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Evaluation of the implementation of the Iris automated coding system in the Philippines

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Abstract

Background

In 2016, the Bloomberg Philanthropies Data for Health initiative assisted the Philippine Statistical Authority (PSA) in implementing Iris, an automated coding software program that allows death records to be coded according to ICD-10 standards and improve the quality, timeliness, and consistency of coded data. The improvement of the quality of cause of death data will help to strengthen the Civil Registration and Vital Statistics System in the Philippines and provide robust evidence for health policy planning and evaluation. This study reviews the Philippines' cause of death data from 2017 to 2019 and evaluates the consistency and quality of the data for major disease groups.

Objectives

The Iris implementation was evaluated to ensure that there are no significant inconsistencies in the data and that they reflect as closely as possible the health status and mortality pattern of the Philippine population and to ensure that the Iris-coded mortality data were of sufficient quality to be released and disseminated.

Methods

All the data were analysed and evaluated for obvious errors and inconsistencies, and changes and trends for the last three years were examined for plausibility. Cause-specific mortality distributions were calculated for each of the three years and compared for consistency, and annual numeric and percentage changes were calculated and compared for all age groups. The typology, reasons, and proportions of Iris rejects were studied.

Results

The cause-specific mortality fractions for 20 leading causes of death showed reassuring stability. Population growth is reflected in the growing number of deaths each year, which amounted to 2% between 2017-2018 and 5% between 2018-2019. Even for non-hospital deaths, doctors at least manage to certify the cause to a major ICD group, confirming that the Philippines has a functional collection system for mortality data and that Iris is working well. Further, the timeliness of coded data is greatly enhanced.

Most of the Iris rejects fall into the 'code' category, while a tiny percentage falls into 'Acme May Be'. Code rejects mean a specific code is unavailable for a reported cause of death. 'Acme may be' reject means the decision tables recognize some causal relationships as unsure and refer for nosologist review.

Conclusions

This study demonstrates that the Philippine mortality collection system functions well and the PSA successfully runs Iris. The data compiled in the standard annual tables are timely and of adequate quality. However, further improvement in the utility of the data will be attained as the certification practices improve.

Introduction

Reliable mortality statistics are crucial for public health, medical research, evaluating interventions and setting health priorities (Phillips 2015). The underlying cause of death, which is the disease or injury that initiated the train of morbid events leading to death, is the most important aspect of the death certificate (WHO 2016). To standardise mortality data and make them globally comparable, the International Statistical Classification of Diseases and Related Health Problems (ICD) was developed and adopted by all World Health Organization (WHO) member countries (WHO 2016). The ICD contains rules on how the collected cause of death data should be coded. Consequently, coders must be trained in ICD and apply its coding rules (WHO 2016).

In the Philippines, like in most countries, the source of cause of death data is the medical death certificate, and around 90% of the deaths are registered (PSA 2021). In 2016, the Philippines Ministry of Health joined the Bloomberg Philanthropies Data for Health (D4H) Initiative to improve the quality of cause of death data, allowing them to make informed decisions regarding policy and health programs (D4H 2019). As a partner of this Initiative, D4H has assisted the Philippine Statistics Authority (PSA) in implementing Iris, an automated coding software program which allows death records to be coded according to ICD-10 standards. Before the introduction of automated coding, 30 coders in the Vital Statistics Unit at the PSA annually coded approximately 580,000 death certificates, routinely taking two to three years to produce the cause of death statistics for the country. Manual coding is associated with increased workloads for the coders and results in untimely, erroneous and inconsistent coded data (Lu, Lee et al. 2000, Harteloh 2020).

Iris automated mortality coding software

Iris is a software for automatic coding of multiple causes of death and for the selection of the underlying cause of death (Iris 2022). The Iris system, managed by the German Federal Institute of Drugs and Medical Devices (BfArm), is free to download and provides a consistent application of ICD coding rules and improves international comparability. Iris coding software is governed and maintained by a user group including the countries who use Iris. All mortality coding rules included in the software are the decisions of the Mortality Reference Group (MRG) of the World Health Organization. Iris automated coding software is used by many countries in the European Union. The Philippines is the first country in Asia to implement Iris.

