THE USE OF HOSPITAL ADMISSION DATA IN EPIDEMIOLOGICAL RESEARCH: A PILOT STUDY BASED ON BRITISH COLUMBIA HOSPITAL INSURANCE SERVICE RECORDS

by

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CONTENTS

INTRODUCTION

This paper represents an attempt to come to grips with a methodological problem arising out of recent trends in epidemiological research. During the past twenty years epidemiology has seen a marked change from interest in the infectious diseases to concern with non-infectious diseases.

> The identification of cigarette smoking as the major cause of this century's epidemic of lung cancer has clearly demonstrated the potential contribution of epidemiological research at the present state of knowledge of those chronic diseases that now constitute the predominant health problems in this country (U.S. Department of Health, Education, and Welfare 1968:2).

This shift in emphasis has led to the need for new approaches in both theory and methodology.

> New or newly emphasized methods are required to deal with problems such as:
>
> 1. Detection of causal associations in which decades or generations may lapse between cause and effect.
>
> 2. Measurement of existence and stage of diseases whose onset and progression are insidious and often unknown to the patient for many years.
>
> 3. Description of demographic distribution of conditions of low mortality for which the quality of

> medical diagnosis may vary markedly between populations and population subgroups.
>
> 4. Scientific and administrative problems of cohort studies that require large numbers and long-term followup.
>
> 5. Detection of clustering of diseases in time or place at a much lower level of intensity than that observed in frank infections.
>
> (U.S. Department of Health, Education, and Welfare: 1968:2).

Bearing the closest relation to the present study are items 1, 3, and 5. Long-term cause-effect relationships, demographic distribution of certain pathological conditions, and the discovery of patterns of disease incidence are of greatest interest. The methodology required to deal with such problems is the specific topic of this paper. The same publication that yielded the above problem statements goes on to discuss the need for appropriate modification of the basic vital records and health statistics. However, given the speed with which such changes are customarily achieved, this paper proceeds from the view that it is worthwhile to bend some effort to devise methods of manipulating *currently available* forms of data for the purpose of addressing the problems mentioned.

OBJECTIVES

The basic problem which this paper attempts to confront is one of devising and describing a method whereby traditional forms of vital records can be made to support inferences of the kind necessary if the above problems are to be tackled. I have chosen hospital records and census data for the province of British Columbia in 1961, 1966, and 1971 in order to develop the type of methodology which can be expected to provide additional insight into these new areas of epidemiological enquiry. I intend (a) to describe the methods used to modify, synthesize and manipulate the available governmental data, (b) to list and describe the tabular and graphic results of this investigation, (c) to discuss these results as they pertain to the larger problems to be confronted by future studies of this nature, (d) to examine alternate possibilities for attacking these kinds of problems, and (e) to draw tentative conclusions from this study by an evaluation and an assessment of its implications for possible follow-up research.

The specific problem that my project seeks to deal with is to ascertain general temporal and demographic trends or patterns in disease prevalence on the basis of

routinely available data compiled by governmental agencies. Since traditional correlations are primarily two-dimensional, attempting to control for three variables (e.g. age, demographic area, and disease), while examining fluctuations in prevalence over time, is not possible. Yet this is the kind of investigation which will be necessary if recent trends in epidemiology are to be successful. In order to make possible this kind of polyfactorial analysis the researcher must have available some form of complex cross tabulation which can be interpreted by means of a highly sophisticated computer programme (Fienberg 1970). My problem was to construct such a cross tabulation.

Essentially I wanted to produce a multi-dimensional partition of the set of all admissions to hospital in British Columbia during 1961, 1966 and 1971. These years were chosen because, being federal census years, the appropriate population figures were available to be used in the construction of rates for the four-dimensional contingency table. By means of such a table I believe that the production and interpretation of medical statistics is facilitated; and by medical statistics I do not mean the bi-variate correlations that are routinely produced by government agencies, but rather the sort of statistics whose task was described by Westergaard as "the presentation in numerical form of the influence of all conditions of life upon man's health" (Peller 1967:4ff). In view of

the multiplicity of variables which impinge on human physiological and mental processes, it is evident that "the influence of all conditions of life" is a complex variable and cannot be approximated or described by merely correlating successively different pairs of variables, as is the traditional approach to the compilation of vital statistics.

In my attempt to generate a multi-dimensional table from standard forms of data it became apparent that recurrent government modifications of data collection and recording procedures constitute a serious impediment to diachronic investigation. Also the internal structure of such records is rarely, if ever, compatible with the design of records from other government agencies. These two aspects proved to be the major problems in the production of the research tool that I had in mind.

MATERIAL AND METHODS

Nature of the Data

In order to ascertain information regarding patterns of disease prevalence in a population several basic kinds of data are required. Primarily one needs to establish *rates* of disease incidence, for the determination of which two components are essential: a crude measure of disease prevalence and a base population. An index was sought which would qualitatively reflect disease prevalence. [The distinction between prevalence and incidence, while important, does not really become critical until one examines specific disease categories closely. I will continue to use these two terms interchangeably, recognizing that a distinction exists and is significant at a different level.] The most comprehensive and large scale set of data containing such an index is compiled by the British Columbia Hospital Insurance Service [BCHIS), whose Director of Research, Mr. Donald Thomson, kindly made available to me selected computer tapes comprising complete hospital admission/separation records for British Columbia. Records covering the three most recent census years were chosen in order to accommodate the second essential component of a *rate* of disease incidence: population base figures.

Before choosing a set of census data on which to base the rates required for the contingency table, it was necessary to decide on the geographic unit which would allow the generation of reasonably specific rates. The ideal demographic partition seemed to be that based on school districts, since both BCHIS and the British Columbia Department of Industrial Development, Trade and Commerce use this variable in their data. Back issues of the latter department's publication, *Age Group Distribution of British Columbia's Population by School Districts*, were made available to me by departmental research staff. A weakness encountered in the population data is the failure on the part of the issuing department to provide a combined sex and age-group distribution. Instead these two variables are handled independently making it impossible for me to include sex in the multi-dimensional array.

The hospital admission records were in the computer tape form of 80-column IBM punch-card entries. A total of around 1,200,000 cards (cases) were on the tapes of the three years to be covered. Appendix I contains a copy of the basic form on which punch-cards are based, along with a copy of the appropriate (sample) punch-card.

Data Modification

The entry in the hospital record which relates most directly to the pathological condition which led to the

admission is "primary diagnosis." This is defined by BCHIS as "the cause of admission to hospital as designated by the attending physician following diagnostic examinations, tests, treatments, and other procedures" (BCHIS 1971). This item is coded according to the *International Classification of Diseases* (ICD) and may vary depending upon which revision of ICD is used. It did not come as a surprise to find that each of the three years chosen, upon which to build the correlation table, saw the deployment of a different revision of the ICD. In 1961 the code used was based on the *Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death* (World Health Organization: 1957). An adaptation in 1962 for use in the United States led to the 1966 use in B.C. of the *International Classification of Diseases, Adapted* (U.S. Department of Health, Education and Welfare: 1962). The changes incorporated in this version were mainly numerical with the aim of allowing for additional specificity. By 1971, the basis of disease classification was the *Eighth Revision International Classification of Disease, Adapted* (U.S. Department of Health, Education, and Welfare: 1967). This revision saw considerable change in disease categorization, with the effect of compelling me to recode much of the 1971 data according to the 1966 version of ICDA. The final recoding resulted in a classification which was reasonably compatible with the data from all three years.

To make this initial cross-tabulation feasible I chose a relatively crude partition of the set of all disease categories. This was a seventeen-category grouping labelled as follows: (1) Infective and Parasitic Diseases, (a) Neoplasms, (3) Allergic, Endocrine System, Metabolic, and Nutritional Diseases, (4) Diseases of the Blood and Blood-Forming Organs, (5) Mental, Psychoneurotic, and Personality Disorders, (6) Diseases of the Nervous System and Sense Organs, (7) Diseases of the Circulatory System, (8) Diseases of the Respiratory System, (9) Diseases of the Digestive System, (10) Diseases of the Genito-Urinary System, (11) Deliveries and Complications of Pregnancy, Childbirth, and the Puerperium, (12) Diseases of the Skin and Cellular Tissue, (13) Diseases of the Bones and Organs of Movement, (14) Congenital Malformations, (15) Certain Diseases of Early Infancy, (16) Symptoms, Senility and Ill-Defined Conditions, and (17) Injuries and Adverse Effects.

In addition to modifying the disease entity data, it was necessary to regroup the age groups offered by both hospital and census data. This resulted in the unequal intervals 0-9, 10-19, 20-34, 35-54, 55-69, 70+. In the tables of pathology and age specific admission rates, age groups are identified descriptively. However, for the purpose of graphic simplicity, the figures featuring frequency distributions have the age groups labelled from 1 through 6, corresponding to the above intervals.

In order to involve a demographic variable thought

to have a possible effect on "condition of life" and hence on "man's health" (Peller 1967:4), the population density variable was singled out as one feasibly incorporated into a multi-dimensional contingency table. The provincial government employs a classification which is adapted for use in this study. In 1971 this classification split the province's school districts into three categories, (metro, urban, and rural) as follows:

LIST OF SCHOOL DISTRICTS WITHIN METRO, URBAN AND RURAL GROUPINGS 1971

School District No.	Name	School District No.	Name
METRO			
36	Surrey	41	Burnaby
37	Delta	43	Coquitlam
38	Richmond	44	North Vancouver
39	Vancouver	45	West Vancouver
40	New Westminster	61	Greater Victoria
URBAN			
11	Trail	53	Terrace
15	Penticton	57	Prince George
22	Vernon	59	Peace River South
23	Kelowna	63	Saanich
24	Kamloops	65	Cowichan
33	Chilliwack	68	Nanaimo
34	Abbotsford	70	Alberni
35	Langley	80	Kitimat
42	Maple Ridge		
47	Powell River		
52	Prince Rupert		

School No.	District Name	School No.	District Name
RURAL			
1	Fernie	49	Ocean Falls
2	Cranbrook	50	Queen Charlotte
3	Kimberley	51	Portland Canal
4	Windermere	54	Smithers
7	Nelson	55	Burns Lake
8	Slocan	56	Vanderhoof
9	Castlegar	58	McBride
10	Arrow Lakes	60	Peace River North
12	Grand Forks	62	Sooke
13	Kettle Valley	64	Gulf Islands
14	South Okanagan	66	Lake Cowichan
16	Keremeos	67	Ladysmith
17	Princeton	69	Qualicum
18	Golden	71	Courtenay
19	Revelstoke	75	Mission
20	Salmon Arm	76	Agassiz
21	Armstrong-Spallumcheen	77	Summerland
25	Barriere	78	Enderby
26	Birch Island	79	Ucluelet
27	Williams Lake	81	Fort Nelson
28	Quesnel	82	Chilcotin
30	South Cariboo	83	Portage Mountain
31	Merritt	84	Vancouver Island West
32	Fraser Canyon	85	Vancouver Island North
46	Sechelt	86	Creston-Kaslo
48	Howe Sound	87	Stikine

Due to the frequent changes in school district boundaries since 1961, considerable attention was given to the respective mappings of these boundaries. Based on the

1972 mapping (Appendix II), a hypothetical map was constructed which allowed for the recognition of all school district number codes in effect in all three years. All school districts were then classified as either metro, urban or rural, with school districts no longer in effect in 1971 being classified subjectively. The tables which follow this section on material and method refer to this demographic criterion as 'overall demographic density in school district of residence'.

In order to compute the essential rates a 3-dimensional (age group, demographic variable, year) table of total population base figures was constructed (Table 18).

Sampling Procedure

Although it may have been possible to work with the 'universe' of admissions which was available, budgetary considerations forced the limitation of this pilot-project to the consideration of a sample. Three 5% samples were generated by means of a computer programme: Three numbers were randomly selected (without replacement) from the numbers 1 through 20 and each number formed the base of one 5% sample by having the computer select the corresponding case and every 20th case thereafter. These three samples were copied separately onto tape and compared for general consistency. To improve the reliability of the sample for table cells in which entries were numerically

very small, the three samples were combined manually and the resulting 15% sample constituted the basis for the contingency table. This procedure was repeated for each of the three years.

Data Manipulation

The utilization of SPSS (Statistical Package for Social Sciences) presented no major problems. One difficulty did, however, present itself in the form of an inherent incompatibility in the disease classifcations as used in each of the three years under consideration. In order to group these in a manner appropriate to the classification used in 1966 the 5 column variable had to be treated as numeric. This was not initially possible due to the occurrence of alphanumeric characters in the second digit of the variable. The problem was overcome by splitting the variable into two, recoding both separately and computing a third, which was then amenable to treatment as a numeric variable. Three separate partitions of all disease categories were required in order to yield compatible partitions of hospital admissions for the three years in question.

The CROSSTABS routine of SPSS was then instructed to produce a three-way correlation between age group, population density and disease category. This yielded a three-dimensional table of admissions. The combination of

the tables for 1961, 1966 and 1971 was done manually as was the conversion from raw sample admission figures to age-group and population density specific rates. The following formula was used to convert the sample frequencies to population rates:

$$\frac{6.6\overline{6} \times 10^5 \times (\text{sample admissions in cell})}{\text{total population in cell}} = \text{admission rate per 100,000 persons}$$

RESULTS

The results of this project are presented in tables and figures on the following pages. The four-dimensional contingency table, itself consisting of 17 three-dimensional tables, is interspersed with the respective graphic representations. Table 18 consists of a tabular rendering of the census base figures required in the generation of population rates.

TABLE 1

Infective and parasitic diseases: Sample admissions and population admission rates per 100,000 in age-group in British Columbia for census years 1961, 1966, and 1971, by age and overall demographic density in school district of residence.

	Metro			Urban			Rural		
Age	1961	1966	1971	1961	1966	1971	1961	1966	1971
				Sample Admissions*					
0 - 9	92	83	262	63	116	258	82	113	301
10 - 19	55	33	66	28	32	45	34	35	64
20 - 34	64	40	95	37	24	63	43	24	74
35 - 54	43	29	58	27	22	44	31	20	47
55 - 69	17	20	47	10	16	29	17	11	60
70+	24	24	38	7	12	26	12	10	31
				Population Admission Rates					
0 - 9	337	287	949	663	783	1,584	710	847	2,113
10 - 19	278	125	208	270	251	259	422	328	447
20 - 34	246	135	238	371	198	364	473	223	510
35 - 54	119	74	138	207	145	241	277	155	322
55 - 69	107	110	207	186	243	321	375	199	835
70+	208	193	284	227	349	615	496	392	944

* 15% sample

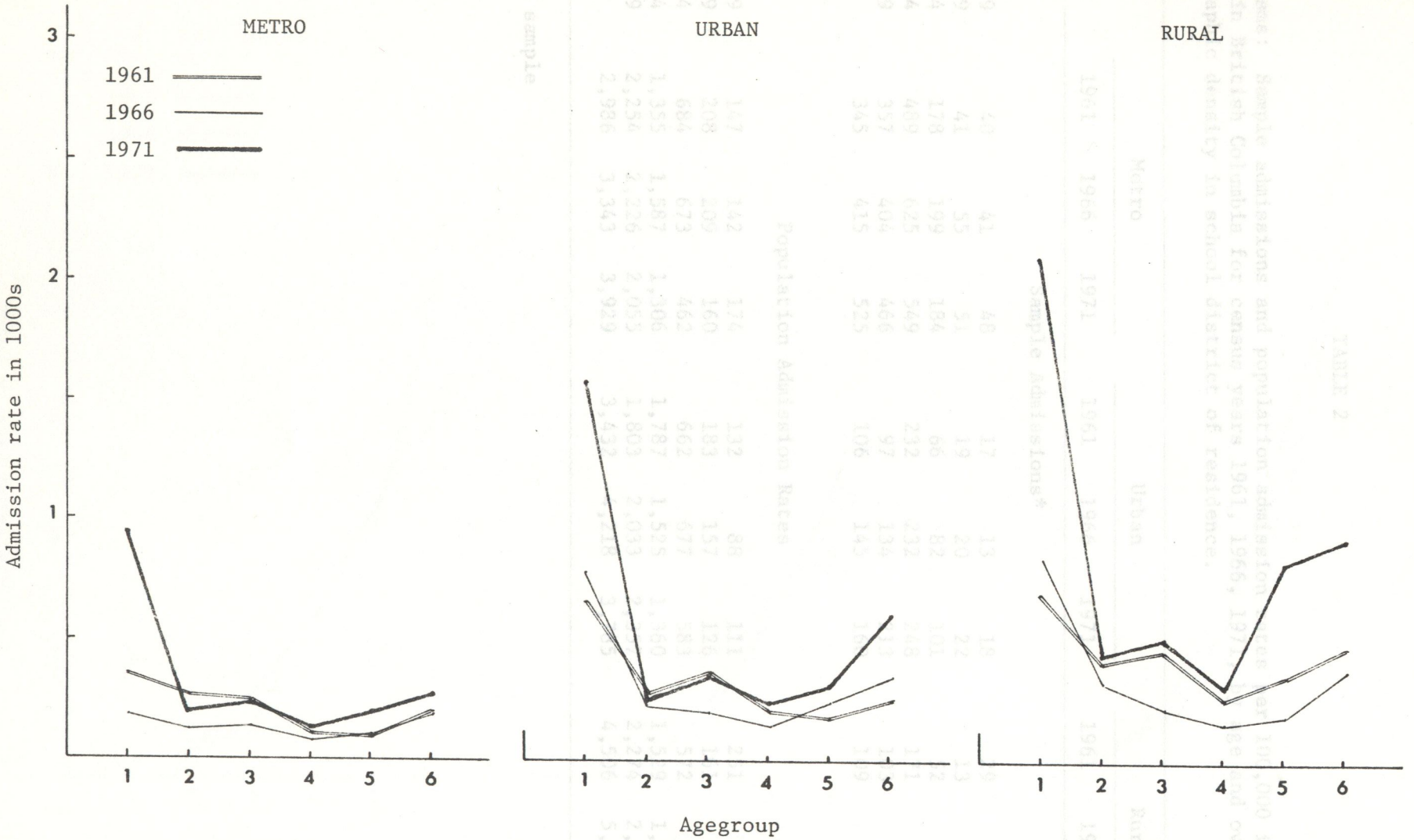


Fig. A Age and population density specific admission rates for infective and parasitic diseases in British Columbia in 1961, 1966, and 1971. Rates per 100,000 persons.

