality card. From the valuation card, our reserve, gain and loss figures, policy exhibit, state figures as to insurance in force, paid-for, etc., and various other statistics, such as the amount in force by substandard rating, the amount in force on female risks and other statistics, are derived. The Connecticut State insurance valuation set is also obtained by reproducing this set. All the work is handled by a system of ins and outs.

On new business, the valuation cards are punched on a paid-for basis from a hand card which is derived by a stencil process which provides not only the other hand cards needed in the Company for the Premium Accounting Division, the Branch Office, the Audit Department, M.I.B., etc., but also the typewriting on the actual policy itself. The amount of insurance on the punched card is taken to the nearest \$100, as it was

thought that we wouldn't obtain the necessary accuracy for the attained age valuation factors and resulting reserve if the insurance were taken only to the nearest \$1,000. Until recently the valuation factors were put on the stencil cards by hand during the month and punched at the same time the whole card was, but now we have adopted a system of putting the factors on at the end of each month by the multiplying punch. Perhaps the most essential difference between our system and the New York Life's is that ours covers all the business, instead of 20% of the business plus the very special classes Mr. Ryan enumerates. We have been aware for a long time that some companies use only 20% of their business, and recognize that that probably produces representative samples for many investigations in such a large company. But, aside from other considerations, we felt that because we are a nonparticipating company and want to study our mortality experience more thoroughly and as soon as possible, it is worth while to make our studies possible on all of our business. The establishment of the original mortality cards without the impairments, etc., costs little, as the first 60% is reproduced from the valuation card. Also, no attempt is made to code impairments, blood pressure, etc., on non-medical business or on the salary allotment business, whether medical or nonmedical.

Another reason for having a complete set is so that it can be used for other purposes. We might classify our uses roughly as:

- (1) Some new business statistics.
- (2) Furnishing the basis of at present four model offices for valuation purposes.
- (3) Our experience on Additional Indemnity Provision and our exposures for the various subdivisions of our Disability Clause investigations.
- (4) Routine general mortality investigations.
- (5) Special investigations for which the New York Life card is so well designed.

If the occasion should arise, our cards could be used as a basis for valuation by the group method of all or any section of our business. The statistics mentioned are mainly classifications of new business by form and age which are not by-products of our attained age method of valuation, and also a special tabulation necessary to complete the calculation of our expense limits under the New York Expense Limitation Law.

At present, this mortality set is used by a system of ins and outs to obtain skeleton model offices from which Disability Clause, Additional Indemnity, Fractional Waiver and gross premium valuation reserve factors may be obtained from which the corresponding reserves are later derived

with very little extra work. In these model offices, the insurance in force is listed by year of issue and quinquennial age groups with the form of policy handled in either of two ways. Either all forms are grouped together into about a half dozen representative groups, which are all treated according to the most important typical policy form included in the group, or valuation work is carried out on only a limited number of forms that give what have been tested to be reasonably correct results. As in other uses all the current work is handled by ins and outs.

One of the differences previously implied between our system and the New York Life's appears to be the variety of our routine yearly mortality investigations, owing partly to the amount of Term insurance we issue, but principally to the fact that we are a nonparticipating company with very little margin in our premiums. As early in the year as possible, we obtain an analysis of our mortality experience on regular standard business in four sections: (1) medical—attained age conversions, (2) other medical, (3) nonmedical—attained age conversions, and (4) other non-medical, the second of which furnishes the basis of our contribution to the annual joint mortality investigation. Later in the year, our experience on Term policies is obtained by four different policy forms, each subdivided in several size-of-policy groups and our Other Than Term forms are similarly analyzed.

Another investigation is by year of issue which ties in with the contribution to the joint investigation but in this instance, and in fact for all of our investigations, detailed analyses are now made only on issues of 1931 and later; our general experiences, however, include separately in summary form the last year's experience and the experience since 1931 on all years of issue. For a time we made annual mortality investigations of the business of about fifty of our branch offices with the others grouped so that everything could be summarized by section of the country.

A special investigation is made of attained age conversions for which we also have another punched card system, whereby the converted policy can be studied in conjunction with the original policy in which the duration can be calculated from the date of the original policy.

Our substandard experience is worked by cause of rating and amount of rating classifications. Our Salary Allotment Experience is analyzed separately between medical and nonmedical. Also, this experience is worked separately on about a half dozen groups of policies, each of employees of one company or of the closely associated groups of companies.

We have contributed to the various joint impairment and occupation investigations and we have made a limited number of such investigations of our own. During the war we discontinued our occupation coding be-

cause sufficient information wasn't available about many cases to furnish a significant coding, and because we hoped that the codes would be revised to better reflect modern industrial conditions.

From the preceding, it will appear that our card is used mostly for more general investigations than for those involving the great detail shown in Mr. Ryan's paper. I have mentioned them, however, because such uses may be of interest to other actuaries designing systems of their own.

At one time we used a size-of-city code but that was discontinued. Before our 80-column card was designed, we punched three impairments where they existed but, in actual practice, we found that this was too unwieldy. If we sort the cards to one impairment that is to be investigated, it seems to us that those with more than that impairment should be discarded in order to make a more homogeneous group uninfluenced by other impairments. A man with a heart impairment shouldn't be included in a gastric ulcer group. We seldom, if ever, had enough cases to make a worth while investigation of a combination of any certain two impairments. An undue proportion of our cards had two or three impairments, some of which were quite minor and we stopped coding most of what are classified in the instructions as optional impairments.

We have also eliminated most of the handwritten material on the punched cards, such as Mr. Ryan mentions, and, as far as possible, we have eliminated all double punching because our Tabulating Department feels that the resulting chances of error are too great and the amount of the work is increased too greatly.

We also obtain general withdrawal experiences by policy form, year of issue and age at issue on the mean duration method. Apparently the New York Life method of coding cancellations doesn't distinguish maturities, expiries and conversions which we distinguish from voluntary cancellations. We generally exclude conversions from our withdrawal rates but on occasion have worked rates both including them and excluding them.