Iris is language independent provided the included dictionary is translated and populated with local diagnostic expressions. All entries on the death certificate are assigned an ICD-10 code and the selection of the underlying cause of death is guided by a set of overarching principles developed by the WHO and outlined in Volume 2 of the ICD-10 (WHO 2016). Although the selection of the underlying cause of death and the corresponding ICD code is mostly done automatically by Iris, there will always be a certain number of death certificates that cannot be solved and coded by Iris and hence, are rejected. This can be due to spelling or other simple errors on certificates that can easily be corrected and re-fed into Iris. The ICD-10 classification and coding rules for selection of an underlying cause of death are reviewed regularly by the WHO Mortality Reference Group (MRG) with updates implemented annually. These ICD updates are

implemented into Iris on annual basis and therefore the cause of death coding practices with Iris are up to date (Harteloh 2020, Iris 2022).

In September 2016, D4H together with the Australian Bureau of Statistics (ABS), who also use the Iris software, visited the Vital Statistics Unit at PSA to first develop a roadmap towards Iris implementation and to verify that the basic ICD knowledge and information technology (IT) infrastructure the pre-conditions for Iris were in place. A clear understanding of the registration and data collection process was established through the development of business process maps. Based on these, several key changes were implemented to the civil registration and vital statistics (CRVS) system, most significantly that PSA's Regional Offices became responsible for encoding all the information on the death certificates so that these could be entered directly into the primary, central database – the Disseminated Vital Statistics System (DVSS). Some internal processes in the Vital Statistics Unit were also clarified and changed, and coders were trained in the WHO ICD rules for selecting the underlying cause of death, including how to use the mortality decision tables. Mortality decision tables are a set of tables originally developed by the National Centre for Health Statistics (NCHS), USA to help coders easily understand causal relationships and apply mortality coding rules. Together with the IT team, the Iris process was mapped (**Figure 1**), and changes made to the DVSS to enable the database to store the data in a different format, compatible with Iris. A PSA programmer wrote an interface program to allow the import of data into Iris from DVSS and export of Iris coded data back to DVSS for storage.

Figure 1 The flow of data from DVSS to Iris and back

Once this was all operational, a full pre-testing of Iris and the work processes, including those of the interface program, was completed in April 2017 by D4H, with a number of issues resolved to reduce the number of Iris rejects.

After the pre-test, a formal five-day training on Iris automated coding software was conducted in June 2017 by the D4H Initiative, covering (i) the Iris module; (ii) the DVSS – Iris – DVSS interface program module; (iii) the administrative module, and; (iv) the ICD module. Following training, participants were able to:

a. Understand the different operations of Iris.
b. Use Iris in both text (user enters diagnostic text into Iris) and code entry (The user enters ICD codes) modes.
c. Use DVSS-Iris interface program to transfer death certificate data into Iris and back.
d. Attend successfully to the different types of Iris rejects.

The existing DVSS program with the help of interface program transfers the death certificate data into Iris and the Iris coded data back into DVSS.

This study reviews the Philippines' cause of death data from 2017 to 2019 and evaluates the consistency and quality of the data for major disease groups.

Objectives

The Iris implementation was evaluated to ensure that there are no significant inconsistencies in the data and that they reflect as closely as possible the health status and mortality pattern of the Philippine population and to ensure that the Iris-coded mortality data were of sufficient quality to be released and disseminated.

Methods

Death certificate data from 2017 to 2019 were analysed and evaluated for obvious errors and inconsistencies. Cause of death trends were examined for plausibility. Cause-specific mortality distributions were calculated for each of the three years and compared for consistency, and annual numeric and percentage changes were calculated and compared for all age and sex groups. The typology, reasons, and proportions of Iris rejects were studied. Cause-specific mortality distributions were calculated for each of the three years and compared for consistency, annual numeric and percentage changes were calculated and compared for all age groups. The assessment report and summary tables focus on the 20 leading diseases which alone are responsible for 88% of all deaths in the Philippines.

Results

Across the three years, 579237, 590709, and 620414 deaths were reported (57% males) for 2017, 2018 and 2019 respectively.

