

Preliminary Evaluation of Seafarers Health Care and Determination of Predictors of Illness

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Future Care, Inc. and The Yale Occupational & Environmental Medicine Program

In early 2012 Christina DeSimone, CEO of Future Care, Inc., an internationally recognized medical managed care specialist for seafarers, determined that there was an immediate need for an analysis of the incidence of illness and injury among this singular group, with particular emphasis on their special risk factors. Ms. DeSimone pioneered and developed the original managed care solutions which have evolved into the industry's current medical cost containment techniques. Her ultimate goal is to draw conclusions that will assist in the development of improved programs for the prevention of illness and injury onboard and the efficient treatment of seafarers' medical issues when these do occur. Her vision is to increase the health and well-being of seafarers, an underserved and understudied population that plays a vital role in the world economy.

Ms. DeSimone approached the renowned medical research center, Yale University School of Medicine; in particular, Rafael Lefkowitz, MD; Carrie Redlich, MD, MPH and Martin Slade, MPH, all of the School's Department of Occupational & Environmental Medicine. Yale University School of Occupational & Environmental Medicine Program shares this vision and is excited to lead this very important study.

There are upwards of 1.3 million seafarers working around the world. They represent a vulnerable population typically working far from home under stressful and dangerous working conditions. These workers tend to come from poor countries with limited medical resources, further impacting their overall wellbeing.

At the Maritime Labour Convention 2006, what in effect is a Seafarers' Bill of Rights was introduced and will come into effect on August 20, 2013. As part of this Bill of Rights, ship owners and port states are required to protect their employees and to provide medical care on ship and ashore. Also included is the requirement that comprehensive statistics of accidents and diseases be kept, analyzed, published, and where appropriate, followed up by research into general trends and the hazards identified.

This Preliminary Study is based on data collected and maintained by Future Care during the course of managing the healthcare of its clients' sea-going employees, involving the medical events of over 3,500 seafarers on over 1,500 vessels, as more fully explained herein. The conclusions and observations on seafarer health contained within this preliminary work represent a valuable first step in what Future Care and Yale anticipate will be an evolving and persistent effort to review, monitor and improve seafarer healthcare. This continuing study will require expanded data on seafarer health, including information on pre-employment medical

status and information on the general health of the sea-going population, among other categories. For a detailed proposal on the substantive requirements of this proposed, expanded study, and information on financial sponsorship, please contact Ms. DeSimone or Professor Slade.

Evaluation of Seafarers' Health Care and Determination of the Root Causes of Disease and Injury

A. Introduction & Background

Providing quality healthcare to seafarers entails unique medical, logistical and economic challenges, given the geographically diverse locations, lack of continuity of care, and the potential economic consequences of individual illnesses. By necessity seafarers receive treatment and healthcare at the time of illness/injury, irrespective of whether this is in the middle of the ocean via telephonic services or in a port. Anecdotally, the medical and economic burden of illness in these workers is substantial, but there has been little research focused on this unique group of workers. A better understanding of the health problems seen in seafarers and their impact on the shipping industry should lead to improved preventive and therapeutic approaches as well as substantial cost savings to the industry.

Over the last six years, Future Care Inc., as part of its management of global medical care for ship owners, has been collecting health care and related information on medical events (illnesses and injuries) that occur among seafarers for which Future Care Inc. provides medical case management services. To date, data has been collected on medical events involving over 3,500 seafarers on over 1,500 vessels. As part of this case management program, the following information is typically available:

1. Case Information
 - a. Demographic and health information
 - b. Pre-employment medical examination data
 - c. Illness/injury: Diagnosis, date, location and type of medical services, duration of illness, and clinical outcome

2. Vessel Information
 - a. Type of vessel, crew's medical training, and inventory of medical chest
 - b. Location of vessel (proximity to care at the time of the medical event)

3. Costs
 - a. Direct cost of medical services
 - b. Related direct expenses such as agent fee and transportation costs

- c. Indirect costs including those associated with lost work days and the number of days the ship was delayed

As is typical for non-seafarer workers who receive medical services in more traditional settings, cases of illness and injury among seafarers have, to date, been analyzed largely on an individual basis, as more extensive analysis of a cohort of workers such as seafarers requires additional epidemiological data management and biostatistical support and expertise.

Future Care Inc.'s rich dataset on seafarer illness and injury provides a unique opportunity to learn more about the health of seafarers and modifiable risk factors for adverse health events and outcomes. Such information is key to both improving the health of these essential workers and also for reducing the substantial related costs.

The Yale Occupational & Environmental Medicine Program ("YALE") specializes in providing clinical and consultative services; education and research in the fields of occupational and environmental medicine. Yale's clinical activities consisted of the following:

1. Assessment of workplace hazards;
2. Analysis workers compensation, medical claims, other data;
3. Development of occupational health policies and programs;
4. Evaluation of the effectiveness of programs;
5. Compliance with OSHA other regulations; and
6. Risk assessment of exposures or events;

The current state of the limited published research conducted in this important but neglected area reveals that international seafarers, when compared with their land-based brethren, face an increased risk of injuries,¹ particularly:

¹ Ellis, N. *et. al.*, "Patterns of seafarer injuries." *Mar. Pol. Manage.* 2010.

Hansen H. L. *et. al.*, "Hospitalizations among seafarers on merchant ships." *OEM.* 2005. Iverson, R.T.B. "The mental health of seafarers: a brief review." *Act. Prob. Trans. Med.* 2011.

Kaerlev, L. *et. Al.*, "Cancer incidence among Danish seafarers: a population based cohort study." *OEM.* 2005

Jaremin, B. *et. al.*, "Myocardial infarction (MI) at the work-site among Polish seafarers. The risk and the impact of occupational factors." *Int. Mar. Health.* 2003 Schlaich, C.C. *et. al.*, "Estimating the risk of communicable diseases aboard cargo ships." *J. Travel Med.* 2009.

- Fractures, burns, crush/trap, lacerations, strains and/or /sprains and fatalities
- Gastrointestinal diseases
- Respiratory diseases (flu-like illness)
- Suicide
- Cardiovascular mortality

In 2012, this pilot study was conducted by the Yale Occupational & Environmental Medicine Program utilizing data obtained from Future Care Inc. The objectives of this pilot study were to:

1. Characterize seafarer medical events and related expenses, and
2. Determine modifiable risk factors for development of medical events.

Yale-Future Care Seafarer Health Study Overall Goals

1. Characterize the medical events and services provided
2. Characterized related medical expenses
3. Determine risk factors for the development of medical events
4. Develop interventions to reduce injury & illness

The Data

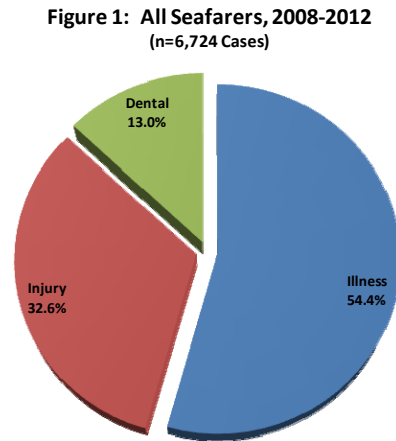
Future Care Database: Case Management and Claims:

- 6 years
- 106 companies
- 916 ships
- 3,315 seafarers
- 6,724 on-board inquiries
- 3,537 independent claims (injury, illness)
- 16,711 billed events

B. Analysis

I The quantitative data evaluated for this study was obtained from Future Care's database which spanned six years of case management and medical claims covering over 3,300 seafarers on 1,500 ships owned by 106 companies, consisting of 6,724 on-board inquiries; 3,537 independent claims (injury, illness) and 16,711 billed medical events.

Overall, 54.4% of cases were due to illness, 32.6% were the result of injury, and 13.0% were dental issues (Figure 1). Age, gender and nationality stratified distributions of diagnoses, along with their associated costs, were calculated. Results of these analyses revealed that Asians accounted for the greatest percentage of medical events (46.3%) and that 97.5% of all medical events occurred to males. Also, the vast majority (76.7%) of medical claims were incurred by seafarers 50 years of age or less. Injury and musculoskeletal claims accounted for more than half of all medical events (50.3%) with an associated direct cost of almost 14 million dollars. Cardiovascular disease, while accounting for only 4.8% of claims, had an associated direct cost of well over 5 million dollars. With regard to point of service, inpatient services accounted for only 2.4% of bills, but 40% of all charges.



II The distribution of diagnoses varied by gender and age as depicted in Figures 2 through 6 below. For example, genitourinary and neurological diagnoses accounted for a greater percentage among women than they did among men. Among older seafarers (aged 51 through 60 years of age), cardiovascular disease accounted for a much greater percentage than it did among younger seafarers (under 30 years of age).