Our procedure is considerably different from most other life companies, also, in the fact that all of our work is done in the Tabulating Department which is designed to do the work of the whole Company as efficiently as possible, including Automobile, Workmen's Compensation, Fire, Accident and Health, Group, Steam Boiler, Plate Glass and various other lines, including not only experience, reserves and analyses of agents' business, but also Mortgage Loans, Policy Loans, etc. The Life business is but a small proportion of the total. This summer a section of this general Tabulating Department has been moved to be adjacent to, but still separate from, the Actuarial Department. This unit includes about

18 tabulators, sorters, collators, reproducers and a multiplying punch. This is mainly for the use of our department together with the Mortgage Loan and Policy Loan Departments but will be coordinated with the work in the general Tabulating Department. This arrangement of a separate tabulating department has undoubtedly had considerable influence on the arrangement of the rest of the work described herein.

WILLIAM J. NOVEMBER:

As the author has brought out in his paper, there has been a surprising lack of information in actuarial literature on the subject covered in the paper. This may have been due in part to a virtual suspension of activity, as a result of the war, in the investigation of mortality under medical impairments and occupations. About ten years have elapsed since the last such investigation by the Joint Committee on Mortality, and it is only now that plans are being laid for a new intercompany study.

A renewal of interest in mortality investigations of this type has been indicated by the number of inquiries which in the last year or two have come to the Joint Committee on Mortality for information regarding forms of cards and procedures for preparing them. It is particularly helpful therefore to have a description of the New York Life's procedures in the literature and it is to be hoped that this will be supplemented in the discussion by information regarding the practices of other companies.

Anyone approaching this problem should realize that there is considerable variation among companies in the form of statistical card used for mortality purposes and in the methods followed for the preparation and maintenance of the cards. When the Joint Committee on Mortality in 1924 published the pamphlet described by Mr. Ryan, uniform 45-column cards were recommended. It is doubtful that all companies adopted those cards at the start, but certainly with the passage of time the trend was for the companies to design their own form of card, although having in mind the needs of the Joint Committee on Mortality. The development of an 80-column card speeded up the process of individualization; by this time most companies have shifted to the 80-column basis. It was the original intention of the Joint Committee when an investigation was undertaken to ask contributing companies to send in individual mortality cards, from which the experience for all companies could be tabulated. This would have required uniformity of cards. It was later found more feasible to ask the companies to transmit sheets summarizing their exposures, and with this development the need for uniformity virtually disappeared.

The content and design of a company's mortality card will generally be

governed by the kinds of studies the card is intended to produce, the order in which the items of information are obtained, and the company's methods of file maintenance and statistical analysis. The list of items included in the New York Life's card is rather typical. However, I believe it is unusual to attempt to include the rather special information needed for aviation studies in a general mortality card. Companies more generally maintain a separate card for the purpose of studying their experience on aviation risks. One other point that might perhaps be mentioned in this connection is a difference of practice which has been found in the number of fields devoted to impairment codes. There are three such fields in Mr. Ryan's card and many companies include a like number. Provision for only two impairments is not uncommon, however, as it has been found that the number of instances in which more than two impairments need to be coded is rather small. Whether there is space for three impairments will depend upon the usage to be made of the card and the number of items that have to be included in it.

The decision as to the extent to which mortality cards are to be prepared no doubt depends upon the expense the company is willing to incur for that purpose. A company which maintains a medical impairment card file would certainly wish to punch a card for every substandard case, as a minimum. Standard cases can be handled in a number of different ways. A company might punch a card for every case to which a numerical rating has been assigned because of a minor impairment, so as to be in a position to study these cases at a later time. This might entail too many cards in relation to the value to be derived from them. One way to reduce the file is to eliminate types of impairments not likely to come up for study or to ignore cases where the numerical debit is below some minimum figure. The course adopted by the New York Life, and followed by some other companies, is to use a sampling procedure for their standard lives. A company has to write an extensive amount of business for this approach as the results based on a sample are not likely to be statistically significant unless there is a sizable number of cases to begin with. The statistical reliability can be improved if along with the sample of exposures all of the deaths of the class under investigation are used. This involves some hindsight in the coding of death claims, but if proper care is exercised the method can be satisfactorily used for keeping down the size of the impairment card file.

The New York Life has apparently not thought through completely the method by which it would keep its file on a current status. From information in the files of the Joint Committee it would appear that a majority of the companies maintain their individual card files currently, but

that a number of companies get the information from the policy register, history card or equivalent file, as needed. As Mr. Ryan has suggested, the current maintenance of a file enables a company to make studies quickly. If the maintenance of the file is efficiently integrated with other statistical procedures, it is also true that the cost may be lower than that involved in the process of looking up the cases when a study is undertaken. On the other hand, it should be recognized that it is not at all certain which cards are going to be studied eventually, and unless a high proportion of the cards is investigated, much maintenance cost may be wasted. It is also true that errors of file maintenance are more likely under the current maintenance method since failure to post a termination to a mortality card may go undiscovered without special controls.

NORMAN BRODIE:

I believe that a paper on a subject not previously covered, or inadequately covered in actuarial literature and of importance to actuaries, should be especially appreciated by the members of the Society. I feel that this is so in that we are led to compare our procedure with that of the company represented by the author of the original paper and eventually with the practices of the companies contributing to the discussion. In this way we reappraise our procedure, and in some cases discover a number of economies and improvements that can be carried over to our own companies. In addition the paper together with the discussion provides a digest of the practices of a number of companies for the guidance of students and actuaries in companies coming face to face with the problem for the first time.

Mr. Ryan points out very clearly in the first part of his paper that there has been a very limited discussion of the use of punched cards for mortality purposes in our literature. This is somewhat surprising since the adoption of a punched card system for mortality experience would seem to require a number of decisions by the actuary. Some of these are listed below:

1. Since the card itself provides for punching only 80 columns of information it is necessary to decide which items are to be provided for in the card form. This requires very careful evaluation of the various factors affecting the mortality experience and consideration of the possible uses of the file for other than mortality studies. It is impossible to complete the card in such a fashion as to provide for all conceivable experience studies and still retain the advantages of a punched card over a handwritten card.

2. A working procedure has to be established such that the cost of

maintaining the file and the cost of preparing mortality studies from the file will not be unreasonable relative to the value of the statistics produced. This involves decisions as to the types of cases to be included in the file and may also involve a decision as to whether or not a sample procedure should be adopted. If a sample is used, the actuary has to determine the size of the sample which would produce results with the desired degree of reliability.

3. The actuary should also be concerned with the working procedure for maintaining the file in so far as it affects the completeness of the file and the accuracy of the punched cards. Errors are probably inevitable and therefore he should attempt to establish a procedure which would assure him that the file is reasonably accurate at all times and that sufficient controls have been introduced to bring to light any systematic omissions or errors.