TABLE 2

Neoplasms: Sample admissions and population admission rates per 100,000 in age-group in British Columbia for census years 1961, 1966, 1971, by age and overall demographic density in school district of residence.

	Metro			Urban			Rural		
Age	1961	1966	1971	1961	1966	1971	1961	1966	1971
				Sample Admissions*					
0 - 9	40	41	48	17	13	18	29	23	16
10 - 19	41	55	51	19	20	22	13	23	32
20 - 34	178	199	184	66	82	101	52	67	72
35 - 54	489	625	549	232	232	248	171	237	186
55 - 69	357	404	466	97	134	213	103	135	208
70+	345	415	525	106	145	160	109	144	144
				Population Admission Rates					
0 - 9	147	142	174	132	88	111	251	174	112
10 - 19	208	209	160	183	157	126	161	216	224
20 - 34	684	673	462	662	677	583	572	622	497
35 - 54	1,355	1,587	1,306	1,787	1,525	1,360	1,529	1,842	1,275
55 - 69	2,254	2,226	2,055	1,803	2,033	2,357	2,274	2,439	2,896
70+	2,986	3,343	3,929	3,432	4,218	3,785	4,506	5,646	4,386

* 15% sample

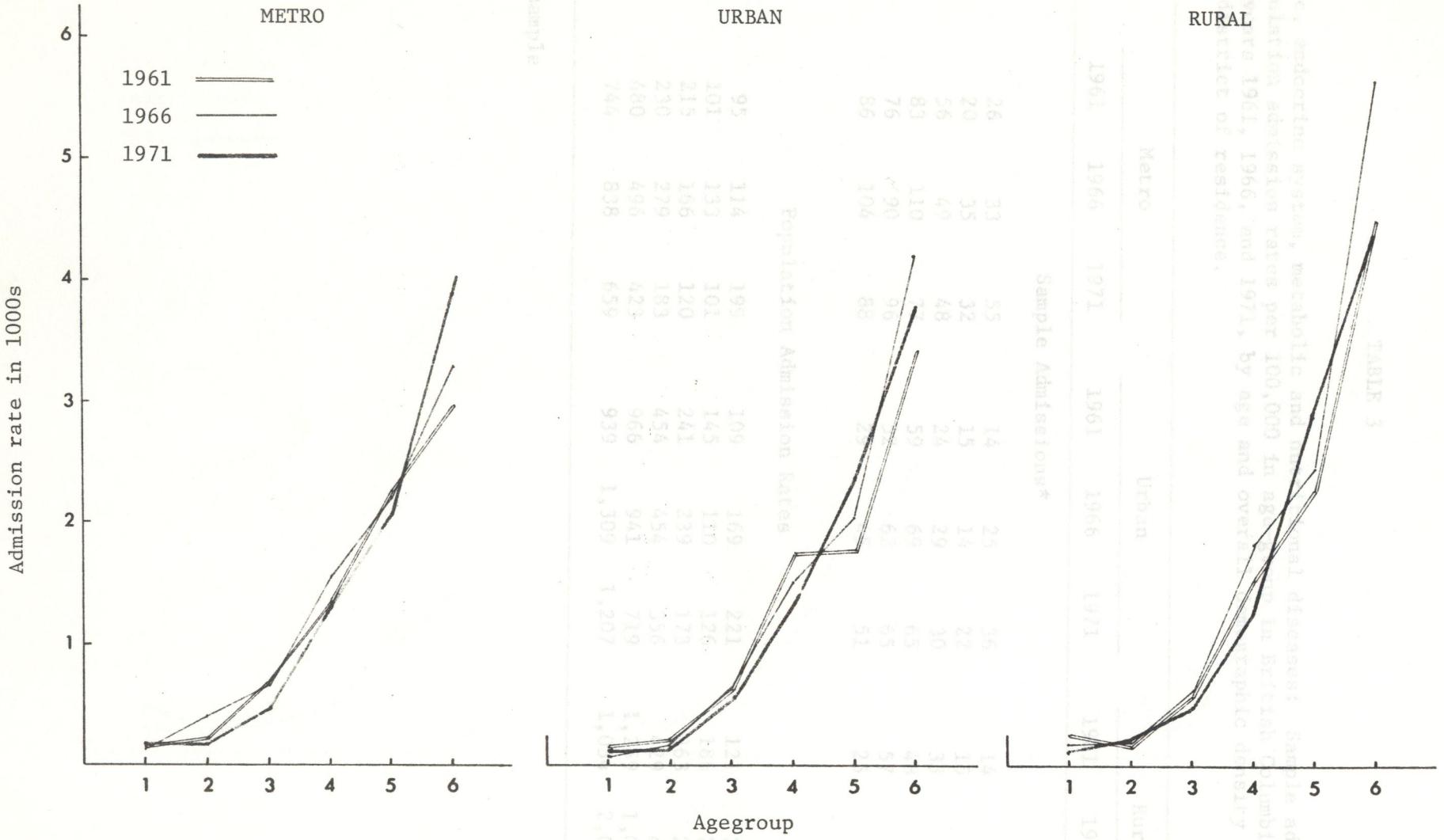


Fig. B Age and population density specific admission rates for neoplasms in British Columbia in 1961, 1966, and 1971. Rates per 100,000 persons.

TABLE 3

Allergic, endocrine system, metabolic and nutritional diseases: Sample admissions and population admission rates per 100,000 in age-group in British Columbia for census years 1961, 1966, and 1971, by age and overall demographic density in school district of residence.

Age	Metro			Urban			Rural		
	1961	1966	1971	1961	1966	1971	1961	1966	1971
				Sample Admissions*					
0 - 9	26	33	55	14	25	36	14	34	40
10 - 19	20	35	32	15	14	22	15	27	18
20 - 34	56	49	48	24	29	30	33	30	19
35 - 54	83	110	77	59	69	65	48	63	68
55 - 69	76	90	96	52	62	65	57	60	55
70+	86	104	88	29	45	51	25	53	61
				Population Admission Rates					
0 - 9	95	114	199	109	169	221	121	257	281
10 - 19	101	133	101	145	110	126	186	253	126
20 - 34	215	166	120	241	239	173	363	278	131
35 - 54	230	279	183	454	454	356	429	490	466
55 - 69	480	496	423	966	941	719	1,259	1,084	766
70+	744	838	659	939	1,309	1,207	1,034	2,078	1,858

* 15% sample

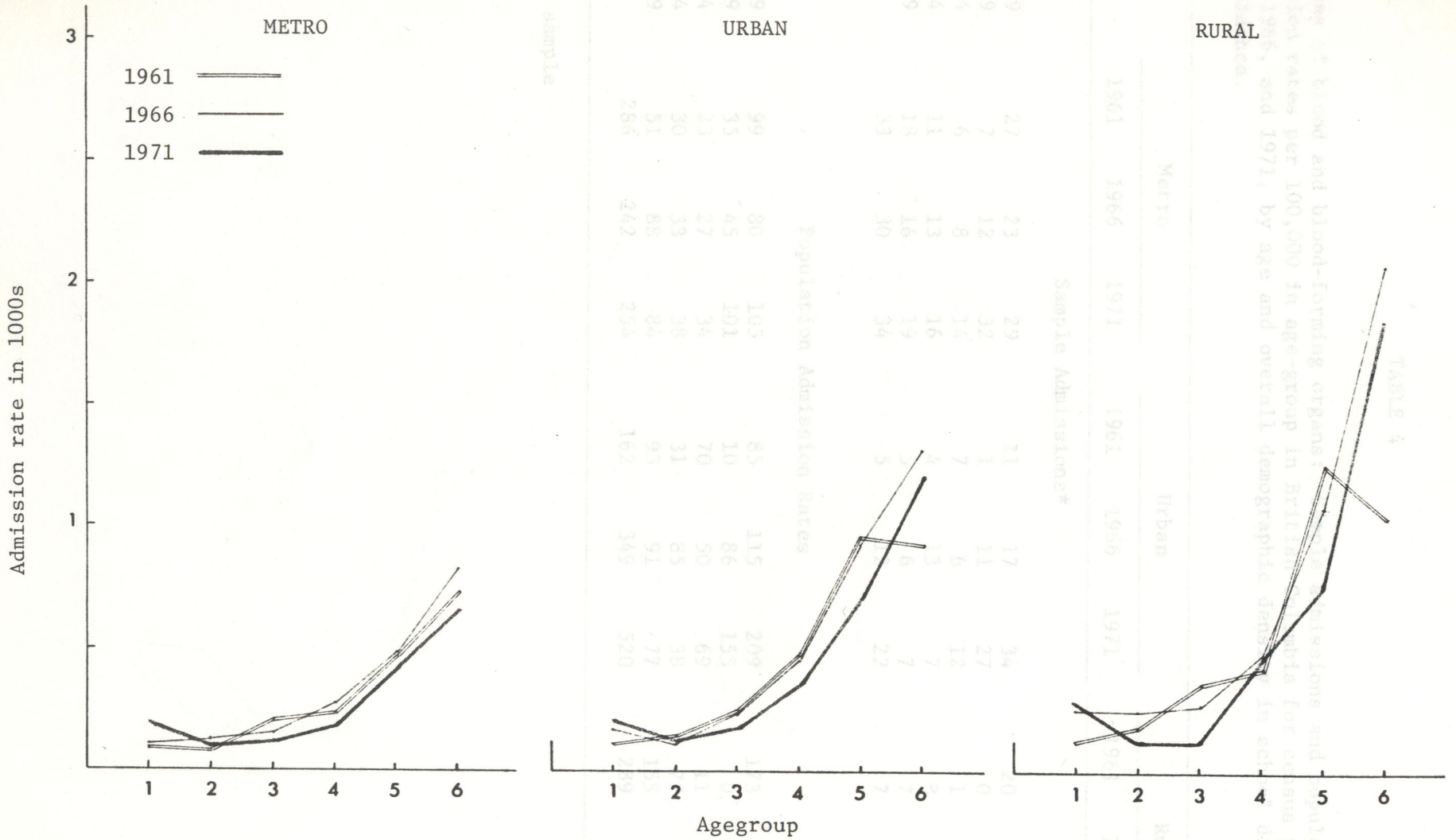


Fig. C Age and population density specific admission rates for allergic, endocrine system, metabolic and nutritional diseases in British Columbia in 1961, 1966, and 1971. Rates per 100,000 persons.

TABLE 4

Diseases of blood and blood-forming organs: Sample admissions and population admission rates per 100,000 in age-group in British Columbia for census years 1961, 1966, and 1971, by age and overall demographic density in school district of residence.

	Metro			Urban			Rural		
Age	1961	1966	1971	1961	1966	1971	1961	1966	1971
				Sample Admissions*					
0 - 9	27	23	29	11	17	34	20	18	28
10 - 19	7	12	32	1	11	27	0	11	32
20 - 34	6	8	14	7	6	12	1	2	7
35 - 54	11	13	16	4	13	7	8	5	10
55 - 69	18	16	19	5	6	7	7	5	8
70+	33	30	34	5	12	22	7	9	12
				Population Admission Rates					
0 - 9	99	80	105	85	115	209	173	136	197
10 - 19	35	45	101	10	86	155	0	103	224
20 - 34	23	27	34	70	50	69	11	19	48
35 - 54	30	33	38	31	85	38	72	39	69
55 - 69	51	88	84	93	91	77	155	90	111
70+	286	242	254	162	349	520	289	353	365

* 15% sample

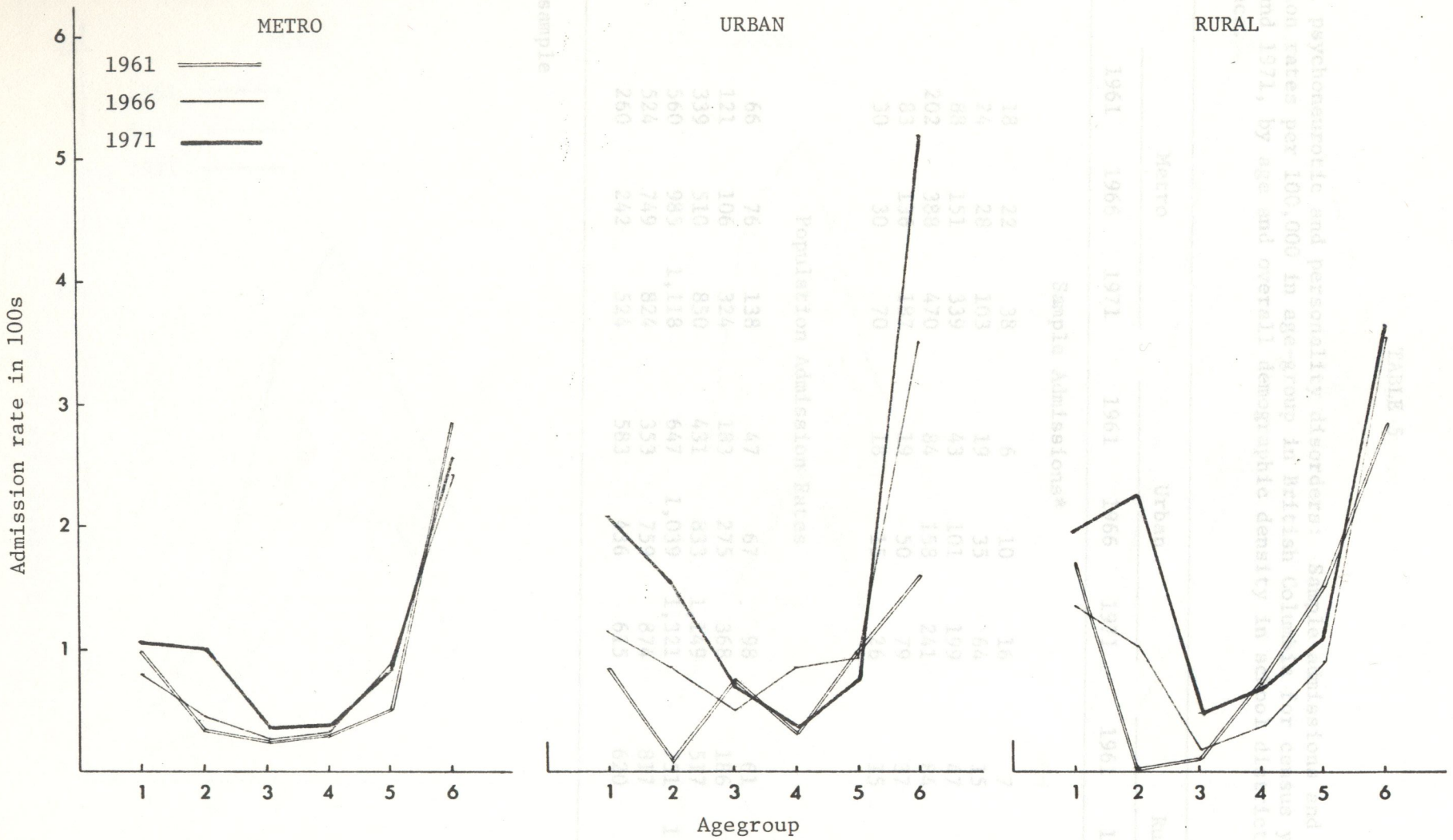


Fig. D Age and population density specific admission rates for diseases of blood and blood-forming organs in British Columbia in 1961, 1966, and 1971. Rates per 100,000 persons.

