

**Appendix table 1.** Elements used in construction of each morbidity variable

| Domain | System         | Condition     | Definition, if needed | Method of derivation                      | 1st pass drugs<br>(Assign condition if drug is present)   | 2nd pass drugs<br>(Remove drugs if condition present)  |  | 3rd pass drugs<br>(Assign condition if drug present after step 2) |
|--------|----------------|---------------|-----------------------|---|---|--|--|---|
| NCDs   | Cancer         | Cancer        | Any cancer            | 1- Self reported<br>2- Medication process | Chemotherapy<br>Radiotherapy<br>Tamoxifen<br>Vinblastin Amp<br>Megestrol Acetate<br>Imatinib  | Gabapentin<br>Vinblastin Amp<br>Cyclophosphamide<br>Cyclophosphamide Amp<br>Tamoxifen<br>Chemotherapy<br>Megestrol Acetate<br>Imatinib<br>Radiotherapy | Cyproterone<br>Cyproterone Compound<br>Calcitonin nasal spray<br>Haloperidol<br>Trazodone<br>Perphenazine<br>Fluoxetine<br>Trifluoperazine | Cyclophosphamide<br>Cyclophosphamide Amp                          |
|        | Cardiovascular | Diabetes      |                       | 1- Self reported<br>2- Medication process | Acarbose<br>Other “anti-diabetes” medication<br>Insulin<br>Insulin NPH<br>Insulin Regular<br>Glibenclamide<br>chlorpropamide<br>Metformin | Acarbose<br>Other “anti-diabetes” medication<br>Metformin<br>Insulin<br>Insulin NPH  | Insulin Regular<br>Glibenclamide<br>Chlorpropamide   |   |
|        |                | Dyslipidaemia |                       | 1- Medication process                     | Other “anti-lipid” medication<br>Nicotinic Acid<br>Clofibrate<br>Gemfibrozil  | Nicotinic Acid<br>Other “anti-lipid” medication<br>Clofibrate<br>Gemfibrozil   | Atorvastatin<br>Lovastatin<br>Simvastatin  | Atorvastatin<br>Lovastatin<br>Simvastatin                         |

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|--|--|--------------|--|--|------------------------|---|--|-----------|
|  |  | Hypertension |  | 1- Self Report<br>2- Examination<br>(Average BP readings above 140/90*)<br>3- Medication process | Anti HTN<br>Methyldopa | Methyldopa<br>Prazosin<br>Trazosin<br>Enalapril<br>Captopril<br>Lisinopril<br>Carvedilol<br>Losartan<br>Atenolol<br>Propranolol<br>Metoprolol<br>Sotalol<br>Sotalol | Amlodipine<br>Diltiazem<br>Nifedipine<br>Verapamil<br>Metoral<br>Furosemide<br>Diuretic<br>Hydrochlorothiazide<br>Triamterene H<br>Anti HTN<br>Clonidine<br>Methyldopa | Clonidine |
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|  |  | Heart Disease           | Ischaemic Heart Disease/<br>Heart Failure/<br>Arrhythmia | 1- Self reported<br>2- Medication process | Amiodarone<br>Digoxin<br>Isosorbide<br>TNG Pearl<br>Nitrocanthin<br>Nitroglycerin | Captopril<br>Lisinopril<br>Carvedilol<br>Warfarin<br>Clopidogrel<br>Dipyridamole<br>Ticlopidine<br>Aspirin<br>Losartan<br>Atenolol<br>Propranolol<br>Metoprolol<br>Sotalol<br>Other "cardiac" medication<br>Amlodipine<br>Diltiazem<br>Nifedipine<br>Verapamil<br>Metoral<br>Furosemide | Enalapril<br>Prazosin<br>Trazosin<br>Diuretic<br>Hydrochlorothiazide<br>Triamterene H<br>Pentoxiphylline<br>Hydralazine<br>Atorvastatin<br>Lovastatin<br>Simvastatin<br>Clonidine<br>TNG Pearl<br>Amiodarone<br>Digoxin<br>Isosorbide<br>Nitrocanthin<br>Nitroglycerin<br>Amilodipine<br>Flurazepam<br>Lorazepam |  |
|  |  | Rheumatic Heart Disease |  | 1- Self report                            |   |   |  |  |
|  |  | Stroke                  | Both haemorrhagic and ischaemic                          | 1- Self reported<br>2- Medication process |   | Warfarin<br>Clopidogrel<br>Dipyridamole<br>Ticlopidine  | Aspirin<br>Atorvastatin<br>Lovastatin<br>Simvastatin   |  |

|  |  |                |   |                       |  |  |  |   |
|--|--|----------------|---|-----------------------|--|--|--|---|
|  |  | CV Unspecified | On Cardiovascular related medication but no assigned cardiovascular condition | 1- Medication process |  | Carvedilol<br>Warfarin<br>Clopidogrel<br>Dipyridamole<br>Ticlopidine<br>Aspirin<br>Losartan<br>Atenolol<br>Propranolol<br>Metoprolol<br>Sotalol<br>Other "cardiac" medication<br>Amlodipine<br>Diltiazem | Spirolactone<br>Enalapril<br>Captopril<br>Lisinopril<br>Nifedipine<br>Verapamil<br>Metoral<br>Furosemide<br>Diuretic<br>Hydrochlorothiazide<br>Triamterene H<br>Pentoxiphylline<br>Hydralazine<br>Amlodipine | Enalapril<br>Captopril<br>Lisinopril<br>Spirolactone<br>Carvedilol<br>Warfarin<br>Clopidogrel<br>Dipyridamole<br>Ticlopidine<br>Aspirin<br>Losartan<br>Atenolol<br>Propranolol<br>Metoprolol<br>Sotalol<br>Cardiac<br>Amlodipine<br>Diltiazem<br>Nifedipine<br>Verapamil<br>Metoral<br>Furosemide<br>Diuretic<br>Hydrochlorothiazide<br>Triamterene H<br>Pentoxiphylline<br>Hydralazine |
|--|--|----------------|---|-----------------------|--|--|--|---|

|  |           |                       |   |                       |  |   |  |   |
|--|-----------|-----------------------|---|-----------------------|--|---|--|---|
|  | Endocrine | Thyroid Disease       | Hypo- or hyperthyroid   | 1- Medication process | Anti Hyperthyroidism<br>Anti Thyroidism<br>Propylthiouracil<br>Levothyroxine<br>Radioactive Iodine<br>Methimazole<br>Metimazole  | Anti Hyperthyroidism<br>Anti Thyroidism<br>Methimazole<br>Metimazole<br>Propylthiouracil<br>Levothyroxine<br>Radioactive Iodine |  |   |
|  |           | Endocrine Unspecified | Endocrine disorders excluding thyroid disease (On Endocrine related medication but no assigned Endocrine condition) | 1- Medication process | Testosterone<br>Growth Hormone<br>Hormone<br>Somatostatin<br>Clomifene<br>HCG<br>HMG<br>Esterogen<br>Estradiol<br>Estrogen Conjugated<br>Ethinyl Estradiol<br>Progesterone<br>Desmopressin | Testosterone<br>Growth Hormone<br>Hormone<br>Somatostatin<br>Clomifene<br>Bromocriptine<br>Finasteride<br>HCG<br>HMG            | Esterogen<br>Estradiol<br>Estrogen Conjugated<br>Ethinyl Estradiol<br>Progesterone<br>Desmopressin<br>Cyproterone<br>Cyproterone<br>Compound<br>Calcitonin nasal spray | Cyproterone<br>Cyproterone Compound<br>Calcitonin nasal spray |
|  | GI        | Diarrhoea             | Symptom   | 1- Medication process | Loperamide<br>Diphenoxylate  | Loperamide<br>Diphenoxylate   |  |   |