In this discussion I should like to concentrate on a presentation of an outline of the working procedure and card form for the Medical Impairment Mortality file maintained by the Equitable, to which Mr. Ryan refers in the early part of his paper.

We actually maintain more than one file for our specialized mortality investigations and do not restrict ourselves to a single file as is the apparent intent of the New York Life. These other special files will be mentioned later in the discussion and I will also discuss briefly at that point the advantages as we see them in maintaining separate files. Our Medical Impairment file is of course the largest of these special files since it covers a much broader class of issues.

The general procedure followed by the Equitable in the preparation and maintenance of the Medical Impairment Mortality cards is outlined below:

1. We maintain a special file of punched cards on each policy issued by the Equitable for a period of two calendar years after the year of issue, which we identify as the Analysis Card file. This file is in addition to that maintained for valuation purposes and is kept on a current basis by application of policy transactions quarterly. It is designed primarily for determination of L.I.A.M.A. lapse rates, lapse rates by agencies, production by agencies, and analyses of other characteristics of new business. It also serves as a basis for the preparation of three of the permanent special mortality files that are maintained. In the early part of each calendar year the first 35 columns of the Medical Impairment cards are reproduced from the Analysis Cards for the desired issues of the preceding year. These Medical Impairment cards are prepared for all of the substandard issues and 10% of the standard issues that were in force at the end of the calendar year of issue or terminated by death during the calendar year of issue.

2. From these Medical Impairment cards we reproduce the policy number, issue age and code for type of underwriting into a dual form IBM card, which we call the Medical Impairment Transcript card. This latter set of cards provides for the writing in of codes on the left hand side and for the punching of these codes on the right hand side.

3. Working with the Transcript card, the code clerks send for and code the applications for the issues of the previous year. This operation is generally completed before the end of the calendar year following the year of issue.

4. The Transcript card is then punched with the coded information, collated against the file of Medical Impairment cards which had originally been prepared from the Analysis card file, and the coded information then reproduced mechanically into the Medical Impairment card. The Transcript card is then destroyed, except for those cases where a blood sugar test was made since we want to retain for special studies the blood sugar equation which had been entered on the Transcript card.

5. The policy transactions are coded on punched cards as they are reported. The transaction cards thus prepared for each calendar year are then mechanically applied to the Medical Impairment file in the early part of the subsequent calendar year. We are thus able to study the experience through the anniversaries in any year by the Spring of the following calendar year.

There are a few supplementary comments that might be made with respect to the above procedure. It will be noted that we do not prepare Medical Impairment cards for terminations other than by death in the calendar year of issue since such terminations do not contribute to the exposure when the mean duration approach is used on such cases. Considerable effort is saved in adopting this procedure since there are many lapses shortly after issue.

It might be mentioned that at one time we completed the Medical Impairment cards by punching directly from the application papers without any intermediate coding operation. Theoretically this process should be faster, but we actually found it to be unsatisfactory in other respects. The key punch machines and verifiers were not being efficiently used under such a procedure and any coding errors necessitated repunching the entire card. After some experiments with various procedures, we adopted our current practice involving the use of Transcript cards. This has an additional advantage in that at the end of the year, when the Transcript cards and Medical Impairment cards are matched, any unmatched Medical Impairment cards represent lost Transcript cards. These cases can then be completed and we are assured that all of the wanted cases have been added to the file.

A detailed outline of our Medical Impairment card form is presented herewith.

Column Numbers	Item	Remarks
1	Type of underwriting	
2- 9	Policy number	
10-11	Age at issue	
12-14	Plan of insurance	
15-20	Amount of insurance	
21-22	State code (at issue)	
23-25	Agency code	
26-28	Year and month insurance effective	
29	Sex of the insured	
30	Accidental death benefit	
31	Disability benefit	
32	Feature ratings	
33	Policy rating	
34	Mode of premium payment (at issue)	
35	Conversion code	To identify term and group conversions
36-38	Year and month insurance terminated	
39-40	Duration at termination	Curtate duration on deaths, mean durations on other terminations
41	Mode of termination	
42-44	Occupational code	
45	Race	
46	Medical tests	
47	Number of impairments	Standard cases—number of impairments which have a debit attached to them Substandard cases—number of impairments which in themselves would have made the case substandard
48-53	First medical impairment code and rating	An X double punched in column 54 indicates that there are more than two impairments on the life. These additional impairments are <i>not</i> written on the cards
54-59	Second medical impairment code and rating	
60-63	International cause of death code	
64-65	Equitable's cause of death code	
66-68	Total numerical rating	
69-73	Blood pressure readings	
74-75	Height in feet and inches	
76-78	Weight	
79	Build code (percentage departures from average build)	
80	Policy count	Because of the use of adjustment cards when policies are consolidated or divided, a "0" is punched into those cards that are not counted in determining the number of policies

A comment might be in order with respect to the impairment ratings which are coded in columns 53 and 59. This code enables us to mechanically differentiate between major and minor impairments. (A major impairment is defined as one which would call for a substandard issue regardless of whether or not other impairments were present on the case.) Another objective of this code is to enable us to study the mortality of minor impairments with reference to the actual ratings assessed.

Until recently, our card form provided for coding three impairments and did not provide for cause of death. When we reviewed this situation, we decided that we could eliminate the third impairment field. On studies of substandard issues, we have generally restricted ourselves to cases where there was only one major impairment or one major combination of two impairments. The situation where the third impairment would enter into a study of such issues is extremely rare. As for standard issues, we felt that we could dispense with the third impairment field, although studies on standard issues could conceivably be made from any of the rated impairments, since a test indicated that only slightly over 1% of the standard issues had three or more rated impairments and that in practice the third impairment would never involve a debit in excess of +10.

It should be noted that we do not currently post any handwritten data to the Medical Impairment card. A serious objection to handwritten information is that the necessity for transcribing it from the Transcript card to the Medical Impairment card slows up the process considerably. In addition, it is sometimes found desirable to reproduce the older Medical Impairment cards so as to minimize machine difficulties in handling the cards, and here again the cards with handwritten data require special processing. In fact, the same problem arises every time cards are damaged during a machine operation. Another objection, of course, is that the machine tabulations have to be adjusted if the handwritten data affect the exposure or the claims.

