ENVIRONMENTAL-RISK (E-RISK) LONGITUDINAL TWIN STUDY
CONCEPT PAPER FORM

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Provisional Paper Title: Adolescent loneliness and employment outcomes in young adulthood

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Objective of the study and its significance:

Loneliness has been identified as a key risk factor for a range of mental and physical health problems, with the productivity losses and the healthcare burden linked with loneliness having the potential for significant economic and societal costs (Mihalopoulos et al. 2020). Loneliness has also been linked to poor performance in education and employment (Lim et al. 2019), with lonely individuals more likely to be unemployed (Morrish & Medina-Lara 2021), less confident in the workplace and less optimistic about their career prospects (Matthews et al. 2018). As such, associations between loneliness and poor occupational outcomes may be an additional way in which loneliness exerts an economic burden.

In particular, findings from a recent study suggested that loneliness could be a force for downward social mobility (Matthews et al. 2018). This study indicated that while they were from similar socioeconomic backgrounds, lonelier young adults were more likely to be out of work and education (NEET) by age 18 than their non-lonely peers. This is of particular concern, as NEET status is associated with mental health problems (Goldman-Mellor et al. 2018), and individuals who experienced a 6-month period of NEET are more likely to experience persistent unemployment later in adulthood (Samoilenko & Carter 2015).

The mechanisms underlying the association between loneliness and poor employment outcomes are unclear, with a range of individual and situational factors potentially explaining this downward movement. Children who are lonely during their school years may experience social and academic difficulties that result in them leaving school with lower qualifications (Matthews et al. 2022), disadvantaging them in the job market. Mental health problems linked with loneliness may also drive this association. Further, as most existing research on the topic has utilised cross-sectional data (Morrish & Medina-Lara 2021), the direction of this association is not well understood. While academic and mental health difficulties associated with loneliness may impede lonely individuals' employment prospects, being unemployed may lead to isolation and feeling rejected by society. Greater clarity on this association using longitudinal data will facilitate the identification of young people at-risk of poor work outcomes and inform intervention strategies.

The majority of research on the association between loneliness and occupational functioning has focused on unemployment (Morrish & Medina-Lara 2021) or NEET status (Matthews et al. 2018). However, an individual's employability and social position are multifaceted and cannot be captured using employment status alone. Employability is the capacity of an individual to gain meaningful and sustainable employment, and depends on the knowledge, skills and attitudes they bring to the job market (Hillage & Pollard 1998). In particular, an individual's employability is composed of factors including their technical skills, 'soft' skills,

qualifications, work experience and job seeking behaviour (McQuaid & Lindsey 2005).

The socioeconomic position of emerging adults is also not well captured using employment status (Goodman et al. 2003). During young adulthood, individuals transition from childhood social status, which is primarily determined by their family's status, and adult social status, which is determined by their own occupation, education and income. As such, employment is not a sufficient indicator of young adults' status, with perceived social status an alternative measure appropriate for this developmental stage (Goodman et al. 2003). Research using detailed measures capturing multiple dimensions of employability and social status is needed to understand the link between loneliness and poor occupational outcomes.

An issue when asking individuals about their perceived employability and social status, is that loneliness could be a source of reporting bias. Loneliness is associated with bias towards threats (Spithoven et al. 2017), which could negatively bias individuals' perceptions of their skills and social status, as well as their optimism about their career prospects. This could become a self-fulfilling prophecy, in which lonely individuals' are less inclined to seek desirable jobs or promotions. Sibling and twin designs offer a method for testing whether the 'effects' of loneliness are accounted for by negatively skewed perceptions. For instance, if an adolescent who has experienced loneliness perceives their prospects to be poorer than a non-lonely sibling who shares the same level of education, employment status and family SES, this would suggest that loneliness is associated with negatively biased perceptions, highlighting an important target for interventions.

The present study aims to address the following research questions:
1. Are lonely children less employable as young adults?
   Associations between early adolescent loneliness and both NEET status and an index of employability at age 18 will be examined.
2. Do lonely children feel more negatively about their social status as young adults?
   Associations between early adolescent loneliness and subjective social status at age 18 will be examined.
3. Do lonely individuals have more negative perceptions of their social status compared to non-lonely individuals with comparable socioeconomic circumstances?
   Sibling control methods using cohabiting twins will be used to further control for household socioeconomic status. Twin discordance in qualification levels and current employment status will also be controlled for.