Figure 2 Number of deaths ranked for the five leading causes of deaths from 2017 to 2019

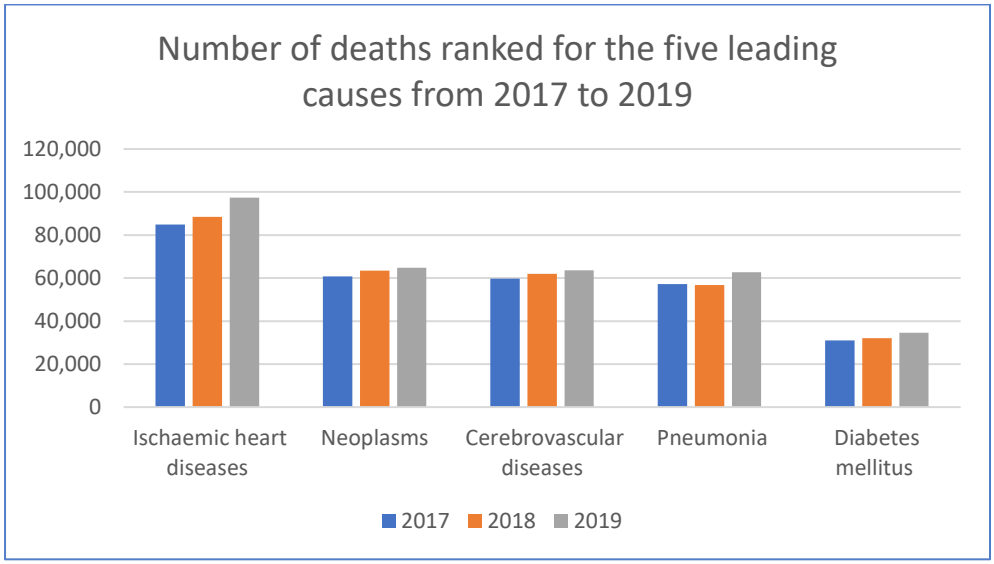
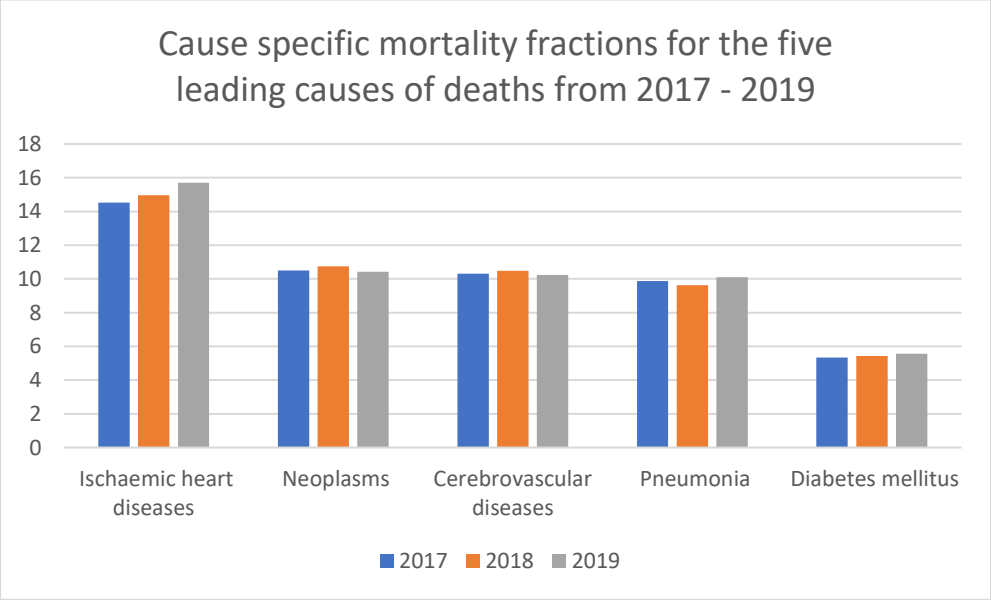


Table 1 (See annexure 1) shows the total number of deaths as well as what were the 20 leading causes of death in the Philippines for the last three years. **Figure 2** explains the five leading causes of death during the same period. Population growth is reflected in the growing number of deaths each year, which amounted to 2% between 2017-2018 and 5% between 2018-2019. In a country at the development stage as the Philippines, one would expect that the non-communicable diseases such as heart diseases, cancers, cerebrovascular and diabetes would dominate the COD distribution. This was exactly the case for each year where they consistently accounted for more than half of all deaths, while communicable diseases such as Pneumonia and tuberculosis (TB) being less than 15%. Transport accidents and Assaults, both external causes, each accounted for under 2 % of all deaths.