|  |  |                      |  |   |   |  |  |  |
|--|--|----------------------|--|---|---|--|--|--|
|  |  | GI Small Bowel       | Ulcers, Reflux, IBS                              | 1- Medication process   | Anti Acid<br>Anti Acid Syrup<br>Bismuth Subcitrate<br>AL MG<br>Sucralfate<br>ranitidine<br>Cimetidine<br>Famotidine<br>H2 Blocker | Anti Acid<br>Anti Acid Syrup<br>Sucralfate<br>ranitidine<br>Cimetidine<br>Famotidine   | H2 Blocker<br>Omeprazole<br>Lansoprazole<br>pantoprazole<br>Bismuth Subcitrate<br>AL MG  | Omeprazole<br>Lansoprazole<br>pantoprazole |
|  |  | IBD                  | Inflammatory Bowel Disease                       | 1- Medication process   | Mesalazine<br>Asacol  | Mesalazine<br>Asacol   | Sulfasalazine  | Sulfasalazine                              |
|  |  | Liver Disease        | Alcoholic related liver disease, NAFLD, PBC, PSC | 1- Self reported<br>2- Symptoms (Jaundice)<br>2- Medication process | Ursodeoxycholic Acid  | Spirolactone<br>Chlordiazepoxide<br>Penicillamine<br>Pentoxiphylline<br>Prednisone<br>Perdnisolone<br>Azathioprine<br>Prednisolone<br>Ursodeoxycholic Acid | Vitamin B Complex<br>Vitamin B<br>Vitamin B1<br>Vitamin B12<br>Vitamin B6<br>Folic Acid<br>Naltrexone<br>Vitamin E<br>rifampin |  |
|  |  | Pancreatic disorders | Requirement of pancreatic enzyme supplement      | 1- Medication process   | Pancreatin  | Pancreatin   |  |  |

|  |             |                |   |  |   |  |  |                  |
|--|-------------|----------------|---|--|---|--|--|------------------|
|  |             | GI Unspecified | On gastrointestinal related medication but no assigned gastrointestinal condition | 1- Medication process                    | Sorbitol<br>Clidinium C<br>Dicyclomine<br>Hyoscine<br>Cholestyramine<br>Digestive<br>Psyllium<br>GI<br>Cisapride<br>Lactulose<br>Bisacodyl<br>C Lax | Sorbitol<br>Clidinium C<br>Dicyclomine<br>Hyoscine<br>Cholestyramine<br>Digestive<br>Psyllium                    | GI<br>Cisapride<br>Lactulose<br>Bisacodyl<br>C Lax<br>Thiethylperazine                         | Thiethylperazine |
|  | Respiratory | Asthma         |   | 1- Medication process                    | Anti-Asthmatic  | Beclomethasone<br>Corticosteroid spray<br>Fluticasone<br>Belladonna<br>Ipratropium Bromide<br>Anti Asthmatic     | Formetrol Fumarate<br>Salbutamol<br>Salmeterol<br>Terbutaline<br>Aminophylline<br>theophylline |                  |
|  |             | COPD           |   | 1 - Self Report<br>2- Medication process |   | Beclomethasone<br>Corticosteroid spray<br>Fluticasone<br>Belladonna<br>Ipratropium Bromide<br>Formetrol Fumarate | Salbutamol<br>Salmeterol<br>Terbutaline<br>Aminophylline<br>Theophylline                       |                  |

|  |           |                         |   |  |  |  |   |   |
|--|-----------|-------------------------|---|--|--|--|---|---|
|  |           | Respiratory Unspecified | On Respiratory related medication but no assigned respiratory condition | 1- Medication process                    | Expectorant<br>Bromhexine<br>Pseudoephedrine                             | Expectorant<br>Bromhexine<br>Pseudoephedrine<br>Ipratropium Bromide<br>Formetrol Fumarate                    | Salbutamol<br>Salmeterol<br>Terbutaline<br>Aminophylline<br>Theophylline                | Ipratropium Bromide<br>Formetrol Fumarate<br>Salbutamol<br>Salmeterol<br>Terbutaline<br>Aminophylline<br>Theophylline |
|  | Renal     | CKD                     | Chronic kidney disease  | 1 - Self Report<br>2- Medication process |  | Enalapril<br>Captopril<br>Lisinopril<br>Losartan   | Atorvastatin<br>Lovastatin<br>Simvastatin   |   |
|  | Neurology | Dementia                |   | 1- Medication process                    | Rivastigmine   | Rivastigmine<br>Haloperidol  | Risperidone   |   |
|  |           | Epilepsy                |   | 1- Medication process                    | Anti-Convulsant<br>Phenytoin<br>Phenobarbital<br>Topiramate<br>Primidone | Anti-Convulsant<br>Carbamazepine<br>Gabapentin<br>Lamotrigine<br>Phenytoin<br>Sodium Valproate<br>Topiramate | Phenobarbital<br>Primidone<br>Acetazolamide<br>Benzodiazepine<br>Clonazepam<br>Diazepam | Carbamazepine<br>Gabapentin<br>Lamotrigine<br>Sodium Valproate<br>Clonazepam  |
|  |           | Headaches               |   | 1- Medication process                    | Dihydroergotamine<br>Ergotamine  | Dihydroergotamine<br>Ergotamine  | Amitriptyline   |   |
|  |           | Myaesthesia Gravis      |   | 1- Medication process                    | Neostigmine<br>Pyridostigmine  | Neostigmine<br>Pyridostigmine  |   |   |



|  |              |            |  |                       |  |   |   |                              |
|--|--------------|------------|--|-----------------------|--|---|---|------------------------------|
|  |              | Parkinsons |  | 1- Medication process | Biperiden<br>Trihexyphenidyl<br>Levodopa<br>Selegiline<br>Amantadine | Biperiden<br>Trihexyphenidyl<br>Levodopa<br>Selegiline  | Amantadine<br>Bromocriptine<br>pramipexole<br>Clozapine   | Bromocriptine<br>Pramipexole |
|  | Rheumatology | Gout       |  | 1- Medication process | Colchicine<br>Allopurinol  | Colchicine<br>Allopurinol   |   |                              |
|  |              | Arthritis  |  | 1- Medication process | Hydroxychloroquine<br>Glucosamine                                    | Hydroxychloroquine<br>Glucosamine<br>Cyclophosphamide<br>Cyclophosphamide Amp<br>Sulfasalazine<br>Penicillamine<br>Omeperazole<br>Lansoprazole<br>Pantoprazole<br>Aspirin | Diclofenac<br>Ibuprofen<br>Celecoxib<br>Indomethacin<br>Mefenamic Acid<br>Naproxen<br>NSAIDS<br>Piroxicam<br>Tolmetin | Penicillamine                |

|  |                               |                    |  |                       |  |  |   |  |
|--|-------------------------------|--------------------|--|-----------------------|--|--|---|--|
|  | Other inflammatory conditions | Immunosuppressants | Conditions needing immunosuppressants or antiinflammatories (Not including conditions with drugs specifically for Rheumatoid arthritis or IBD) | 1- Medication process | Methotrexate<br>Methotrexate Amp<br>Betamethasone<br>Clobetasol Propionate<br>Dexamethasone<br>Dexamethasone Amp<br>Fludrocortisone<br>Hydrocortisone<br>Triamcinolone<br>Cellcept<br>Cyclosporin<br>IVIG<br>Cromolyn Sodium | Methotrexate<br>Methotrexate Amp<br>Betamethasone<br>Clobetasol Propionate<br>Dexamethasone<br>Dexamethasone Amp<br>Fludrocortisone<br>Hydrocortisone<br>Triamcinolone<br>Cellcept<br>Cyclosporin<br>IVIG<br>Cromolyn Sodium<br>Diclofenac<br>Ibuprofen<br>Celecoxib | Indomethacin<br>Mefenamic Acid<br>Naproxen<br>NSAIDS<br>Piroxicam<br>Tolmetin<br>Prednisone<br>Azathioprine<br>Beclomethasone<br>Corticosteroid spray<br>Fluticasone<br>Prednisolone<br>Diclofenac<br>Ibuprofen<br>Celecoxib<br>Indomethacin<br>Mefenamic Acid<br>Naproxen<br>NSAIDS<br>Piroxicam<br>Tolmetin | Prednisone<br>Azathioprine<br>Beclomethasone<br>Corticosteroid spray<br>Fluticasone<br>Prednisolone<br>Diclofenac<br>Ibuprofen<br>Celecoxib<br>Indomethacin<br>Mefenamic Acid<br>Naproxen<br>NSAIDS<br>Piroxicam<br>Tolmetin |
|--|-------------------------------|--------------------|--|-----------------------|--|--|---|--|