Statistical analyses:

1. An exploratory factor analysis of educational attainment, job preparedness, work experience, job search behaviour, attitudes about work and career optimism at age 18 will be conducted to examine the relationship between the variables related to employability. An index of employability at age 18 will be derived using these variables.
2. Linear, logistic, and Poisson models will be used to regress employment status, an index of employability, and perceived social status at age 18 on loneliness at age 12. Age 12 personality, mental health and functioning will be entered into the model as a second step, to test whether any effects detected are accounted for by childhood confounders. Age 18 loneliness, mental health and functioning will be entered as a third step to test whether any associations are explained by covariates that may impact an individual's ability to get a job.
3. Fixed-effects models will be used to regress within-twin pair differences in the age-18 outcomes on within-pair differences in loneliness. This analysis will be limited to twins living in the same home, to hold the SES of the family household constant. Twin differences in qualifications and employment status will also be controlled for.

Variables Needed at Which Ages (names and labels):

Demographic variables
FAMILYID ID   Family
ATWINID ID   Twin 1
BTWINID ID   Twin 2

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SAMPSEX	Sex of twins
RORDERP5	Random order variable
ZYGOSITY	Zygosity
SETHNIC	Ethnicity of twins
SESWQ35	SES
SESDISM5	Disadvantage

Age 12
Social status
STA01EC12	Status within family - Elder
STA01YC12	Status within family - Younger
STA02EC12	Status within peers - Elder
STA02YC12	Status within peers - Younger
STA03EC12	Status within school - Elder
STA03YC12	Status within school - Younger
STA04EC12	Status within country - Elder
STA04YC12	Status within country - Younger

Loneliness
LONELYE12	Loneliness age 12 - Elder
LONELYY12	Loneliness age 12 - Younger

Mental health and functioning covariates
CDIE12	Depression Scale - CDI - Elder
CDIY12	Depression Scale - CDI - Younger
MASCE12	Anxiety Scale - MASC - Elder
MASCY12	Anxiety Scale - MASC - Elder
DEPRSE12	Depression scale [from CBCL] - P12 - Elder
DEPRSY12	Depression scale [from CBCL] - P12 – Younger
PE70AM12	Uses drugs for non-medical purposes
PE70BM12	Drinks alcohol w/o parents approval
PE70CM12	Smokes tobacco'
BFINE12	Neuroticism Subscale (BFI) - Elder Twin
BFINY12	Neuroticism Subscale (BFI) - Younger Twin

Age 18
Education and employment variables
NEETE18	NEET: Not in education, employment or training - P18 - Elder
NEETY18	NEET: Not in education, employment or training - P18 – Younger
DEM2E18	Currently studying - elder
DEM2Y18	Currently studying – younger
DEM4E18	Reason left education – elder
DEM4Y18	Reason left education – younger
EDUCACHVE18	Highest educational achievement (based on QCF) - P18 - Elder
EDUCACHVY18	Highest educational achievement (based on QCF) - P18 – Younger
DEM5E18	Currently working - elder
DEM5Y18	Currently working - younger

Employment history variables - including raw reasons for leaving job
DEM9E18	Ever paid for work – elder
DEM9E18	Ever paid for work - younger
DEM10E18	Ever lost job - elder
DEM10Y18	Ever lost job - younger
DEM10aE18	Ever lost job (sacked) - elder
DEM10aY18	Ever lost job (sacked) - younger
DEM10bE18	Ever lost job (redundant) - elder
DEM10bY18	Ever lost job (redundant) - younger
DEM10cE18	Ever lost job (closed) - elder
DEM10cY18	Ever lost job (closed) - younger
DEM10dE18	Ever lost job (pay) - elder
DEM10dY18	Ever lost job (pay) - younger
DEM10eE18	Ever lost job (disliked job) - elder
DEM10eY18	Ever lost job (disliked job) - younger
DEM10fE18	Ever lost job (progression) - elder
DEM10fY18	Ever lost job (progression) - younger
DEM10gE18	Ever lost job (boss/co-workers) - elder

DEM10gY18	Ever lost job (boss/co-workers) - younger
DEM10hE18	Ever lost job (prison) - elder
DEM10hY18	Ever lost job (prison) - younger
DEM10iE18	Ever lost job (illness) - elder
DEM10iY18	Ever lost job (illness) - younger
DEM10jE18	Ever lost job (mental health) - elder
DEM10jY18	Ever lost job (mental health) - younger
DEM10kE18	Ever lost job (transport) - elder
DEM10kY18	Ever lost job (transport) - younger
DEM10lE18	Ever lost job (carer) - elder
DEM10lY18	Ever lost job (carer) - younger
DEM10mE18	Ever lost job (better job) - elder
DEM10Ym18	Ever lost job (better job) - younger
DEM10nE18	Ever lost job - elder
DEM10nY18	Ever lost job - younger