Figure 2: Diagnoses for All Claims (total claims = 3,537)

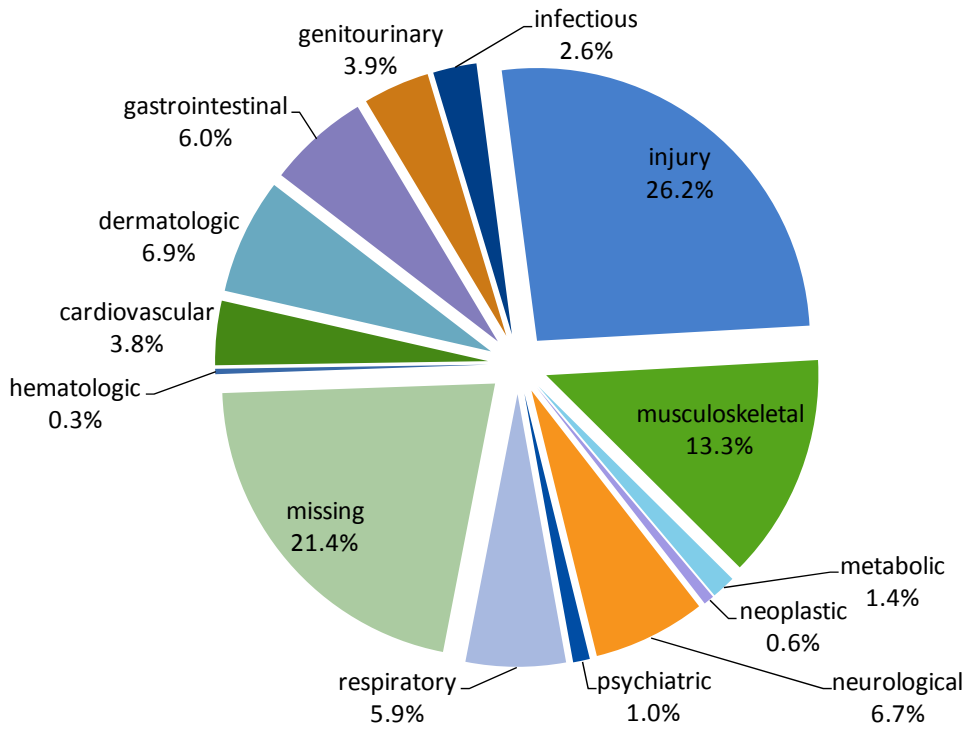


Figure 3: Diagnoses for Men (3,109 claims)

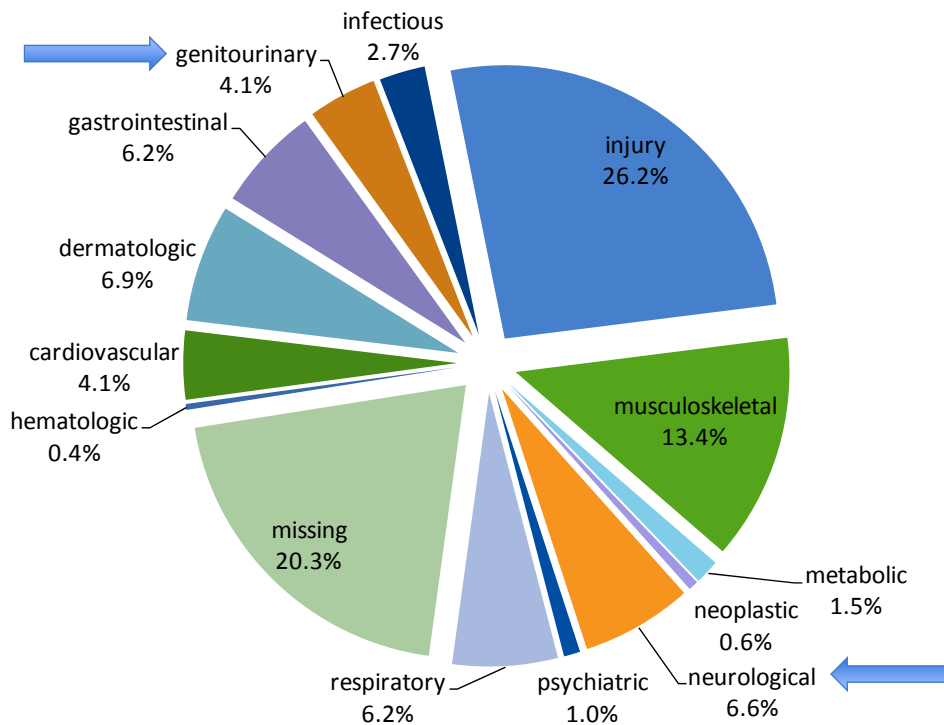


Figure 4: Diagnoses for Women (78 claims)

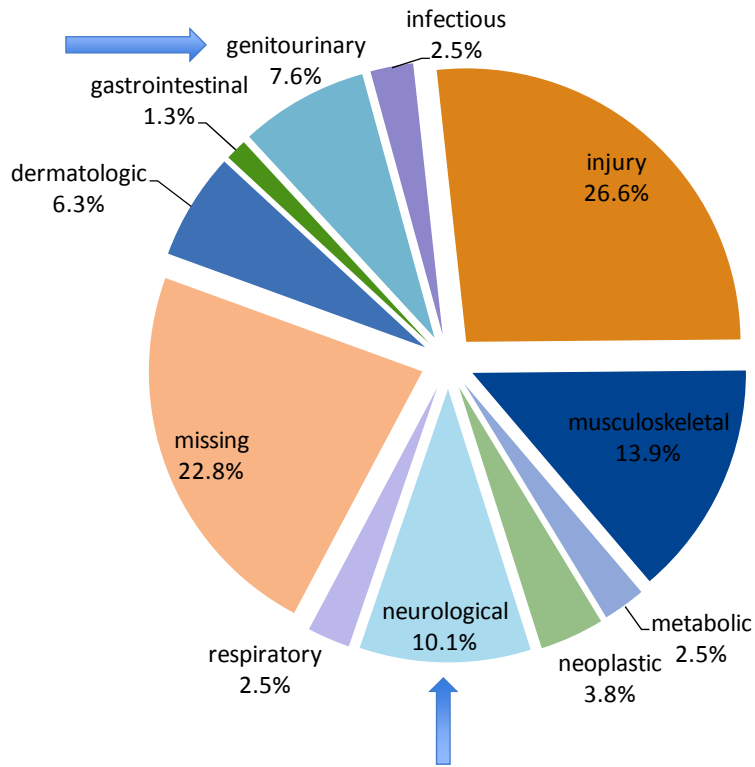


Figure 5: Diagnoses for Seafarers Under 30 Years of Age (775 claims)