It will be noted that our card file is not designed to produce all of the mortality experience studies derivable from Mr. Ryan's card. In addition to the card file described above we maintain the following specialized mortality experience punched card files for insurance issues:

1. Large amount risks
2. Term conversions
3. Group conversions
4. Pension Trust issues
5. Juvenile issues with supplementary coverage on life of applicant.

Mr. Ryan outlines in his paper the advantages and disadvantages of a single card file for specialized mortality experiences. He indicates that multiple files might be desirable to secure the maximum flexibility of the punched card system, whereas a single card file would be more economical to maintain. I would like to say a little more at this point as to why we maintain separate files. There are certain elements of coded information in each of the above files which do not appear on the Medical Impairment cards. To adopt a single card form would require (i) elimination of certain items, (ii) the introduction of handwritten data to the card file or (iii) the use of the same columns for coding different information on the various issues, the distinction being made by an identifying punch in a specified column. Although there are some items on the Medical Impairment card that we are currently willing to drop, there are not enough of these items to accommodate all of the coded information that we find necessary in the other files. As for the second alternative, I have already indicated our objection to the use of handwritten data. The last alternative would complicate the mechanical handling of the cards and would require a relatively complex coding procedure. It might be mentioned also that coding errors are probably more frequent when complex codes are used.

The procedure that a company finds most efficient for determination of the entrants to each specialized mortality group might also be such as to call for and warrant special files. For example, in the Equitable the Actuary's Department receives a copy of reports made by the Underwriting Department on large amount policies after issuance. This copy, numbered in numerical sequence for control purposes, is prepared when the application is received and then completed with the amount issued and the policy numbers assigned when the policies are issued. Since the routine for determining the new issues of Large Amount policies is quite different from the corresponding procedure for the Medical Impairment file, it seems convenient to maintain separate files.

The use of the special files for purposes other than mortality studies might also dictate the maintenance of separate files. To illustrate this, in our annual studies of select mortality we use our Term and Group Conversion files as negative adjustments to the valuation in-force. We therefore find it practical to keep these files separate so that they can be summarized once a year at our convenience. Still another advantage of separate files is that they permit simultaneous studies without any concern as to whether a particular policy contributes to more than one study.

We are still making our aviation studies from the handwritten standard Pilot Form Card designed by the Aviation Committee of the Actuarial Society a few years ago. Since it is very inconvenient to determine the ex-

posures from these cards in such fine subdivisions as were requested this past year by the Aviation Committee, a punch card system would appear to be in order. Accordingly we plan to devise a punch card for our aviation file in the near future.

As for studies of our nonmedical business, our valuation detail cards contain a special punch which identifies the type of underwriting. Accordingly we can work from special summaries on this code to develop the mortality experience. We similarly use valuation summaries to analyze our mortality experience by plan of insurance and premium class.

NORMAN F. BUCK:

Beginning January 1, 1950, the Lincoln National will replace its present 45-column mortality punch card form with an 80-column form, and will at the same time make a number of changes in its procedures for handling these mortality cards. In essence the card is designed to produce with the minimum of effort annual select and attained age mortality studies by number of policies and by amount of insurance, as well as all periodic or specialized studies. It is intended that the most common impairments or impairment groups will be studied annually by the same process as the whole volume of business. The new form will make use of several ideas presented in Mr. Ryan's excellent paper.

The new card will omit several items that are punched into the New York Life form. It is felt that the mode of premium payment will not significantly affect mortality rates. Any studies of waiver of premium or double indemnity experience will be made from other records. Under a system of filing all the cards in policy number order, separated only into in-force, death claims and other terminations, no punch is needed for a file number. With data on the height and on the build in percentage deviation from standard weight, the weight itself is unnecessary. Studies of build will be run on the basis of percentage deviation from standard weight rather than of the less desirable deviation in pounds. Special aviation data will continue to be entered on the cards provided by the Aviation Committee of the Society.

A number of items are to be punched into both cards but are to be handled differently. The Lincoln plan code will be a very simple one-column affair, distinguishing essentially among life, term, endowment, single premium and joint insurance. A finer break-down for mortality study purposes does not seem warranted. An extra premium, whether assessed on the basis of a table rating or a flat extra, will be shown indirectly by an appropriate code in the rating classification field. This technique requires more mortality study groups and hence more summary cards

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than does punching the total monetary extra in dollars, but it has the advantage of permitting a mortality study by number of policies as well as by amount of insurance. Only two significant impairments will be punched; mere test codes, such as that denoting x-ray, will be punched in a separate column. This method avoids the necessity, where a test code would ordinarily occupy the first field, of sorting also on the second field to determine the significant impairment. It also makes possible the easy location of all cards for policies issued on the basis of given medical tests. Electrocardiographic data when available will be punched into a two-column field. The first column will indicate the time elapsed since the EKG was taken. The second column will separate the findings into the following ten groups: states regarded as normal or not usually substandard, the various blocks, irregularities or abnormalities of rhythm, paroxysmal tachycardia or auricular fibrillation, QRS impairments not listed elsewhere, Q wave abnormalities, marked axis deviation, T wave abnormalities, abnormal chest lead, and miscellaneous abnormalities. It is felt that EKG cases are too few to provide reliable studies under more detailed break-downs.

Certain additional information is to be punched on the new card. In a company doing a considerable volume of both participating and non-participating business, it is deemed necessary to distinguish between these on the mortality card. Every card will show the source of the business and the general agency. A miscellaneous column will indicate certain types of business that are expected to give unique mortality rates: group conversions, attained age term conversions, nonmedical cases, brokerage cases, business taken over *en bloc* from other companies. There will be a three-column field for blood sugar tests. The findings at two or two and one-half hours will be punched, the latter being given preference. The type of test and finding will also be shown. Because of the large amount of time consumed in reviewing death claim papers in a recent study of mortality among impaired lives, the new card will contain both the primary and any secondary cause of death. The code will be the recently announced 1950 intercompany code. The settlement of a claim by compromise or by return of premiums or reserve is to be indicated by an overpunch. The death claim number will also be punched.

An attempt has been made to adhere to three principles not emphasized by Mr. Ryan. First, the card is to contain virtually no handwritten information. Second, except for minor distinctions by classes of business, a given punch in a given column will always mean the same thing. Third, because a blank field could mean either an oversight or a deliberate omission, in so far as feasible every field is to contain some punch.