|       |       |                    |                             |                       |  |  |  |  |
|-------|-------|--------------------|-----------------------------|-----------------------|--|--|--|--|
| Other | Other | Vit Min Deficiency | Vitamin/Mineral Deficiency  | 1- Medication process | Alendronate<br>Calcium<br>Calcium Carbonate<br>Calcium D<br>Calcium Fort<br>Calcium Gluconate<br>Fefol<br>Ferrous Sulfate<br>Hematinic Acid<br>Venofer<br>Potassium Cholride | Potassium Cholride<br>Alendronate<br>Calcium<br>Calcium Carbonate<br>Calcium D<br>Calcium Fort<br>Calcium Gluconate<br>Fefol<br>Ferrous Sulfate<br>Hematinic Acid<br>Venofer<br>Multivitamin<br>Omega3 | vitamin A<br>Vitamin C<br>Vitamin D3<br>Vitaminmineral<br>Zinc sulfate<br>Vitamin B Complex<br>Vitamin B<br>Vitamin B1<br>Vitamin B12<br>Vitamin B6<br>Folic Acid<br>Vitamin E | Vitamin B Complex<br>Vitamin B<br>Vitamin B1<br>Vitamin B12<br>Vitamin B6<br>Folic Acid<br>Vitamin E |
|       |       | BPH                | Benign Prostate Hyperplasia | 1- Medication process | Tamsulosin   | Tamsulosin<br>Finasteride  | Prazosin<br>Trazosin   | Finasteride<br>Prazosin<br>trazosin  |

|               |  |    |  |                       |  |   |  |   |
|---------------|--|----|--|-----------------------|--|---|--|---|
| Mental Health | Mental health (Depression, Anxiety, Psychosis) | MH | Mental health (Depression, Anxiety, Psychosis) | 1- Medication process | Doxepin<br>Methadone<br>Busprione<br>Anti Depressant<br>Chlorpromazine<br>Fluphenazine<br>Olanzapin<br>Thioridazine<br>Alprazolam<br>Midazolam<br>Oxazepam<br>Lithium Carbonate<br>Mental<br>Tranlycypromine<br>Sedative<br>Citalopram<br>Fluvoxamine<br>Sertraline<br>Imipramine<br>Nortriptyline<br>Clomipramine<br>Desipramine<br>Maprotiline<br>Maprotiline<br>TCA<br>Trimipramine | Naltrexone<br>Methadone<br>Carbamazepine<br>Lamotrigine<br>Sodium Valproate<br>Busprione<br>Anti Depressant<br>Trazodone<br>Trifluoperazine<br>Chlorpromazine<br>Clozapine<br>Fluphenazine<br>Haloperidol<br>Olanzapin<br>Perphenazine<br>Risperidone<br>Thioridazine<br>Chlordiazepoxide<br>Alprazolam<br>Benzodiazepine<br>Clonazepam<br>Diazepam<br>Flurazepam | Lorazepam<br>Midazolam<br>Oxazepam<br>Lithium Carbonate<br>Mental<br>Tranlycypromine<br>Sedative<br>Fluoxetine<br>Citalopram<br>Fluvoxamine<br>Sertraline<br>Imipramine<br>Nortriptyline<br>Amitriptyline<br>Clomipramine<br>Desipramine<br>Maprotiline<br>Maprotiline<br>TCA<br>Trimipramine<br>Doxepin<br>Thiethylperazine | Naltrexone<br>Clozapine<br>Trifluoperazine<br>Trazodone<br>Haloperidol<br>Perphenazine<br>Risperidone<br>Chlordiazepoxide<br>Benzodiazepine<br>Diazepam<br>Flurazepam<br>Lorazepam<br>fluoxetine<br>amitriptyline |
|---------------|--|----|--|-----------------------|--|---|--|---|

|                               |                |                  |              |  |  |  |  |          |
|-------------------------------|----------------|------------------|--------------|--|--|--|--|----------|
| Chronic communicable Diseases | Respiratory    | TB               | Tuberculosis | 1 - Self Report<br>2- Medication process | Anti TB<br>Streptomycin<br>Ethambutol<br>Isoniazid<br>Para-aminosalicylic acid<br>Pyrazinamide | Streptomycin<br>Anti TB<br>Ethambutol<br>Isoniazid | Para-aminosalicylic acid<br>Pyrazinamide<br>Rifampin | Rifampin |
|                               | Hepatitis/ HIV | Hepatitis or HIV |              | 1- Medication process                    | Interferon<br>lamivudine   | Interferon<br>lamivudine                           |  |          |

| Appendix table 2. Number of conditions assigned to participants through the medication process |  |   |                              |
|--|--|---|------------------------------|
|  | Participants before Medication process | New assignments found in Medication process | Final Number of Participants |
| <b>Cancer</b>  | 149                                    | 11  | 160                          |
| <b>Cardiovascular Disease</b>  |  |   |                              |
| Diabetes   | 3,248                                  | 98  | 3,346                        |
| Dyslipidaemia  | -                                      | 693   | 693                          |
| Hypertension   | 13,302                                 | 34  | 13,336                       |
| Heart Disease  | 2,851                                  | 187   | 3,038                        |
| Rheumatic Heart Disease  | 66                                     | -   | 66                           |
| Stroke   | 379                                    | -   | 379                          |
| Unspecified CV Disease   | -                                      | 2,022                                       | 2,022                        |
| <b>Endocrine</b>   |  |   |                              |
| Thyroid Disease  | -                                      | 694   | 694                          |
| Unspecified Endocrine Disease  | -                                      | 196   | 196                          |
| <b>Gastrointestinal</b>  |  |   |                              |
| Diarrhoea  | -                                      | 33  | 33                           |

|                                       |       |       |       |
|---------------------------------------|-------|-------|-------|
| Reflux, Ulcers, IBS                   | -     | 9,130 | 9,130 |
| Inflammatory Bowel Disease            | -     | 27    | 27    |
| Liver Disease                         | 1,307 | 6     | 1,313 |
| Pancreatic disorders                  | -     | 50    | 50    |
| Unspecified GI Conditions             | -     | 1,333 | 1,333 |
| <b>Respiratory</b>                    |       |       |       |
| Asthma                                | -     | 18    | 18    |
| COPD                                  | 2,848 | -     | 2,848 |
| Unspecified Respiratory Disease       | -     | 115   | 115   |
| <b>Renal - Chronic Kidney Disease</b> | 90    | -     | 90    |
| <b>Neurology</b>                      |       |       |       |
| Dementia                              | -     | 1     | 1     |
| Epilepsy                              | -     | 358   | 358   |
| Headaches                             | -     | 475   | 475   |
| Myaesthesia Gravis                    | -     | 4     | 4     |
| Parkinsons                            | -     | 150   | 150   |
| <b>Rheumatology</b>                   |       |       |       |

|  |       |       |       |
|--|-------|-------|-------|
| Gout   | -     | 29    | 29    |
| Arthritis  | -     | 99    | 99    |
| <b>Unspecified conditions needing Immunosuppressants</b> | -     | 3,691 | 3,691 |
| <b>Other</b>   |       |       |       |
| Vitamin or Mineral Deficiency                            | -     | 1,249 | 1,249 |
| Benign Prostate Hyperplasia                              | -     | 41    | 41    |
| <b>Mental Health (any)</b>                               | -     | 4,188 | 4,188 |
| <b>Communicable Diseases</b>                             |       |       |       |
| Tuberculosis   | 1,455 | 70    | 1,525 |
| Hepatitis / HIV  | -     | 9     | 9     |