None of the changes in the 2018-2019 period seemed surprising except for the decrease in Assaults (grouped under 'All other external causes'), which was even stronger between 2017-2018.

Figure 3 Cause specific mortality fractions for the five leading causes of deaths from 2017 to 2019



As per **Table 2** (Annexure 2), the cause-specific mortality fractions (CSMF) for 20 leading causes of death showed reassuring stability. **Figure 3** shows the CSMF of the five leading causes of death. Even for non-hospital deaths, doctors manage to certify the cause to a major ICD group, confirming that the Philippines has a functional collection system for mortality data and that Iris is working well. Further, the timeliness of coded data is greatly enhanced meaning PSA can publish previous year's data by the November the following year.

Of the 620,414 people who died in 2019, 57% were males. Data showed that men and women die from similar diseases apart from some specific conditions related the reproductive system and those affected by

lifestyle differences and risk-taking behaviour. The only leading disease where more women die is Neoplasms, due to breast cancer and cancers of the reproductive system.

In the Philippines, 41% of infant deaths were early neonatal 14% were late neonatal, and 45% were post-neonatal, corresponding to expectations. In 2019, 21,723 children in the Philippines died before reaching their first birthday, this number has been growing steadily in line with the total population (**Table 3**, Annexure 3). Registered infant deaths account for 3% of all deaths. Three major cause groups, Conditions in the perinatal period, Congenital malformations, and Diseases of the respiratory system account for 80% of all infant deaths. This has not changed since 2017.

Overall malignant cancers claimed 68,566 lives in 2019, an increase of 7% in relation to 2017, while the share of cancer deaths have remained around 10% of total deaths. A couple of common cancers that according to the data seem to have increased significantly since 2017 are cervix, colon and rectum cancers are likely related to population ageing (Pilleron, Soto-Perez-de-Celis et al. 2021).

In 2019, cancer deaths increased by 7% compared to 2017, while the share of cancer deaths has remained around 10% of total deaths. Common cancers that seem to have increased since 2017 are cervix (3.54%), colon (8.60%) and rectum cancers (1.68%), likely related to population ageing (Pilleron, Soto-Perez-de-Celis et al. 2021).T

The typology of Iris rejects

When the information provided to Iris is not sufficient to identify a COD, the record is rejected, and manual intervention is needed. Most records are rejected because of minor errors that can easily be solved and corrected by the coder, and then the record is re-submitted to Iris. At PSA, Iris is run on individual PCs, and therefore it is not easy to study the typology pattern of all Iris rejects. However, in 2018 it was still possible to study several batch-processing lots to identify some common types of rejects. Most of the rejects fall into the ‘code’ category, while there was a very small percentage falling into ‘Acme May Be’. Code rejects mean that a specific code is not available in the dictionary for a diagnosis written in the death certificate. This may be due to different expressions of diagnoses for which the dictionary and the standardization tables cannot match a specific ICD code. ‘Acme may be’ reject means the acme decision tables recognizes some causal relationships as unsure or undecided and then an expert coder will have to review the record for further processing.

Discussion

The extensive use of mortality data for public health programmes and research purposes has led to the need to improve the accuracy of cause-of-death statistics from time to time. The quality of mortality data primarily depends on the quality of cause of death certification and coding (Rampatige, Mikkelsen et al. 2014).

This study was conducted to ensure that the Iris-automatically coded mortality data in the Philippines were of sufficient quality to be released and disseminated. Death certificate data from 2017 to 2019 were analysed and evaluated for obvious errors and inconsistencies. Cause of death trends was examined for plausibility.

Cause-specific mortality distributions were calculated for each of the three years and compared for consistency, annual numeric and percentage changes were calculated and compared for all age groups. This consistency check of mortality pattern was important since some deviations of major causes have been reported in other countries who implemented Iris automated coding (Vallmuur, Walker et al. 2002, Harteloh 2020). The assessment report and summary tables focus on the 20 leading diseases which alone are responsible for 88% of all deaths in the Philippines. As the Philippine population is still growing rapidly, the number of deaths is also increasing annually. This together with population ageing, makes it difficult to depend on raw numbers to assess changes and trends. In future assessments, it is recommended that PSA, in addition to the provided tables, also prepares standardised death rates for the 20 leading diseases. This would allow the separation of these two drivers on observed changes.