Procedure for Handling the Cards

It is considered necessary to punch a mortality card for every standard as well as for every substandard policy paid for. Annual mortality investigations, even those involving large exposures and utilizing large age groups, reveal such marked fluctuations in the ratios of actual to expected mortality as to rule out any studies by samples. Moreover, when cards are punched for only a portion of the paid policies, it becomes difficult if not impossible to verify the completeness of the file and to maintain adequate checks and controls. An effort was recently made to base a specialized mortality study on the cases indicated as appropriate by the underwriters. Unfortunately so many cases were overlooked that this technique had to be abandoned.

To minimize the added work involved in punching a card for every paid policy, the following system has been used for some years. For every new policy the Issue section by a duplicating process makes up cards and data sheets for all the interested departments of the company. When the first premium is paid these are distributed. The "master sheet" received by the Statistical section contains all the information needed for punching the mortality card without further reference to the files. Most of the information appears on the master sheet in such form that it can be punched directly into the mortality card without preliminary coding.

The Lincoln has for many years based its valuation procedures on a two-card system and its mortality files on a one-card system. The two-card system, having proved more convenient and having made possible a more dependable verifying device, will henceforth be applied also to the mortality files. For each newly paid policy two cards will be punched by independent operators and will then be mechanically compared by a reproducer. The white or "file" card will go into a permanent file; the yellow card will go into a "working" file. Incoming cases will enter the annual investigations via the yellow cards and outgoing cases will leave via the white cards. The month, year and mode of entry will be punched into a control field on each yellow card. The month, year and mode of exit will be punched into the same control field on each white card when the corresponding policy is terminated. When a policy is changed materially—changes in plan or residence, for instance, will be ignored—the old white card will be terminated and new white and yellow cards will be made up.

The card form contains a "subtraction duration" field in addition to the usual "plus duration" field. When a policy is changed significantly, the old white card will be terminated with the appropriate mean duration, say k , and mode of termination. Both new cards will ordinarily be punched

with the original issue year and age and a subtraction duration of k ; upon eventual termination the second white card will be punched with a plus duration dating from the time of original issue.

Mortality Studies

At the end of a particular calendar year a summary card for each combination of attained age and rating classification will be punched to indicate the in-force as of December 31. To these sums will be added the claims incurred after the policy anniversary in the calendar year just ended (alpha claims). The totals of these two groups, punched into exposure summary cards, will give the exposures for the policy year beginning with the anniversary in the calendar year just ended. Each subsequent year the totals from that year's changes, terminations and alpha claims will be applied to the appropriate quantities in the in-force summary cards from the previous year to produce new exposure summary cards. Exposures on new issues of that year will also be punched into summary cards. Each year after the summary cards have been punched, the yellow mortality cards may be thrown away. The white cards will be saved permanently. Alternatively the yellow cards can be saved and used, along with the (white) terminated cards, as the basis of various special mortality investigations.

HARRY F. GUNDY:

The paper presented by Mr. Ryan will prove of particular value to companies considering the introduction of special mortality investigation cards and is also valuable for comparative purposes to those companies which already have such cards.

The Sun Life of Canada has maintained a system of punched cards for mortality statistical purposes for a number of years, the initial file having been on 45-column cards. Transfer to 80-column cards was completed in 1939. A brief statement of the apparent differences in procedure may be of interest.

1. A card is prepared for each policy placed. As the volume of business is not as large as that of the New York Life it has been felt that the file should be complete in order to obtain the greatest value from it. Sampling methods undoubtedly have advantages where the volume of business is substantial but with an incomplete file obvious difficulties are created in maintaining the file up-to-date with cancellations and changes.

2. When the policy record card and other Head Office record cards are being prepared a "Mortality coding card" is also prepared from the same master card. The information on this card together with information from the application itself permits the coding to be completed for preparation

of the punched card. The coding and preparation of the punched card are delayed for approximately three months to allow for final action on applications and the elimination of Not Taken policies.

3. Only one set of cards is prepared and maintained. These cards are used for Total Disability and Accidental Death Benefit studies as well as mortality studies. When the cards are not in use for investigation purposes they are kept in numerical order in three groups, the cancellations and deaths being kept separately from the "in force" cards. Although only one set of cards is maintained a register is kept of all cards coded. This register is simply a numerical list of the cards completed after the coding has been finished and showing policy number, amount, race, age, year of issue, residence, evidence of insurability and how issued. This list is used to check that all cards have been prepared and thereafter is of value in locating cards when cancellations and changes are being completed at the year-end or when investigations are in progress.

4. Changes affecting essential details of an investigation card are handled by canceling such card at the policy duration in the year of change and including a "change" card on which is punched the duration at change. In preparing mortality studies the original card is treated as a cancellation and the new card is introduced into its proper class at the duration at change. The mode of termination column on our card indicates for canceled cards the actual mode such as lapse, extended term expiry, cash surrender, death, change, etc. The cards are used for termination studies by duration and mode. In the case of changes the continuing card includes a code indicating the nature of the change, *e.g.*, addition of family income benefits, change from substandard to standard, etc.

5. The sources of information used to notify Head Office record departments of cancellations and changes are used by the Mortality Section for the preparation of "finder" cards. In the case of changes affecting the card a new mortality investigation card on the regular form is used as a "finder" card. The card is punched with those details available from the change abstract including the duration to date of change and the reason for change. These cards are used at the end of each year to extract the original card from the main file by means of the collator. The two sets of cards are placed in groups according to the reason for change, after which the original card is canceled by mode "change" and the duration to change is added thereto. Details missing from the new card are reproduced thereon from the original card and both cards are then available for the purpose of adjusting the "in force" figures. The original card is eventually

filed with the cancellations and the new card is filed with the "in force" cards.

In the case of cancellations a special "finder" card is prepared showing policy number, amount, plan, mode of termination and effective year of cancellation. At the end of each year these cards together with the change cards mentioned in the previous paragraph are processed against the main file. When the original cards are located they are broken down into their respective classes by mode of termination and sorted into groups permitting the mode of termination and the duration to be punched thereon. For the bulk of the cards machine methods are used but individual cases must be handled separately, *e.g.*, where more than one transaction affecting a card has occurred in one year. In the case of death claims the investigation cards are checked against special handwritten cards prepared from the claims dockets.

The "finder" cards are available for use in estimating the mortality experience during the calendar year.

6. Tabulations of business in force as at the end of each calendar year are maintained for continuous mortality studies of various sections of the Company's business. At the end of each year the adjustments are tabulated for the purpose of bringing the "in force" figures down to date. Consideration is now being given to mechanical methods for adjusting the "in force" figures by preparing summary cards of the "in force" figures at the end of each year which may be tabulated with the adjustment cards representing changes and cancellations.