| Appendix Table 3. Conditions included within each disease domain category |  |        |                   |        |                |        |
|---|--|--------|-------------------|--------|----------------|--------|
|   | Individuals Used in Survival Analysis (Including 2297 lost to follow up) |        | Lost to Follow up |        | Complete Cases |        |
|   | n  | %      | n                 | %      | n              | %      |
| n   | 47883  |        | 2297              | 4.80%  | 45586          | 95.20% |
| <b>Morbidity</b>  |  |        |                   |        |                |        |
| <b>Number of diseases, Mean (SD)</b>                                      | 1.06 (1.19)  |        | 1.18 (1.28)       |        | 1.05 (1.19)    |        |
| <b>Any Disease (N)</b>  | 28539  | 59.60% | 1436              | 62.52% | 27103          | 59.45% |
| <b>Non-communicable Diseases (at least one)</b>                           | 27198  | 56.80% | 1373              | 59.77% | 25825          | 56.65% |
| <b>Cancer</b>   | 160  | 0.33%  | 4                 | 0.17%  | 156            | 0.34%  |
| <b>Cardiovascular Disease (at least one condition)</b>                    | 17815  | 37.21% | 881               | 38.35% | 16934          | 37.15% |
| Diabetes  | 3346   | 6.99%  | 173               | 7.53%  | 3173           | 6.96%  |
| Dyslipidaemia   | 693  | 1.45%  | 77                | 3.35%  | 616            | 1.35%  |
| Hypertension  | 13336  | 27.85% | 618               | 26.90% | 12718          | 27.90% |
| Heart Disease   | 3038   | 6.34%  | 174               | 7.58%  | 2864           | 6.28%  |
| Rheumatic Heart Disease   | 66   | 0.14%  | 3                 | 0.13%  | 63             | 0.14%  |
| Stroke  | 379  | 0.79%  | 13                | 0.57%  | 366            | 0.80%  |
| Unspecified CV Disease  | 2022   | 4.22%  | 102               | 4.44%  | 1920           | 4.21%  |
| <b>Endocrine (at least one condition)</b>                                 | 885  | 1.85%  | 55                | 2.39%  | 830            | 1.82%  |
| Thyroid Disease   | 694  | 1.45%  | 45                | 1.96%  | 649            | 1.42%  |
| Unspecified Endocrine Disease   | 196  | 0.41%  | 10                | 0.44%  | 186            | 0.41%  |
| <b>Gastrointestinal (at least one condition)</b>                          | 10698  | 22.34% | 610               | 26.56% | 10088          | 22.13% |
| Diarrhoea   | 33   | 0.07%  | 2                 | 0.09%  | 31             | 0.07%  |
| Reflux, Ulcers, IBS   | 9130   | 19.07% | 525               | 22.86% | 8605           | 18.88% |
| Inflammatory Bowel Disease  | 27   | 0.06%  | 2                 | 0.09%  | 25             | 0.05%  |
| Liver Disease   | 1313   | 2.74%  | 87                | 3.79%  | 1226           | 2.69%  |
| Pancreatic disorders  | 50   | 0.10%  | 3                 | 0.13%  | 47             | 0.10%  |
| Unspecified GI Conditions   | 1333   | 2.78%  | 75                | 3.27%  | 1258           | 2.76%  |

|  |      |       |     |        |      |       |
|--|------|-------|-----|--------|------|-------|
| <b>Respiratory (at least one condition)</b>              | 2948 | 6.16% | 114 | 4.96%  | 2834 | 6.22% |
| Asthma   | 18   | 0.04% | 0   | 0.00%  | 18   | 0.04% |
| COPD   | 2848 | 5.95% | 110 | 4.79%  | 2738 | 6.01% |
| Unspecified Respiratory Disease                          | 115  | 0.24% | 4   | 0.17%  | 111  | 0.24% |
| <b>Renal - Chronic Kidney Disease</b>                    | 90   | 0.19% | 4   | 0.17%  | 86   | 0.19% |
| <b>Neurology (at least one condition)</b>                | 965  | 2.02% | 51  | 2.22%  | 914  | 2.01% |
| Dementia   | 1    | 0.00% | 0   | 0.00%  | 1    | 0.00% |
| Epilepsy   | 358  | 0.75% | 23  | 1.00%  | 335  | 0.73% |
| Headaches  | 475  | 0.99% | 23  | 1.00%  | 452  | 0.99% |
| Myaesthesia Gravis                                       | 4    | 0.01% | 0   | 0.00%  | 4    | 0.01% |
| Parkinsons   | 150  | 0.31% | 7   | 0.30%  | 143  | 0.31% |
| <b>Rheumatology (at least one condition)</b>             | 127  | 0.27% | 8   | 0.35%  | 119  | 0.26% |
| Gout   | 29   | 0.06% | 0   | 0.00%  | 29   | 0.06% |
| Arthritis  | 99   | 0.21% | 8   | 0.35%  | 91   | 0.20% |
| <b>Unspecified conditions needing Immunosuppressants</b> | 3691 | 7.71% | 208 | 9.06%  | 3483 | 7.64% |
| <b>Other (at least one condition)</b>                    | 1290 | 2.69% | 86  | 3.74%  | 1204 | 2.64% |
| Vitamin or Mineral Deficiency                            | 1249 | 2.61% | 85  | 3.70%  | 1164 | 2.55% |
| Benign Prostate Hyperplasia                              | 41   | 0.09% | 1   | 0.04%  | 40   | 0.09% |
| <b>Mental Health (any)</b>                               | 4188 | 8.75% | 258 | 11.23% | 3930 | 8.62% |
| <b>Communicable Diseases (at least one condition)</b>    | 1534 | 3.20% | 64  | 2.79%  | 1470 | 3.22% |
| Tuberculosis   | 1525 | 3.18% | 61  | 2.66%  | 1464 | 3.21% |
| Hepatitis / HIV  | 9    | 0.02% | 3   | 0.13%  | 6    | 0.01% |

Cardiovascular disease (CV)

Inflammatory bowel disease (IBS)

Gastrointestinal (GI)

Chronic obstructive pulmonary disease (COPD)

| <b>Appendix Table 4. Occurrence of each outcome during the ten year study period by demographic, lifestyle, disease, and multimorbidity categories, using complete cases only</b> |              |   |          |                      |           |   |          |   |           |   |           |
|---|--------------|---|----------|----------------------|-----------|---|----------|---|-----------|---|-----------|
|   | <b>Total</b> | <b>Number of individuals who died *</b> |          | <b>Time to Death</b> |           | <b>Number of individuals who had any hospitalisations</b> |          | <b>Number of hospital visits considering only individuals who were hospitalised</b> |           | <b>Number of hospital visits (considering all participants)</b> |           |
|   | <b>n</b>     | <b>n</b>                                | <b>%</b> | <b>Mean</b>          | <b>SD</b> | <b>n</b>  | <b>%</b> | <b>Mean</b>   | <b>SD</b> | <b>Mean</b>   | <b>SD</b> |
|   | 45586        | 5411                                    | 11.87%   | 5.50                 | 2.79      | 17855   | 39.17%   | 1.94  | 1.39      | 0.76  | 1.28      |
| <b>Demographic variables</b>  |              |   |          |                      |           |   |          |   |           |   |           |
| <b>Gender</b>   |              |   |          |                      |           |   |          |   |           |   |           |
| Females   | 26003        | 2333                                    | 8.97%    | 5.60                 | 2.75      | 10596   | 40.75%   | 1.97  | 1.47      | 0.80  | 1.35      |
| Males   | 19583        | 3078                                    | 15.72%   | 5.42                 | 2.81      | 7259  | 37.07%   | 1.88  | 1.26      | 0.70  | 1.19      |
| <b>Age of entrance</b>  |              |   |          |                      |           |   |          |   |           |   |           |
| <40   | 722          | 11                                      | 1.52%    | 6.42                 | 2.37      | 169   | 23.41%   | 1.68  | 1.14      | 0.39  | 0.90      |
| 40-49   | 21938        | 1094                                    | 4.99%    | 5.50                 | 2.85      | 6709  | 30.58%   | 1.79  | 1.29      | 0.55  | 1.09      |
| 50-59   | 14227        | 1666                                    | 11.71%   | 5.55                 | 2.80      | 5959  | 41.89%   | 1.97  | 1.43      | 0.82  | 1.34      |
| 60-69   | 6516         | 1707                                    | 26.20%   | 5.50                 | 2.78      | 3658  | 56.14%   | 2.11  | 1.48      | 1.19  | 1.53      |
| ≥70   | 2183         | 933                                     | 42.74%   | 5.38                 | 2.71      | 1360  | 62.30%   | 2.08  | 1.34      | 1.30  | 1.46      |
| <b>Education level</b>  |              |   |          |                      |           |   |          |   |           |   |           |
| Illiterate  | 31856        | 4289                                    | 13.46%   | 5.50                 | 2.78      | 13341   | 41.88%   | 1.96  | 1.42      | 0.82  | 1.34      |
| Not illiterate  | 13730        | 1122                                    | 8.17%    | 5.50                 | 2.83      | 4514  | 32.88%   | 1.86  | 1.29      | 0.61  | 1.14      |
| <b>Marital Status</b>   |              |   |          |                      |           |   |          |   |           |   |           |
| Not Married   | 5429         | 993                                     | 18.29%   | 5.48                 | 2.68      | 2594  | 47.78%   | 2.08  | 1.50      | 0.99  | 1.47      |
| Married   | 40157        | 4418                                    | 11.00%   | 5.50                 | 2.81      | 15261   | 38.00%   | 1.91  | 1.37      | 0.73  | 1.25      |
| <b>Geography</b>  |              |   |          |                      |           |   |          |   |           |   |           |
| Urban   | 9461         | 1036                                    | 10.95%   | 5.38                 | 2.76      | 4136  | 43.72%   | 2.04  | 1.49      | 0.89  | 1.41      |
| Rural   | 36125        | 4375                                    | 12.11%   | 5.52                 | 2.79      | 13719   | 37.98%   | 1.91  | 1.35      | 0.72  | 1.25      |