Regarding the leading cause of death, there is a decline in the deaths due to assaults during 2018 – 2019 compared with 2017 – 2018. This should be investigated further as it is unlikely that a policy change would have caused it. It is recommended that if there is no obvious explanation for this, PSA should pursue this trend and investigate what type of assaults are responsible for the decrease and what age groups. It could be fictitious and caused by changes in how police or coroner's report these deaths, in which case a technical note should be added to the disseminated table. Of the 8,830 persons who died from assaults 91% were males, which is not uncommon in this category.

Some of the smaller changes that occurred can be explained in part by population ageing. For instance, the increases in Ischemic heart diseases (10.17%), Pneumonia (510.37%) and the category (Remainder of the nervous system) that includes dementia and degenerative brain diseases. The 10% increase in Pneumonia in likely to be a result of the growing numbers of both infants and elderly people who die from this. Pneumonia is the second most common COD for the 75+ and the disease that causes most deaths among the very old (+80) and in post-neonatal children in the Philippines.

On the other hand, when specific diseases are investigated e.g. Alzheimer the numbers, even for the oldest, are low, suggesting that this disease is under-diagnosed and under-reported in the Philippines. Even in the highest age group 80-84 years, less than 200 people are reported to die from this disease in the Philippine in 2019, which in many other countries is among the leading diseases. This suggests that doctors do not diagnose it correctly as an underlying cause of death.

The increasing percentage of deaths due to common cancers of old age is likely related to population ageing.

The use of Iris by the Philippines Statistics Authority (PSA) helped them to strengthen the centralised coding practice. Compared to manual coding automated coding also increased the consistency of coded data by the

coders. The use of Iris also enhanced the comparability of cause of death data by using a product which is widely used internationally.

This study demonstrates that the Philippine mortality collection system functions well and the PSA successfully runs Iris. The data compiled in the standard annual tables are timely and of adequate quality. However, further improvement in the utility of the data will be attained as the certification practices improve.

Conclusions & Recommendations

The year 2023 is the seventh year that all the mortality data collected by the Civil Registration system in the country have been automatically coded with Iris. Each year before dissemination, the data have undergone a thorough assessment to ensure that they correctly describe the population's health status and can be used for policy purposes to make further improvements. The previous assessments were also important to ensure that the implementation of Iris was progressing well, and that coders and supervisors had the necessary capabilities to operate the software and that the coded output produced plausible and reliable data.

Based on the statistical tables provided for 2019 and analysis done on the data, including those from the two previous years (2017 and 2018), we conclude that the Philippine mortality collection system functions well and that the Vital Statistics Division at PSA is fully able to run Iris and code manually the rejects. The data compiled in the standard annual tables are of sufficient quality to be used for policy. However, further improvement in the utility of the data will be attained as the certification practices improve in hospitals and for home deaths (Hart JD 2020). This will allow PSA to compile the data in increasing detail and provide policymakers with the information they need to develop more focused preventive policies.

It is recommended that the Iris software be used as the key tool for cause of death coding in the Philippines Statistical Authority office. Iris does not replace the skill of mortality coding, but instead enables coders to focus on difficult cases.

For consistency of process, it is recommended that in future perinatal deaths are coded using Iris.

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Annexure 1

Table 1 Number of Death ranked for the 20 leading causes from 2017 to 2019 and % change from year to year