7. A separate card file is maintained for large amount cards but an identifying code is included on the corresponding cards in the main file.

8. A separate card file is maintained for death claims and for disability claims giving more information than may be included on the mortality investigation cards.

9. Certain additional information is written on the cards prepared by the New York Life, *e.g.*, where the occupational code does not adequately describe the occupation. We also have certain handwritten details. It has been our experience, however, that such information is likely to be lost when cards must of necessity be duplicated, and for that reason it is advisable to keep handwritten information to a minimum.

10. We have attempted to dispense with double punches in any one column to the greatest possible extent as they tend to complicate tabulating and printing controls.

11. The more important differences in our coding practices which are not mentioned above are as follows:

- (a) We code the office year of birth (year of issue minus the age at issue) which has been found useful in studies by attained age.
- (b) In one column we indicate the nature of the evidence of insurability—medical, nonmedical or without evidence.
- (c) The New York Life practice of coding the numerical debit for each impairment has much to recommend it as the absence of such a code on our cards complicates the preparation of impairment studies.

NEIL W. MACINTYRE:

We have read with interest the procedures followed by the New York Life in the preparation of their Mortality punch card. As Mr. Ryan states there is very little information in actuarial literature regarding the general methods used by life insurance companies in the preparation of these cards. About six years ago in the Mutual Life we centralized our tabulating and at that time took the occasion to review and revise our procedures for establishing our punch cards.

We wished to obtain a maximum amount of information from the centralized punch card file. In particular we wanted:

1. Agency statistics, as to both applied-for business and paid-for business.
2. A valuation file.
3. A statistical file for mortality investigations.

After due consideration, it seemed to us that the best results could be obtained by being prepared to create all the files at the inception of the policy, even though it meant coding some cards on "not taken" business. We realize that there is some waste if a policy is canceled, but consider that there are offsetting advantages. Since the establishment of the Central Tabulating Division we have been able to extend the use of the original card files by punching additional cards. We might mention that punch cards are the essential control for our Agents Compensation Plan.

As our routine differs from that of the New York Life, I am giving a short summary of our practice in the hope that it may be helpful.

When we make our policy cards by addressograph plates, we also make a Transfer Coding card which forms our punching medium. From the addressograph plate we reproduce all the policy details; the balance of the card is for the coding of the details which are filled in by hand from the application. From the Transfer Coding card the following cards are punched.

1. Considered Business Card.

From this we make various underwriting analyses such as average numerical ratings, percentage of policies accepted standard or sub-standard, quality rating studies (expected persistency), etc.

2. Initial Commission Card.

From this we calculate the initial commission paid to our agents. Ultimately this information is transferred to a second punch card giving the agent's total annual compensation.

3. Agents Control Card.

From this we make our "paid" run by agency. By punching a "paid for" card with the agent's code number we can establish the total insurance in force for each field underwriter. Aside from any general statistical purpose, we need this information, as part of the compensation of an agent depends on the amount of insurance remaining in force at the end of the 5th, 10th and 15th years.

4. Valuation Card.

5. Substandard Valuation Card.

6. Mortality Statistical Card.

Information common to all cards, roughly about 28 columns, is reproduced from the first card.

After the Transfer Coding card has been completed, the application is sent to the files and the Transfer Coding card to the key punch unit. At this time the Considered Business card and the Initial Commission card are created. When a policy is reported paid from the agencies, the Valuation card (standard and substandard), the Agents Control card and the Mortality Statistical card are completed, the additional information being punched from the Transfer Coding card.

Our mortality statistical card is designed primarily for studies of occupations and medical impairments. We prepare these cards for the following groups of policies:

- (a) Standard issues with policy numbers ending in 0 or 5.
- (b) Standard issues with substandard double indemnity benefits.
- (c) Standard issues with substandard waiver of premium benefits.
- (d) All substandard issues.
- (e) Large amount issues.

A sample of our mortality statistics card is shown on the following page. The card is similar to that described by Mr. Ryan, but there are some differences:

1. We do not code race and family history unless the family history is one of the two principal "medical impairments."
2. We code two medical impairments rather than three.

We have our own medical impairment 4-column code which enables us to give the break-downs of various impairments without referring to the original papers. Further information as to the code can be found in

Dr. Carber's paper in the *Proceedings* of the Association of Life Insurance Medical Directors, Volume XIX.

3. We do not have a separate coding for the true age, as we do not issue substandard policies rated by age, but the card contains the year of birth.
4. We do not have an elaborate aviation code. Regular cards completed for the Aviation Committee of the Society seem to us to be all that is necessary.

On the mortality card file we service the cards only at the time a study is being made.

Mr. Ryan's paper is of great value, not only to students but to all concerned with the maintenance of Company records of all kinds.

PRESTON C. BASSETT:

The Prudential also maintains a mortality file on perforated 80-column cards. This file contains the basic data for making the mortality investigations which are expected to be desirable within our company. The file also may be used for many of the Joint Studies prepared by the Society of Actuaries.

As Mr. Ryan points out, it is only natural to expect that many differences would exist among companies maintaining mortality card files. However, it was interesting to note the many fundamental similarities in the method of obtaining the files. There are some differences and it is these differences that are of chief interest.

The more important differences are: (1) considerable information is left in written form until perforated codes are needed for a specific study, (2) the status of the cards is not kept up-to-date, (3) space is provided for writing additional information on the cards, and (4) supplementary files are maintained for the Intercompany Large Amount and Aviation Studies. These points are discussed in the order given.

Our mortality card is made up by exactly the same procedure as in the New York Life through the time the data is written on the card. Thus, the steps that Mr. Ryan gives are followed down through the point where the information is taken from the application and written on the mortality card. At this point, our cards are filed and no further information is entered until we are ready for some specific study. The only information that is perforated in the card is that portion of the data that can be taken directly from the valuation card by mechanical means. The various codes for impairments, occupations and the like are not perforated in the card at this time. Also, any change in status is not recorded in the mortality card until a study is to be made. The decision of which method is preferable is

strictly a matter of opinion. We have felt that it is more economical to wait until we wish to study an impairment. At that time the procedure is: (1) the required mortality cards are sorted out by hand, (2) the policy numbers on these cards are listed in numerical order by mechanical means, (3) this list is sent to the register where the current status is recorded, and (4) the status and other pertinent information is perforated in the cards. Often gang punching is possible for the impairment code and status. Many cards that go into the mortality file are of potential value but actually never get used. We feel that the quantity of these is such that time should not be spent perforating additional information until it is needed. A little of the history on our mortality file and the way in which it is used was given in a paper by Mr. E. B. Whittaker in *RAIA XXII*.

