**Supplemental Data**

**Supplemental 1***Flow chart of the available data in each wave of the English Longitudinal Study of Ageing (ELSA).*

**A diagram of a flowchart

Description automatically generated with low confidence**

**Supplemental 2**

Cox proportional hazard regression predicting hearing loss from baseline physical activity adults 50-years and older, data from waves 1 - 9 of the ELSA.

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| --- | --- | --- | --- | --- | --- | --- |
|  | Model 1 | | | Model 2 | | |
|  | HR | 95% CI | p-value | HR | 95% CI | p-value |
| Baseline Physical Activity |  |  |  |  |  |  |
| *Not sufficiently active* | [REF] |  |  | [REF] |  |  |
| *Physically active* | 0.90 | 0.83-0.97 | **.007** | 0.95 | 0.88-1.03 | .180 |

Model 1: Adjusted for age, gender, education, wealth quintiles.

Model 2: Adjusted for age, gender, education, wealth quintiles, cardiovascular conditions, chronic health conditions, BMI, smoking status, loneliness, depression, and dementia.

**Supplemental 3**

Odds Ratios (OR) of sufficient physical activity across time (waves 1-9) for individuals with and without self-reported hearing loss by wave that hearing loss was first reported, estimated from multilevel logistic regression models (42,042 observations nested in 6,381 individuals).

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| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Model 1** | | |  | **Model 2** | | |
| Predictors | OR | 95% CI | Sig. |  | OR | 95% CI | Sig. |
| Time (wave) | 0.93 | 0.91 – 0.95 | **<.001** |  | 0.91 | 0.90 – 0.93 | **<.001** |
| Hearing loss reported |  |  |  |  |  |  |  |
| *No hearing loss* | [REF] |  |  |  |  |  |  |
| *Wave 1* | 0.66 | 0.56 – 0.77 | **<.001** |  | 0.94 | 0.79 – 1.13 | .517 |
| *Wave 2* | 0.57 | 0.46 – 0.70 | **<.001** |  | 0.77 | 0.61 – 0.97 | **.025** |
| *Wave 3* | 0.98 | 0.78 – 1.25 | .896 |  | 1.17 | 0.90 – 1.53 | .237 |
| *Wave 4* | 0.79 | 0.60 – 1.06 | .114 |  | 1.19 | 0.86 – 1.66 | .295 |
| *Wave 5* | 0.90 | 0.67 – 1.20 | .478 |  | 0.96 | 0.70 – 1.32 | .805 |
| *Wave 6* | 1.03 | 0.77 – 1.38 | .846 |  | 1.28 | 0.92 – 1.77 | .144 |
| *Wave 7* | 1.13 | 0.81 – 1.58 | .469 |  | 1.10 | 0.77 – 1.57 | .608 |
| *Wave 8* | 1.38 | 0.97 – 1.95 | .072 |  | 1.38 | 0.96 – 1.99 | .081 |
| *Wave 9* | 1.20 | 0.83 – 1.72 | .330 |  | 1.40 | 0.90 – 2.06 | .092 |
| Hearing\*time interaction |  |  |  |  |  |  |  |
| *No hearing loss* | [REF] |  |  |  |  |  |  |
| *Wave 1* | 0.92 | 0.89 – 0.94 | **<.001** |  | 0.93 | 0.90 – 0.96 | **<.001** |
| *Wave 2* | 0.92 | 0.89 – 0.96 | **<.001** |  | 0.94 | 0.90 – 0.98 | **.002** |
| *Wave 3* | 0.89 | 0.85 – 0.93 | **<.001** |  | 0.91 | 0.86 – 0.95 | **<.001** |
| *Wave 4* | 0.91 | 0.86 – 0.96 | **<.001** |  | 0.92 | 0.86 – 0.97 | **.004** |
| *Wave 5* | 0.90 | 0.85 – 0.94 | **<.001** |  | 0.91 | 0.86 – 0.96 | **.001** |
| *Wave 6* | 0.87 | 0.83 – 0.91 | **<.001** |  | 0.88 | 0.83 – 0.93 | **<.001** |
| *Wave 7* | 0.91 | 0.87 – 0.96 | **.001** |  | 0.94 | 0.89 – 0.99 | **.036** |
| *Wave 8* | 0.88 | 0.84 – 0.93 | **<.001** |  | 0.91 | 0.86 – 0.96 | **.001** |
| *Wave 9* | 0.94 | 0.89 – 1.00 | **.039** |  | 0.95 | 0.89 – 1.01 | .077 |

Model 1: Adjusted for age, gender, education, wealth quintiles.