| <b>Wealth</b>                                   |       |      |        |      |      |       |        |      |      |      |      |
|---|-------|------|--------|------|------|-------|--------|------|------|------|------|
| 1   | 9747  | 1595 | 16.36% | 5.51 | 2.78 | 3729  | 38.26% | 1.90 | 1.33 | 0.73 | 1.24 |
| 2   | 8508  | 1141 | 13.41% | 5.43 | 2.81 | 3304  | 38.83% | 1.93 | 1.34 | 0.75 | 1.26 |
| 3   | 9909  | 1042 | 10.52% | 5.61 | 2.80 | 3888  | 39.24% | 1.93 | 1.38 | 0.76 | 1.28 |
| 4   | 8655  | 909  | 10.50% | 5.42 | 2.70 | 3455  | 39.92% | 1.97 | 1.44 | 0.78 | 1.32 |
| 5   | 8767  | 724  | 8.26%  | 5.50 | 2.86 | 3479  | 39.68% | 1.97 | 1.45 | 0.78 | 1.33 |
| <b>Ethnicity</b>                                |       |      |        |      |      |       |        |      |      |      |      |
| Torkman   | 34431 | 4003 | 11.63% | 5.50 | 2.78 | 12744 | 37.01% | 1.88 | 1.34 | 0.70 | 1.22 |
| Other   | 11155 | 1408 | 12.62% | 5.48 | 2.82 | 5111  | 45.82% | 2.08 | 1.48 | 0.95 | 1.44 |
| <b>Lifestyle</b>                                |       |      |        |      |      |       |        |      |      |      |      |
| <b>Smoking</b>                                  |       |      |        |      |      |       |        |      |      |      |      |
| Non-smoker                                      | 37599 | 3947 | 10.50% | 5.55 | 2.75 | 14700 | 39.10% | 1.94 | 1.41 | 0.76 | 1.29 |
| Ex-smoker                                       | 1567  | 319  | 20.36% | 4.97 | 2.85 | 697   | 44.48% | 1.94 | 1.32 | 0.86 | 1.31 |
| Current smoker                                  | 6420  | 1145 | 17.83% | 5.46 | 2.88 | 2458  | 38.29% | 1.92 | 1.27 | 0.73 | 1.22 |
| <b>BMI (kg/m<sup>2</sup>)</b>                   |       |      |        |      |      |       |        |      |      |      |      |
| <18.5   | 2169  | 465  | 21.44% | 5.31 | 2.82 | 872   | 40.20% | 1.80 | 1.15 | 0.72 | 1.15 |
| 18.5≤x<25                                       | 16395 | 2273 | 13.86% | 5.48 | 2.82 | 5899  | 35.98% | 1.85 | 1.25 | 0.66 | 1.16 |
| ≥25   | 27022 | 2673 | 9.89%  | 5.54 | 2.75 | 11084 | 41.02% | 2.00 | 1.47 | 0.82 | 1.36 |
| <b>Physical Activity Status</b>                 |       |      |        |      |      |       |        |      |      |      |      |
| 1   | 15888 | 2786 | 17.54% | 5.38 | 2.77 | 7555  | 47.55% | 2.05 | 1.49 | 0.98 | 1.45 |
| 2   | 14607 | 1204 | 8.24%  | 5.67 | 2.80 | 5417  | 37.08% | 1.91 | 1.38 | 0.71 | 1.25 |
| 3   | 15091 | 1421 | 9.42%  | 5.58 | 2.79 | 4883  | 32.36% | 1.78 | 1.22 | 0.58 | 1.08 |
| <b>Morbidity</b>                                |       |      |        |      |      |       |        |      |      |      |      |
| <b>Non-communicable Diseases (at least one)</b> |       |      |        |      |      |       |        |      |      |      |      |
| Cancer  | 156   | 45   | 28.85% | 3.96 | 3.10 | 84    | 53.85% | 2.20 | 1.57 | 1.19 | 1.59 |

|  |       |      |        |      |      |      |        |      |      |      |      |
|--|-------|------|--------|------|------|------|--------|------|------|------|------|
| <b>Cardiovascular Disease (at least one condition)</b> | 16934 | 3023 | 17.85% | 5.35 | 2.79 | 8785 | 51.88% | 2.17 | 1.58 | 1.12 | 1.57 |
| Diabetes   | 3173  | 771  | 24.30% | 5.34 | 2.76 | 2121 | 66.85% | 2.59 | 1.90 | 1.73 | 1.97 |
| Dyslipidaemia  | 616   | 91   | 14.77% | 5.77 | 2.48 | 381  | 61.85% | 2.53 | 1.87 | 1.56 | 1.92 |
| Hypertension   | 12718 | 2327 | 18.30% | 5.39 | 2.79 | 6515 | 51.23% | 2.15 | 1.58 | 1.10 | 1.56 |
| Heart Disease  | 2864  | 799  | 27.90% | 4.98 | 2.85 | 1926 | 67.25% | 2.54 | 1.81 | 1.71 | 1.90 |
| Rheumatic Heart Disease                                | 63    | 17   | 26.98% | 5.72 | 3.36 | 42   | 66.67% | 2.48 | 1.67 | 1.65 | 1.80 |
| Stroke   | 366   | 131  | 35.79% | 4.92 | 2.65 | 238  | 65.03% | 2.23 | 1.59 | 1.45 | 1.67 |
| Unspecified CV Disease                                 | 1920  | 254  | 13.23% | 5.03 | 2.77 | 904  | 47.08% | 2.02 | 1.37 | 0.95 | 1.38 |
| <b>Endocrine (at least one condition)</b>              | 830   | 62   | 7.47%  | 5.62 | 2.69 | 388  | 46.75% | 2.09 | 1.64 | 0.98 | 1.53 |
| Thyroid Disease  | 649   | 54   | 8.32%  | 5.39 | 2.75 | 310  | 47.77% | 2.11 | 1.69 | 1.01 | 1.57 |
| Unspecified Endocrine Disease                          | 186   | 9    | 4.84%  | 6.72 | 2.12 | 81   | 43.55% | 2.02 | 1.44 | 0.88 | 1.38 |
| <b>Gastrointestinal (at least one condition)</b>       | 10088 | 1249 | 12.38% | 5.57 | 2.77 | 4587 | 45.47% | 2.06 | 1.49 | 0.94 | 1.43 |
| Diarrhoea  | 31    | 6    | 19.35% | 6.57 | 3.20 | 15   | 48.39% | 1.53 | 0.92 | 0.74 | 1.00 |
| Reflux, Ulcers, IBS                                    | 8605  | 1038 | 12.06% | 5.65 | 2.75 | 3927 | 45.64% | 2.05 | 1.49 | 0.94 | 1.43 |
| Inflammatory Bowel Disease                             | 25    | 2    | 8.00%  | 6.96 | 1.40 | 11   | 44.00% | 2.09 | 1.04 | 0.92 | 1.26 |
| Liver Disease  | 1226  | 156  | 12.72% | 5.43 | 2.79 | 536  | 43.72% | 2.09 | 1.45 | 0.91 | 1.41 |
| Pancreatic disorders                                   | 47    | 7    | 14.89% | 5.55 | 1.93 | 20   | 42.55% | 2.10 | 1.65 | 0.89 | 1.49 |
| Unspecified GI Conditions                              | 1258  | 175  | 13.91% | 4.97 | 2.90 | 597  | 47.46% | 2.08 | 1.55 | 0.98 | 1.49 |
| <b>Respiratory (at least one condition)</b>            | 2834  | 555  | 19.58% | 5.13 | 2.85 | 1499 | 52.89% | 2.33 | 1.71 | 1.23 | 1.71 |
| Asthma   | 18    | 7    | 38.89% | 3.55 | 2.40 | 14   | 77.78% | 2.71 | 1.54 | 2.11 | 1.78 |