TABLE 5

Mental, psychoneurotic and personality disorders: Sample admissions and population admission rates per 100,000 in age-group in British Columbia for census years 1961, 1966, and 1971, by age and overall demographic density in school district of residence.

	Metro			Urban			Rural		
Age	1961	1966	1971	1961	1966	1971	1961	1966	1971
				Sample Admissions*					
0 - 9	18	22	38	6	10	16	7	11	17
10 - 19	24	28	103	19	35	64	15	28	86
20 - 34	88	151	339	43	101	199	47	107	194
35 - 54	202	388	470	84	158	241	84	158	243
55 - 69	83	136	187	19	50	79	37	49	89
70+	30	30	70	18	15	26	15	17	23
				Population Admission Rates					
0 - 9	66	76	138	47	67	98	61	83	119
10 - 19	121	106	324	183	275	368	186	262	601
20 - 34	339	510	850	431	833	1,149	517	993	1,338
35 - 54	560	985	1,118	647	1,039	1,321	751	1,228	1,665
55 - 69	524	749	824	353	759	874	817	885	1,239
70+	260	242	524	583	436	615	620	667	700

* 15% sample

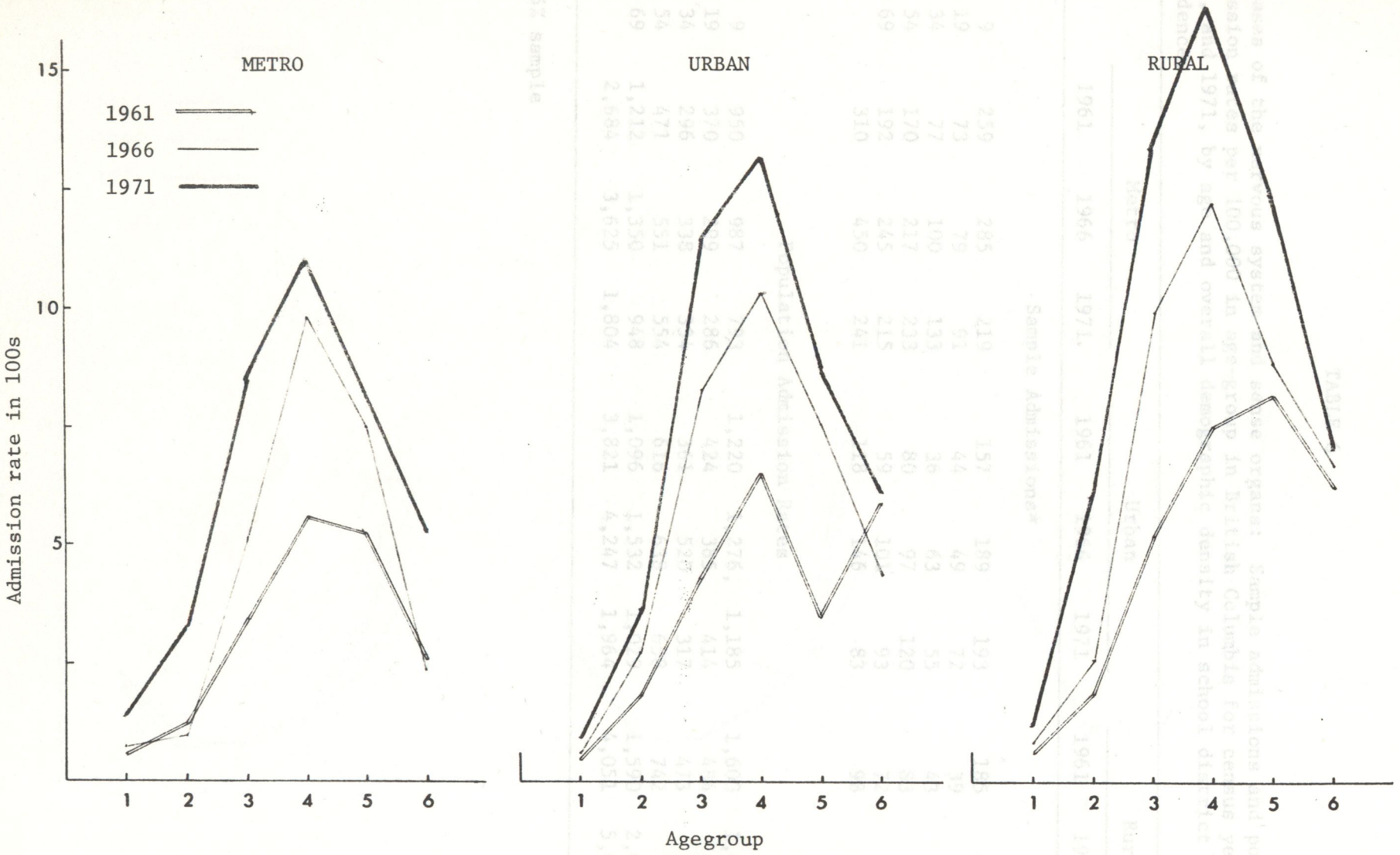


Fig. E Age and population density specific admission rates per 100,000 persons for diseases relating to mental, psychoneurotic and personality disorders in British Columbia in 1961, 1966, and 1971.

TABLE 6

Diseases of the nervous system and sense organs: Sample admissions and population admission rates per 100,000 in age-group in British Columbia for census years 1961, 1966, and 1971, by age and overall demographic density in school district of residence.

	Metro			Urban			Rural		
Age	1961	1966	1971	1961	1966	1971	1961	1966	1971
				Sample Admissions*					
0 - 9	259	285	219	157	189	193	185	212	220
10 - 19	73	79	91	44	49	72	39	47	63
20 - 34	77	100	133	36	63	55	43	54	72
35 - 54	170	217	233	80	97	120	83	96	113
55 - 69	192	245	215	59	101	93	72	115	83
70+	310	450	241	118	146	83	98	145	58
				Population Admission Rates					
0 - 9	950	987	793	1,220	1,276,	1,185	1,603	1,603	1,544
10 - 19	370	299	286	424	385	414	484	441	440
20 - 34	296	338	334	361	520	317	473	501	497
35 - 54	471	551	554	616	638	658	742	746	774
55 - 69	1,212	1,350	948	1,096	1,532	1,029	1,590	2,078	1,156
70+	2,684	3,625	1,804	3,821	4,247	1,964	4,051	5,686	1,766

* 15% sample

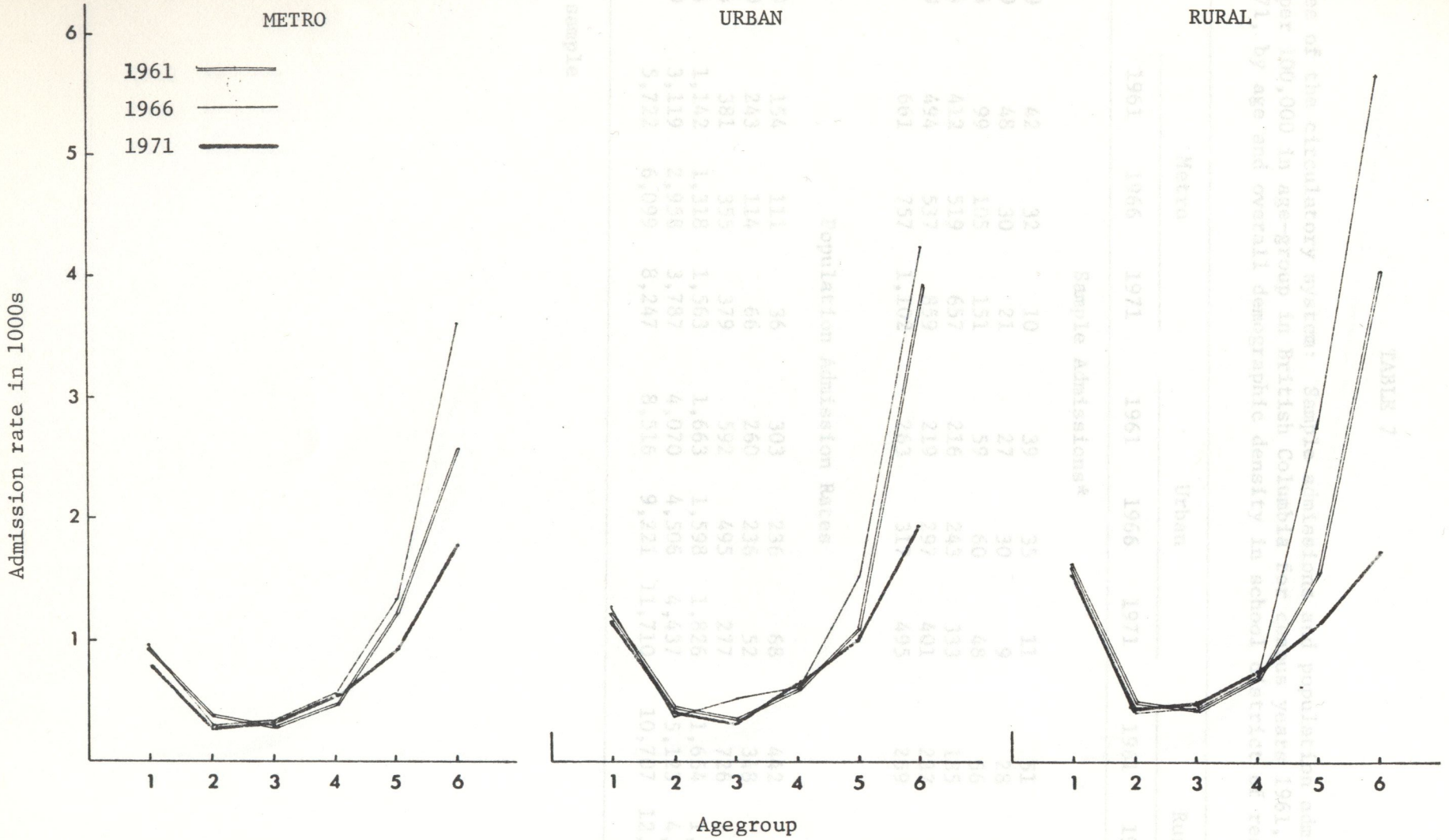


Fig. F Age and population density specific admission rates per 100,000 persons for diseases of the nervous system and sense organs in British Columbia in 1961, 1966, and 1971.

TABLE 7

Diseases of the circulatory system: Sample admissions and population admission rates per 100,000 in age-group in British Columbia for census years 1961, 1966, and 1971, by age and overall demographic density in school district of residence.

	Metro			Urban			Rural		
Age	1961	1966	1971	1961	1966	1971	1961	1966	1971
				Sample Admissions*					
0 - 9	42	32	10	39	35	11	51	34	3
10 - 19	48	30	21	27	30	9	28	30	16
20 - 34	99	105	151	59	60	48	66	57	81
35 - 54	412	519	657	216	243	333	185	230	296
55 - 69	494	537	859	219	297	401	232	273	412
70+	661	757	1,102	263	317	495	259	312	474
				Population Admission Rates					
0 - 9	154	111	36	303	236	68	442	257	21
10 - 19	243	114	66	260	236	52	348	281	112
20 - 34	381	355	379	592	495	277	726	529	559
35 - 54	1,142	1,318	1,563	1,663	1,598	1,826	1,654	1,788	2,208
55 - 69	3,119	2,958	3,787	4,070	4,506	4,437	5,123	4,933	5,736
70+	5,722	6,099	8,247	8,516	9,221	11,710	10,707	12,234	14,436

* 15% sample

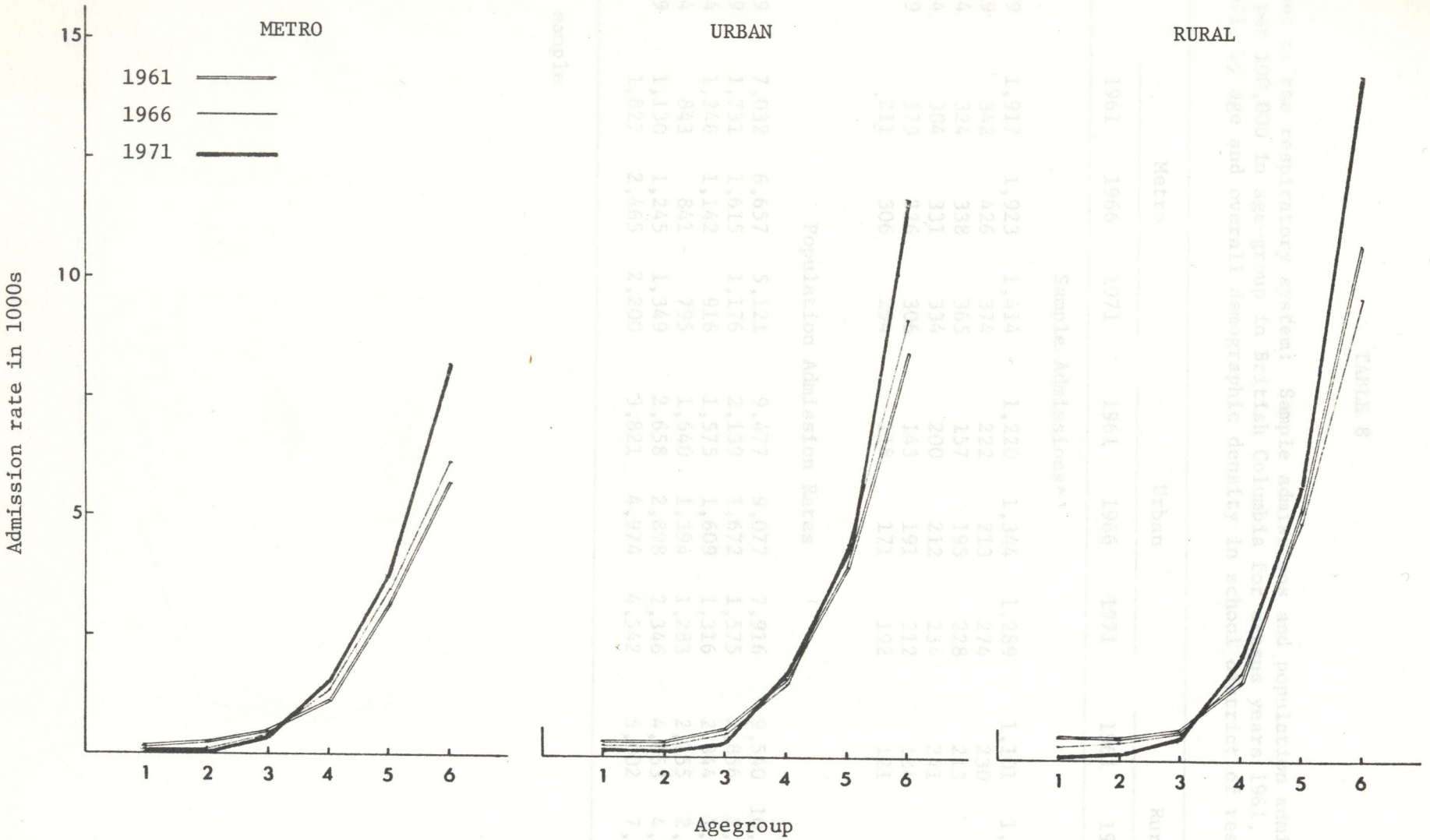


Fig. G Age and population density specific admission rates per 100,000 persons for diseases of the circulatory system in British Columbia in 1961, 1966, and 1971.

