Number of Surviving Teeth for Japanese Age Groups

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Abstract

We have done research for these 20 years on the model for dental diseases in Japan. We started from 2 sectors of demography and dental caries, then added pyorrhea, baby teeth and technology sectors.

The demographic sector covered populations of 5 threeyear age groups under 14 years of age and 13 fiveyear age groups above 15 years of age. From the total number of defective teeth, total dental costs in Japan were calculated annually from 1963 and projected to 2025.

We reported each stage of this model at the 1987, 1992 and 1993 International System Dynamics Conference.

We will make a general explanation of this research progress and show how changes of metamorphic rates among dental diseases affect number of surviving teeth for Japanese age groups and total dental costs in Japan.

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1. MODEL FOR DENTAL DISEASES

1. 1 Parts composing the model

This model contained 5 sectors: demography, dental caries, pyorrhea, baby teeth, and technology. In each sector we deal with all of Japan. Relations among sectors are shown in Fig.1.

1. 2 Demographic Sector

The demographic sector covers populations of 5 three-yea age classes under 14 years of age and 13 five-year age classes above 15 years of age. The former are the classes 0-2, 3-5, 6-8, 9-11 and 12-14 years of age, and the latter are the classes of 15-19, 20-24,--,70-74 and 75- years of age. The population of each age class depends on the rates of birth and death. The first age class Z0 begins with births and ends where a new age class begins or, through deaths within the class. Our other age classes Z3, Z6, -- , Z75 follow this same pattern.

1. 3 Dental Caries Sector

The Dental Caries Sector has 13 subsectors corresponding to 13 five-year classes of the population sector.
Dental caries are classified as follows;
Healthy teeth: Carious symptoms and dental care are not recognized.
C0 : Similar to healthy teeth, but there is indecision as to whether teeth are decayed or not.
C1 : Small surface cavities which may be easily filled and treated.
C2 : Cavities are worse than in C1, but health teeth may be restored fillings without pulpectomy.
C3 : Cavities are worse than in C2, after pulpectomy, in some cases decayed teeth are only filled, but generally metal crowns may be used. In the case of front teeth complete care of bridges may be necessary.
C4 : Carious symptoms are serious; to the point that decayed teeth must be extracted and a denture may be necessary.

The meaning of variables may be self explanatory in fig.3. The word 15 seen in variable names means the Z15 population class. The number of C1 teeth is first computed. Then C2, C3, C4, filled teeth, crowns and bridges, missing teeth and dentures are successively computed as seen in fig.4.
Other dental caries subsectors are quite similar to the one for the Z15 population subsector.
Data for this sector have all been collected by Japanese Dental Association.

1.4 Pyorrhea Sector

1.4.1 The Patient Population for C1, C2 and C3

The patient population for C1, C2 and C3 is obtained from the sum of C1, C2 and C3 teeth for five-year age classes divided by the number of C1,C2 and C3 teeth per patient.

1.4.2 The Periodontal Patient Population for Each Age Class

This variable may be calculated from the sum of the above population of periodontal patients for each age class times the cost for treatment per capita.

1.4.3 Cost of Periodontal treatment

This variable may be calculated from the sum of the above population of periodontal patients for each age class times the cost for treatment per capita.