|  |      |     |        |      |      |      |         |      |      |      |      |
|--|------|-----|--------|------|------|------|---------|------|------|------|------|
| COPD   | 2738 | 533 | 19.47% | 5.12 | 2.85 | 1441 | 52.63%  | 2.33 | 1.71 | 1.22 | 1.70 |
| Unspecified Respiratory Disease                          | 111  | 29  | 26.13% | 4.93 | 2.98 | 68   | 61.26%  | 2.59 | 1.78 | 1.59 | 1.88 |
| <b>Renal - Chronic Kidney Disease</b>                    | 86   | 23  | 26.74% | 4.83 | 3.24 | 49   | 56.98%  | 2.63 | 2.48 | 1.50 | 2.28 |
| <b>Neurology (at least one condition)</b>                | 914  | 96  | 10.50% | 5.45 | 2.71 | 406  | 44.42%  | 2.07 | 1.64 | 0.92 | 1.50 |
| Dementia   | 1    | 1   | 100%   | 6.47 | NA   | 1    | 100.00% | 1.00 | NA   | 1.00 | NA   |
| Epilepsy   | 335  | 53  | 15.82% | 5.62 | 2.67 | 163  | 48.66%  | 2.30 | 1.85 | 1.12 | 1.73 |
| Headaches  | 452  | 16  | 3.54%  | 6.09 | 2.57 | 177  | 39.16%  | 1.89 | 1.46 | 0.74 | 1.30 |
| Myaesthesia Gravis                                       | 4    | 1   | 25.00% | 5.28 | NA   | 3    | 75.00%  | 1.00 | 0.00 | 0.75 | 0.50 |
| Parkinsons   | 143  | 27  | 18.88% | 4.52 | 2.88 | 75   | 52.45%  | 2.07 | 1.46 | 1.08 | 1.48 |
| <b>Rheumatology (at least one condition)</b>             | 119  | 17  | 14.29% | 4.44 | 3.32 | 64   | 53.78%  | 2.36 | 1.33 | 1.27 | 1.53 |
| Gout   | 29   | 4   | 13.79% | 3.79 | 3.44 | 15   | 51.72%  | 2.67 | 1.72 | 1.38 | 1.82 |
| Arthritis  | 91   | 13  | 14.29% | 4.64 | 3.40 | 49   | 53.85%  | 2.27 | 1.19 | 1.22 | 1.43 |
| <b>Unspecified conditions needing Immunosuppressants</b> | 3483 | 552 | 15.85% | 5.63 | 2.74 | 1748 | 50.19%  | 2.21 | 1.63 | 1.11 | 1.60 |
| <b>Other (at least one condition)</b>                    | 1204 | 150 | 12.46% | 5.16 | 2.83 | 596  | 49.50%  | 2.19 | 1.66 | 1.08 | 1.60 |
| Vitamin or Mineral Deficiency                            | 1164 | 143 | 12.29% | 5.11 | 2.82 | 574  | 49.31%  | 2.21 | 1.68 | 1.09 | 1.62 |
| Benign Prostate Hyperplasia                              | 40   | 7   | 17.50% | 6.22 | 3.05 | 22   | 55.00%  | 1.59 | 0.85 | 0.88 | 1.02 |
| <b>Mental Health (Any)</b>                               | 3930 | 499 | 12.70% | 5.39 | 2.80 | 1916 | 48.75%  | 2.08 | 1.53 | 1.01 | 1.49 |
| <b>Communicable Diseases (at least one condition)</b>    | 1470 | 281 | 19.12% | 5.52 | 2.77 | 685  | 46.60%  | 2.10 | 1.57 | 0.98 | 1.50 |
| Tuberculosis   | 1464 | 281 | 19.19% | 5.52 | 2.77 | 683  | 46.65%  | 2.11 | 1.57 | 0.98 | 1.50 |

|  |       |      |        |      |      |       |        |      |      |      |      |
|--|-------|------|--------|------|------|-------|--------|------|------|------|------|
| Hepatitis / HIV  | 6     | 0    | 0.00%  | NA   | NA   | 2     | 33.33% | 1.00 | 0.00 | 0.33 | 0.52 |
| <b>Number of morbidities</b>   |       |      |        |      |      |       |        |      |      |      |      |
| 0  | 18483 | 1383 | 7.48%  | 5.66 | 2.74 | 5228  | 28.29% | 1.63 | 1.01 | 0.46 | 0.91 |
| 1  | 14367 | 1747 | 12.16% | 5.56 | 2.81 | 5707  | 39.72% | 1.84 | 1.26 | 0.73 | 1.20 |
| 2  | 7478  | 1218 | 16.29% | 5.50 | 2.80 | 3763  | 50.32% | 2.10 | 1.51 | 1.06 | 1.50 |
| 3  | 3319  | 625  | 18.83% | 5.30 | 2.76 | 1863  | 56.13% | 2.28 | 1.70 | 1.28 | 1.70 |
| 4+   | 1939  | 438  | 22.59% | 5.01 | 2.77 | 1294  | 66.74% | 2.60 | 1.91 | 1.73 | 1.98 |
| <b>Multiple Morbidity (defined as 2+ morbidities in any domain or system)</b>  |       |      |        |      |      |       |        |      |      |      |      |
| Not MM   | 32850 | 3130 | 9.53%  | 5.60 | 2.78 | 10935 | 33.29% | 1.74 | 1.15 | 0.58 | 1.06 |
| MM   | 12736 | 2281 | 17.91% | 5.35 | 2.79 | 6920  | 54.33% | 2.24 | 1.65 | 1.22 | 1.65 |
| Body mass index (BMI)<br>Cardiovascular disease (CV)<br>Inflammatory bowel disease (IBS)<br>Gastrointestinal (GI)<br>Chronic obstructive pulmonary disease (COPD)<br>Multimorbidity (MM) |       |      |        |      |      |       |        |      |      |      |      |
| * Out of complete cases who died in 10 years from admission to study   |       |      |        |      |      |       |        |      |      |      |      |

