Table 38. Vitamin D and all-cause mortality: Characteristics of cohort studies (updated from original report)

| **Author Year**  **Study Name**  **Location**  **(Latitude)**  **[PMID]** | **Population** | | **Vitamin D Concentration** | | **Comparisons** | **Confounders/Effect Modifiers Adjusted** | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Nutrients** | **Demograph** | **Anthrop** | **Medical** | **UV Exposure** | **Lifestyle** |
| **Radioreceptor Assay** | | | | | | | | | | | |
| Pilz 2009[73](#_ENREF_73)  Hoorn Study  Netherlands | * Health status | More than 20% Type 2 Diabetes or impaired glucose tolerance |  |  | All-cause mortality stratified by 25(OH)D quartiles |  | x | x | X | X | x |
| * Mean Age (range), y | 69.2 (6.5) |  |  |  |  |  |  |
| * Male (%) | 50% |  |  |  |  |  |  |  |  |
| Visser 2006[222](#_ENREF_222)  Longitudinal Aging Study  Netherlands  (52°N)  [16960177] | * Health status | General populationB | * Assay method | Competitive protein binding | Comparison of various 25(OH)D concentration categories |  | x | x |  |  | x |
| * Age range, y | >65 |  |  |  |  |  |  |
| * Male (%) | 51 | * Season blood drawn | ND |  |  |  |  |  |  |
| **Radioimmunoassay** | | | | | | | | | | | |
| Jia 2007[219](#_ENREF_219)  UK  (57°N)  [17442130] | * Health status | Not terminally ill or demented | * Assay method | RIA | Comparison of various 25(OH)D concentration categories |  | x |  | x | x | x |
| * Age range, y | >75 |
| * Male (%) | 52 | * Season blood drawn | ND |
| Sambrook 2004 & 2006[220](#_ENREF_220),[221](#_ENREF_221)  FREEA  Australia  (33°S)  [15531500 & 16598375] | * Health status | Not bedridden | * Assay method | RIA (Dia-sorin) | Association with log 25(OH)D |  | x |  | x |  |  |
| * Age range, y | >65 |  |  |  |  |  |  |
| * Male (%) | 22 | * Season blood drawn | ND |  |  |  |  |  |  |
| Melamed 2008[85](#_ENREF_85)  NHANES III  US  (various)  [18695076] | * Health status | General population | * Assay method | RIA (Dia-sorin) | Comparison of various 25(OH)D concentration categories | x | x | x | x | x | x |
| * Age mean (range), y | 45 (≥20) |  |  |  |  |  |  |
| * Male (%) | 46 | * Season blood drawn | ND |  |  |  |  |  |  |
| Bolland 2010[58](#_ENREF_58)  New Zealand | * Health status | Healthy  Post-menopausal |  |  | Comparison of various 25(OH)D concentration categories |  | x | X | x |  | x |
| * Age range, y | 74 (SD 4.2) |
| * Male (%) | 0% |  |  |
| Johansson 2012[211](#_ENREF_211)  MrOS  Sweden: Gothenburg, Malmö, Uppsala | * Health status | Some with diabetes, htn, cancer, stroke, MI, angina |  |  | Death and mortality stratified by varying 25(OH)D concentration levels |  | X |  | x |  | X |
| * Mean Age (SD), y | 75.7 (SD 3.4) |  |  |  |  |  |  |
| * Male (%) | 100% |  |  |  |  |  |  |  |  |
| Kritchevsky 2012[212](#_ENREF_212)  Health, Aging, and Body Composition (ABC) Study  US  Pittsburgh, Memphis | * Health status | Well-functioning |  |  | All-cause mortality stratified by 25(OH)D quartiles |  | X | X | X | X | X |
| * Mean Age (SD), y | 74.7 (SD 2.9) |  |  |  |  |  |  |
| * Male (%) | 49% |  |  |  |  |  |  |  |  |