One other feature of our card that has some advantages is that we have provided spaces for writing out additional pertinent information. This would include occupations that are not covered in the regular coding, results of blood sugar tests, other insurance, etc. This written information is often of value and could only be obtained by referring to the original papers which may have been destroyed.

In our Company, we maintain a separate and handwritten file for making Intercompany Large Amount and Aviation Studies. I was very much interested in the system Mr. Ryan has for having all this information in one mortality file. This appears to work out very well for the large amount file, and we are considering the same procedure for our studies. However, for the aviation mortality studies there are some valid objections to utilizing a punch card file as is done in the New York Life. Coding the aviation information the way the New York Life has done, although they have a very neat system, freezes the pattern of information available for an intercompany aviation study. Some information is not available and some is in such form that it cannot be conveniently combined with the information from other companies. As the data called for by an intercompany investigation varies from time to time, it frequently may be impossible to include the data from the New York Life. If every company set up its own coding for the aviation cards, it is conceivable that an intercompany study to include all contributing companies would be impossible, particularly so for some subdivisions of the data. Other information that might prove to be of considerable value may not be available. For example, the name of the insured is not given. This is of particular interest on death claims where several companies may have policies on one life. Although the study is made by policies, if there are a large number of claims on one life it should be known to the Committee. Also, the date of birth, while not too important, nevertheless is not available. The number of hours

flown is coded in units covering 50 or more hours so that finer breakdowns are not possible. This applies to the hours flown in the preceding 12 months, probable flying time in next 12 months and the total solo hours flown to date of issue of policy. When the intercompany aviation card is used, the exact number of hours is shown as determined at the time of application. The intercompany aviation card also has space for the following information: accident record, occupation and employer, owner of the aircraft, cause of death (details), date and place of death, and remarks. None of this information is available if the mortality card described in the above paper is used. This information is important and often used by the Committee, particularly on the death cards. The New York Life this year was able to give this information by sorting out their death cards from their mortality file and then preparing a standard intercompany aviation death card with the required information. If this procedure is to be followed in the future, there would not be a great amount of additional work to make up the cards at the time of issue.

The system we use is to have a perforated mortality card for aviation cases in our mortality card file but no information is entered on the card other than the word "Aviation." A standard intercompany aviation card is made up on each case.

Until such time as the Aviation Committee of the Society of Actuaries standardizes the pattern of its studies sufficiently to recommend a uniform punch card for all contributing companies, it does not seem advisable for individual companies to do so if it can be avoided. Even if a uniform procedure is recommended it may be necessary to write in additional information. Mr. Ryan has worked out a method of entering a wealth of information on his aviation card. Perhaps his system, modified where necessary, could be adopted by the Aviation Committee for the uniform card to be used by all contributing companies.

GORDON D. SHELLARD:

Mr. Ryan's paper describes an interesting approach to a problem which is probably faced by many companies at this time. It also provides an occasion for exchange of ideas with respect to the entire problem of how to obtain in convenient form the data necessary for specialized mortality studies.

In 1935 the Metropolitan revised its procedures for obtaining occupational and medical impairment data for mortality studies and began to use an 80-column punched card for this purpose. The procedures then adopted are now being reviewed with particular reference to reducing costs. Since our review has only just begun the following remarks are

based entirely on our current procedures and will be limited to those points where our procedures differ from those of the New York Life.

Our procedures differ from those described by Mr. Ryan in two major respects. First, we use separate records for aviation and large amount studies, and second, we do not attempt to keep our cards up to date as to standing. Status is determined only at the time a study is made.

The classification section of our Actuarial Division mechanically selects the cases to be coded and sends partially reproduced cards, already used in checking classification work, to the section where additional data are coded from the application. In this section applications are secured in bulk from the files, thus eliminating the necessity for individual requisitions. Data are hand coded in a special block on the remainder of the punched card and a new card, entirely punched, is then prepared from the partially punched card. We thus end up with two cards for each coded case just as does Mr. Ryan, but one of our cards is completely punched and the other is partially punched and partially handwritten. Any desired information can be directly read by eye from this latter card. These are filed in numerical order by policy number, while the wholly punched cards are used in carrying out studies.

As in the case of the New York Life, we code only a sample of standard issue. Our sample consisted in prewar years of all policies written for \$5,000 or more of insurance and 10% of the remaining policies. These latter were selected as those policies having the same units digit as the units digit of the year of issue, thus insuring a random sample over the years. It may be of interest to mention that we have also experimented with the process of obtaining mortality rates by relating the total deaths on standard issues to the exposures built up from a sample of issues. This means that for deaths not originally in our sample we must code the facts as of issue in order to properly relate the deaths to exposures.

Wholesale insurance, conversions from group and wholesale, and interim term insurance are not coded. Changed policies, except those involving only a trifling change, are excluded beginning from the date of change.

Differences between our underwriting practice and that of the New York Life are reflected in certain of our coding procedures. Since we classify risks into broad mortality classes and do not follow the numerical underwriting method explicitly, we do not show any numerical ratings on our card.

Our codes include four items which facilitate work with impairments. An index column is provided in which is punched the hundreds digit of each impairment coded on the card. Another column is provided in which

is punched a code indicating any special tests that were employed, such as electrocardiogram, x-ray, or blood sugar test. An "X" is punched in the last column of the last impairment field used, to indicate that no further impairments are punched or handwritten on the card. An "X" is likewise punched in the first column of each of any impairment fields bearing codes of related impairments.

Certain other differences between the procedures of the Metropolitan and New York Life are listed below. In general the Metropolitan has apparently recorded items in less detail than the New York Life.