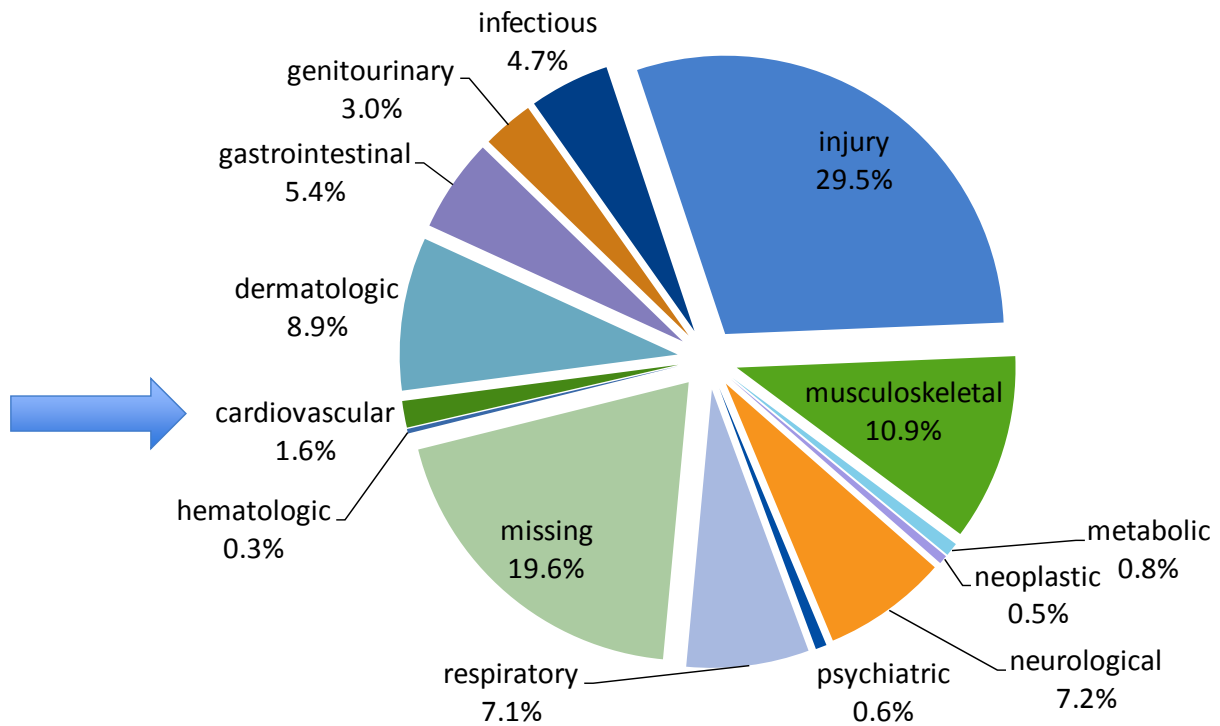
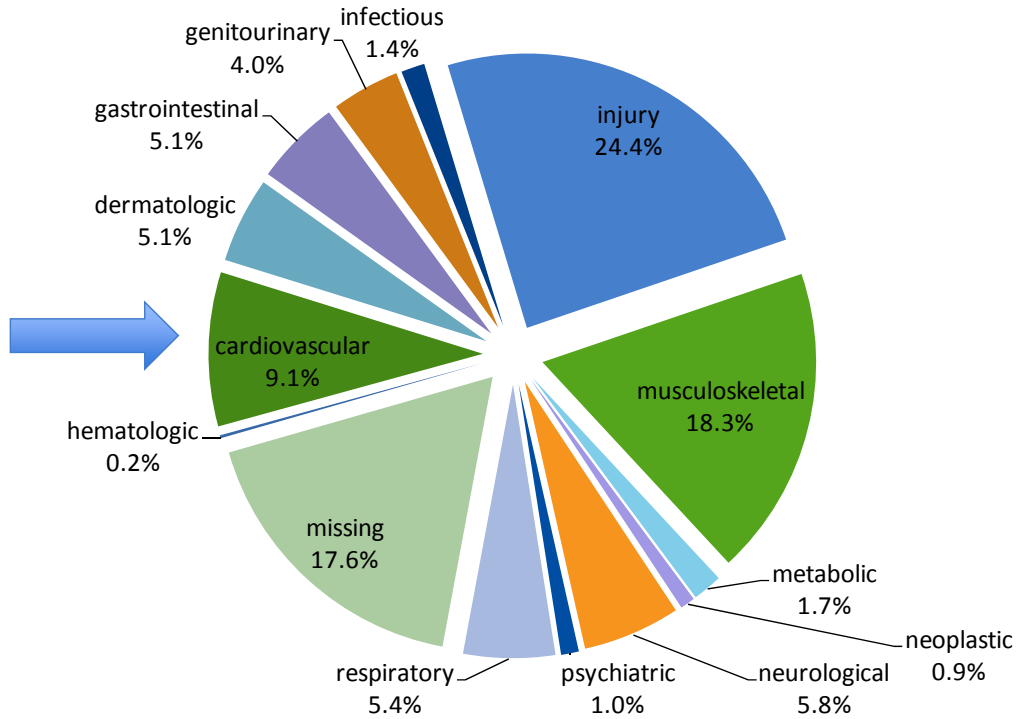


Figure 6: Diagnoses for Seafarers Aged 51 to 60 Years (775 claims)



III The number of claims, the total claim charges and the mean claim charges all varied by diagnosis, gender and age as depicted in Figures 7 through 15, which follow. It can be seen that there were relatively few claims with a neoplastic diagnosis but the mean charge for each of those claims was approximately \$170,000. With regard to age, there were generally less claims from older seafarers but these claims had higher mean charges. Almost all of the claims were for male seafarers. Additionally, the mean charge for a male claim was almost three times that of a female claim.