| <b>Appendix table 5</b>   |                       |          |                        |          |                    |          |
|---|-----------------------|----------|------------------------|----------|--------------------|----------|
| Characteristics of multimorbid vs not multimorbid in complete cases |                       |          |                        |          |                    |          |
|   | <b>Complete Cases</b> |          | <b>Not Multimorbid</b> |          | <b>Multimorbid</b> |          |
|   | <b>n</b>              | <b>%</b> | <b>n</b>               | <b>%</b> | <b>n</b>           | <b>%</b> |
| n   | 45586                 |          | 32850                  | 72.06%   | 12736              | 27.94%   |
| <b>Demographic variables</b>  |                       |          |                        |          |                    |          |
| Males   | 19583                 | 42.96%   | 15891                  | 48.37%   | 3692               | 28.99%   |
| Females   | 26003                 | 57.04%   | 16959                  | 51.63%   | 9044               | 71.01%   |
| Age, Mean (SD)  | 51.93<br>(8.85)       |          | 51.1 (8.63)            |          | 54.08<br>(9.03)    |          |
| <40   | 722                   | 1.58%    | 593                    | 1.81%    | 129                | 1.01%    |
| 40-49   | 21938                 | 48.12%   | 17106                  | 52.07%   | 4832               | 37.94%   |
| 50-59   | 14227                 | 31.21%   | 9775                   | 29.76%   | 4452               | 34.96%   |
| 60-69   | 6516                  | 14.29%   | 4018                   | 12.23%   | 2498               | 19.61%   |
| ≥70   | 2183                  | 4.79%    | 1358                   | 4.13%    | 825                | 6.48%    |
| Education level*  |                       |          |                        |          |                    |          |
| Illiterate  | 31856                 | 69.88%   | 22139                  | 67.39%   | 9717               | 76.30%   |
| Literate  | 13730                 | 30.12%   | 10711                  | 32.61%   | 3019               | 23.70%   |
| Marital Status  |                       |          |                        |          |                    |          |
| Single/Widowed/Divorced/Seperated                                   | 5429                  | 11.91%   | 3223                   | 9.81%    | 2206               | 17.32%   |
| Married   | 40157                 | 88.09%   | 29627                  | 90.19%   | 10530              | 82.68%   |



|                                   |                 |        |                  |        |                 |        |
|-----------------------------------|-----------------|--------|------------------|--------|-----------------|--------|
| Geography                         |                 |        |                  |        |                 |        |
| Urban                             | 9461            | 20.75% | 6195             | 18.86% | 3266            | 25.64% |
| Rural                             | 36125           | 79.25% | 26655            | 81.14% | 9470            | 74.36% |
| Wealth                            |                 |        |                  |        |                 |        |
| 1                                 | 9747            | 21.38% | 7146             | 21.75% | 2601            | 20.42% |
| 2                                 | 8508            | 18.66% | 6264             | 19.07% | 2244            | 17.62% |
| 3                                 | 9909            | 21.74% | 7233             | 22.02% | 2676            | 21.01% |
| 4                                 | 8655            | 18.99% | 6203             | 18.88% | 2452            | 19.25% |
| 5                                 | 8767            | 19.23% | 6004             | 18.28% | 2763            | 21.69% |
| Ethnicity                         |                 |        |                  |        |                 |        |
| Torkman                           | 34431           | 75.53% | 25184            | 76.66% | 9247            | 72.61% |
| Other                             | 11155           | 24.47% | 7666             | 23.34% | 3489            | 27.39% |
| <b>Lifestyle</b>                  |                 |        |                  |        |                 |        |
| Smoking,                          |                 |        |                  |        |                 |        |
| Non-smoker                        | 37599           | 82.48% | 26617            | 81.03% | 10982           | 86.23% |
| Ex-smoker                         | 1567            | 3.44%  | 1083             | 3.30%  | 484             | 3.80%  |
| Current smoker                    | 6420            | 14.08% | 5150             | 15.68% | 1270            | 9.97%  |
| Pack years for smokers, Mean (SD) | 16.9<br>(18.25) |        | 16.48<br>(17.68) |        | 18.43<br>(20.1) |        |
| BMI (kg/m <sup>2</sup> )          |                 |        |                  |        |                 |        |

|   |             |        |            |        |             |         |
|---|-------------|--------|------------|--------|-------------|---------|
| Underweight (<18.5)                             | 2169        | 4.76%  | 1709       | 5.20%  | 460         | 3.61%   |
| Normal Weight (18.5≤ weight <25)                | 16395       | 35.96% | 12906      | 39.29% | 3489        | 27.39%  |
| Overweight (≥25)                                | 27022       | 59.28% | 18235      | 55.51% | 8787        | 68.99%  |
| Physical Activity Status**                      |             |        |            |        |             |         |
| 1   | 15888       | 34.85% | 9859       | 30.01% | 6029        | 47.34%  |
| 2   | 14607       | 32.04% | 10593      | 32.25% | 4014        | 31.52%  |
| 3   | 15091       | 33.10% | 12398      | 37.74% | 2693        | 21.14%  |
| <b>Morbidity</b>                                |             |        |            |        |             |         |
| <b>Number of diseases, Mean (SD)</b>            | 1.05 (1.19) |        | 0.44 (0.5) |        | 2.64 (0.95) |         |
| <b>Number of Morbidities</b>                    |             |        |            |        |             |         |
| 0   | 18483       | 40.55% | 18483      | 56.26% | 0           | 0.00%   |
| 1   | 14367       | 31.52% | 14367      | 43.74% | 0           | 0.00%   |
| 2   | 7478        | 16.40% | 0          | 0.00%  | 7478        | 58.72%  |
| 3   | 3319        | 7.28%  | 0          | 0.00%  | 3319        | 26.06%  |
| 4+  | 1939        | 4.25%  | 0          | 0.00%  | 1939        | 15.22%  |
| <b>Any Disease (N)</b>                          | 27103       | 59.45% | 14367      | 43.74% | 12736       | 100.00% |
| Non-communicable Diseases (at least one)        | 25825       | 56.65% | 13109      | 39.91% | 12716       | 99.84%  |
| Cancer  | 156         | 0.34%  | 50         | 0.15%  | 106         | 0.83%   |
| Cardiovascular Disease (at least one condition) | 16934       | 37.15% | 7045       | 21.45% | 9889        | 77.65%  |

|  |       |        |       |        |      |        |
|--|-------|--------|-------|--------|------|--------|
| Endocrine (at least one condition)                   | 830   | 1.82%  | 214   | 0.65%  | 616  | 4.84%  |
| Gastrointestinal (at least one condition)            | 10088 | 22.13% | 3740  | 11.39% | 6348 | 49.84% |
| Respiratory (at least one condition)                 | 2834  | 6.22%  | 782   | 2.38%  | 2052 | 16.11% |
| Renal - Chronic Kidney Disease                       | 86    | 0.19%  | 19    | 0.06%  | 67   | 0.53%  |
| Neurology (at least one condition)                   | 914   | 2.01%  | 217   | 0.66%  | 697  | 5.47%  |
| Rheumatology (at least one condition)                | 119   | 0.26%  | 12    | 0.04%  | 107  | 0.84%  |
| Unspecified conditions needing<br>Immunosuppressants | 3483  | 7.64%  | 823   | 2.51%  | 2660 | 20.89% |
| Other*****   | 1204  | 2.64%  | 207   | 0.63%  | 997  | 7.83%  |
| Mental Health (any)                                  | 3930  | 8.62%  | 765   | 2.33%  | 3165 | 24.85% |
| Communicable Diseases (at least one condition)       | 1470  | 3.22%  | 493   | 1.50%  | 977  | 7.67%  |
| <b>Medications</b>                                   |       |        |       |        |      |        |
| 0  | 18824 | 41.29% | 18259 | 55.58% | 565  | 4.44%  |
| 1  | 12085 | 26.51% | 10082 | 30.69% | 2003 | 15.73% |
| 2  | 6722  | 14.75% | 3401  | 10.35% | 3321 | 26.08% |
| 3  | 3506  | 7.69%  | 829   | 2.52%  | 2677 | 21.02% |
| 4+   | 4449  | 9.76%  | 279   | 0.85%  | 4170 | 32.74% |

\* Non-illiterate includes any education

\*\* Physical activity tertiles have been calculated based on the intensity of physical activity, based on METs