TABLE 8

Diseases of the respiratory system: Sample admissions and population admission rates per 100,000 in age-group in British Columbia for census years 1961, 1966, and 1971, by age and overall demographic density in school district of residence.

	Metro			Urban			Rural		
Age	1961	1966	1971	1961	1966	1971	1961	1966	1971
				Sample Admissions*					
0 - 9	1,917	1,923	1,414	1,220	1,344	1,289	1,101	1,419	1,306
10 - 19	342	426	374	222	213	274	230	275	263
20 - 34	324	338	365	157	195	228	213	200	162
35 - 54	304	331	334	200	212	234	241	279	252
55 - 69	179	226	306	143	191	212	184	230	233
70+	211	306	294	118	171	192	121	193	214
				Population Admission Rates					
0 - 9	7,032	6,657	5,121	9,477	9,077	7,916	9,540	10,732	9,167
10 - 19	1,731	1,615	1,176	2,139	1,672	1,575	2,856	2,578	1,838
20 - 34	1,246	1,142	916	1,575	1,609	1,316	2,344	1,856	1,117
35 - 54	843	841	795	1,540	1,394	1,283	2,155	2,168	1,727
55 - 69	1,130	1,245	1,349	2,658	2,898	2,346	4,063	4,156	3,244
70+	1,827	2,465	2,200	3,821	4,974	4,542	5,002	7,568	6,517

* 15% sample

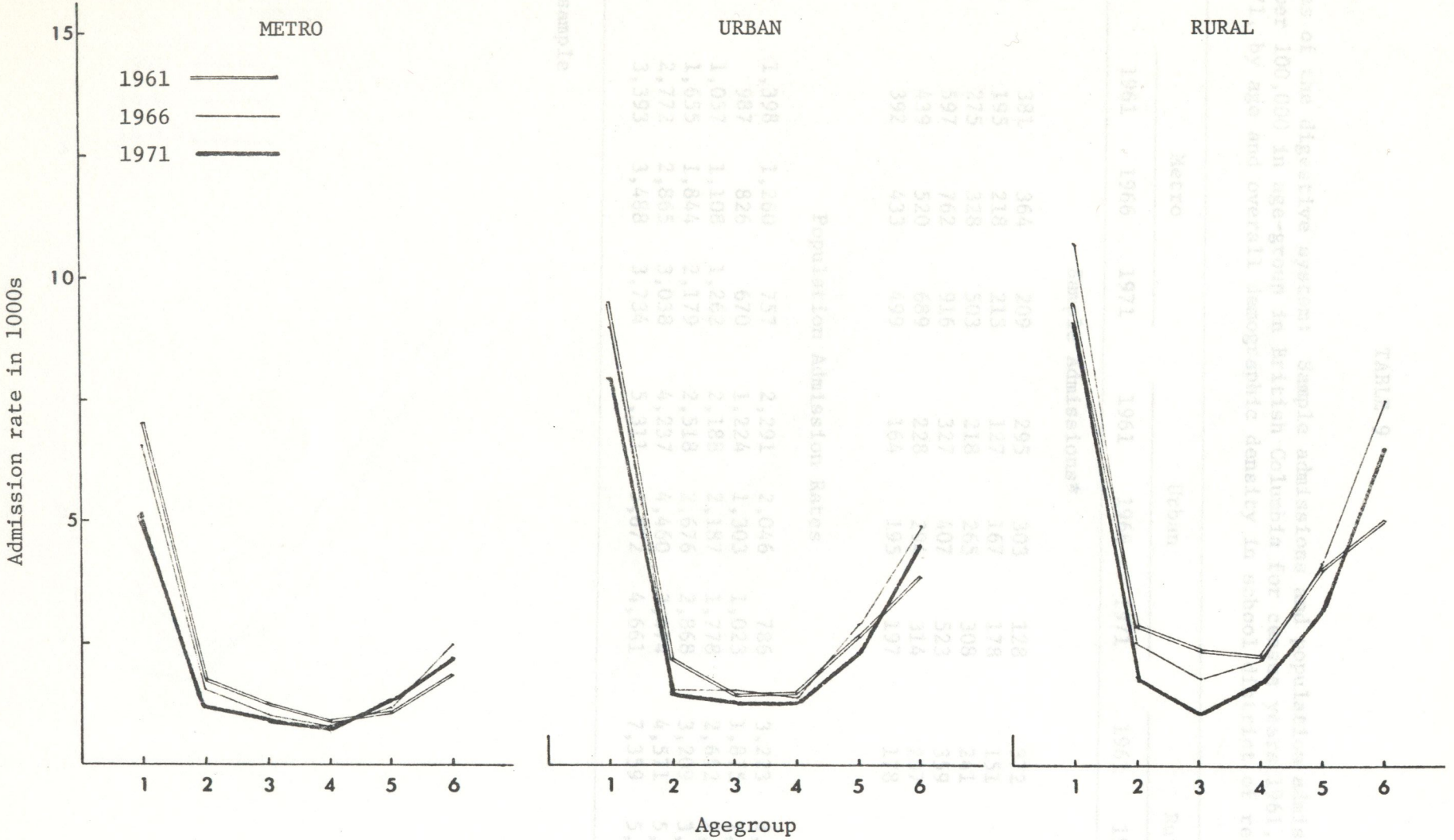


Fig. H Age and population density specific admission rates per 100,000 persons for diseases of the respiratory system in British Columbia in 1961, 1966, and 1971.

TABLE 9

Diseases of the digestive system: Sample admissions and population admission rates per 100,000 in age-group in British Columbia for census years 1961, 1966, and 1971, by age and overall demographic density in school district of residence.

	Metro			Urban			Rural		
Age	1961	1966	1971	1961	1966	1971	1961	1966	1971
				Sample Admissions*					
0 - 9	381	364	209	295	303	128	372	349	134
10 - 19	195	218	213	127	167	178	151	165	155
20 - 34	275	328	503	218	265	308	241	308	391
35 - 54	597	762	916	327	407	523	359	437	451
55 - 69	439	520	689	228	294	314	207	299	320
70+	392	433	499	164	195	197	178	150	168
				Population Admission Rates					
0 - 9	1,398	1,260	757	2,291	2,046	786	3,223	2,640	1,004
10 - 19	987	826	670	1,224	1,303	1,023	1,875	1,547	1,083
20 - 34	1,057	1,108	1,262	2,188	2,187	1,778	2,652	2,858	2,696
35 - 54	1,655	1,844	2,179	2,518	2,676	2,868	3,209	3,396	3,090
55 - 69	2,772	2,865	3,038	4,237	4,460	3,474	4,571	5,403	4,455
70+	3,393	3,488	3,734	5,311	5,672	4,661	7,359	5,882	5,116

* 15% sample

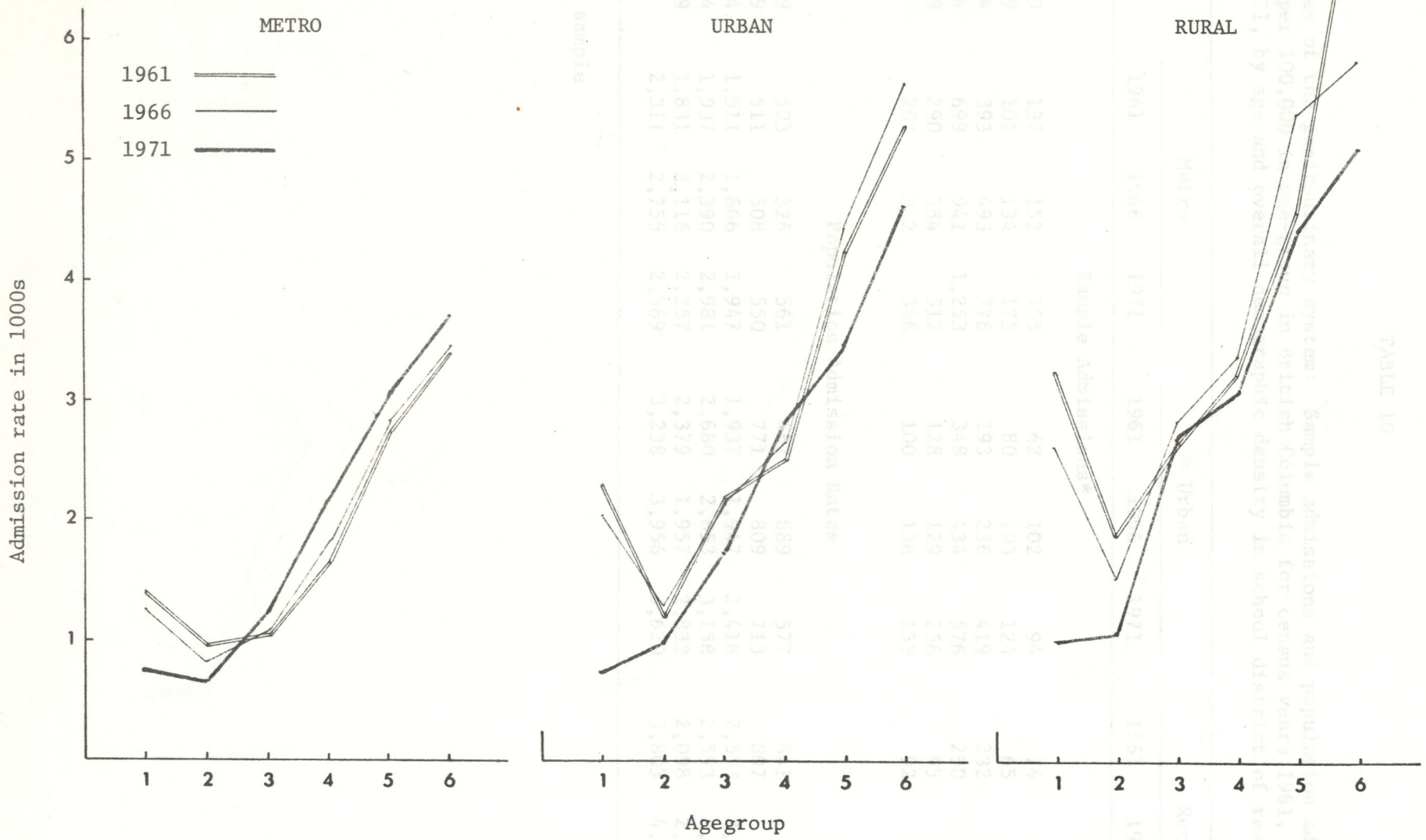


Fig. I Age and population density specific admission rates per 100,000 persons for diseases of the digestive system in British Columbia in 1961, 1966, and 1971.

TABLE 10

Diseases of the genitourinary system: Sample admissions and population admission rates per 100,000 in age-group in British Columbia for census years 1961, 1966, and 1971, by age and overall demographic density in school district of residence.

	Metro			Urban			Rural		
Age	1961	1966	1971	1961	1966	1971	1961	1966	1971
				Sample Admissions*					
0 - 9	137	152	155	62	102	94	74	99	101
10 - 19	101	134	175	80	103	124	65	74	129
20 - 34	393	493	776	193	236	419	232	288	361
35 - 54	699	941	1,253	348	434	576	290	348	394
55 - 69	290	384	512	128	129	256	95	145	212
70+	267	342	346	100	136	153	92	119	94
				Population Admission Rates					
0 - 9	503	526	561	482	689	577	641	749	709
10 - 19	511	508	550	771	809	713	807	694	901
20 - 34	1,511	1,666	1,947	1,937	1,947	2,418	2,553	2,672	2,489
35 - 54	1,937	2,390	2,981	2,680	2,853	3,158	2,593	2,705	2,700
55 - 69	1,831	2,116	2,257	2,379	1,957	2,832	2,098	2,620	2,952
70+	2,311	2,755	2,589	3,238	3,956	3,620	3,803	4,666	2,863

* 15% sample

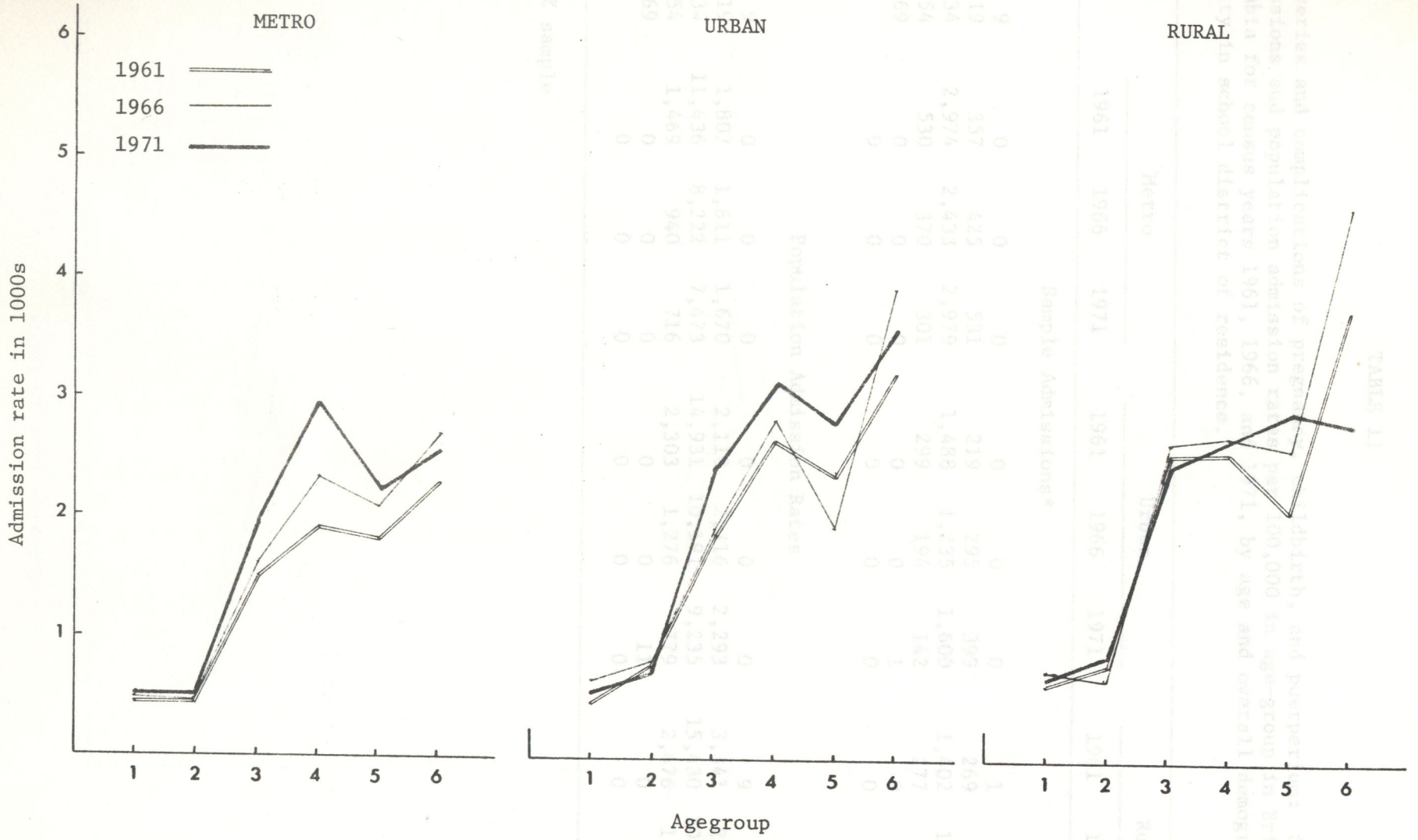


Fig. J Age and population density specific admission rates per 100,000 persons for diseases of the genitourinary system in British Columbia in 1961, 1966, and 1971.