Figure 7: Number of Claims per Diagnosis

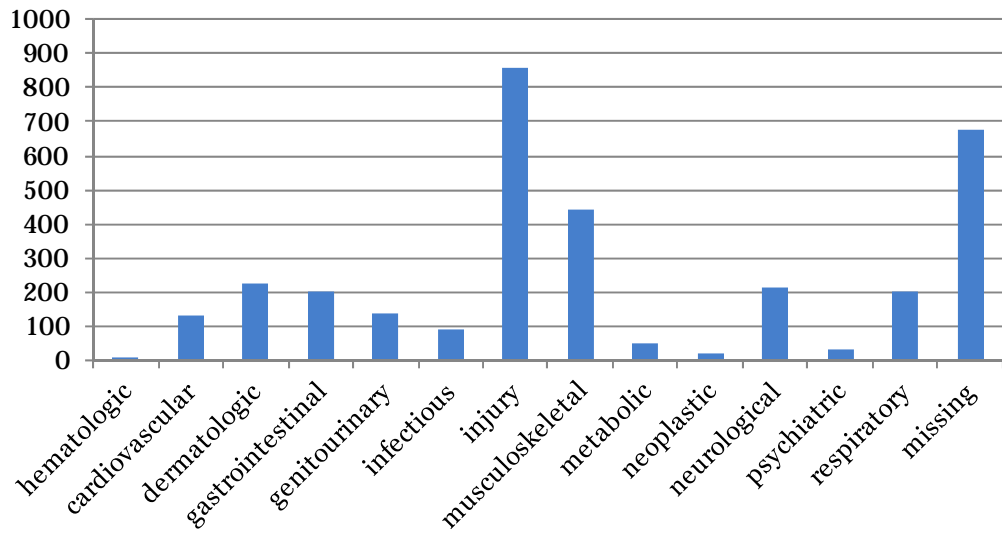


Figure 8: Total Claim Charges per Diagnosis

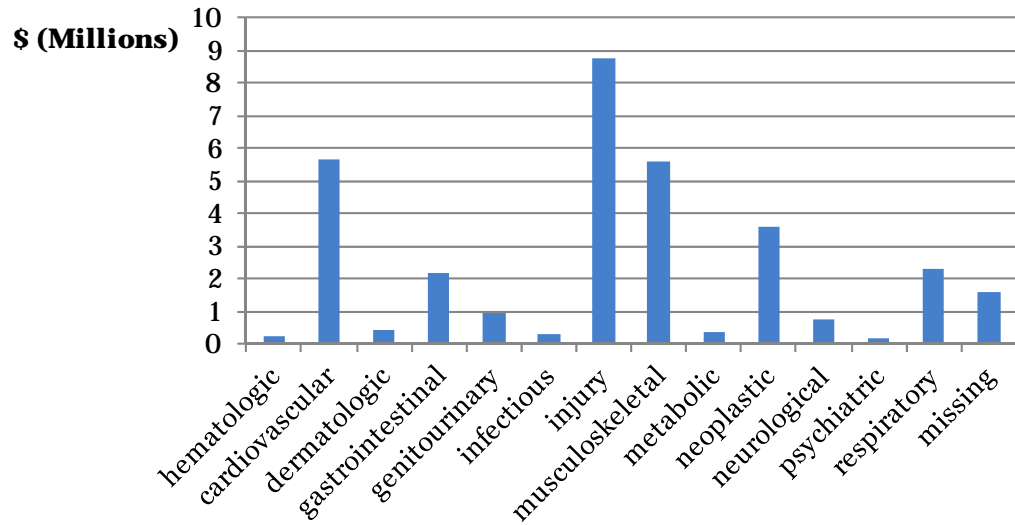


Figure 9: Mean Claim Chargers per Diagnosis

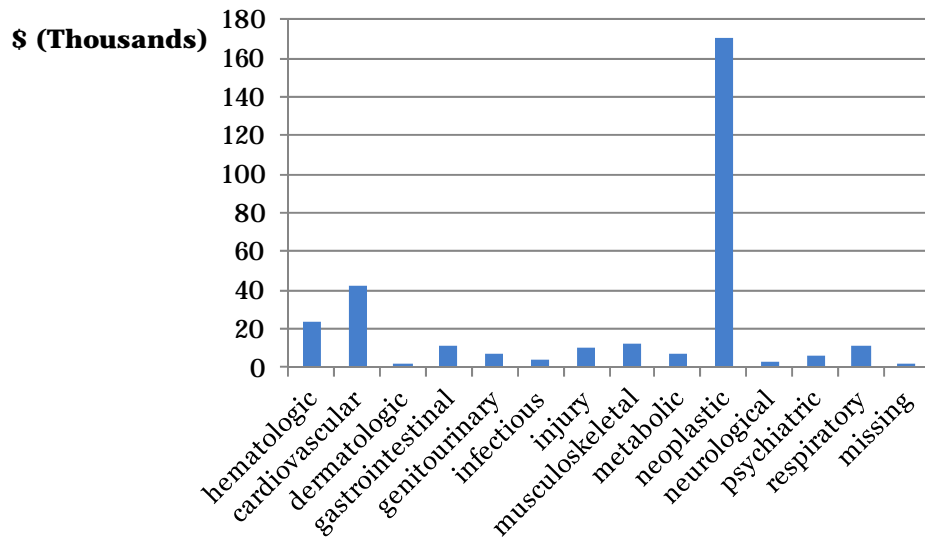


Figure 10: Number of Claims by Age

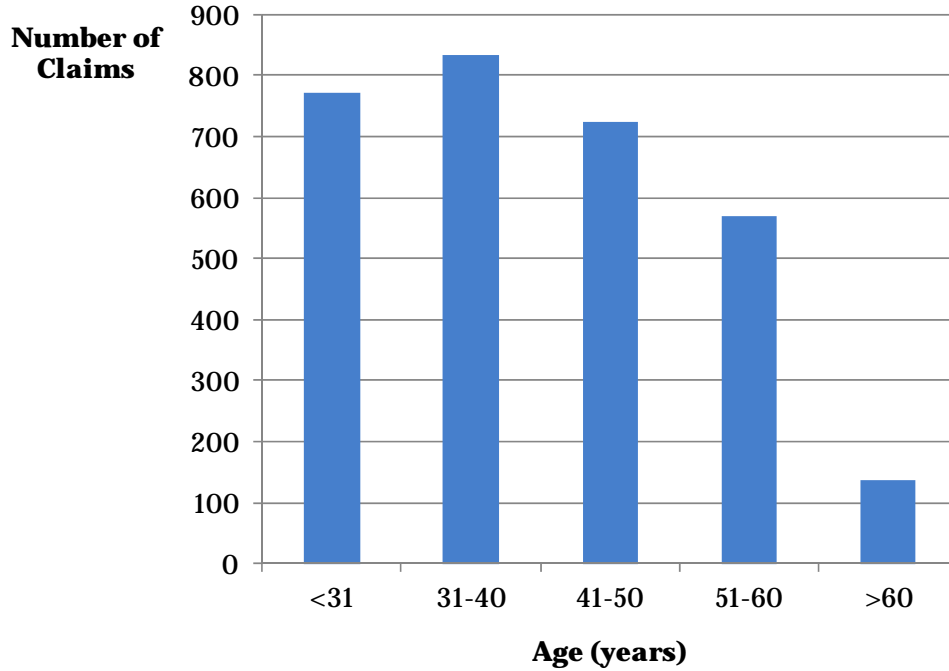


Figure 11: Total Claim Charges by Age

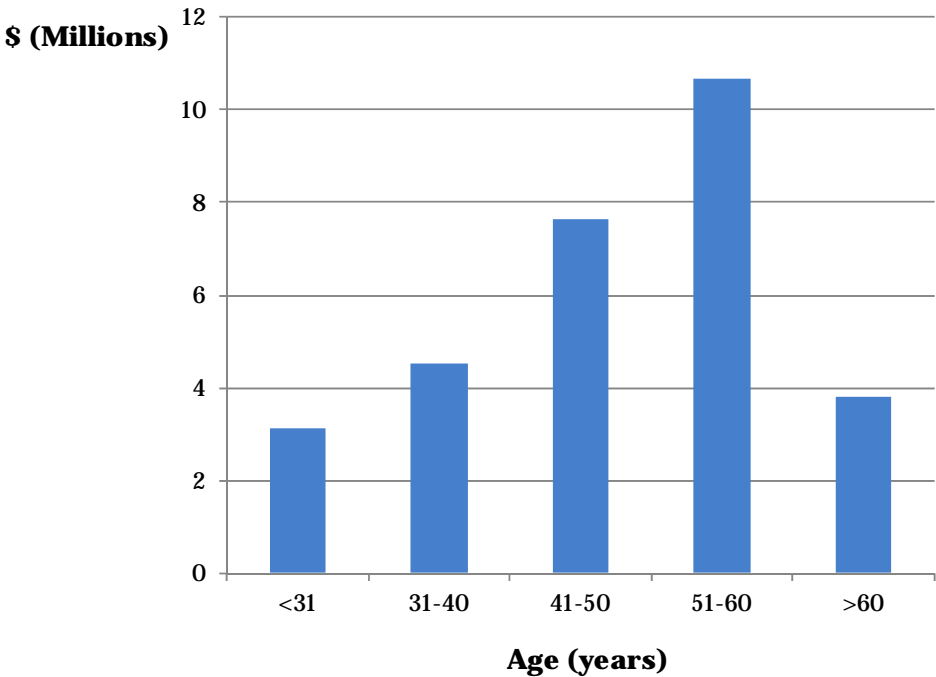


Figure 12: Mean Charges per Claim by Age

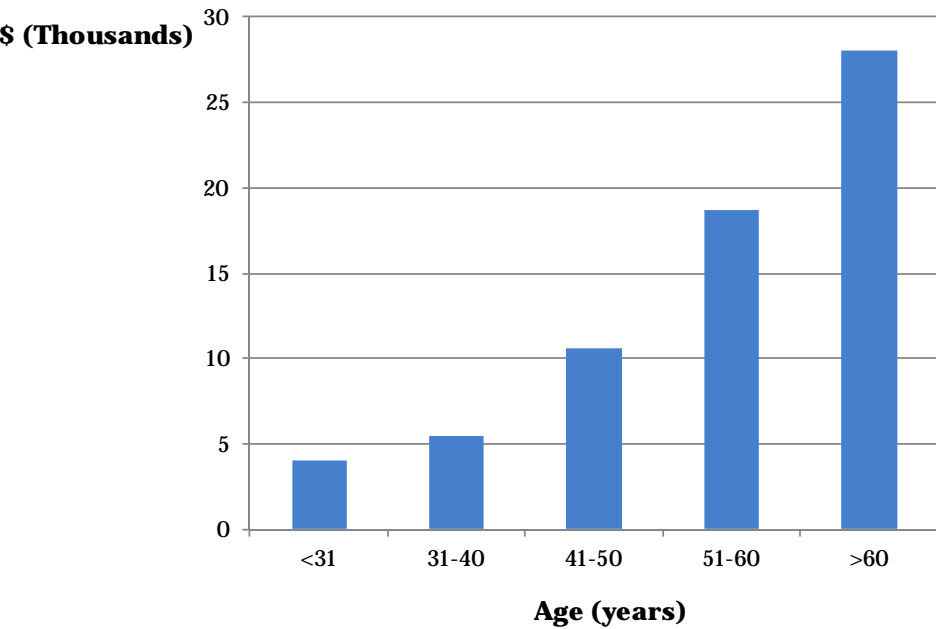


Figure 13: Number of Claims by Gender

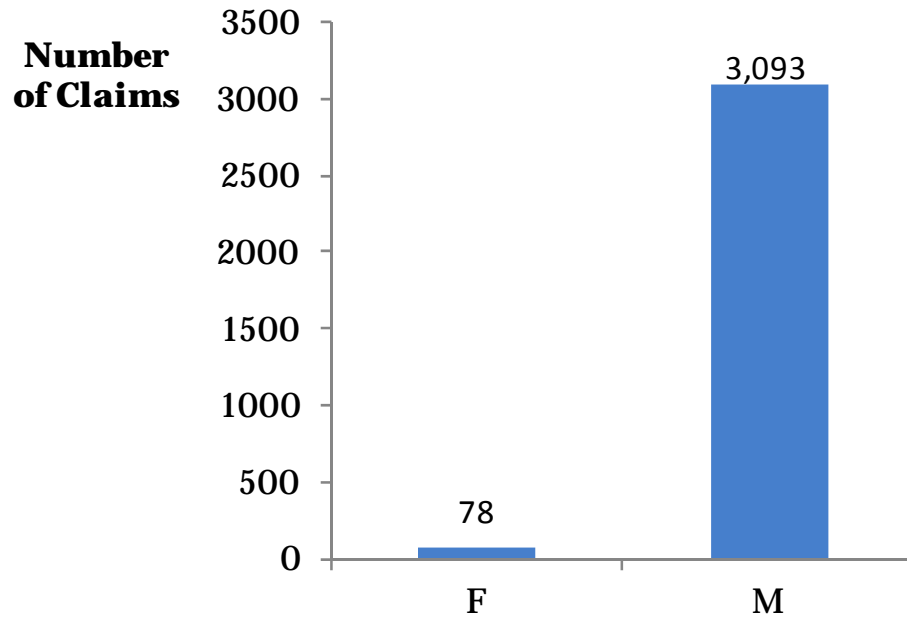


Figure 14: Total Claim Charges by Gender

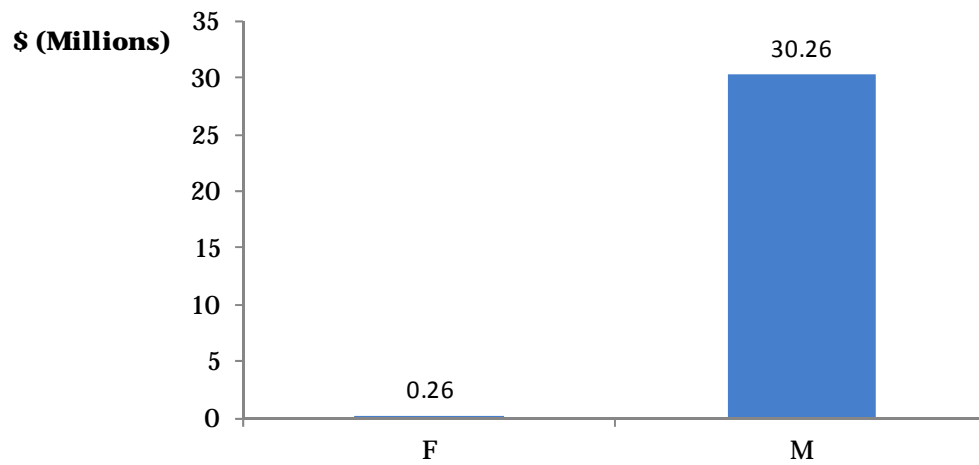
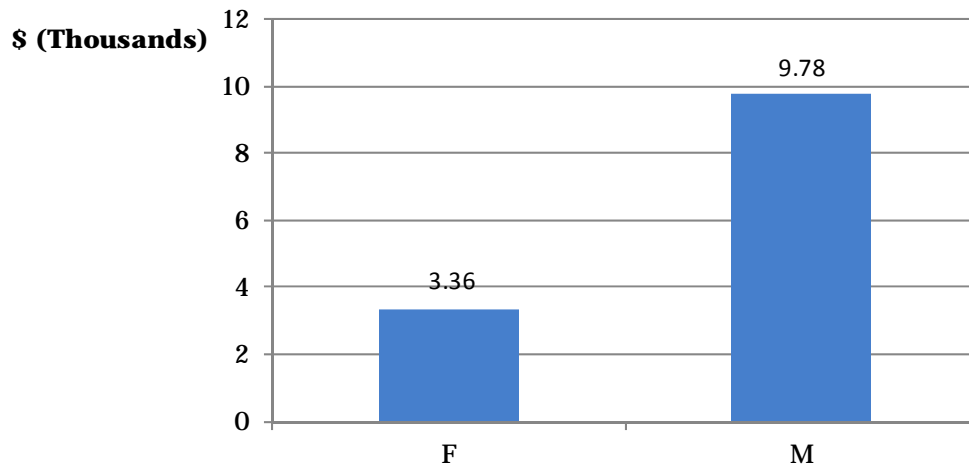


Figure 15: Mean Charges per Claim by Gender