| Semba 2010[93](#_ENREF_93)  InCHIANTI  Italy | * Health status | Nd |  |  | All-cause mortality and cardiovascular mortality stratified by 25(OH)D quartiles |  | x | x |  | x | x |
| * Mean Age (range), y | 78 (72-85) |  |  |  |  |  |  |
| * Male (%) | 67.3% |  |  |  |  |  |  |  |  |
| Smit 2012[213](#_ENREF_213)  NHANES III  US  (various) | * Health status | Malnourished/frailty, pre-frail, not frail |  |  | All-cause mortality stratified by 25(OH)D quartiles |  | X | X | X | X | X |
| * Mean Age (SD), y | 69.4 (SD 0.3) |  |  |  |  |  |  |
| * Male (%) | 46.5% |  |  |  |  |  |  |  |  |
| Szulc 2009[214](#_ENREF_214)  MINOS Study  Montceau les Mines, France | * Health status | nd |  |  | Mortality stratified by 25(OH)D quartiles | X | x | X | x |  | x |
| * Mean Age (SD), y | 64 (SD 7) |
| * Male (%) | 55% |  |  |
| Szulc 2009[215](#_ENREF_215)  MINOS Study  Montceau les Mines, France | * Health status | nd |  |  | Mortality stratified by 25(OH)D quartiles |  | x | X | x |  | x |
| * Mean Age (SD), y | 64 (SD 7) |
| * Male (%) | 100% |  |  |
| Tomson 2013[75](#_ENREF_75)  Whitehall study  London, UK | * Health status * Mean age (SD), y * Male (%) | self-reported health good/excellent 77.4%  76.9 (SD 4.9)  100% |  |  | Death (all non-vascular) and Death (al causes) stratified by 25(OH)D doubling concentration |  |  | X | X |  | X |
| Sempos 2013[218](#_ENREF_218)  NHANES III  US | * Health status * Mean age (SE), y * Male (%) | NR  45 (SE 0.47)  49% |  |  | All-cause mortality stratified by 25(OH)D in 9 categories |  | X |  |  | X |  |
| Formiga 2014[77](#_ENREF_77)  Octabaix  Spain | * Health status * Mean age (SD), y * Male (%) | Oldest old  85 (SD 0)  39.4% |  |  | Total mortality stratified by 25(OH)D quartiles |  | X |  | X |  |  |
| **Chemiluminescence Assay** | | | | | | | | | | | |
| Eaton 2011[70](#_ENREF_70)  WHI substudy  US (multisite) | * Health status | nd |  |  | Post-menopausal women 50-79 years stratified by 25(OH)D quartiles |  |  | x | x | x | x |
| * Mean Age (SD), y | 65.1 (SD 7.6) |  |  |  |  |  |  |
| * Male (%) | 0% |  |  |  |  |  |  |  |  |
| Jacobs 2011[144](#_ENREF_144)  Women’s Healthy Eating and Living Well (WHEL) Study | * Health status | Cancer in remission |  |  | Breast cancer survivors stratified by 25(OH)D concentration categories |  |  |  |  |  |  |
| * Mean Age (SD), y | 51.9 (SD 9) |
| * Male (%) | 0% |  |  |
| Skaaby 2013[86](#_ENREF_86)  Monica10 and Inter99  Denmark | * Health status * Mean age (SD), y * Male (%) | NR  Monica 10: 55.4  Inter 99: 46.1  Monica 10: 50.2  Inter 99: 49.2 |  |  | All-cause mortality stratified by 25(OH)D quartiles |  | X |  | X | X | X |
| Wong 2013[217](#_ENREF_217)  Australia | * Health status * Mean age (SD), y * Male (%) | NR  76 (70-88)  100% |  |  | All-cause mortality stratified by 25(OH)D quartiles |  | X | X | X |  | X |
| Schottker 2013[76](#_ENREF_76)  ESTHER  Germany | * Health status * Mean age (SD), y * Male (%) | NR  62 (SD 6.5)  43.8% |  |  | All-cause mortality stratified by 25(OH)D tertiles | X | X |  | X | X | X |