TABLE 11

Deliveries and complications of pregnancy, childbirth, and puerperium: Sample admissions and population admission rates per 100,000 in age-group in British Columbia for census years 1961, 1966, and 1971, by age and overall demographic density in school district of residence.

	Metro			Urban			Rural		
Age	1961	1966	1971	1961	1966	1971	1961	1966	1971
				Sample Admissions*					
0 - 9	0	0	0	0	0	0	1	0	0
10 - 19	357	425	531	219	295	399	269	282	371
20 - 34	2,974	2,433	2,979	1,488	1,235	1,600	1,402	1,170	1,415
35 - 54	530	370	301	299	194	142	277	209	137
55 - 69	0	0	0	0	0	1	0	0	0
70+	0	0	0	0	0	0	0	0	0
				Population Admission Rates					
0 - 9	0	0	0	0	0	0	9	0	0
10 - 19	1,807	1,611	1,670	2,110	2,316	2,293	3,341	2,643	2,592
20 - 34	11,436	8,222	7,473	14,931	10,191	9,235	15,430	10,857	9,758
35 - 54	1,469	940	716	2,303	1,276	779	2,476	1,624	939
55 - 69	0	0	0	0	0	11	0	0	0
70+	0	0	0	0	0	0	0	0	0

* 15% sample

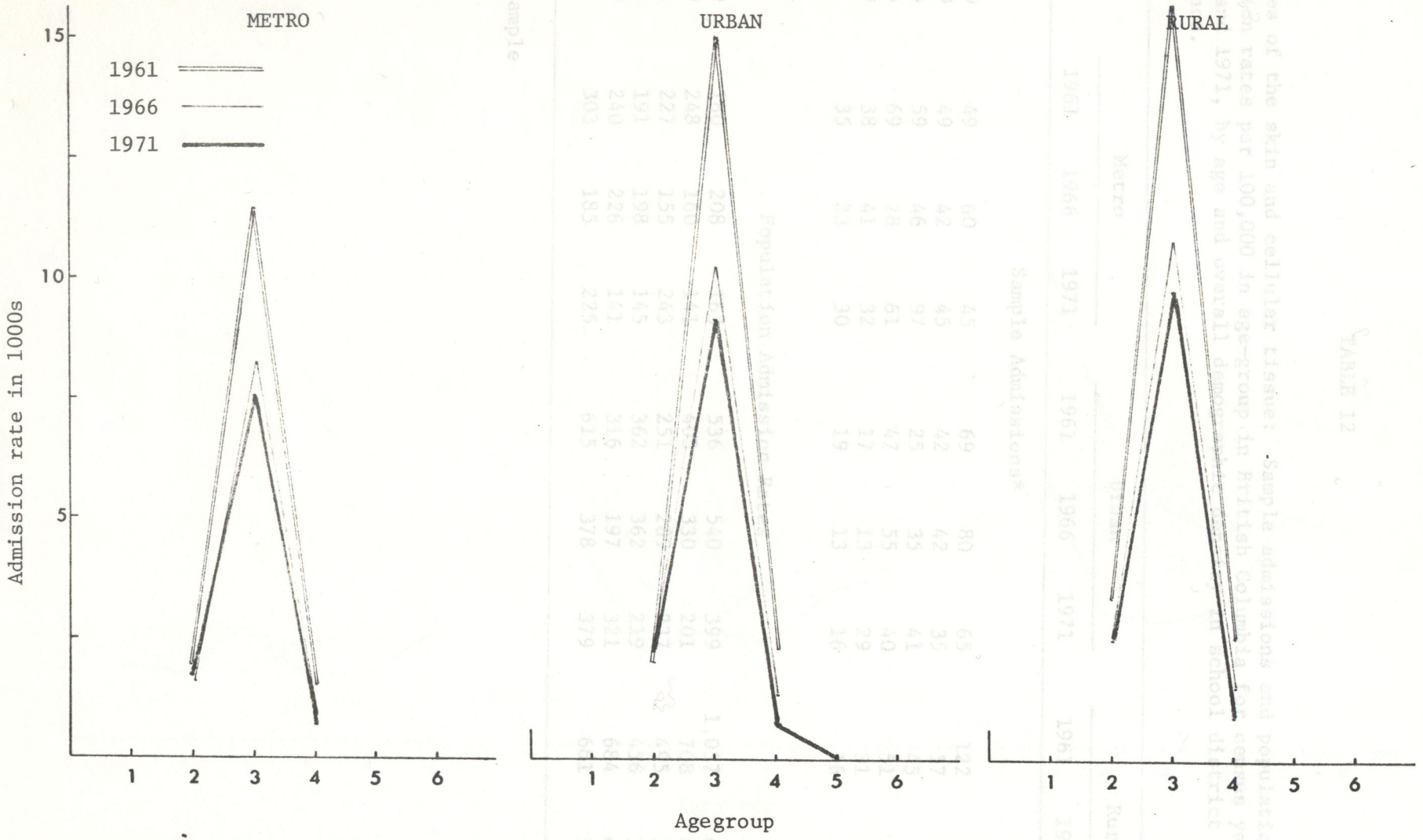


Fig. K Age and population density specific admission rates per 100,000 persons for diseases relating to deliveries and complications of pregnancy, childbirth, and puerperium in British Columbia in 1961, 1966, and 1971.

TABLE 12

Diseases of the skin and cellular tissue: Sample admissions and population admission rates per 100,000 in age-group in British Columbia for census years 1961, 1966, and 1971, by age and overall demographic density in school district of residence.

	Metro			Urban			Rural		
Age	1961	1966	1971	1961	1966	1971	1961	1966	1971
				Sample Admissions*					
0 - 9	49	60	45	69	80	65	122	88	83
10 - 19	49	42	45	42	42	35	57	50	41
20 - 34	59	46	97	25	35	41	45	40	39
35 - 54	69	78	61	47	55	40	51	51	45
55 - 69	38	41	32	17	13	29	31	24	35
70+	35	23	30	19	13	16	16	18	15
				Population Admission Rates					
0 - 9	180	208	163	536	540	399	1,057	666	583
10 - 19	248	160	141	405	330	201	708	469	286
20 - 34	227	155	243	251	289	237	495	371	269
35 - 54	191	198	145	362	362	219	456	396	308
55 - 69	240	226	141	316	197	321	684	434	487
70+	303	185	225	615	378	379	661	706	457

* 15% sample

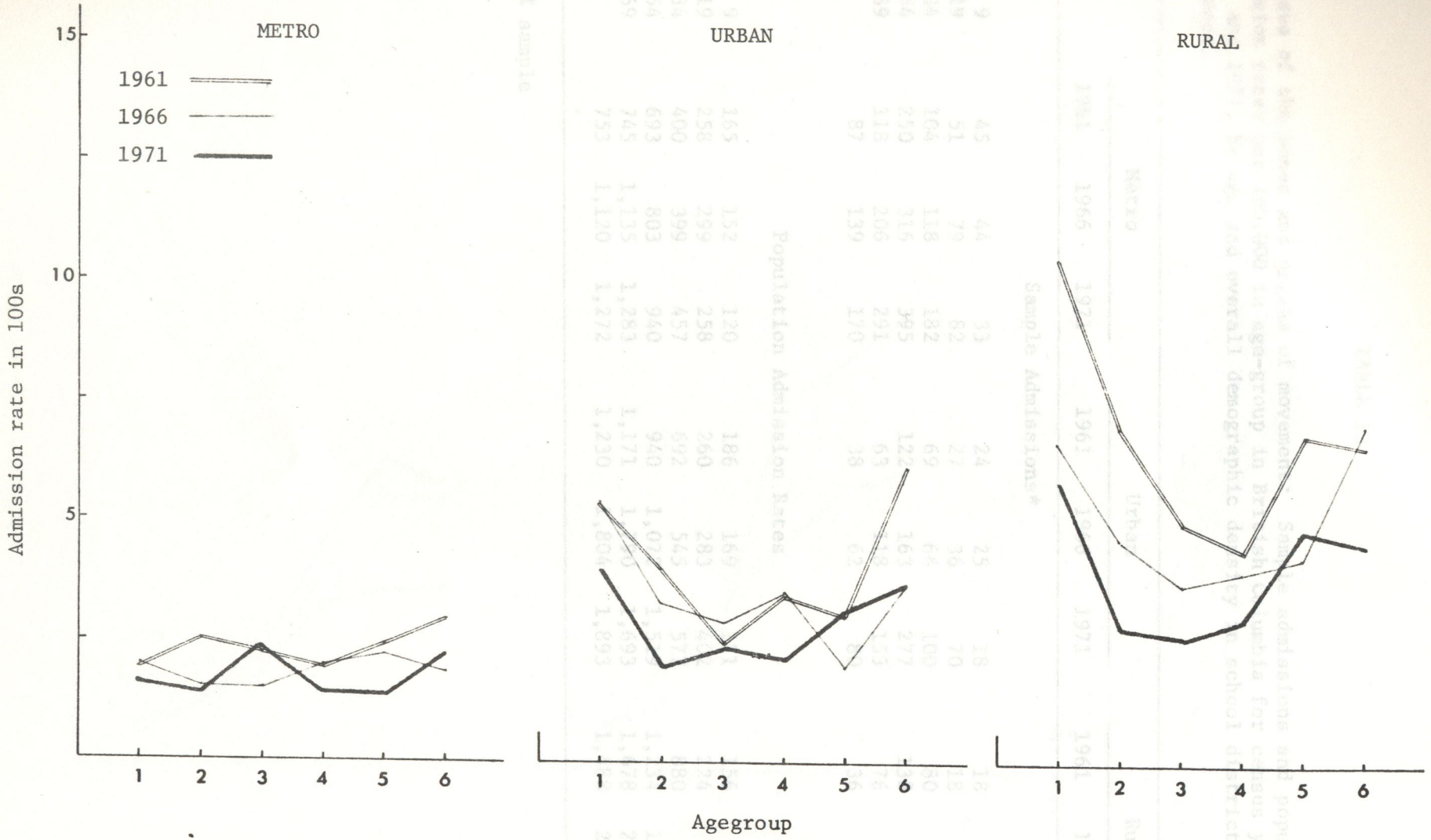


Fig. L Age and population density specific admission rates per 100,000 persons for diseases of the skin and cellular tissue in British Columbia in 1961, 1966, and 1971.

TABLE 13

Diseases of the bones and organs of movement: Sample admissions and population admission rates per 100,000 in age-group in British Columbia for census years 1961, 1966, and 1971, by age and overall demographic density in school district of residence.

	Metro			Urban			Rural		
Age	1961	1966	1971	1961	1966	1971	1961	1966	1971
				Sample Admissions*					
0 - 9	45	44	33	24	25	18	18	31	22
10 - 19	51	79	82	27	36	70	18	42	49
20 - 34	104	118	182	69	66	100	80	59	105
35 - 54	250	316	395	122	163	277	138	178	248
55 - 69	118	206	291	63	118	153	76	111	167
70+	87	139	170	38	62	80	36	67	66
				Population Admission Rates					
0 - 9	165	152	120	186	169	111	156	234	154
10 - 19	258	299	258	260	283	402	224	394	342
20 - 34	400	399	457	692	545	577	880	547	724
35 - 54	693	803	940	940	1,072	1,519	1,234	1,383	1,699
55 - 69	745	1,135	1,283	1,171	1,790	1,693	1,678	2,006	2,325
70+	753	1,120	1,272	1,230	1,804	1,893	1,488	2,627	2,010

* 15% sample

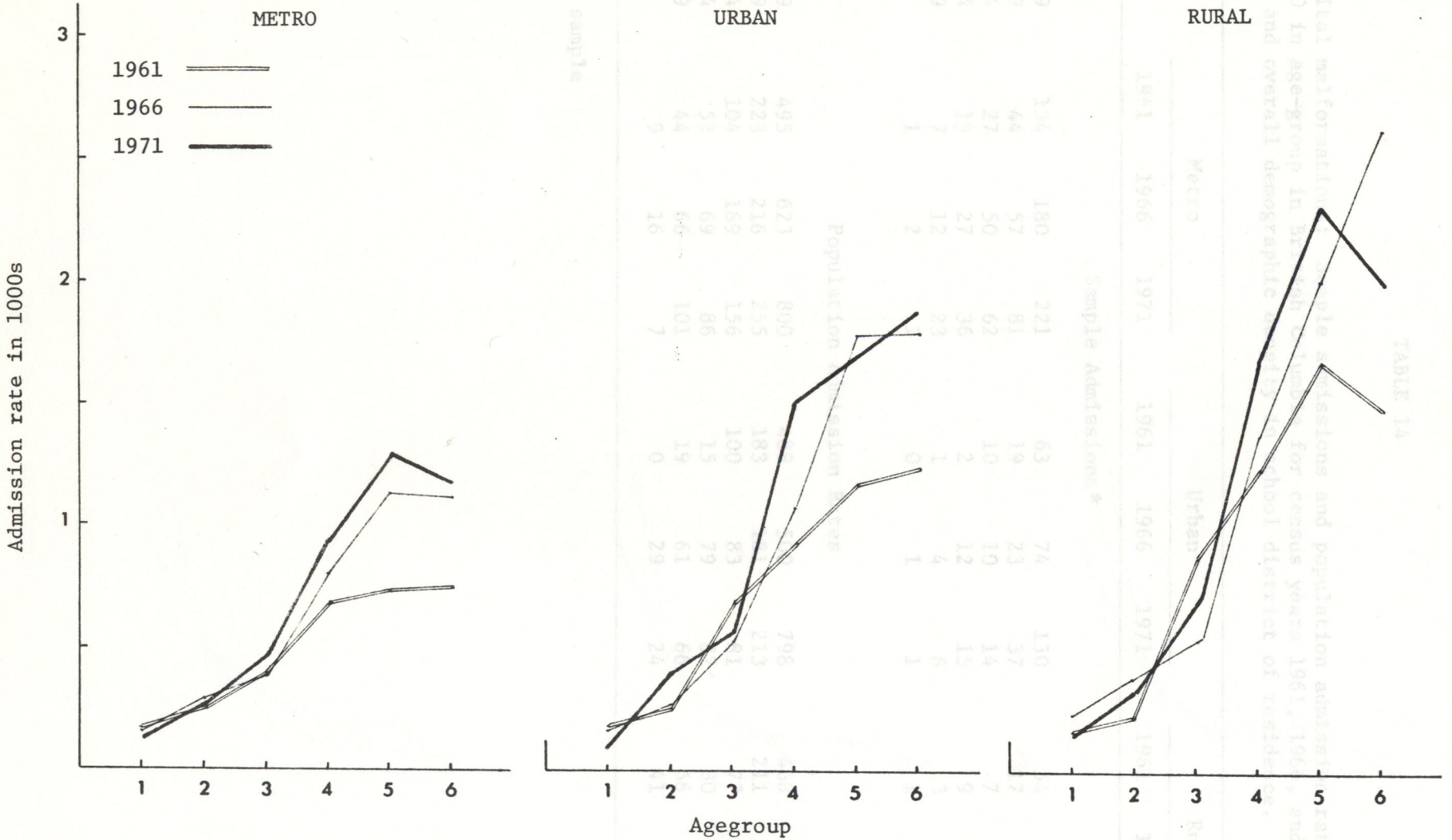


Fig. M Age and population density specific admission rates per 100,000 persons for diseases of the bones and organs of movement in British Columbia in 1961, 1966, and 1971.

TABLE 14

Congenital malformations: Sample admissions and population admission rates per 100,000 in age-group in British Columbia for census years 1961, 1966, and 1971, by age and overall demographic density in school district of residence.