Cause of Death	2017	2018	2019	% change	
				2017-2018	2018-2019
ALL AGES	**579,237**	**590,709**	**620,414**	**1.98**	**5.03**
Ischaemic heart diseases	84,912	88,433	97,427	5.13	10.17
Neoplasms	60,807	63,454	64,728	4.35	2.01
Cerebrovascular diseases	59,774	61,959	63,532	3.66	2.54
Pneumonia	57,210	56,815	62,706	-0.69	10.37
Diabetes mellitus	30,932	32,106	34,557	3.80	7.63
Hypertensive diseases	26,471	26,836	27,762	1.38	3.45
Chronic lower respiratory diseases	24,818	24,820	26,574	0.01	7.07
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	20,680	21,918	23,093	5.99	5.36
Respiratory tuberculosis	22,523	22,103	22,566	-1.86	2.09
Other heart diseases	22,134	20,042	20,411	-9.45	1.84
Remainder of diseases of the genitourinary system	15,717	16,029	17,247	1.99	7.60
Transport accidents	11,399	12,536	12,797	9.97	2.08
Certain conditions originating in the perinatal period	11,054	11,768	11,260	6.46	-4.32
All other external causes	11,567	10,902	10,914	-5.75	0.11
Diseases of the liver	9,425	9,968	10,354	5.76	3.87
Remainder of diseases of the digestive system	9,574	9,115	9,367	-4.79	2.76
Assault	11,845	9,916	8,830	-16.29	-10.95
Remainder of diseases of the nervous system	7,057	7,351	8,227	4.17	11.92
Remainder of endocrine, nutritional and metabolic diseases	7,128	6,903	7,083	-3.16	2.61
Remainder of diseases of the respiratory system	5,554	5,928	6,457	6.73	8.92

Annexure 2

Table 2 Cause-specific mortality fractions of 20 leading causes of death 2017 – 2019

Cause of Death	2017	2018	2019
Ischaemic heart diseases	14.52	14.97	15.70
Neoplasms	10.50	10.74	10.43
Cerebrovascular diseases	10.32	10.49	10.24
Pneumonia	9.88	9.62	10.11
Diabetes mellitus	5.34	5.44	5.57
Hypertensive diseases	4.57	4.54	4.47
Chronic lower respiratory diseases	4.28	4.20	4.28
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	3.57	3.71	3.72
Respiratory tuberculosis	3.89	3.74	3.64
Other heart diseases	3.82	3.39	3.29
Remainder of diseases of the genitourinary system	2.71	2.71	2.78
Transport accidents	1.97	2.12	2.06
Certain conditions originating in the perinatal period	1.91	1.99	1.81
All other external causes	2.00	1.85	1.76
Diseases of the liver	1.63	1.69	1.67
Remainder of diseases of the digestive system	1.65	1.54	1.51
Assault	2.04	1.68	1.42
Remainder of diseases of the nervous system	1.22	1.24	1.33
Remainder of endocrine, nutritional and metabolic diseases	1.23	1.17	1.14
Remainder of diseases of the respiratory system	0.96	1.00	1.04

Annexure 3

Table 3 Leading causes of infant deaths 2017 – 2019

Cause of Death	2017		2018		2019	
	Number	%	Number	%	Number	%
Total	20,311	3.51	21,019	3.56	21,723	3.5
Certain conditions originating in the perinatal period (P00-P96)	11,008	54.20	11,766	55.98	11,259	51.83
Congenital malformations, deformations and chromosonal abnormalities (Q00-Q99)	2,851	14.04	2,875	13.68	3,409	15.69
Diseases of the respiratory system (J00-J98)	2,383	11.73	2,238	10.65	2,524	11.62
Certain infectious and parasitic diseases (A00-B99)	1,571	7.73	1,752	8.34	2,179	10.03
Diseases of the nervous system (G00-G98)	598	2.94	619	2.94	587	2.70
Symptoms, signs and abnormal clinical and laboratory findings, NEC (R00-R99)	581	2.86	575	2.74	570	2.62
Endocrine, nutritional and metabolic diseases (E00-E88)	353	1.74	315	1.50	308	1.42
External causes of morbidity and mortality (V01-Y89)	243	1.20	253	1.20	305	1.40
Diseases of the digestive system (K00-K92)	208	1.02	191	0.91	221	1.02
Diseases of the circulatory system (I00-I99)	214	1.05	181	0.86	146	0.67
Diseases of the blood and blood forming organs and ceratin disorders involving the immune mechanism (D50-D89)	127	0.63	128	0.61	119	0.55
Neoplasms (C00-D48)	94	0.46	91	0.43	80	0.37
Diseases of the genitourinary system (N00-N98)	32	0.16	31	0.15	16	0.07
Diseases of the ear and mastoid process (H60-H93)	-	-	4	0.02	-	-