Job search behaviour – including raw job search items for factor analysis

DEM11E18	Job search behaviour - elder
DEM11Y18	Job search behaviour - younger
DEM11aE18	Job search behaviour (classifieds) - elder
DEM11aY18	Job search behaviour (classifieds) - younger
DEM11bE18	Job search behaviour (internet) - elder
DEM11bY18	Job search behaviour (internet) - younger
DEM11cE18	Job search behaviour (listing) - elder
DEM11cY18	Job search behaviour (listing) - younger
DEM11dE18	Job search behaviour (CV) - elder
DEM11dY18	Job search behaviour (CV) - younger
DEM11eE18	Job search behaviour (talking) - elder
DEM11eY18	Job search behaviour (talking) - younger
DEM11fE18	Job search behaviour (applied) - elder
DEM11fY18	Job search behaviour (applied) - younger
DEM11gE18	Job search behaviour (interview) - elder
DEM11gY18	Job search behaviour (interview) - younger
DEM11hE18	Job search behaviour (agency) - elder
DEM11hY18	Job search behaviour (agency) - younger
DEM11iE18	Job search behaviour (contacted employer) - elder
DEM11iY18	Job search behaviour (contacted employer) - younger
DEM11jE18	Job search behaviour (training) - elder
DEM11jY18	Job search behaviour (training) - younger
DEM11kE18	Job search behaviour (nothing) - elder
DEM11kY18	Job search behaviour (nothing) - younger
DEM11lE18	Job search behaviour (other) - elder
DEM11lY18	Job search behaviour (other) - younger
DEM12aE18	Hurt chances of getting job (qualifications) - elder
DEM12aY18	Hurt chances of getting job (qualifications) - younger
DEM12bE18	Hurt chances of getting job (age) - elder
DEM12bY18	Hurt chances of getting job (age) - younger
DEM12cE18	Hurt chances of getting job (ethnicity) - elder
DEM12cY18	Hurt chances of getting job (ethnicity) - younger
DEM12dE18	Hurt chances of getting job (economy) - elder
DEM12dY18	Hurt chances of getting job (economy) - younger
DEM12eE18	Hurt chances of getting job (gender) - elder
DEM12eY18	Hurt chances of getting job (gender) - younger
DEM12fE18	Hurt chances of getting job (availability) - elder
DEM12fY18	Hurt chances of getting job (availability) - younger
DEM12gE18	Hurt chances of getting job (relocation) - elder
DEM12gY18	Hurt chances of getting job (relocation) - younger
DEM12hE18	Hurt chances of getting job (personality) - elder
DEM12hY18	Hurt chances of getting job (personality) - younger
DEM12iE18	Hurt chances of getting job (health) - elder
DEM12iY18	Hurt chances of getting job (health) - younger
DEM12jE18	Hurt chances of getting job (looks) - elder
DEM12jY18	Hurt chances of getting job (looks) - younger
DEM12kE18	Hurt chances of getting job (work record) - elder
DEM12kY18	Hurt chances of getting job (work record) - younger
DEM12lE18	Hurt chances of getting job (transport) - elder

DEM12lY18 Hurt chances of getting job (transport) - younger
DEM12mE18 Hurt chances of getting job (childcare) - elder
DEM12mY18 Hurt chances of getting job (childcare) - younger
DEM12nE18 Hurt chances of getting job (criminal record) - elder
DEM12nY18 Hurt chances of getting job (criminal record) - younger
DEM12oE18 Hurt chances of getting job (mental health) - elder
DEM12oY18 Hurt chances of getting job (mental health) - younger

Attitudes about work – including raw items for factor analysis
DEM13E18 Work attitudes (lottery) - elder
DEM13Y18 Work attitudes (lottery) - younger
DEM14E18 Work attitudes (important) - elder
DEM14Y18 Work attitudes (important) - younger
DEM15E18 Work attitudes (bored) - elder
DEM15Y18 Work attitudes (bored) - younger
DEM16E18 Work attitudes (self-respect) - elder
DEM16Y18 Work attitudes (self-respect) - younger
DEM17E18 Work attitudes (worst) - elder
DEM17Y18 Work attitudes (worst) - younger
DEM18E18 Work attitudes (money) - elder
DEM18Y18 Work attitudes (money) - younger
DEM19E18 Work attitudes (prefer to work) - elder
DEM19Y18 Work attitudes (prefer to work) - younger