| Signorello 2013[74](#_ENREF_74)  Southern Community Cohort Study  US | * Health status | nd |  |  | All-cause mortality stratified by 25(OH)D quartiles |  |  | X |  |  | X |
| * Mean Age (range), y | nd |  |  |  |  |  |  |
| * Male (%) | nd |  |  |  |  |  |  |  |  |
| * Male (%) | 100% |  |  |  |  |  |  |  |  |
| **Enzyme-linked Immunoabsorption Assay** | | | | | | | | | | | |
| Hutchinson 2010[79](#_ENREF_79)  Tromsø Study  Tromso, Norway | * Health status | Nd |  |  | Smoking and non-smoking cause of death stratified by 25(OH)D quartiles |  | x | x | x |  | x |
| * Mean Age (range), y | nd |  |  |  |  |  |  |
| * Male (%) | nd |  |  |  |  |  |  |  |  |
| Fedirko 2012[101](#_ENREF_101)  EPIC  US (4 sites) | * Health status | nd |  |  | Diagnosis at age of 62 stratified by 25(OH)D quintiles |  | X | X | X | x | X |
| * Mean Age (SD), y | 62.1 (4.2) |
| * Male (%) | 40.5% |  |  |
| Lin 2012[83](#_ENREF_83)  General Population Trial of Linxian, China | * Health status | Healthy, Hypertension |  |  | All-cause mortality stratified by continuous 25(OH)D |  | x | X | x |  | x |
| * Mean Age (SD), y | 56.5 (7.9) |
| * Male (%) | 55% |  |  |
| **HPLC-Tandem Mass Spectrometry** | | | | | | | | | | | |
| Cawthon 2010[98](#_ENREF_98)  MrOS (multisite)  US | * Health status | >80% Excellent/good health status |  |  | Association with log 25(OH)D | X | x | X | x | X | X |
| * Mean age (Age range), y | 74 (> or =65) |  |  |  |  |  |  |
| * Male (%) | nd |  |  |  |  |  |  |  |  |
| Michaelsson 2010[84](#_ENREF_84)  Uppsala Longitudinal Study of Adult Men  Uppsala, Sweden | * Health status | More than 1/3 being treated for hypertension |  |  | Overall mortality stratified by 25(OH)D tertiles | X | x | X | x | X | X |
| * Mean Age (range), y | 71 (0.6) |  |  |  |  |  |  |
| * Male (%) | 100% |  |  |  |  |  |  |  |  |
| Kestenbaum 2011[81](#_ENREF_81)  Cardiovascular Health Study  US  (various) | * Health status | nd |  |  | All-cause mortality stratified by 25(OH)D quartiles |  |  |  |  |  |  |
| * Mean Age (range), y | 73 (SD 4) |  |  |  |  |  |  |
| * Male (%) | 42% |  |  |  |  |  |  |  |  |
| Virtanen 2011[216](#_ENREF_216)  Kuopio Ischaemic Heart Disease Risk Factor (KIHD) Study  Finland | * Health status | Post-menopausal,  54-62% hypertension |  |  | Overall mortality stratified by 25(OH)D tertiles |  | x | X | x |  | X |
| * Mean Age (range), y | 61.8 (53.4-72.7/SD 6.2) |  |  |  |  |  |  |
| * Male (%) | 48.6% |  |  |  |  |  |  |  |  |
| Welsh 2012[60](#_ENREF_60)  MIDSPAN Family Study  Renfrew and Paisley, UK | * Health status | vitamin D not deficient |  |  | All-cause mortality stratified by 25(OH)D tertiles | X | X | X | X | X | X |
| * Mean Age (range), y | 45.2 (6.2) |  |  |  |  |  |  |
| * Male (%) | 46% |  |  |  |  |  |  |  |  |
| de Boer 2012[87](#_ENREF_87)  Cardiovascular Health Study  US  (various) | * Health status | nd |  |  | Comparison of various 25(OH)D concentration categories |  | x | x | X |  | x |
| * Mean Age (SD), y | 74 (SD 4.6) |  |  |  |  |  |  |
| * Male (%) | 30% |  |  |  |  |  |  |  |  |

AFracture Risk Epidemiology in the Elderly

B~40% with CVD and ~60% arthritis