Age	Metro			Urban			Rural		
	1961	1966	1971	1961	1966	1971	1961	1966	1971
				Sample Admissions*					
0 - 9	134	180	221	63	74	130	54	86	130
10 - 19	44	57	81	19	23	37	17	18	32
20 - 34	27	50	62	10	10	14	7	8	13
35 - 54	19	27	36	2	12	15	9	11	18
55 - 69	7	12	23	1	4	6	3	5	5
70+	1	2	1	0	1	1	1	4	0
				Population Admission Rates					
0 - 9	495	623	800	489	500	798	468	650	912
10 - 19	223	216	255	183	181	213	211	169	224
20 - 34	104	169	156	100	83	81	77	74	90
35 - 54	53	69	86	15	79	82	80	85	123
55 - 69	44	66	101	19	61	66	66	90	70
70+	9	16	7	0	29	24	41	157	0

* 15% sample

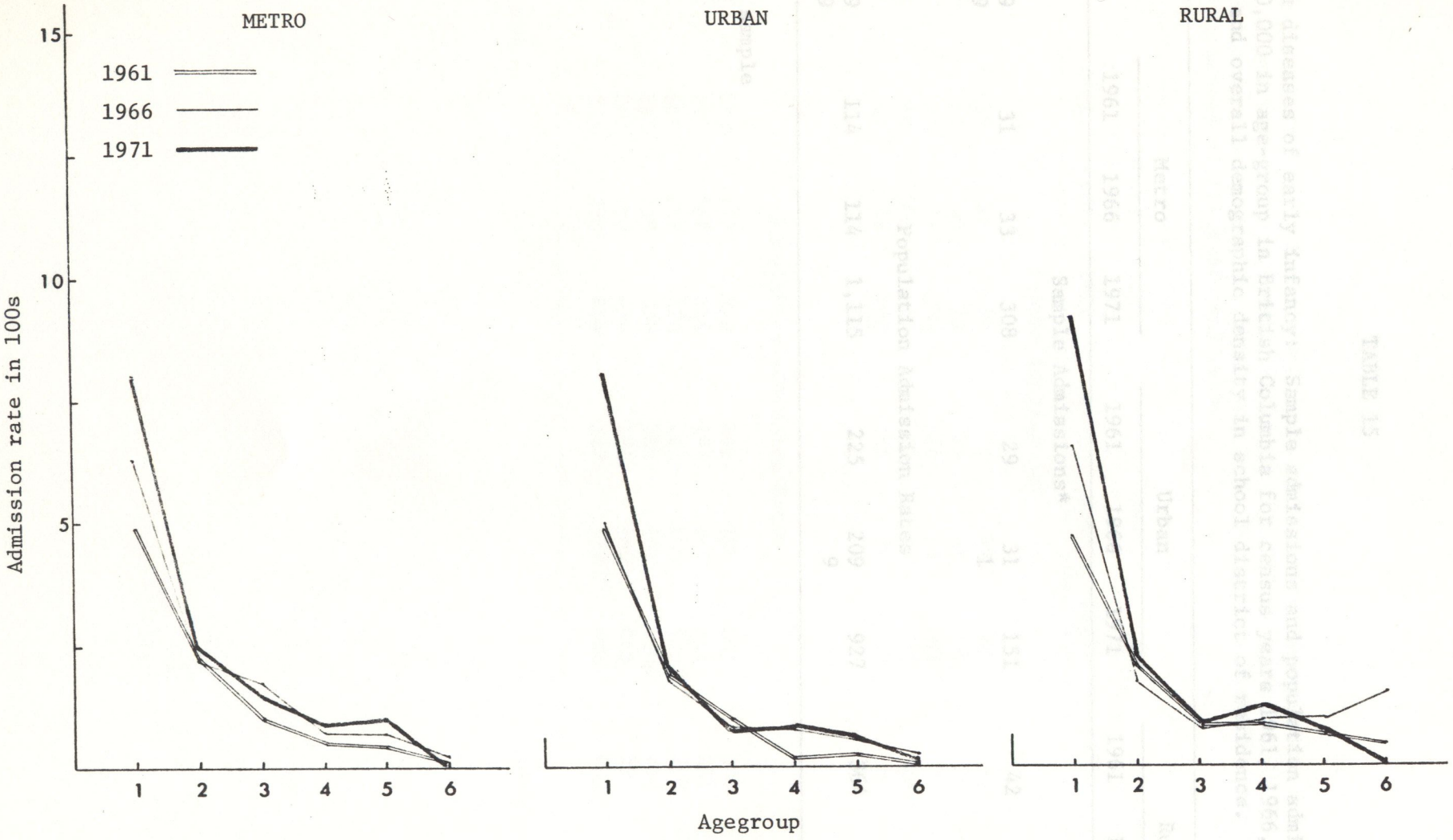


Fig. N Age and population density specific admission rates per 100,000 persons for congenital malformations in British Columbia in 1961, 1966, and 1971.

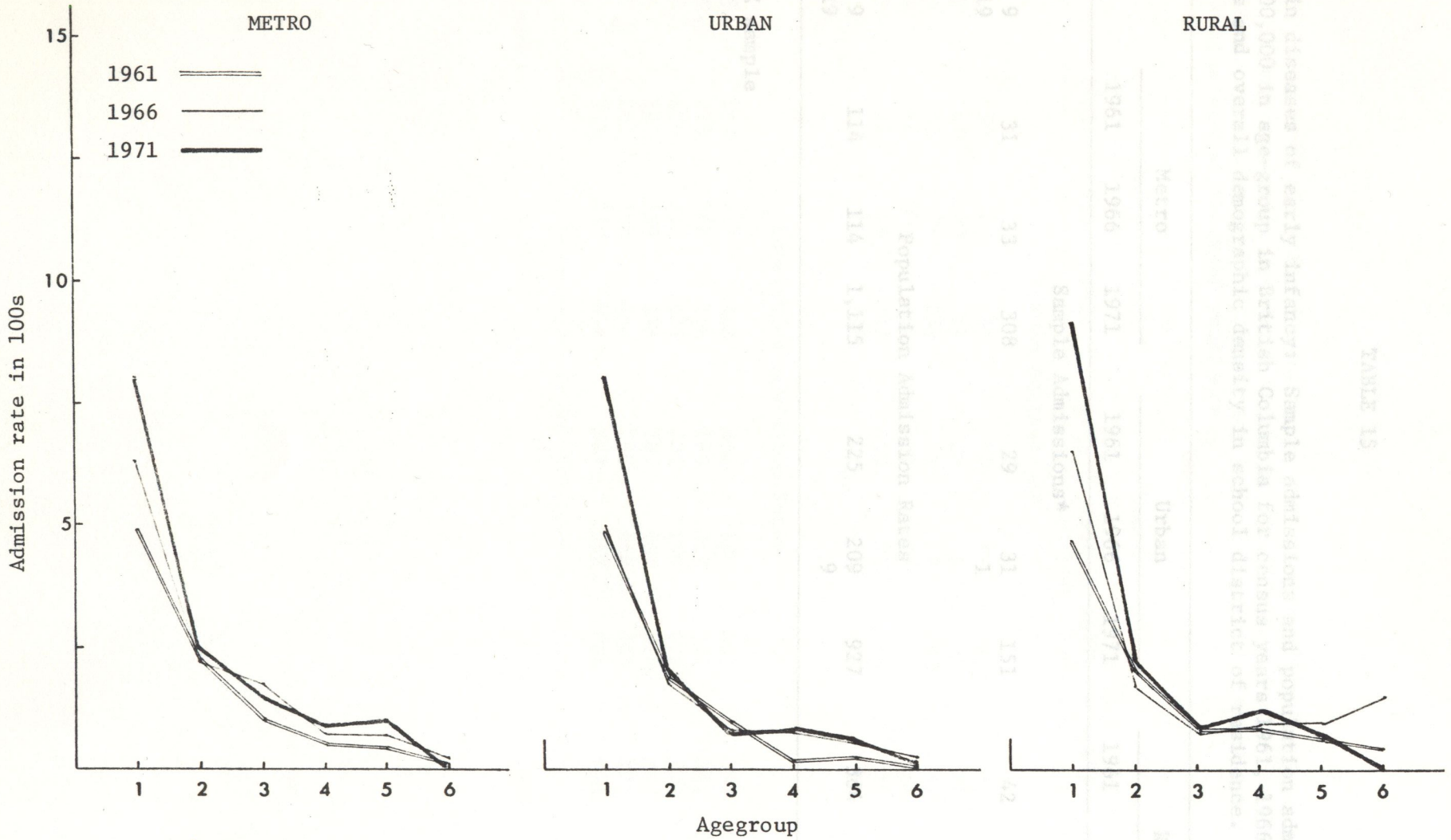


Fig. N Age and population density specific admission rates per 100,000 persons for congenital malformations in British Columbia in 1961, 1966, and 1971.

TABLE 15

Certain diseases of early infancy: Sample admissions and population admission rates per 100,000 in age-group in British Columbia for census years 1961, 1966, and 1971, by age and overall demographic density in school district of residence.

	Metro			Urban			Rural		
Age	1961	1966	1971	1961	1966	1971	1961	1966	1971
				Sample Admissions*					
0 - 9	31	33	308	29	31	151	42	43	112
10 - 19					1				
				Population Admission Rates					
0 - 9	114	114	1,115	225	209	927	364	325	786
10 - 19					9				

* 15% sample

TABLE 16

Symptoms, senility, ill defined conditions, and special admissions: Sample admissions and population admission rates per 100,000 in age-group in British Columbia for census years 1961, 1966, and 1971, by age and overall demographic density in school district of residence.

	Metro			Urban			Rural		
Age	1961	1966	1971	1961	1966	1971	1961	1966	1971
				Sample Admissions*					
0 - 9	50	80	89	33	42	66	35	46	73
10 - 19	42	69	72	20	47	63	21	55	68
20 - 34	43	76	130	22	23	83	27	49	81
35 - 54	66	102	142	37	71	93	26	64	87
55 - 69	42	69	102	10	29	40	10	32	72
70+	26	42	86	7	20	34	16	20	33
				Population Admission Rates					
0 - 9	183	277	322	256	284	405	303	348	512
10 - 19	213	262	226	193	369	362	261	516	475
20 - 34	165	257	326	221	190	479	297	455	559
35 - 54	183	259	338	285	467	510	232	497	596
55 - 69	265	380	450	186	440	443	221	578	1,002
70+	225	338	644	227	582	804	661	784	1,005

* 15% sample

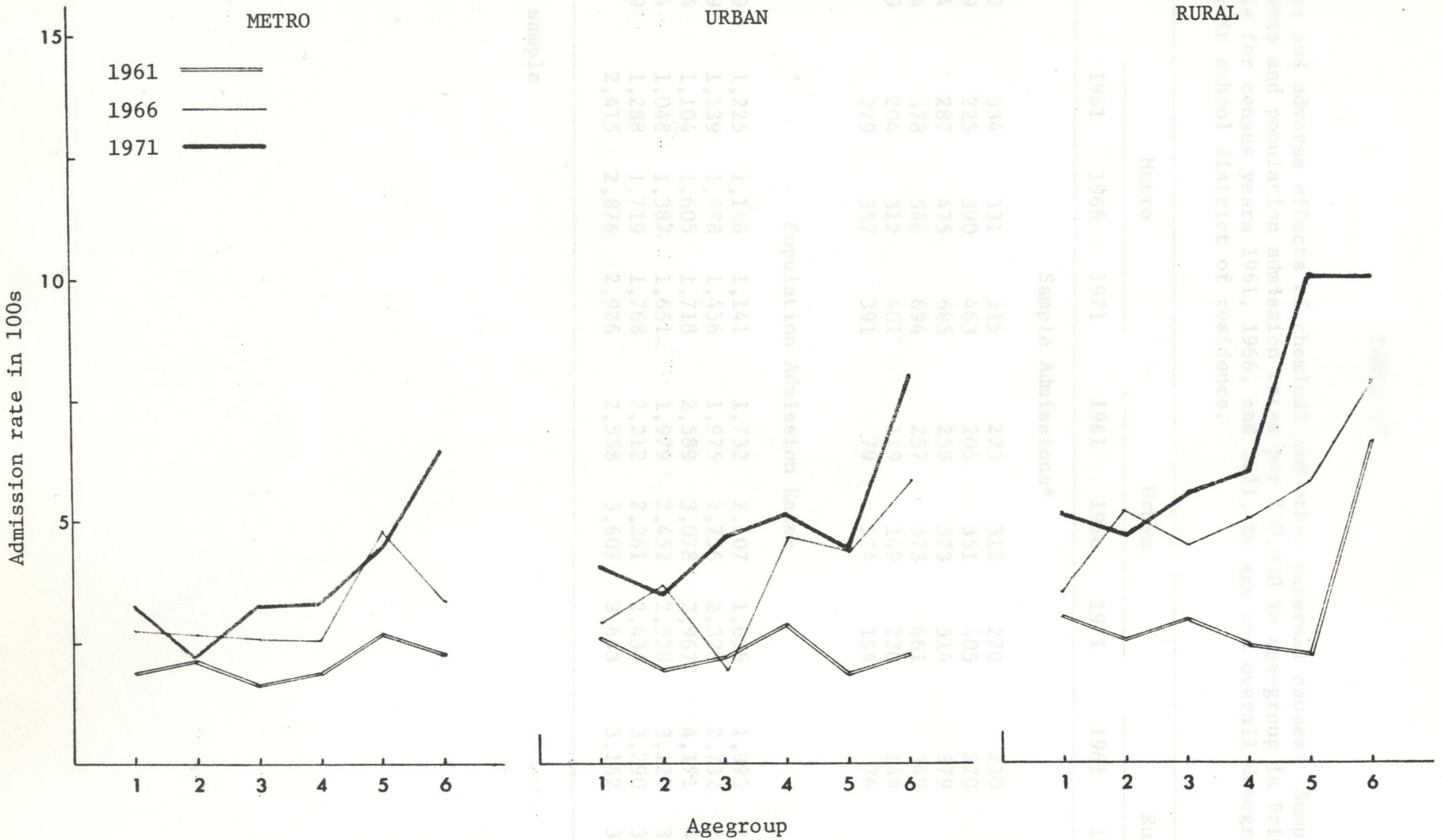


Fig. 0 Age and population density specific admission rates per 100,000 persons for symptoms, senility, ill defined conditions, and special admissions in British Columbia in 1961, 1966, and 1971.

TABLE 17

Injuries and adverse effects of chemical and other external causes: Sample admissions and population admission rates per 100,000 in age-group in British Columbia for census years 1961, 1966, and 1971, by age and overall demographic density in school district of residence.