Model 2: Adjusted for age, gender, education, wealth quintiles, cardiovascular conditions, chronic health conditions, BMI, smoking status, loneliness, depression, and death/attrition.

**Supplemental 4**

Given that age may modify associations between hearing loss and physical activity. Additional exploratory analysis that stratified by age was carried out.

***Supplemental 4.1***

*Cox proportional hazard regression predicting hearing loss from baseline physical activity for adults in midlife (50 – 64 years) at baseline (Models 1A and 1B) and those who were older (≥65 years) at baseline (Models 2A and 2B).*

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|  | **Midlife (50 – 64 years)** | | | | | | **Older (≥65 years)** | | | | | |
|  | **Model 1A** | | | **Model 1B** | | | **Model 2A** | | | **Model 2B** | | |
|  | HR | 95% CI | p-value | HR | 95% CI | p-value | HR | 95% CI | p-value | HR | 95% CI | p-value |
| Baseline Physical Activity |  |  |  |  |  |  |  |  |  |  |  |  |
| *Not sufficiently active* | REF |  |  | REF |  |  | REF |  |  | REF |  |  |
| *Physically active* | 0.87 | 0.78-0.97 | **<.001** | 0.90 | 0.81-1.01 | .075 | 0.95 | 0.86-1.06 | .352 | 1.00 | 0.90-1.12 | .965 |

Models 1A and 2A: Adjusted for age, gender, education, wealth quintiles.

Models 1B and 2B: Adjusted for age, gender, education, wealth quintiles, cardiovascular conditions, chronic health conditions, BMI, smoking status, loneliness, depression, and dementia.

***Supplemental 4.2***

*Odds Ratios (OR) of sufficient physical activity across time (waves 1-9) for individuals with and without self-reported hearing loss estimated from multilevel logistic regression models for those who were in midlife (50-64 years) at baseline (Models 1A and 1B) and those who were older (≥65 years) at baseline (Models 2A and 2B).*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Midlife (50-64 years)** | | | | | | **Older (≥65 years)** | | | | | | |
|  | **Model 1A** | | | **Model 1B** | | | **Model 2A** | | | **Model 2B** | | | |
| Predictors | OR | 95% CI | p-value | OR | 95% CI | p-value | OR | 95% CI | p-value | OR | 95% CI | p-value |
| Time (wave) | 0.99 | 0.95 – 0.98 | **<.001** | 0.96 | 0.94 – 0.98 | **<.001** | 0.78 | 0.76 – 0.86 | **<.001** | 0.76 | 0.74 – 0.78 | **<.001** |
| Hearing Group |  |  |  |  |  |  |  |  |  |  |  |  |
| *No hearing loss* | REF |  |  | REF |  |  | REF |  |  | REF |  |  |
| *Hearing loss* | 0.85 | 0.75 – 0.96 | **.009** | 0.93 | 0.81 – 1.07 | .321 | 0.98 | 0.87 – 1.12 | .808 | 1.04 | 0.88 – 1.22 | .665 |
| Hearing\*time interaction | 0.97 | 0.95 – 0.99 | **.003** | 0.98 | 0.95 – 1.00 | .085 | 0.94 | 0.92 – 0.97 | **<.001** | 0.96 | 0.93 – 0.99 | **.023** |

Models 1A and 2A Adjusted for, age, gender, education, wealth quintiles,

Models 1B and 2B Adjusted for: age, gender, education, wealth quintiles, cardiovascular conditions, chronic health conditions, BMI, smoking status, loneliness, depression. Model 1B estimates based on 25,648 observations nested in 3,608 individuals. Model 2B estimates based on 16,394 observations nested in 2,773 individuals.

***Supplemental 4.3***

*Odds Ratios (OR) of sufficient physical activity across time (waves 1-9) for individuals with and without self-reported hearing loss by wave that hearing loss was first reported, estimated from multilevel logistic regression models for* *who were in midlife (50-64 years) at baseline (24,352 observations nested in 3,026 individuals) and those who were older (≥65 years) at baseline (12,177 observations, nested in 1,831 individuals)*