Appendix table 6. The odds ratio (OR) of being dead within ten years by demographic characteristics, NCD risk factors and multimorbidity ( $\geq 2$  conditions)

| Variable                 |                         | OR       | 95% CI        | P-Value |
|--------------------------|-------------------------|----------|---------------|---------|
| <b>Multimorbid</b>       | <2 conditions           | Referent |               |         |
|                          | $\geq 2$ conditions     | 1.99     | (1.86 - 2.12) | <0.001  |
| <b>Sex</b>               | Females                 | Referent |               |         |
|                          | Males                   | 2.06     | (1.89 - 2.24) | <0.001  |
| <b>Age</b>               | Age at Entrance         | 1.09     | (1.08 - 1.09) | <0.001  |
| <b>Education</b>         | Illiterate              | Referent |               |         |
|                          | Literate                | 0.80     | (0.73 - 0.87) | <0.001  |
| <b>Marital Status</b>    | Not Married (ref)       |          |               |         |
|                          | Married                 | 0.83     | (0.76 - 0.91) | <0.001  |
| <b>Wealth Quintiles</b>  | Wealth Quintile 1       | Referent |               |         |
|                          | Wealth Quintile 2       | 0.90     | (0.82 - 0.98) | 0.02    |
|                          | Wealth Quintile 3       | 0.68     | (0.62 - 0.75) | <0.001  |
|                          | Wealth Quintile 4       | 0.69     | (0.63 - 0.76) | <0.001  |
|                          | Wealth Quintile 5       | 0.58     | (0.52 - 0.65) | <0.001  |
| <b>Smoking status</b>    | Never Smoked            | Referent |               |         |
|                          | Current/Ex-smoker       | 1.48     | (1.37 - 1.61) | <0.001  |
| <b>BMI</b>               | BMI<18.5                | Referent |               |         |
|                          | BMI: $18.5 \leq x < 25$ | 0.66     | (0.59 - 0.75) | <0.001  |
|                          | BMI: $\geq 25$          | 0.60     | (0.53 - 0.68) | <0.001  |
| <b>Physical Activity</b> | Physical Activity 1     | Referent |               |         |
|                          | Physical Activity 2     | 0.76     | (0.70 - 0.82) | <0.001  |
|                          | Physical Activity 3     | 0.69     | (0.63 - 0.75) | <0.001  |

Non communicable disease (NCD)

Body mass index (BMI)

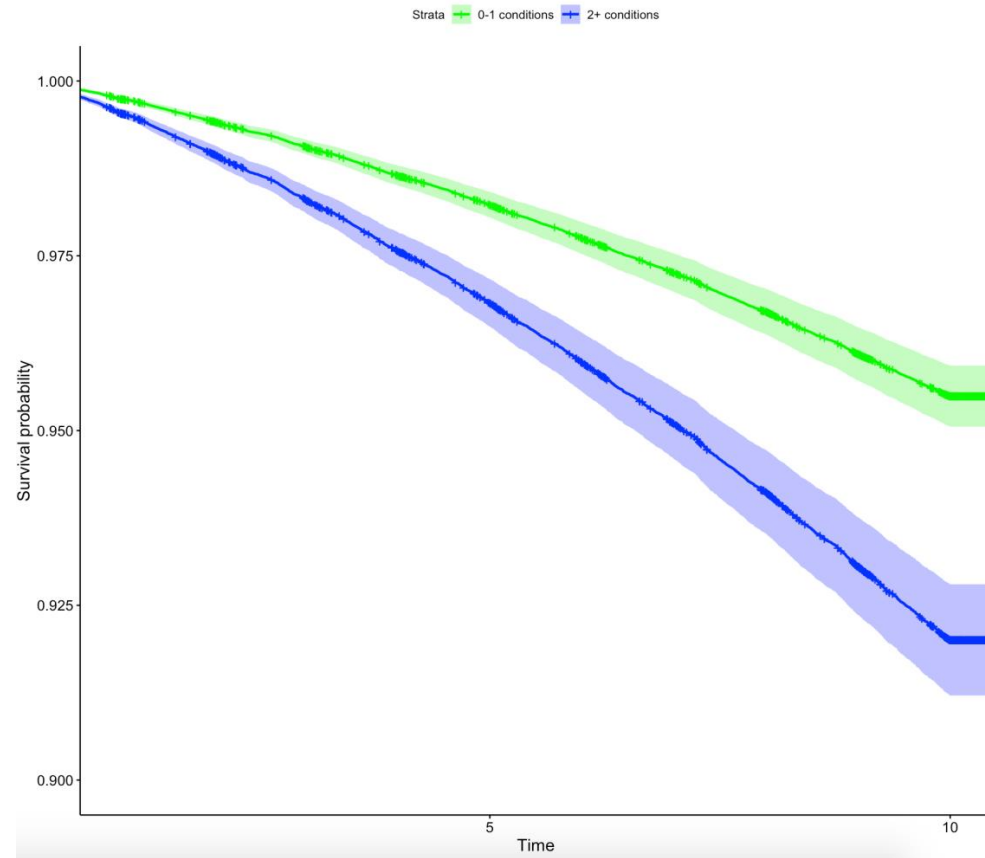
Appendix Table 7. The Hazard Ratio (HR) of dying within the study period by demographic characteristics, NCD risk factors and multimorbidity ( $\geq 2$  conditions)

| Variable                               |  | HR       | 95% CI        | P-value |
|--|--|----------|---------------|---------|
| <b>Sex</b>                             | Females                                  | Referent |               |         |
|  | Males                                    | 3.00     | (2.10 - 4.28) | <0.001  |
| <b>Age</b>                             | Age at Entrance                          | 1.08     | (1.08 - 1.09) | <0.001  |
| <b>Education</b>                       | Illiterate                               | Referent |               |         |
|  | Literate                                 | 0.81     | (0.75 - 0.88) | <0.001  |
| <b>Marital Status</b>                  | Not Married                              | Referent |               |         |
|  | Married                                  | 0.86     | (0.79 - 0.93) | <0.001  |
| <b>Wealth Quintiles</b>                | Wealth Quintile 1                        | Referent |               |         |
|  | Wealth Quintile 2                        | 0.91     | (0.84 - 0.98) | 0.01    |
|  | Wealth Quintile 3                        | 0.71     | (0.66 - 0.77) | <0.001  |
|  | Wealth Quintile 4                        | 0.72     | (0.67 - 0.79) | <0.001  |
|  | Wealth Quintile 5                        | 0.63     | (0.57 - 0.69) | <0.001  |
| <b>Ethnicity</b>                       | Torkmen                                  | Referent |               |         |
|  | Not Torkmen                              | 0.89     | (0.84 - 0.95) | <0.001  |
| <b>Smoking status</b>                  | Never Smoked                             | Referent |               |         |
|  | Current/Ex-smoker                        | 1.39     | (1.30 - 1.49) | <0.001  |
| <b>BMI</b>                             | BMI<18.5                                 | Referent |               |         |
|  | BMI: 18.5≤x<25                           | 0.70     | (0.64 - 0.78) | <0.001  |
|  | BMI: ≥25                                 | 0.64     | (0.58 - 0.71) | <0.001  |
| <b>Physical Activity</b>               | Physical Activity 1                      | Referent |               |         |
|  | Physical Activity 2                      | 0.78     | (0.72 - 0.83) | <0.001  |
|  | Physical Activity 3                      | 0.72     | (0.67 - 0.77) | <0.001  |
| <b>Interaction between Sex and Age</b> | Extra Risk for each age year for Females | Referent |               |         |

|                    |  |          |               |        |
|--------------------|--|----------|---------------|--------|
|                    | Extra Risk for each age year for Males | 0.99     | (0.99 - 1.00) | 0.01   |
| <b>Multimorbid</b> | <2 conditions                          | Referent |               |        |
|                    | ≥2 conditions                          | 1.81     | (1.71 - 1.91) | <0.001 |

Non communicable disease (NCD)

Body mass index (BMI)

**Appendix figure 1.** Survival in the study period for multimorbidity defined as two or more conditions versus fewer than two conditions (n= 47,883)

Plots are shown controlling for demographic characteristics and behavioural factors