IV The number of bills, total charges and mean charges by point of service are depicted in Figures 16 through 19 below. The most striking observation is that although inpatient accounted for only 2.4% of all bills, it accounted for 57% of all charges. This is further evidenced by the approximately 50 fold greater mean charge associated with inpatient care compared to outpatient care.

Figure 16: Number of Bills by Point of Service (n=15,778)

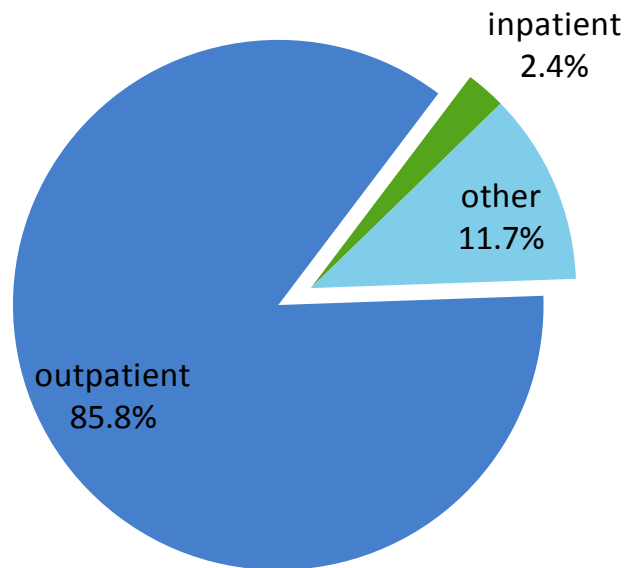


Figure 17: Total Charges by Point of Service (\$32,841,220)

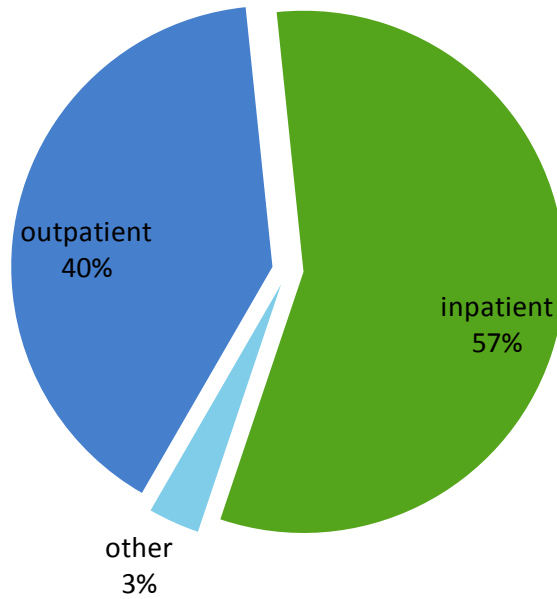


Figure 18: Total Charges by Point of Service

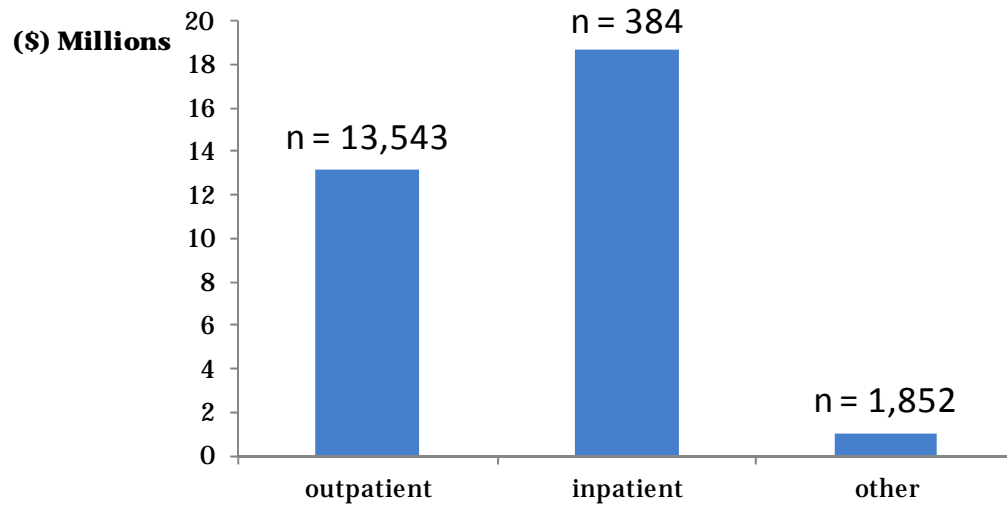
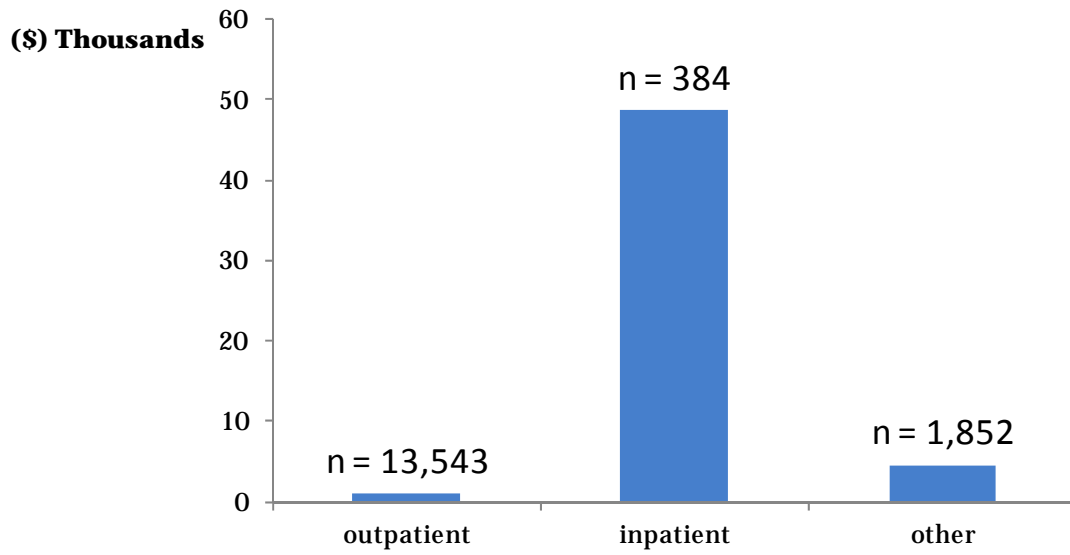


Figure 19: Mean Charges by Point of Service



V. The extent of variation by seafarer nationality can be observed even when comparing only among Asian nationalities. The distributions of cases for various Asian nationalities are depicted in Figures 20 – 32, following.