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| --- | --- | --- | --- | --- | --- | --- |
|  | **Midlife (50 – 64 years)** | | | **Older (≥65 years)** | | |
| Predictors | OR | 95% CI | p-value | OR | 95% CI | p-value |
| Time (wave) | 0.93 | 0.91 – 0.95 | **<.001** | 0.91 | 0.90 – 0.93 | **<.001** |
| Hearing loss reported |  |  |  |  |  |  |
| *No hearing loss* | REF |  |  | REF |  |  |
| *Wave 1* | 0.88 | 0.70 – 1.10 | .253 | 0.65 | 0.47 – 0.90 | **.010** |
| *Wave 2* | 0.74 | 0.58 – 0.93 | **.009** | 0.47 | 0.32 – 0.68 | **<.001** |
| *Wave 3* | 1.10 | 0.84 – 1.43 | .498 | 1.08 | 0.70 – 1.66 | .727 |
| *Wave 4* | 1.16 | 0.83 – 1.62 | .379 | 1.12 | 0.65 – 1.93 | .672 |
| *Wave 5* | 0.91 | 0.67 – 1.25 | .573 | 0.66 | 0.41 – 1.07 | .091 |
| *Wave 6* | 1.25 | 0.90 – 1.74 | .178 | 0.91 | 0.55 – 1.51 | .719 |
| *Wave 7* | 1.04 | 0.73 – 1.48 | .822 | 0.69 | 0.39 – 1.24 | .216 |
| *Wave 8* | 1.39 | 0.96 – 2.00 | .077 | 1.51 | 0.83 – 2.73 | .178 |
| *Wave 9* | 1.42 | 0.96 – 2.09 | .076 | 1.11 | 0.58 – 2.15 | .749 |
| Hearing\*time interaction |  |  |  |  |  |  |
| *No hearing loss* | REF |  |  | REF |  |  |
| *Wave 1* | 0.98 | 0.94 – 1.02 | .249 | 0.95 | 0.90 – 1.01 | .101 |
| *Wave 2* | 0.93 | 0.89 – 0.97 | **.001** | 0.98 | 0.92 – 1.06 | .673 |
| *Wave 3* | 0.91 | 0.87 – 0.95 | **<.001** | 0.89 | 0.82 – 0.97 | **.006** |
| *Wave 4* | 0.92 | 0.86 – 0.97 | **.003** | 0.90 | 0.80 – 1.00 | .057 |
| *Wave 5* | 0.91 | 0.86 – 0.96 | **.001** | 0.98 | 0.90 – 1.07 | .720 |
| *Wave 6* | 0.88 | 0.83 – 0.93 | **<.001** | 0.94 | 0.86 – 1.03 | .165 |
| *Wave 7* | 0.94 | 0.89 – 0.99 | **.029** | 1.06 | 0.96 – 1.16 | .256 |
| *Wave 8* | 0.90 | 0.85 – 0.95 | **<.001** | 0.95 | 0.86 – 1.05 | .325 |
| *Wave 9* | 0.94 | 0.88 – 1.00 | **.043** | 0.98 | 0.88 – 1.08 | .649 |

Both models are adjusted for age, gender, education, wealth quintiles, cardiovascular conditions, chronic health conditions, BMI, smoking status, loneliness, depression, and death/attrition.

***Supplemental 4.4***

*Odds Ratios (OR) of sufficient physical activity for one and two waves before/after hearing loss was reported for a subsample of individuals between waves three and seven. Estimated from multilevel logistic regression models for* *who were in midlife (50-64 years) at baseline (3,442 observations nested in 800 individuals) and those who were older (≥65 years) at baseline (3,295 observations, nested in 832 individuals).*

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|  |  | | | **Midlife (50-64 years)** | | | **Older (≥65 years)** | | |  | | |
|  | **Model 1A** | | | **Model 1B** | | | **Model 2A** | | | **Model 2B** | | |
| Predictors | OR | 95% CI | p-value | OR | 95% CI | p-value | OR | 95% CI | p-value | OR | 95% CI | p-value |
| Hearing loss reported |  |  |  |  |  |  |  |  |  |  |  |  |
| *2 waves before* | 1.06 | 0.84 – 1.35 | .612 | 1.04 | 0.79 – 1.36 | .797 | 2.50 | 1.99 – 2.15 | **<.001** | 2.47 | 1.89 – 3.23 | **<.001** |
| *1 wave before* | 0.90 | 0.73 – 1.12 | .337 | 0.88 | 0.69 – 1.12 | .295 | 1.71 | 1.40 – 2.08 | **<.001** | 1.70 | 1.34 – 2.15 | **<.001** |
| *Wave reported* | REF |  |  | REF |  |  | REF |  |  | REF |  |  |
| *1 wave after* | 0.70 | 0.56 – 0.87 | **.002** | 0.75 | 0.58 – 0.96 | **.025** | 0.76 | 0.62 – 0.95 | **.014** | 0.80 | 0.63 – 1.02 | .077 |
| *2 waves after* | 0.65 | 0.52 – 0.82 | **<.004** | 0.67 | 0.51 – 0.88 | **.003** | 0.51 | 0.40 – 0.64 | **<.001** | 0.56 | 0.43 – 0.74 | **<.001** |