	Metro			Urban			Rural		
Age	1961	1966	1971	1961	1966	1971	1961	1966	1971
				Sample Admissions*					
0 - 9	334	331	315	223	312	270	230	308	306
10 - 19	225	390	463	205	351	405	220	391	410
20 - 34	287	475	685	258	373	514	379	457	581
35 - 54	378	546	694	257	373	461	349	482	475
55 - 69	204	312	401	119	149	220	149	210	224
70+	279	357	391	79	124	154	76	99	166
				Population Admission Rates					
0 - 9	1,225	1,146	1,141	1,732	2,107	1,658	1,993	2,329	2,148
10 - 19	1,139	1,478	1,456	1,975	2,756	2,328	2,732	3,665	2,865
20 - 34	1,104	1,605	1,718	2,589	3,078	2,967	4,171	4,241	4,007
35 - 54	1,048	1,387	1,651	1,979	2,452	2,528	3,120	3,746	3,255
54 - 69	1,288	1,719	1,768	2,212	2,261	2,434	3,290	3,795	3,119
70+	2,415	2,876	2,926	2,558	3,607	3,643	3,142	3,882	5,056

* 15% sample

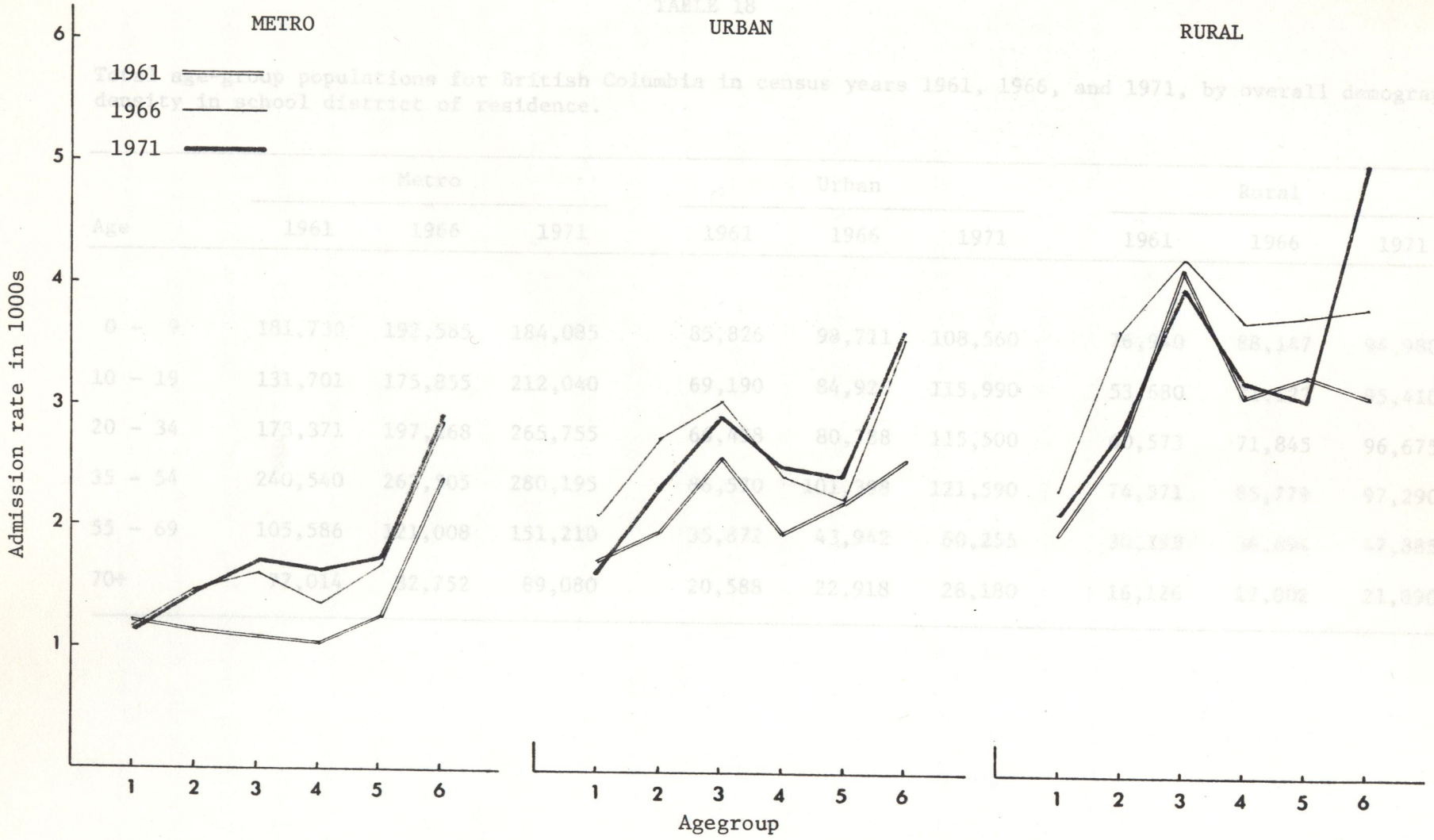


Fig. P Age and population density specific admission rates per 100,000 persons for injuries and adverse effects of chemical and other external causes in British Columbia in 1961, 1966, and 1971.

TABLE 18

Total age-group populations for British Columbia in census years 1961, 1966, and 1971, by overall demographic density in school district of residence.

Age	Metro			Urban			Rural		
	1961	1966	1971	1961	1966	1971	1961	1966	1971
0 - 9	181,730	192,585	184,085	85,826	98,711	108,560	76,940	88,147	94,980
10 - 19	131,701	175,855	212,040	69,190	84,920	115,990	53,680	71,123	95,410
20 - 34	173,371	197,268	265,755	66,438	80,788	115,500	60,573	71,845	96,675
35 - 54	240,540	262,505	280,195	86,570	101,398	121,590	74,571	85,779	97,290
55 - 69	105,586	121,008	151,210	35,872	43,942	60,255	30,193	36,894	47,885
70+	77,014	82,752	89,080	20,588	22,918	28,180	16,126	17,002	21,890

DISCUSSION

Tables and Figures

Probably the best way to examine the results of this project is to look separately at each one of the 17 parts of the four-dimensional contingency table. Figures A to P show clearly how admission rates, in each of the disease categories, vary in relation to the other three variables.

Generally speaking the overall similarity of the admission functions, within a disease category, in terms of both population density and year is ample evidence that admissions do in fact reflect disease incidence in a regular fashion. The important fact to remember is that in those correlations *where admissions are themselves likely to occur differentially* the inferences to disease incidence can be made only very cautiously, if at all. An example (Figure G) shows an increasing gradient of admissions, metro-urban-rural, for persons aged over 55 admitted for diseases of the circulatory system. The near perfect correspondence of the upper ends of the functions suggest that we might be dealing with differential *admissions* policies - possibly reflecting longer home-hospital distances in rural areas, less intensive bed utilization (rural and urban), and the

fact that metro areas are better equipped to handle a high volume of out-patient traffic. The main reason that I would tentatively suggest that disease *incidence* is not the major factor in this case is the similarity of the temporal and demographic gradients. Disease *incidence* variability would probably introduce a factor unilaterally not bilaterally. *Admissions*, on the other hand, are simultaneously affected by the demographic variable and the temporal one, the latter by virtue of an ever increasing population. Thus the expected graph would closely resemble Figure G.

Each of the tables will be discussed by reference to the corresponding figure, and, where appropriate, to the implications for a future expansion of this project.

Infective and Parasitic Diseases (Table 1, Figure A):

As in Figure G the demographic dimension must be suspect, as it is altogether too possible for admissions policies to vary sufficiently to produce the differentials obtained. Particularly at the ends of the functions is the increase of rural over metro admissions evident. More interesting, though, is the temporal trend within each demographic partition. For some reason admissions in this category saw a considerable increase in the 0-9 age-group in 1971. The specific disease entity primarily responsible for this increase is not discernible with the crude partition I was limited to. The same applies to the

temporal dimension; a comparison of all years from 1960 on would reveal whether or not the increase was a regular one or an artifact of the crudeness of this variable.

Neoplasms (Table 2, Figure B):

This graph provides an important check on the possibility of making inferences from admissions to disease prevalence. The demographic factor is under control as cancer diagnoses will all be admitted to hospital for the requisite checks and treatment. Significantly, the demographic variable does not, in this case, introduce appreciable variation. The graph itself is relatively sterile as the lack of discrimination between various forms of cancer does not allow us to identify those neoplasms most prevalent in each year and age-group. Future research in this line will hopefully enable finer distinctions in all variables.

Allergic, endocrine system, metabolic and nutritional diseases (Table 3, Figure C):

The wide variety of ills subsumed under this heading make analysis of this graph unproductive. Again, the general increase in admissions as population density decreases probably reflects variation in admitting policy. However, the overall reduction in admissions in 1971 for each of the demographic categories and nearly all of the age groups is an interesting trend. The research for which

this is a pilot-project will undoubtedly allow one to ascertain the specific disease entities responsible for this change.

Diseases of blood and blood-forming organs (Table 4, Figure D):

Very little can be made of this table mainly because of the small number of cases upon which the rates were constructed. Not only are the sample admissions unreliable, being too small in number, but the corresponding rates fluctuate erratically, making the graph difficult to interpret. An interesting effect of larger sample frequencies can be seen by comparing the internal consistency of the metro functions with the urban and rural functions.

Mental, psychoneurotic and personality disorders (Table 5, Figure E):

An interesting phenomenon is revealed in this category. Outpatient treatment of these disorders in metro areas may again account for the demographic differential. But the temporal trend is clear, showing a definite increase in admissions, and probably prevalence, over time. The increase is most dramatic (as is to be expected) in the 35-54 age-group. A slowing trend is also discernible. Where the 1961 to 1966 increase, in age-group 4, was more than 50%, the 1966 to 1971 change dropped to less than 30%. It will be interesting to see, in a future more detailed

examination, what effect the use of hallucinogenic drugs and alcohol had on this particular trend.

An excellent, though geographically limited to greater Vancouver, study of this particular category is available for 1972 which also produced a four-dimensional table (sex substituting for the time variable). The study (Lazer 1973) relies on collected data rather than on sampled governmental records. One control the Lazer project had which mine lacks is the ability to segregate "repeaters" (Lazer 1973:69-73). I will indicate below, following discussion of these results, what I suggest might be done to eliminate this obvious shortcoming.

Diseases of the nervous system and sense organs (Table 6, Figure F):

Changes in treatment are possibly responsible for the drastic reduction of admissions from 1961 and 1966 to 1971 levels. Particularly in older age groups the admissions policy for circulatory defects is likely changed, reflecting rural implementation of methods used in metro areas in 1961. The reason for 1966 showing overall highest incidence is not within speculation range.

Diseases of the circulatory system (Table 7, Figure G):

Discussed above.

Diseases of the respiratory system (Table 8, Figure H):

Essentially the same argument holds as for Table 3. The reduction in admissions over time may be due either to a reduced incidence or, more likely, to an increased trend toward home and out-patient treatment. The sharp increase in the higher age groups in rural areas could be investigated with a more detailed multi-dimensional table.

Diseases of the digestive system (Table 9, Figure I):

The only thing that seems to emerge from this table is a trend for admissions for digestive ailments to increase in metro areas, while decreasing in urban and rural areas. An interesting possibility exists in the rural part of the graph: The 1966 and 1971 functions make sharp upswings at age groups 2 and 4. One suspects that two different digestive ailments are responsible and this would be readily ascertained in a larger table.

Diseases of the genito-urinary system (Table 10, Figure I):

No readily discernible trend.

Deliveries and complications of pregnancy, childbirth and puerperium (Table 11, Figure K):

Little discussion is necessary here. The admission rate in this disease category is directly proportional to the birth rate which has not decreased as much *since* 1966 as it did from 1961 to 1966. A finer age-group breakdown (5-year groups) would allow correlation with Table 14

(congenital malformations) to discern trends supporting such theories as the "overripe egg" theory of foetal anomalies.

Diseases of the skin and cellular tissue (Table 12, Figure L):

A general decrease in admissions over time is evident, possibly due to changing modes of treatment. However, a strange change in the configuration of the functions is apparent as one compares the urban and rural functions with those in the metro section. At both ends of the age-group scale an increasing rate of admissions occurs both in urban and (even more so) in rural areas. Where admissions policy might increase the overall functions, the change in configuration possibly indicates a special phenomenon not traceable in the present study.

Diseases of the bones and organs of movement (Table 13, Figure M):

Increasing admission rates over time, age groups, and population density are trends apparent in this category. 1961 saw an interesting surge of urban and rural admissions for age-group 3 which is totally out of keeping with the general trends evident in the table. A larger table could give a more specific reason for this surge and thus permit correlation with other factors of a contributive, if not causative, nature.

Congenital malformations (Table 14, Figure N):

A *decreasing* admission rate for pregnancy-related problems (Figure K) accompanied by an *increasing* rate of congenital malformations is dramatic evidence of increases in mutagenic and teratogenic agents at large in the population.

Certain diseases of early infancy (Table 15, no figure):

Essentially only one age group is affected here. The interesting aspect of this table is the distribution of admission rates among the three demographic categories. Where 1961 and 1966 saw significantly higher admission rates in rural and urban areas than in metro areas, 1971 records reveal the opposite. A consistent decrease from metro, through urban, to rural areas is evident. The disease category is obviously too inclusive to permit closer scrutiny of this anomaly; however, the proposed project should be able to deal with it successfully by revealing the nature of the responsible diseases and allowing more productive speculation.

Symptoms, senility and ill-defined conditions (Table 16, Figure O):

Erratic rates and a poorly defined category combine to obviate discussion of this graph.

Injuries and adverse effects of chemical and other external causes (Table 17, Figure P):

Both the overall pattern of admission rates and the nature of the category suggest that this graph reflects reasonably well the incidence of accidents in the population. Particularly the peaking at age-group 3 in urban and rural areas is indicative of the kind of accidental injury experience one is likely to get in manual labour oriented economies in contrast to metro areas with their much higher percentages of white collar workers.

The foregoing intuitive look at the tables and figures resulting from my project is meant to convey an idea as to the kind of questions that might be asked of a larger, more detailed, contingency table. And in so doing it reaffirms the purpose of this paper which was to devise a method whereby standard forms of data may be modified and correlated to produce medical statistics which do in fact present "in numerical form ... the influence of all conditions of life upon man's health" (Peller 1967:4ff). I believe that an expanded version of my multi-dimensional array will produce such statistics, particularly if interpreted by a computer programme designed to deal with multi-dimensional contingency tables (Fienberg 1970).

Outline of Proposed Expanded Project

The first thing to be recognized is that the disease categories must be much more specific. The full ICDA four-

digit code will be necessary to segregate various disease entities. Furthermore, rather than use a 17-category partition, the proposed table would partition a particular subset of hospital admissions, thus allowing complete disease specificity.

The second aspect that requires modification is the relationship between admissions and incidence. An examination of the Admission Separation Record form (Appendix I) shows that the length of stay is available as a variable. This can be made a factor of a prevalence index by first running MARGINALS (frequency distribution) of SPSS on length of stay and disease category. A measure of central tendency can then be selected to provide the denominator of this index. Mere multiplication by 'length of stay' per admission will then result in a fractional index. This index when accumulated will give a more realistic picture of disease prevalence by simultaneously reducing the effect of both admission policy differentials and "repeaters" (Lazer 1973). Thus I believe that the number of admissions for a specific disease entity *can* be modified to give a viable measure of actual disease incidence or prevalence.

Further improvement can be achieved by narrower geographic and demographic categories. Using school districts individually and adapting the results for the 'plotter' the fluctuations over time and age-groups can be

presented graphically.

Another important aspect is, of course, the temporal dimension. The three years used in this study give only a rough idea of the trends that are present in the correlations. Using *all* available years of data would significantly affect the reliability of inferences as to the nature of the trends and correlations. In a similar fashion using five-year age-groups would improve the discernment of disease-specific vulnerable ages. The latter factor was affected in this study by the availability of population base figures.

There are two drawbacks to the proposed project outlined above. First the table would be so large that no complete graphic representation would be feasible. This significantly reduces the possibility of visually determining interesting areas of investigation. However, I am confident that, with the deployment of 'plotting' techniques, selected portions of the table can be rendered visible. It should be kept in mind that when a table exceeds three dimensions, and the proposed table could reach six dimensions (adding sex and 'race'), graphic representation becomes impossible. Thus a computer programme (Fienberg 1970) would certainly be necessary to interpret the table and generate the medical statistics which are the ultimate goal of the research for which this is a pilot-project.

The second major obstacle is cost. A simple extrapolation of the costs of this project would suggest that in its final form the research tool generated might cost anywhere from $10,000 to $20,000 in computer time alone. However, this is surely a negligible factor if the table makes even the most minor contribution to epidemiological research.

CONCLUSION

This paper has attempted to illustrate the development of a research tool for epidemiological enquiry. The variables used were of necessity crude but the implications for possible future modification and the subsequent construction of a powerful multi-dimensional array of data are clear. I believe I have shown that standard forms of government data are capable of revealing more than the traditional two or three-variable tables which, though of interest to public and accounting interests, are useless for medical purposes. Given the current and pressing demands on epidemiological research (U.S. Department of Health, Education and Welfare 1968:2) I believe that this pilot-project has shown how these aims may in part be met by the development of large-scale, multi-dimensional contingency tables based on *currently available* health records and vital statistics.