Figure 20: Chinese, 2008 –2012
(n=179 Cases)

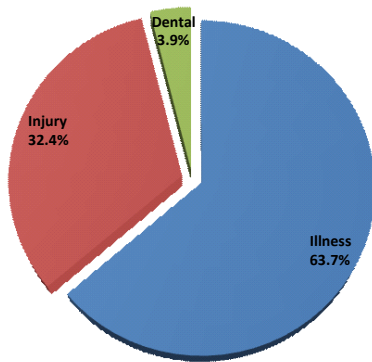


Figure 21: Filipinos, 2008- 2012
(n=1,398 Cases)

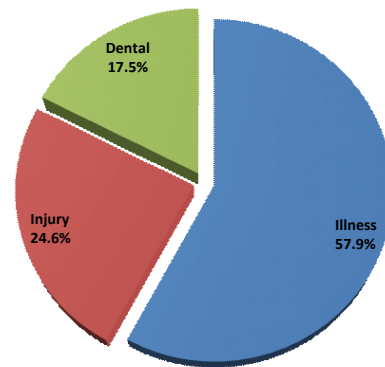


Figure 22: Indians, 2008 - 2012
(n=1,309 Cases)

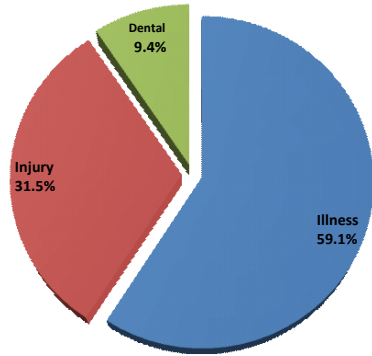


Figure 23: Sri Lankans, 2008 - 2012
(n=6 Cases)

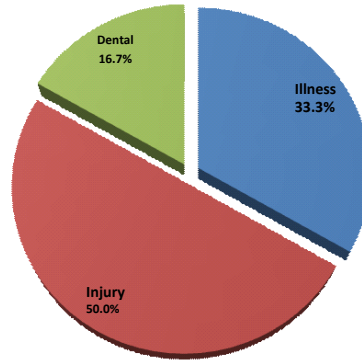


Figure 24: South Koreans, 2008 - 2012
(n=19 Cases)

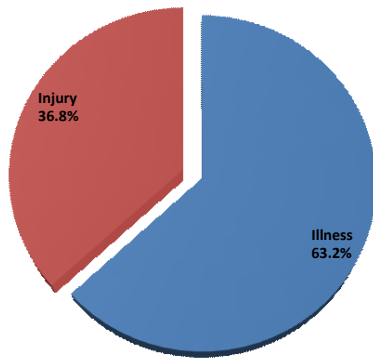


Figure 25: Singaporeans, 2008 - 2012
(n=45 Cases)

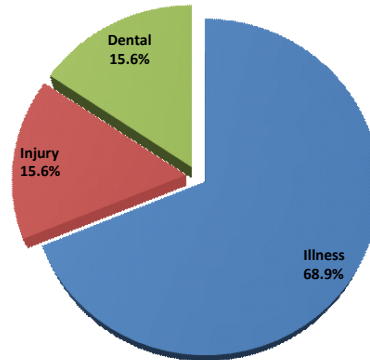


Figure 26: North Koreans, 2008 - 2012
(n=4 Cases)

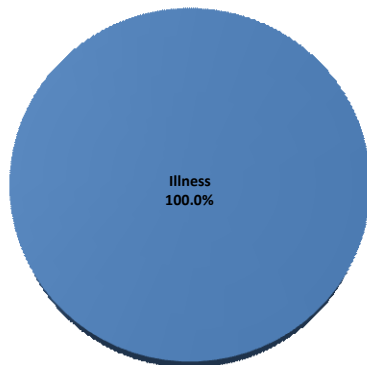


Figure 27: Myanmar, 2008 - 2012
(n=12 Cases)

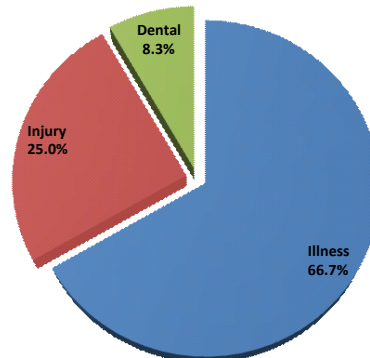


Figure 28: Malaysians, 2008 - 2012
(n=91 Cases)

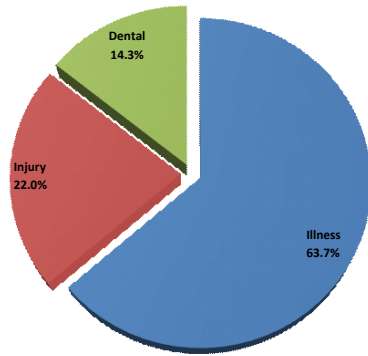


Figure 29: Koreans (unspecified), 2008 - 2012
(n=6,724 Cases)

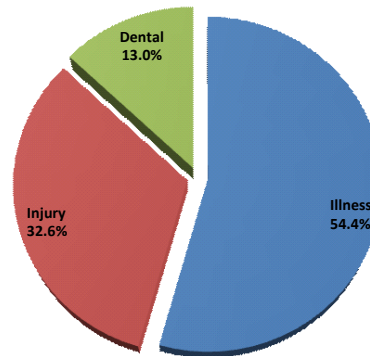


Figure 30: Japanese, 2008 - 2012
(n=2 Cases)

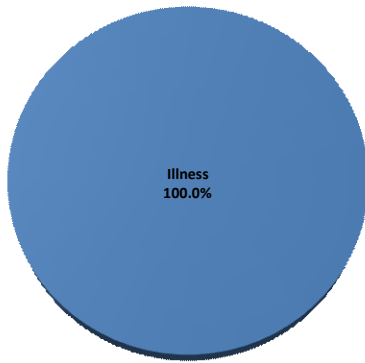


Figure 31: Indonesians, 2008 - 2012
(n=2 Cases)

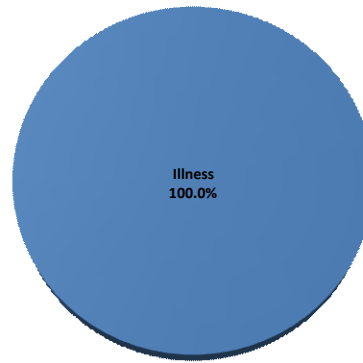
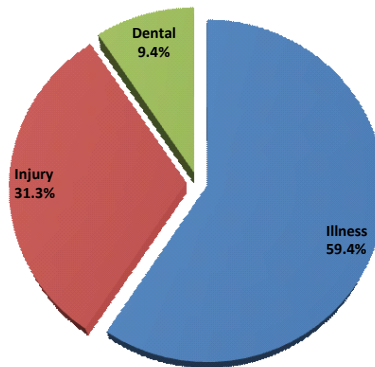


Figure 32: Bangladeshi, 2008 - 2012
(n=32 Cases)



VI As can be seen from the above Figures, the percentage of cases due to injury among Asian nationalities with at least ten (10) cases varies from 36.8% among South Korean seafarers down to 15.6% among Singaporean seafarers. Likewise, the distribution of injury types also varies among the different Asian nationalities as shown in Figures 33 – 42, as follows.