Item of Difference	Metropolitan Procedure	New York Life Procedure
Insurance Begins.	Only issue year shown	Year and month shown
Gross Premium Mode.	Not shown	Shown
Impairment Order on Card.	Numerical order of code	Order of importance
Build.	Girth and chest measurements shown, % overweight or underweight not shown	% overweight or underweight shown, girth and chest measurements not shown
Marital Status.	Shown in all cases	Shown for women only
Family History.	Only intercompany code used and coded in regular impairment fields	Special column used
Cause of Rating.	Not shown	Shown
Extra Premium.	Presence of indicated by Y punch in plan code but amount and term not shown. Separate records kept	Amount and term shown in special field
Mode of Termination.	Each mode shown separately	Separated only into deaths, and "other terminations"
Cause of Death.	Coded by "International List" code	Coded by intercompany code

(AUTHOR'S REVIEW OF DISCUSSION)

JOHN F. RYAN:

I am grateful to everyone who has presented a discussion of my paper. Mr. November has given us the benefit of his knowledge on this subject obtained from his vantage point as Secretary of the Committee on Mortality under Ordinary Insurances and Annuities. Messrs. Elston, Gundy, Bassett and Shellard have presented valuable information on the procedures followed in their companies while Messrs. Brodie, Buck and Macintyre have included not only worth-while general information as to procedure but also details of the mortality cards used in their companies. The material included in these discussions adds considerably to our knowl-

edge of the mortality card procedure followed by the various companies and rounds out the published information on this subject.

In reading the discussions one is impressed by the fact that there is little essential difference in the fundamental procedures followed in preparing mortality cards in the various companies although there are a number of differences in some of the less important phases of operations. Those points on which there is uniformity of thinking require no further comment and my reply will be limited mainly to some of the points of difference which may be noted from the discussions.

The differences of opinion which have been indicated by the discussion are generally of a minor nature. Some companies prepare cards on all business while others prepare cards on a sampling of the standard business plus all substandard issues as well as certain special types of issues. This, of course, is a matter of individual company judgment based on such considerations as the uses to be made of the cards and the number of policies involved. Some companies use their mortality cards for purposes other than mortality investigations while our mortality card is primarily for mortality purposes, with subsidiary information being obtained from other sources. The discussions indicate that practically all of the companies have separate files for aviation cards and for large amount cases and that handwritten cards are maintained by some companies for these files. We believe that our punch card system will enable us to readily produce the information ordinarily needed for intercompany studies without maintaining separate files of handwritten cards.

The volume of our aviation business makes it impractical for us to attempt to prepare the handwritten intercompany aviation card on all aviation issues. We were forced to weigh this matter carefully in setting up our system and to decide what information we would need for our underwriting studies and what information would likely be requested in the future by the Committee. Our decisions in these matters formed the basis for the aviation information coded on our cards. While handwritten aviation cards were probably satisfactory prior to the war, we believe the postwar growth of this business dictates the use of punch cards. Although Mr. Bassett quite correctly points out the lack of flexibility which might result from the use of punch cards for aviation issues, it is of interest to note that Mr. Brodie declared that the Equitable Life is considering the adoption of such cards. As Mr. Bassett stated in his remarks, we prepare the handwritten intercompany card, including all of the information Mr. Bassett enumerates, only on our aviation deaths. This is a very simple matter since deaths are but a small fraction of total issues.

We note that there is some difference of opinion as to the system to be

used in the processing of the mortality files. The discussions indicate that one company processes its cards currently, two companies process them annually and four companies process the cards only when they are needed for a study. In the New York Life cards are processed currently because we wish to be in position to make a study quickly should one be desired. However, since most studies are made with exposures terminating as of the anniversary in the preceding calendar year it is possible that an annual processing of cancellations and changes would satisfactorily meet our objective.

We note that one company perforates only one impairment while three companies perforate two impairments. Our card contains three impairment fields which include coding not only for medical impairments but for medical tests such as x-ray, etc., which are a part of the medical impairment code. We are in complete agreement with Mr. Elston's statement that cases with more than one impairment should be studied separately. However, we also feel that mortality studies to date have not shed much light on the question of multiple impairments and that some underwriting practices on cases involving multiple impairments are based largely on conjecture. With the general lowering of standard mortality, the upper range of substandard mortality which may be acceptable for insurance may tend to increase and in the future multiple impairments may come to play a larger part in underwriting and hence in mortality studies. Our feeling is that while mortality studies may properly center primarily on the most common impairments there should be room for research into some of the aspects about which we know very little. This same principle applies to the handling of such items as "minor" impairments and family history. We believe we should try to build up a file on such cases so that some mortality research of this nature will be possible.

We agree with Mr. Buck that the data on both height and build would enable one to make mortality studies on the basis of percentage deviation from standard weight but we think it desirable to include weight on the mortality card because the present build code is based on percentage deviation from a standard of weight which study may indicate should not continue to be the norm. If weight is not included on the card we are not in good position to study what should be the standard weight. This is a vital subject since every person we insure presents a question of a proper evaluation of weight. It is to be noted that Mr. Brodie and Mr. Macintyre indicate that weight is included on their mortality cards in addition to height and build. Mr. Shellard's discussion indicates that his company takes a different approach to this problem and codes girth and chest measurements instead of percentage overweight or underweight.

We also agree with Mr. Buck that a break-down into life, term, endowment, single premium and joint insurance is probably sufficient for most purposes but we feel that it may be of interest to investigate the mortality under certain types of policies which have become important features of our business, such as Family Income policies or certain types of Juvenile policies, and that it is desirable to be able to identify such cases in the mortality files. In addition, since the first 24 columns of our mortality card are reproduced from the valuation card it is convenient to use the valuation plan code and have the information as to plan reproduced mechanically.

We note that Mr. Gundy's company uses policy registers to keep control of the file. We have such a system under our 45-column punch card system but have discontinued it for our 80-column punch card system since we have other controls which insure that all cancellations will be processed.

Several persons commented that the mortality card should contain few or no double punches and that handwritten information should be eliminated so far as possible. These, of course, are desirable objectives. In the course of our planning we prepared an 80-column punch card without double punches. However, we found that it would not include some essential information already on our 45-column card and we did not consider it practical to switch from a 45-column card to an 80-column card and have less information available to us. Similar considerations apply to handwritten information. The principle we finally followed with respect to double punches was to use them where needed but to have them in positions where they would not likely interfere with machine operations. With respect to handwritten information we have included information that we have found to be needed in the past and we thus hope to keep to a minimum the laborious task of having to secure a large number of application files in the middle of an investigation in order to obtain information which is not on our mortality card but which we find to be needed. Our mortality card contains considerably more detail in many respects than is contained on the cards referred to in some of the discussions. This results in our card being more difficult to prepare but, of course, the amount of information and degree of detail to be included on mortality cards are matters of judgment and a question of objectives.