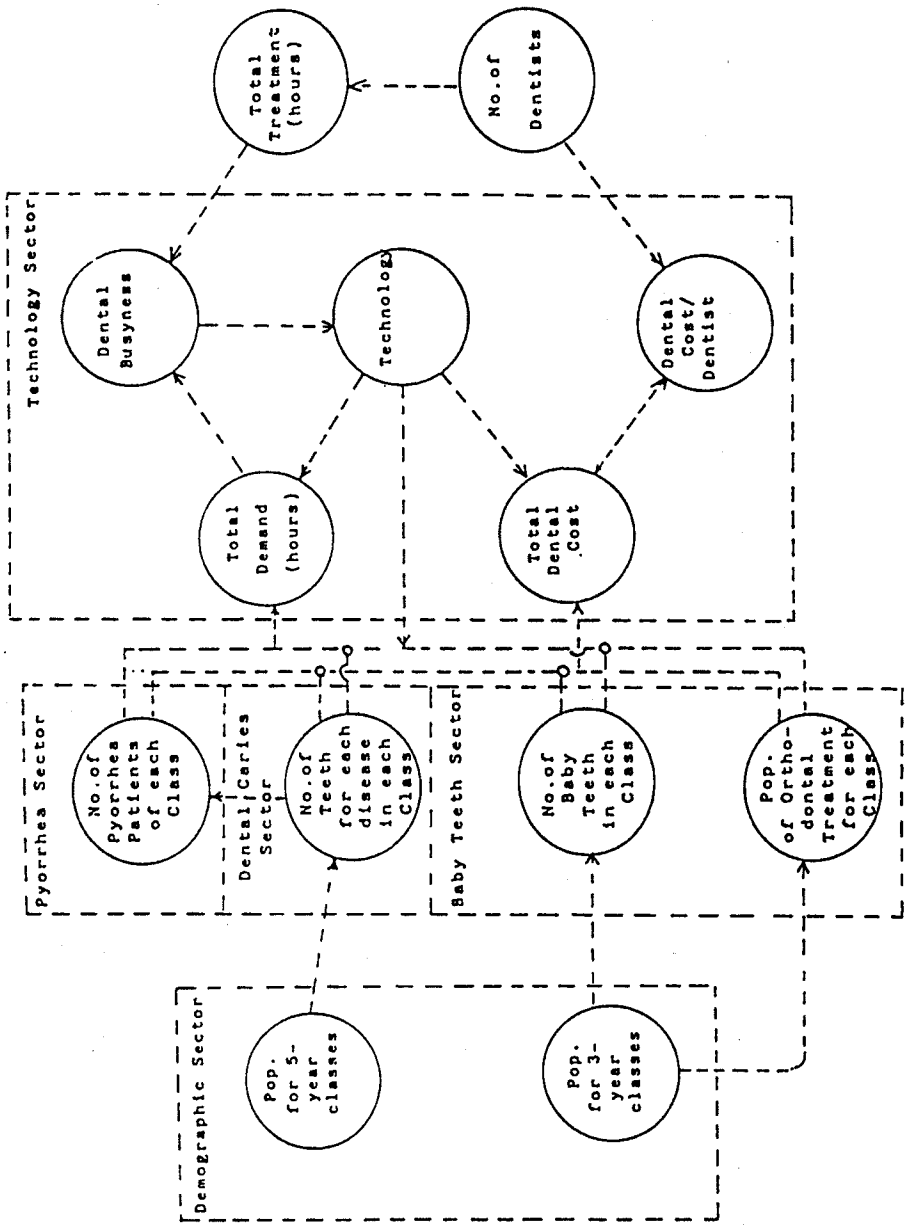

Fig.1 Relation among Sectors

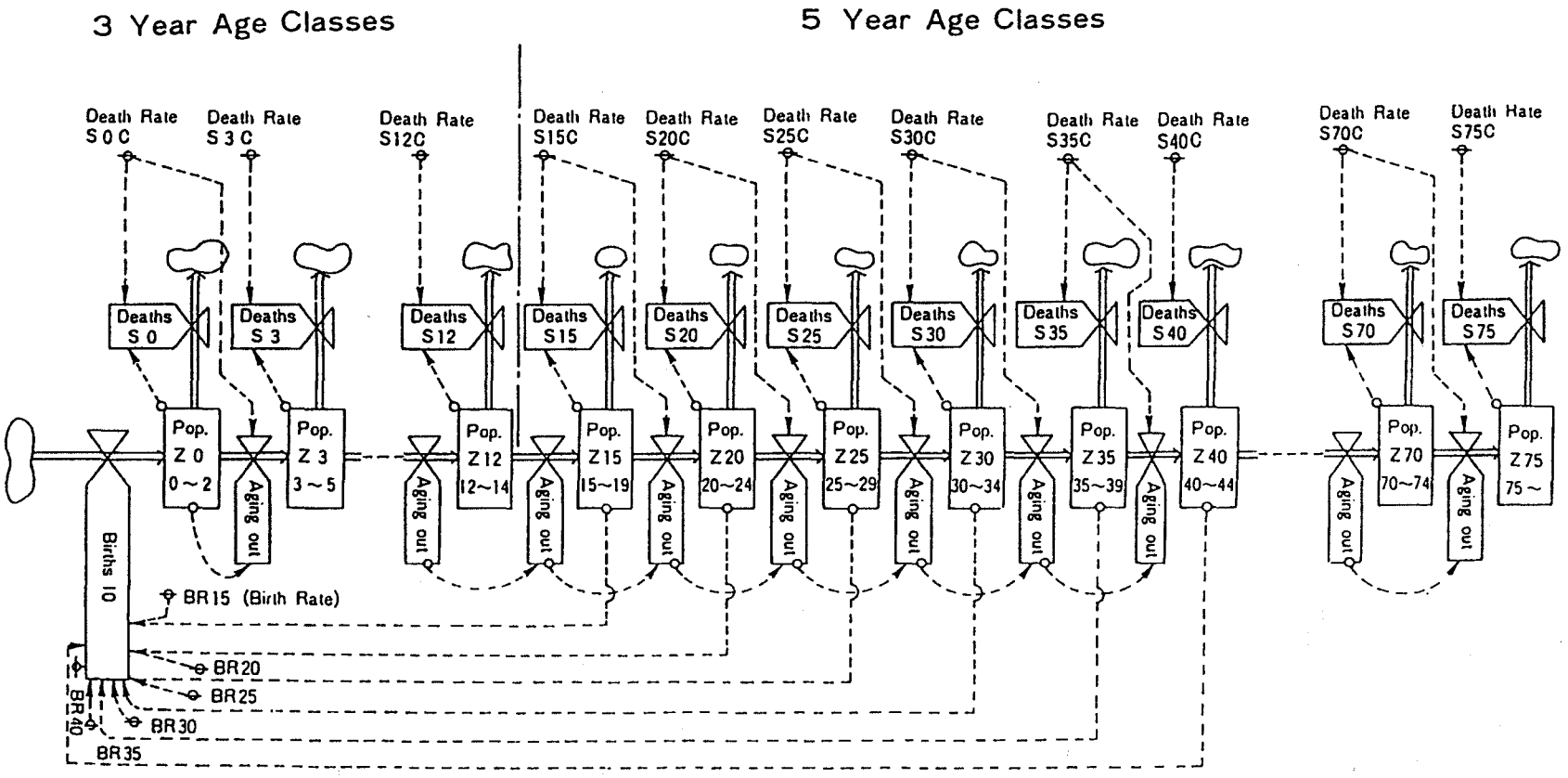

Fig.2 Flow Diagram for Demographic Sector

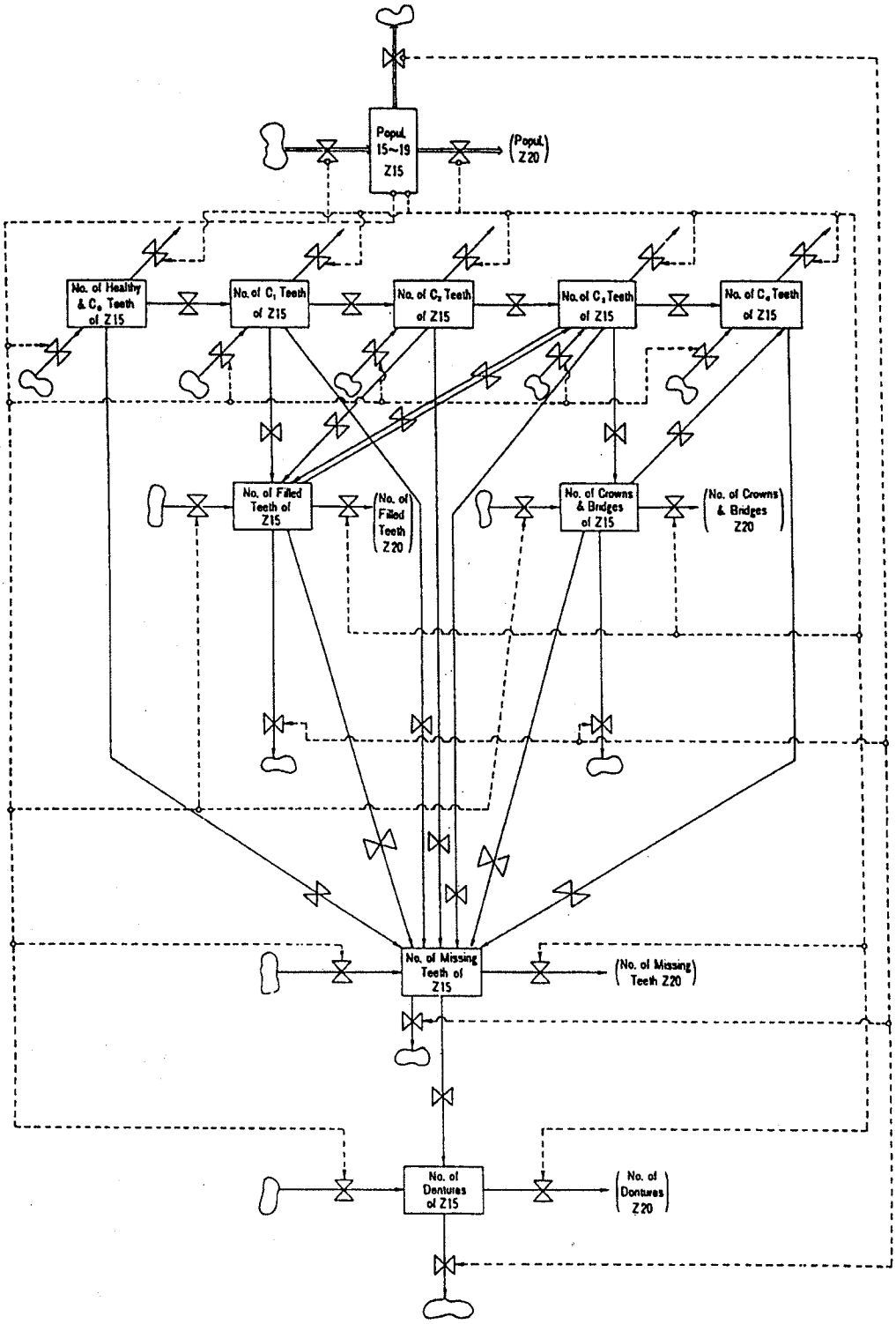

Fig.3 Flow Diagram for Dental Caries Z15 Sector

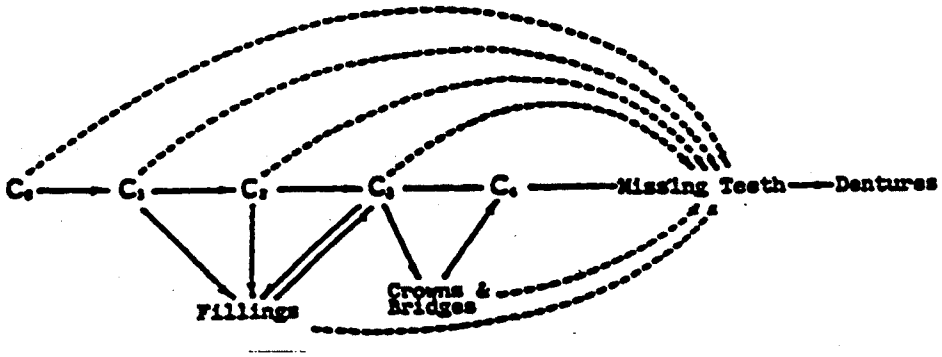

Fig.4 Relation among Diseases.

1. 5 Baby teeth sector

1. 5.1 Number of Defective Baby Teeth

The number of defective baby teeth for a three-year age class is obtained from the population of the class times 20 teeth per capita times the rate of defects or disease .

1. 5.2 Cost of Baby Teeth Treatment

This variable may be computed from the total sum of the number of treated baby teeth for each defect or disease and for each three-year age class times the cost per tooth.

2. Orthodontic Treatment

First the patient population for orthodontic treatment is obtained from the sum of the population of each tree-year age class times the rate of patients for orthodontic treatment. The total cost in Japan for orthodontic treatment can be calculated from the above population for orthodontic treatment multiplied by the cost per patient.

3. Dental Cost