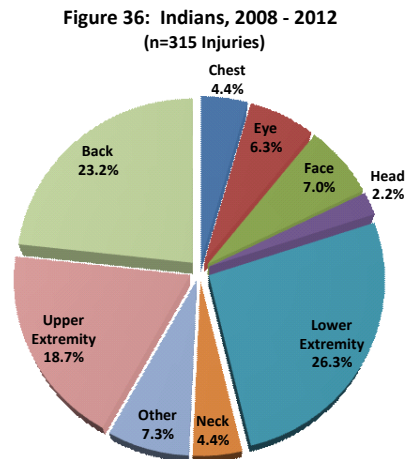
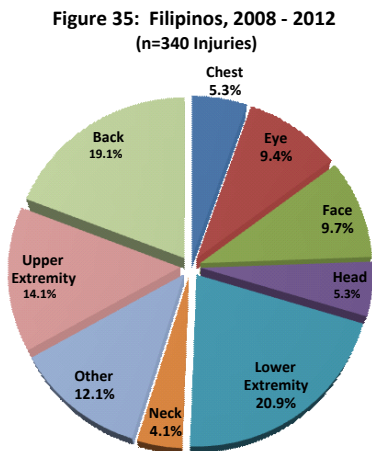
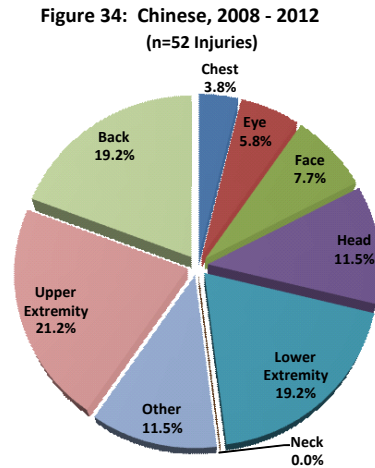
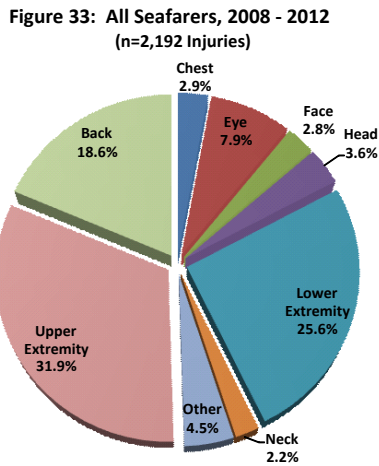


Figure 37: Sri Lankans, 2008 - 2012
(n=3 Injuries)

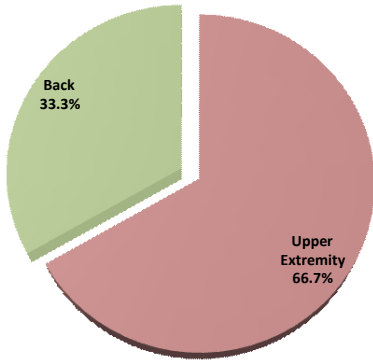


Figure 38: South Koreans, 2008 - 2012
(n=7 Injuries)

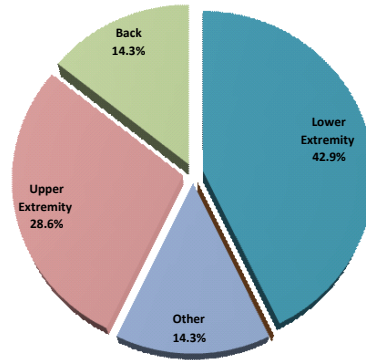


Figure 39: Singaporeans, 2008 - 2012
(n=7 Injuries)

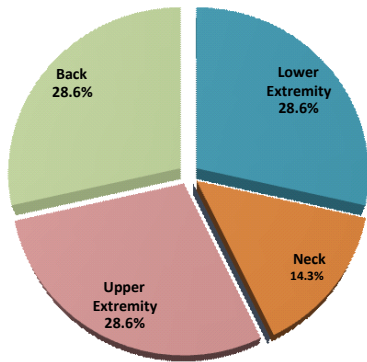


Figure 40: Myanmarse, 2008 - 2012
(n=3 Injuries)

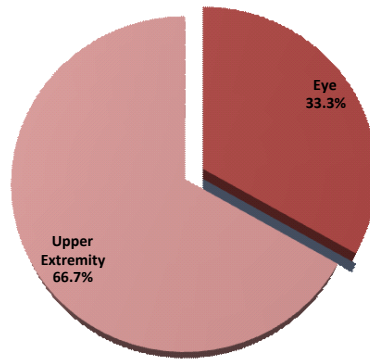


Figure 41: Koreans (unspecified), 2008 - 2012
(n=3 Injuries)

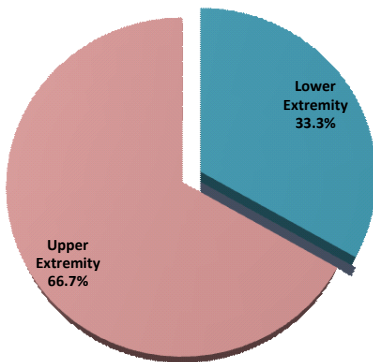
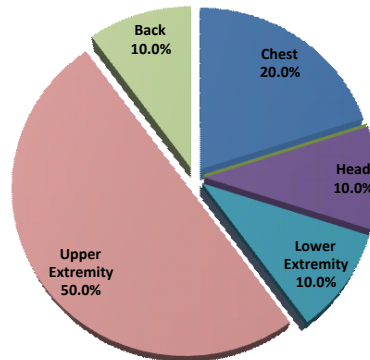


Figure 42: Bangladeshi, 2008 - 2012
(n=10 Injuries)



From these Figures it can be seen that among Asian nationalities with at least ten (10) injuries, the percentage of injuries that affect the back range from a low of 10.0% among Bangladeshi seafarers up to 23.2% among Indian seafarers. Likewise, the percentage of injuries affecting the lower extremity varies from 10.0% among Bangladeshi seafarers to 42.9% among South Korean seafarers.

VII Lastly, the distribution of illness (medical ailments) varies among the different Asian nationalities as shown below in Figures 43 – 56.

Figure 43: All Seafarers, 2008 - 2012
(n=3,658 Medical Ailments)

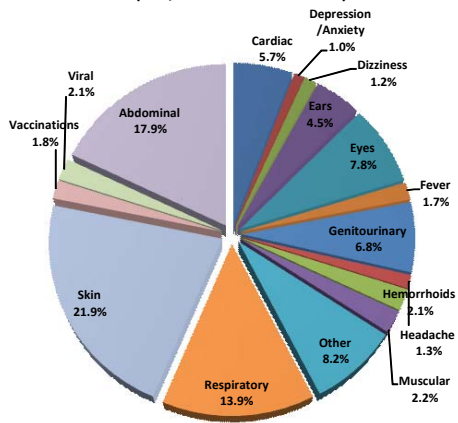


Figure 44: Chinese, 2008 - 2012
(n=123 Medical Ailments)

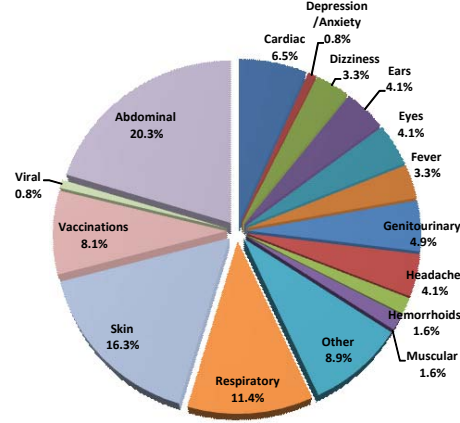


Figure 45: Filipinos, 2008 - 2012
(n=1,065 Medical Ailments)

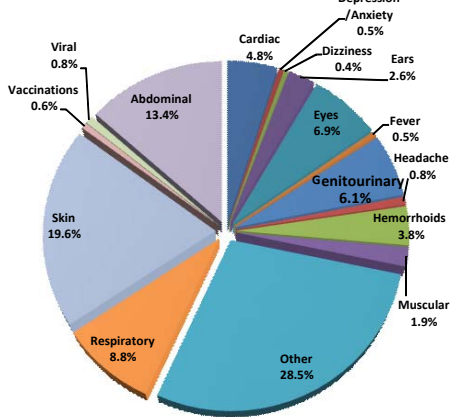


Figure 46: Indians, 2008 - 2012
(n=916 Medical Ailments)

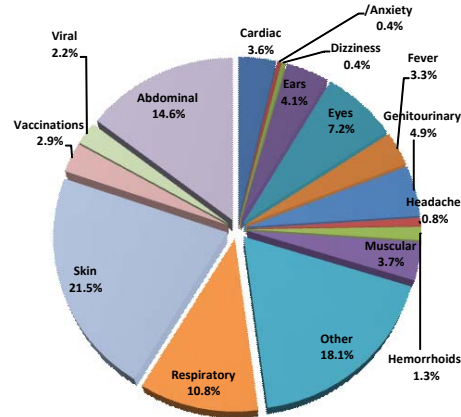


Figure 47: Sri Lankans, 2008 - 2012
(n=4 Medical Ailments)

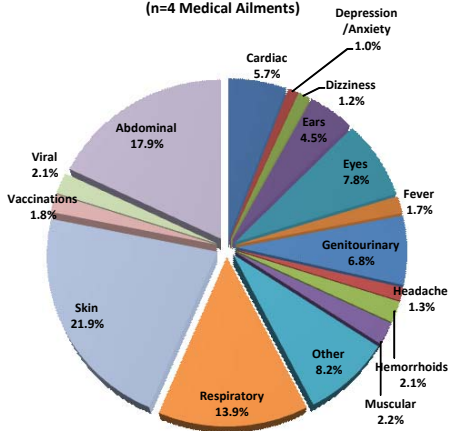


Figure 48: South Koreans, 2008 - 2012
(n=12 Medical Ailments)

