

## THE MORTALITY ATLAS OF CANADA PROJECT

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### I. Introduction

The Mortality Atlas of Canada Project is currently in progress at the Geocartographics Centre and is jointly sponsored by Statistics Canada and Health and Welfare Canada. The atlas is being produced to illustrate the spatial variation of mortality rates thereby facilitating the detection of high risk regions and any general patterns of disease distribution. High risk regions can then be subjected to epidemiological investigation to discover whether the high rates are due to random variation, to biases in the basic mortality data, or to specific causal factors for which control measures can be introduced to reduce the risk of disease. The three groups cooperating in this undertaking are pleased to present the objectives, plans, and progress-to-date for review and comment by the professionals at this gathering.

### II. Background

Production of the atlas began in July 1979 when the Geocartographics group was approached by the staff of the Non-Communicable Disease Division of Health and Welfare Canada. The Geocartographics Group is a multidisciplinary team of 10 people, including geographers, cartographers and computer graphics specialists, that has been recently formed within the Systems and Data Processing Branch of Statistics Canada from research and

development and production units formerly associated with the Census Field. As a result, the products and services of this group are now available throughout the department and to governmental and non-governmental clients external to the department on a cost-recovery basis. (The term "geocartographics" is used to denote a type of integrated approach that combines the requirements and capabilities of computer-assisted geographic information systems, computer-assisted cartographic information systems and computer-assisted graphics systems.)

The atlas consists of two volumes. Volume I focuses on cancer-related mortality. Volume II depicts data on accidents and major diseases other than cancer. Each volume contains between 20 and 30 thematic maps and includes a reference map and a map showing population density. The GIMMS geocartographics package, developed by Thomas Waugh of the University of Edinburgh, is being used to produce both the final colour separation positives and the colour-ballpoint proofs. The proofs are used to select interesting themes and to provide final quality assurance of the data and the text on the map.

### III. Mortality Data: Preparation and Selection

Data originating from death certificates registered by the provinces was collated by staff of the Vital Statistics and Disease Registries Section, Statistics Canada. Age-adjusted mortality rates, for the period 1966-1976 inclusive, were geographically standardized to 1976 Census Divisions and then statistically analysed and classified according to value and significance by staff of the Non-Communicable Disease Division, Health and Welfare Canada. A discussion of the statistical techniques employed to rank the data and to determine significance in relation to national averages is included in the introduction to the Atlas. The data values are included as an appendix to the Atlas.

Proof maps for a selected number of variables for Volume I are currently being evaluated by subject matter specialists. With the obvious exceptions, two maps, one for each sex, were prepared for each of the selected cancer sites. An issue currently being addressed by subject matter staff is whether or not to include both maps for a given cancer site when only one reveals

spatial distributions that are particularly interesting.

After final selection and quality assurance of the cancer site maps a residual map combining the total effect of non-selected sites is to be produced for each sex to complement the individual site maps and the maps showing all sites combined.

The data values supplied for all maps are based on the following classification scheme:

- Class 1 - significantly high
- Class 2 - tenth decile, non-significant
- Class 3 - ninth decile, non-significant
- Class 4 - other
- Class 5 - significantly low

These ordinal classes are to be depicted using the choropleth mapping technique.

#### IV. Geographic Data and Presentation

The availability of coded mortality data at a given level of the geographic code hierarchy, the level and scale of presentation and the availability of boundary descriptions combine to limit the range of possible presentation formats. Alternatives, ranging from wall-size maps for disease research (probably based on Census Sub-Divisions or Municipalities) to page-size atlas of urban areas (possibly based on Census Tracts), are feasible. Each has applications for which it is the most effective manner for representing the spatial variability of mortality data. Some of these avenues will be investigated at a later date. The first priority is two medium-sized (17"x 11") atlases of between 20 to 30 themes, each based on Census Divisions (or counties) and portrayed at the national level.

As a result of earlier computer-mapping activities by the Geocartographics Group, descriptions of the Census Division boundaries were already available in machine readable form and in a variety of formats. To date the most used base is a planimetric presentation of Canada using the area-conserving Lambert Conformal projection. To produce a more representative choropleth map product for inclusion in Census publications, a "population ecumene" was developed to compensate for the non-homo-

geneous distribution of population within Census Divisions. The definition of this ecumene was determined by Statistics Canada subject matter specialists in Geography on the basis of population density. The continuously populated region of minimum density of approximately one person per square mile together with known population centres of population 5000 or more were used to delimit the ecumene. This dasymetric information was then used to limit the extent of cartographic symbolization for published and ad hoc choropleth and dot maps of Census data.

A less used but increasingly popular format for these boundaries results from transformations performed within the PILLAR mapping package developed by David Douglas at the University of Ottawa. The resulting "globogrammed" boundaries can then be used as a backdrop for centroid-based PILLAR maps or can be transferred to the GIMMS package as the basis for locating dots and choropleth shading patterns. The obvious advantage of the globogram base is the visual focus on the populated southern latitudes while representing all or most of the country's land area on a relatively small and rectangular page layout. On the other hand, the transformation does not preserve areal relationships and reduces the size of already critically small Census divisions.

A highly desirable but unavailable alternative would have been to employ an isodemographic cartogram as the base map for cartographic symbolism.

The planimetric map based on the Lambert Conformal projection was selected for the atlas. Cartographic symbolism is restricted to the population ecumene and for the Montreal region an inset will highlight 36 of Canada's smaller Census Divisions. Currently under discussion is the issue of whether or not the population density map should be prepared from population and land area values that relate to entire Census Divisions or solely to the portion(s) within the ecumene.

## V. Cartographic Design and Production

Two designs based on a 17"x11" map size were prepared for final selection by the clients. The first design was a natural extension of the format used for maps

published by the Census of Population and Housing (22" x 11") and the Census of Agriculture (8.5"x 11"). It shows about one-half of Canada's north-south extent with the remainder of the country being "clipped" by the enclosing frame. Supporting text such as data sources and map numbers are located between the page border and the map frame. The second design extends the map to northern reaches. Slightly more space is also available for locating the inset and textual information. In both cases the smaller text was slightly enlarged from previous ratios to improve readability.

The client's preference for the second design dictates that all maps, including the reference and population density maps, will be bled to the page borders and show the population ecumene. The reference map is intended to facilitate cross-referencing of the maps with the appended tables of statistical values and will illustrate the Census Division codes and names. It is likely that a number of major cities will also be located on this map.

Currently colour-ballpoint proofs of Volume II data are being prepared and the production of colour separation positives is underway for the theme already selected for Volume I of the Atlas. Some of the initial colour separation positives are being used to produce "colour-keys" to test a small number of alternative colour combinations.

Friendly but somewhat heated discussions on the current use of colour as an analog for the quantitative and qualitative aspects of the statistical indices are in progress. The problem is compounded by the fact that the indices represent not only increasing rates but also the significance for those rates. A number of alternatives including cultural (e.g. red/amber/green signatures) and psychophysical (e.g. signatures of increasing intensity) aspects are being prepared for evaluation and final selection. An additional concern in the final selection of colours relates to the choice of paper and finish for the printing.

## VI. Closing Remarks

Current plans call for the release of Volume I in the first quarter of 1980 at a selling price between \$10 to \$15. The atlas is expected to be very popular both as

an aid to epidemiological investigations and as a document for general reference. Plans for a modest publicity program are advancing in parallel with map production. As a result of this publicity and the likely widespread distribution of the Mortality Atlas, it is anticipated that there will be a notable increase in ad hoc production projects of national level/wall-sized maps and page-size mini-atlases of urban areas.

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