3.1 Total Dental Cost

Total dental costs in Japan (CHIHI) are obtained as follows;

CHIHI = total demand * unit cost

total demand (hours)

unit cost (1,000 yen/hour/dentist)

Unit cost per dentist per hour is obtained from the model for a Japanese dental office [2] .
For the base model the ratio of treatment cases insured to the total was 0.94 and constant.

3.2 Dental cost per Dentist

The value of this variable is CHIHI divided by the number of dentists and means the dentist's income per capita.

3.3 Dental Costs per Capita

This is CHIHI divided by the population above 15 years of age.

4. Technology Sector

We added a new level variable(technology), rate variables and multipliers to express the effect of technology on the other level variables.

5. Number of Surviving teeth

5.1 Average Number of Surviving Teeth for Each Five-year Age Class

This number is the total number of surviving teeth of each age class as follows;

SV15 average number of surviving teeth for Z15 age class
SV20 average number of surviving teeth for Z20 age class
:
:
SV70 average number of surviving teeth for Z70 age class
SV75 average number of surviving teeth for Z75 age class

this number for basic run is more than 20 below Z45 age class, and further decreases with the age as

SV60 11 -- 13
SV70 8 -- 12
SV75 5 -- 4

5.2 Average Number of Surviving Teeth for 80 Years of Age

By this model we can compute almost all variables yearly, and so the average number of surviving teeth for 80 years of age (SV80) can be calculated as the total number of surviving teeth for 80 years of age divided by the population of 80 years of age. For the basic run SV80 is one or two teeth in number less than SV70.
We tried several simulation runs for change in metamorphic rates, of which only the run including statistics of missing teeth in the decreasing metamorphic rates showed SV80 and others considerably increased in the number of surviving teeth.

6. Conclusion

We made a general explanation of this research progress. We started from 2 sectors of demography and dental caries, then added pyorrhea, baby teeth and technology sectors.
In this paper, we treated average number surviving teeth for each five-year age class and 80 years of age.

Reference

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