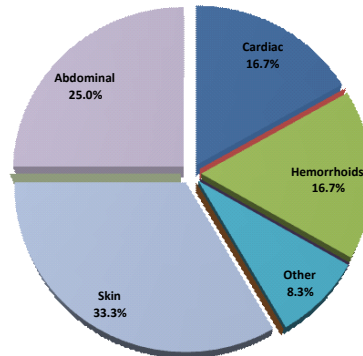


Figure 49: Singaporeans, 2008 - 2012
(n=38 Medical Ailments)

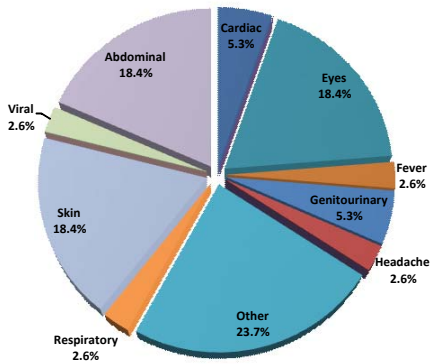


Figure 50: North Koreans, 2008 - 2012
(n=4 Medical Ailments)

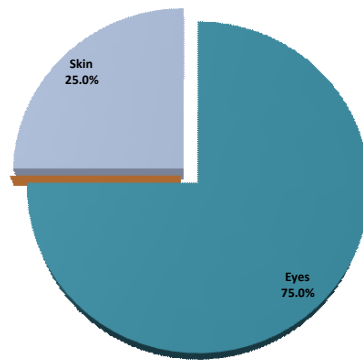


Figure 51: Myanmarese, 2008 - 2012
(n=9 Medical Ailments)

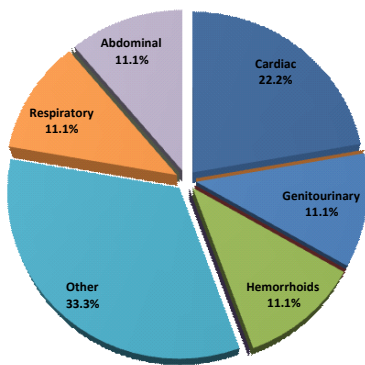


Figure 52: Malaysians, 2008 - 2012
(n=71 Medical Ailments)

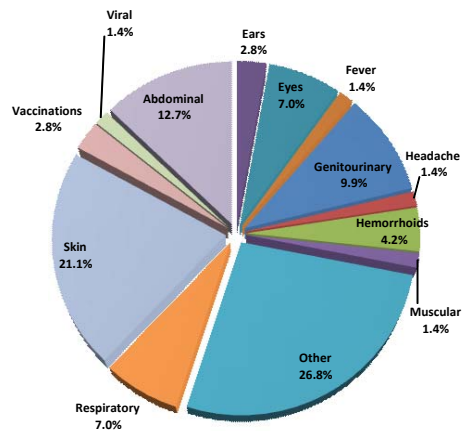


Figure 53: Koreans (unspecified), 2008 - 2012
(n=71 Medical Ailments)

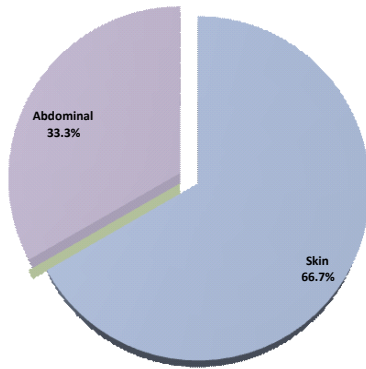


Figure 54: Japanese, 2008 - 2012
(n=2 Medical Ailments)

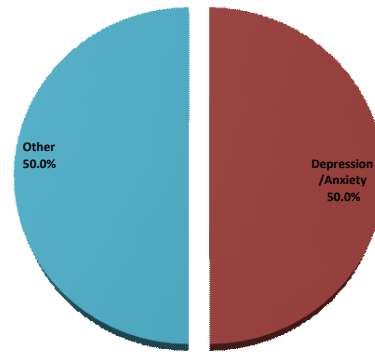


Figure 55: Indonesians, 2008 - 2012
(n=2 Medical Ailments)

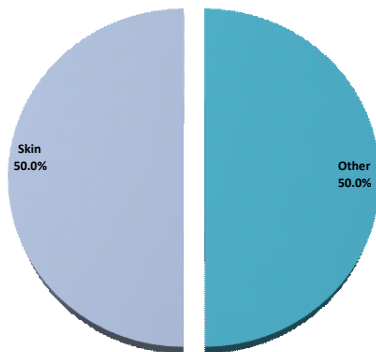
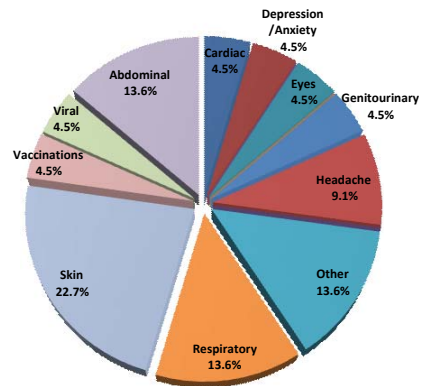


Figure 56: Bangladeshi, 2008 - 2012
(n=22 Medical Ailments)



From this last set of Figures, it can be seen that among Asian nationalities with at least ten (10) cases of illness, respiratory ailments account for 13.6% of illness among Bangladeshi seafarers but only 2.6% among Singaporean seafarers. Other ailments can also be seen to vary by Asian nationality.

Rate Estimates

(Illness or injury rate = # cases /total # of seafarers)

- Medical bills: 20.7 per 100 people each year
- Claims: 4.38 per 100 people each year
- Case-management calls: 8.33 per 100 people each year

Diagnosis	Claims per 100 people	Charges (\$) per 100 people
injury/musculoskeletal	1.73	17,731
Cardiovascular	0.18	7,017
Infectious	0.11	402.8
Dermatologic	0.28	548.3
Total (all claims)	4.38	40,695

Comparison of Risk Between Companies – Example 1

Company A

- MSK Injury
 - 350 claims
 - Crew= 1000 seafarers
 - Rate=35%
- Cardiovascular (CV)
 - 50 claims
 - Crew= 1000 seafarers
 - Rate= 5%

Company B

- MSK Injury
 - 200 claims
 - Crew= 2000 seafarers
 - Rate=10%
 -
- Cardiovascular (CV)
 - 50 claims
 - Crew= 2000 seafarers
 - Rate= 2.5%

As seen from the data presented above, Company A has more claims for MSK injury and also has a greater rate of claims for MSK injury. With regard to cardiovascular claims, both companies have the same number of claims, but due to the fact that Company B employs more seafarers, Company A has a greater rate of claims for cardiovascular disease.

Comparison of Risk Between Companies – Example 2

Company X

- 100 seafarers
- 10 cardiovascular claims
- Rate of CV claims= 10%
- All Seafarers under 40 years of age

Company Y

- 100 seafarers
- 10 cardiovascular claims
- Rate of CV claims= 10%
- All Seafarers over 50 years of age

As noted in the above data, both Company X and Company Y have the same number of claims for cardiovascular disease, employ the same number of seafarers and, therefore, have the same rate of cardiovascular disease claims. Thus it appears that both companies are similar with regard to employee cardiovascular health. However, the employees at Company Y are all substantially older than those at Company X. Since we know that risk of cardiovascular disease increases with age, we would expect Company X to have a lower rate of cardiovascular disease claims. Thus, Company Y appears to be doing better with regard to employee cardiovascular health.

Conclusion

From these statistics some surprising anomalies arise. For example, the results related to the point of service are quite striking. While inpatient encounters were responsible for less than 2.5% of all bills, they accounted for 57% of all charges. Thus, any interventions that could reduce the severity of disease and injury such that the person could receive treatment at an outpatient facility as opposed to being admitted to a hospital will have a profound impact on health expenditures.

Another interesting result is that although injuries accounted for more than a quarter of all claims, whereas cardiovascular diagnoses accounted for less than 4% of the claims, revealing a greater than 6 to 1 ratio, the total claim charges for cardiovascular disease was more than half that of injuries.

Lastly, we also see significant differences in the distribution for the diagnosis of claims by age. The fact that we observed that only 1.6% of the claims for seafarers less than 30 years of age were for cardiovascular disease whereas this percentage increased to 9.1% for seafarers in their fifties is heartening. Due to the fact that cardiovascular disease increases with age in the general population, we would expect to see an increase. This helps substantiate the quality of the data.

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