LITERATURE CITED

B.C. Department of Industrial Development, Trade and Commerce.

1963 *Age Group Distribution of British Columbia's Population by School Districts as of June, 1961.* Victoria: Government of British Columbia.

1968 *Age Group Distribution of British Columbia's Population by School Districts as of June, 1966.* Victoria: Government of British Columbia.

1973 *Age Group Distribution of British Columbia's Population by School Districts as of June, 1971.* Victoria: Government of British Columbia.

B.C. Hospital Insurance Service, Research Division.

1961 *1961 Code Book.* Victoria.

1966 *1966 Code Book.* Victoria.

1971 *1971 Code Book.* Victoria.

Fienberg, S. E.

1970 "The Analysis of Multidimensional Contingency Tables" in *Ecology*, Vol. 51, No. 3.

Lazer, J.

1973 *Study of the Use of Vancouver General Hospital's Emergency Room by Patients with Psychiatric, Drug, and Alcohol Problems in 1972.* Vancouver: Community Care Services Society.

Peller, S.

1967 *Quantitative Research in Human Biology and Medicine.* Bristol: John Wright & Sons, Ltd.

U.S. Department of Health, Education and Welfare.

1962 *International Classification of Diseases, Adapted.* Washington: U.S. Government Printing Office.

1967 *Eighth Revision International Classification of Diseases.* Washington: Public Health Service

1968 *Use of Vital and Health Records in Epidemiological Research.* Washington: Public Health Service.

World Health Organization.
1957 *Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death.* Geneva: W.H.O.

APPENDIX I

HIA 18 REVISED 1973 — PART 6 RETAIN FOR HOSPITAL ACCOUNTING RECORD

ADMISSION-SEPARATION RECORD

NOTIFY

MEDICAL OR INDIAN NO. (IF WAR VETERAN'S ALLOWANCE WRITE "WVA")

HOSPITAL ADMISSION NO. 1-5 | NO. AND DATE OF LAST ADMISSION | CODE NO. 6-8 | NAME OF HOSPITAL AND LOCATION

NAME OF PATIENT—FAMILY NAME FIRST IN BLOCK LETTERS | RELIGION | PHONE | FULL NAME AND ADDRESS OF HEAD OF FAMILY, SPOUSE, OR GUARDIAN | RELATIONSHIP | PHONE

ADMISSION HISTORY

PATIENT'S MAIDEN NAME | S.A. CODE 9 | TIME OF ADMISSION | HOUR A.M. P.M. | DAY 10-11 | MONTH 12 | YEAR 13

WARD NO. | STAND. | SEMI. | PRIV. | NURSY. | ATTENDING PHYSICIAN | CODE NO. 14-17

DIAGNOSIS ON ADMISSION (COMPLETE AFTER SIGNATURE). IF INJURED GIVE FULL DETAILS: HOW, WHEN, WHERE. IF THIRD PARTY MAY BE LIABLE, ATTACH HIA 14.

TRANSFERRED FROM: | CODE 18

TYPE OF ADMISSION: ELECTIVE | URGENT | EMERGENCY

W.C.B. CLAIM NO. AND EMPLOYER AT TIME OF ACCIDENT | TIME A.M. P.M. | DATE DAY MONTH YEAR

IF PATIENT'S B.C. RESIDENCE LESS THAN 6 MONTHS GIVE DATE OF ARRIVAL AND COMPLETE SECTION BELOW. | DAY MONTH YEAR

OTHER PROVINCE OR TERRITORY: NAME | IDENTIFICATION NO. | DATE LEFT OTHER PROV. DAY MONTH YEAR | IS PATIENT'S RESIDENCE IN B.C. PERMANENT? STATE YES OR NO

RESPONS. FOR PAYMENT: BCHIS | W.C.B. | FEDERAL D.V.A. | OTHER 19 | SELF | OTHER AGENCY | OTHER PROV.

SEX: M. F. | N. B. M. MAT. IMMAT. | N. B. F. MAT. IMMAT. | MARITAL STATUS S. M. W.D.S. | DATE OF BIRTH DAY MONTH YEAR | AGE 20-21 | CODE 22-23

SEPARATION HISTORY

TIME OF SEPARATION | DAY 29-30 | MONTH 31 | YEAR 32 | HOUR A.M. P.M. | TOTAL DAYS 33-35 | SERVICE 36

CONDITION ON SEPARATION: IMPRVD. | UNIMPRVD | DIED WITH AUTOPSY 37 | DIED NO AUTOPSY | TRANS. | TRANSFERRED TO:

PRINCIPAL DIAGNOSIS ON SEPARATION 38-42 / 71-75

SECONDARY DIAGNOSIS OR COMPLICATIONS 44-49

DATE(S) TYPE OF OPERATION(S) PERFORMED 50-52

SURGEON 53-55

RECORD BY NUMERAL NO. OF TRTMNTS OR TIMES USED. X-RAYS DIAG THPTC | ROOM OP CABE | ANAESTHETIC LOC GEN SPIN | LAB | BLOOD

ICU/CCU OCCUPANCY TOTAL DAYS

RESIDENCE AND EMPLOYMENT

PATIENT'S PRESENT ADDRESS: NUMBER | STREET (R.R.) | NAME OF CITY, TOWN, VILLAGE | FROM MONTH YEAR

POSTAL CODE

IS ABOVE ADDRESS WITHIN A CITY, TOWN, MUN., OR VILLAGE BOUNDARY? IF SO, GIVE NAME. IF IN UNORGANIZED TERRITORY, STATE "UNORG." | REG. & S.D. 24-25 | MUN. CODE 26-28

PREVIOUS ADDRESSES, IN AND OUT OF B.C. FOR LAST 6 MONTHS (OR MORE IF REQUIRED TO ESTABLISH ELIGIBILITY): | FROM MONTH YEAR | TO MONTH YEAR

PRESENT OCCUPATION OF HEAD OF FAMILY:

PRESENT AND PREVIOUS EMPLOYERS IN AND OUT OF B.C. FOR LAST 6 MONTHS, (OR MORE IF REQUIRED), INCLUDING PERIODS OF UNEMPLOYMENT: | FROM MONTH YEAR | TO MONTH YEAR

GIVE DETAILS OF TWO RELIABLE PERSONS WHO CAN CONFIRM THE ABOVE STATEMENTS OF RESIDENCE.

1. _____ FULL NAME _____ ADDRESS _____ OCCUPATION _____

2. _____ FULL NAME _____ ADDRESS _____ OCCUPATION _____

ACCOUNTING RECORD

ACCOM.	DAYS	RATE	CHARGE TO B.C.H.I.S.	CHARGE TO PATIENT OR OTHER AGENCY
1. PRIV.				
2. SEMI.				
3. STAND.				
4. NURSY				
5. OTHER				
6. PAYABLE BY BCHIS	DAYS	NET RATE	TOTAL CHARGE TO PATIENT OR OTHER AGENCY	310204

TOTAL CHARGE TO BCHIS: DAYS 61-63 | AMOUNT $ 64-70 | 77

GIVE DETAILS OF HOW PATIENT'S STATEMENTS OF RESIDENCE WERE VERIFIED.

VERIFIED _____

I hereby certify that: (1) A PHYSICIAN HAS CERTIFIED THAT THIS PATIENT REQUIRED IN-PATIENT CARE. (2) THE PATIENT RECEIVED THE HOSPITAL CARE AND SERVICES INDICATED ABOVE. (3) THIS HOSPITAL HAS VERIFIED THE STATEMENTS SHOWN HEREON REGARDING RESIDENCE

_____ SIGNATURE OF HOSPITAL ADMINISTRATOR OR OTHER AUTHORIZED EMPLOYEE

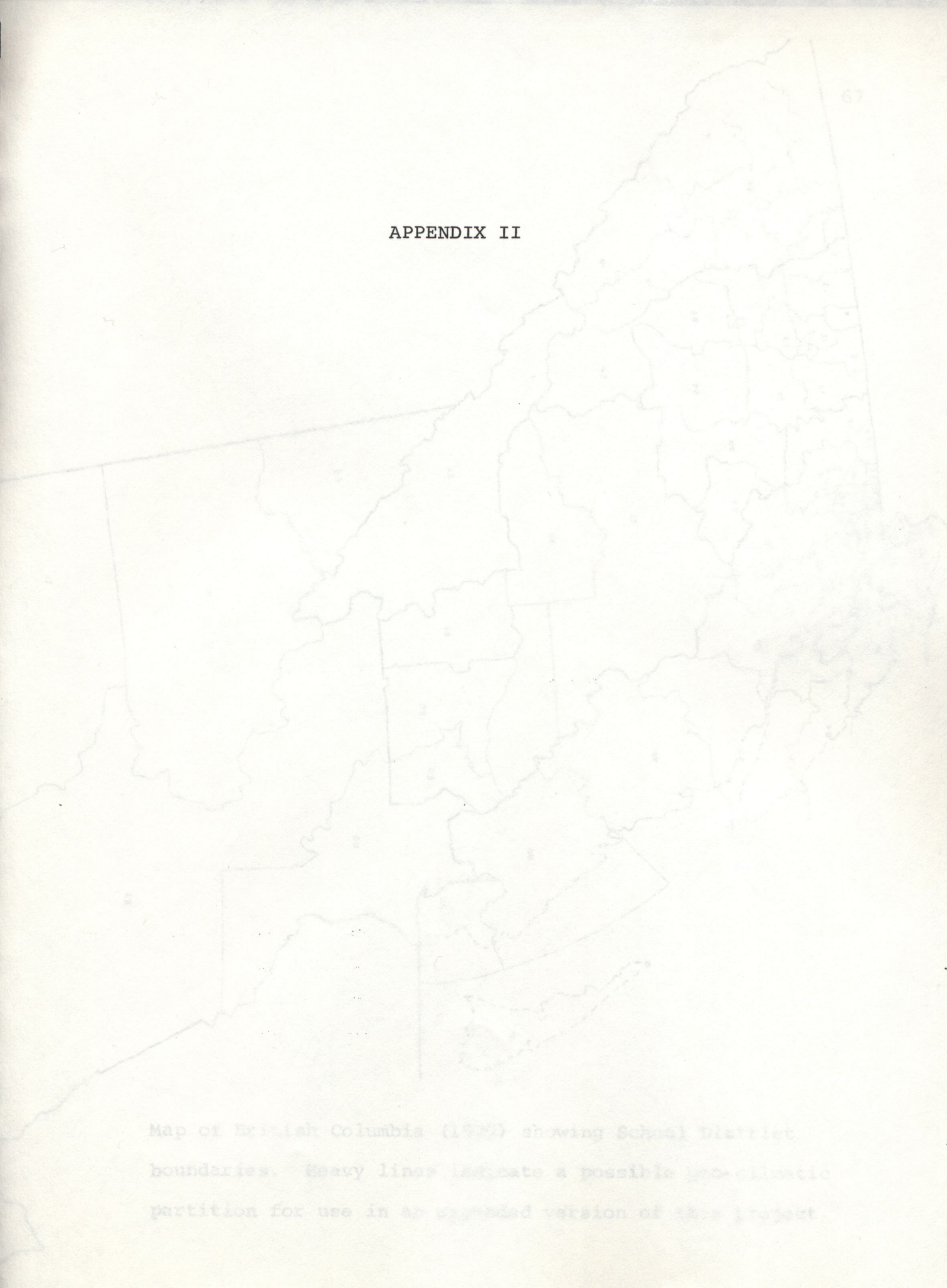
I HEREBY AGREE TO ASSUME RESPONSIBILITY FOR PAYMENT OF HOSPITAL CHARGES NOT COVERED UNDER B.C.H.I.S. OR ANY OTHER AGENCY.

_____ (SIGNATURE OF PATIENT, PARENT OR GUARDIAN)

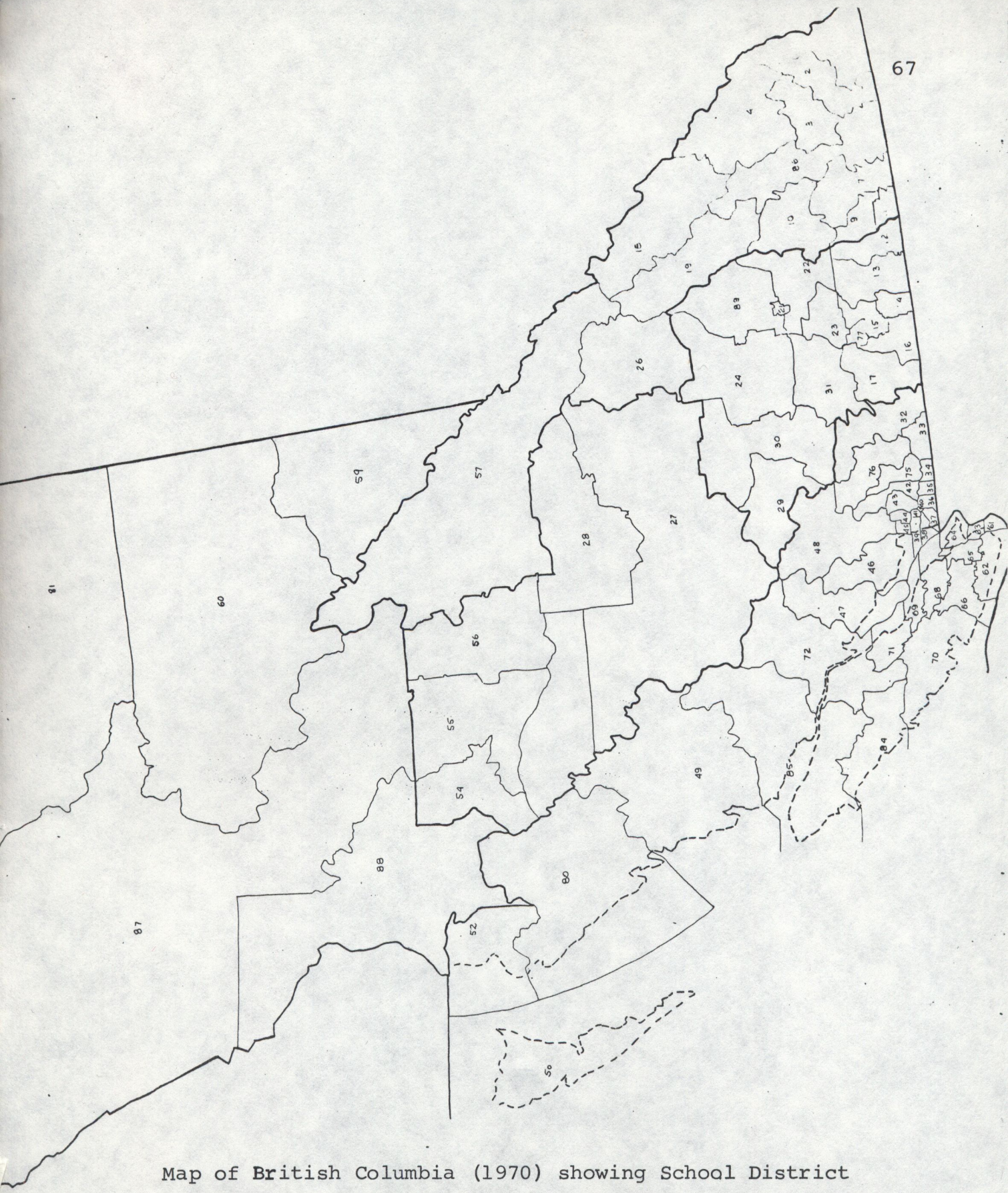
FOR HOSPITAL USE AS ACCOUNTS RECEIVABLE LEDGER

DATE	PARTICULARS	FOLIO	B. C. H. I. S. DR.	B. C. H. I. S. CR.	B. C. H. I. S. BALANCE	OTHER DR.	OTHER CR.	OTHER BALANCE

APPENDIX II



Map of British Columbia (1966) showing School District boundaries. Heavy lines indicate a possible geo-climatic partition for use in an upgraded version of this project.



Map of British Columbia (1970) showing School District boundaries. Heavy lines indicate a possible geo-climatic partition for use in an expanded version of this project.