Job preparedness and optimism – including raw items for factor analysis
JPREPSE18 Job preparedness (skills) scale - P18 - Elder
JPREPSY18 Job preparedness (skills) scale - P18 - Younger
JMP1E18 Job preparedness (skills – word processing) scale - elder
JMP1Y18 Job preparedness (skills - word processing) scale - younger
JMP2E18 Job preparedness (skills - programming) scale - elder
JMP2Y18 Job preparedness (skills - programming) scale - younger
JMP3E18 Job preparedness (skills – second language) scale - elder
JMP3Y18 Job preparedness (skills - second language) scale - younger
JMP4E18 Job preparedness (skills - talent) scale - elder
JMP4Y18 Job preparedness (skills - talent) scale - younger
JMP5E18 Job preparedness (skills - sales) scale - elder
JMP5Y18 Job preparedness (skills - sales) scale - younger
JMP6E18 Job preparedness (skills – customer service) scale - elder
JMP6Y18 Job preparedness (skills - customer service) scale - younger
JMP7E18 Job preparedness (skills - writing) scale - elder
JMP7Y18 Job preparedness (skills - writing) scale - younger
JMP8E18 Job preparedness (skills - cooking) scale - elder
JMP8Y18 Job preparedness (skills - cooking) scale - younger
JMP9E18 Job preparedness (skills - trade) scale - elder
JMP9Y18 Job preparedness (skills - trade) scale - younger
JMP10E18 Job preparedness (skills - business) scale - elder
JMP10Y18 Job preparedness (skills - business) scale - younger
JMP11E18 Job preparedness (skills - other) scale - elder
JMP11Y18 Job preparedness (skills - other) scale - younger
JPREPAE18 Job preparedness (attributes) scale - P18 - Elder
JPREPAY18 Job preparedness (attributes) scale - P18 - Younger
JMP12E18 Job preparedness (attributes – problem solving) scale - elder
JMP12Y18 Job preparedness (attributes - problem solving) scale - younger
JMP13E18 Job preparedness (attributes – critical thinking) scale - elder
JMP13Y18 Job preparedness (attributes - critical thinking) scale - younger
JMP14E18 Job preparedness (attributes - leader) scale - elder
JMP14Y18 Job preparedness (attributes - leader) scale - younger
JMP15E18 Job preparedness (attributes - calm) scale - elder
JMP15Y18 Job preparedness (attributes - calm) scale - younger
JMP16E18 Job preparedness (attributes - explain) scale - elder
JMP16Y18 Job preparedness (attributes - explain) scale - younger
JMP17E18 Job preparedness (attributes - tech) scale - elder
JMP17Y18 Job preparedness (attributes - tech) scale - younger
JMP18E18 Job preparedness (attributes - communication) scale - elder
JMP18Y18 Job preparedness (attributes - communication) scale - younger
JMP19E18 Job preparedness (attributes - others) scale - elder

JMP19Y18	Job preparedness (attributes - others) scale - younger
JMP20E18	Job preparedness (attributes - time) scale - elder
JMP20Y18	Job preparedness (attributes - time) scale - younger
JMP21E18	Job preparedness (attributes - improving) scale - elder
JMP21Y18	Job preparedness (attributes - improving) scale - younger
JMP22E18	Job preparedness (attributes – get along) scale - elder
JMP22Y18	Job preparedness (attributes – get along) scale - younger
JMP23E18	Job preparedness (attributes - adapt) scale - elder
JMP23Y18	Job preparedness (attributes - adapt) scale - younger
JMP24E18	Job preparedness (attributes - tasks) scale - elder
JMP24Y18	Job preparedness (attributes - task) scale - younger
JMP25E18	Job preparedness (attributes - team) scale - elder
JMP25Y18	Job preparedness (attributes - team) scale - younger
JMP26E18	Job preparedness (attributes – reading people) scale - elder
JMP26Y18	Job preparedness (attributes – reading people) scale - younger
JMP27E18	Job preparedness (attributes – on time) scale - elder
JMP27Y18	Job preparedness (attributes – on time) scale - younger
JMP28E18	Job preparedness (attributes - creative) scale - elder
JMP28Y18	Job preparedness (attributes – creative) scale - younger
JMP29E18	Job preparedness (attributes - learner) scale - elder
JMP29Y18	Job preparedness (attributes - learner) scale - younger
JMP30E18	Job preparedness (attributes - likeable) scale - elder
JMP30Y18	Job preparedness (attributes - likeable) scale - younger
JMP31E18	Job preparedness (attributes - advice) scale - elder
JMP31Y18	Job preparedness (attributes - advice) scale - younger

OPTIME18	Optimism scale - P18 - Elder
OPTIMY18	Optimism scale - P18 - Younger
OPT1E18	Optimism scale (education) - elder
OPT1Y18	Optimism scale (education) - younger
OPT2E18	Optimism scale (university) - elder
OPT2Y18	Optimism scale (university) - younger
OPT3E18	Optimism scale (opportunity) - elder
OPT3Y18	Optimism scale (opportunity) - younger
OPT4E18	Optimism scale (job market) - elder
OPT4Y18	Optimism scale (job market) - younger
OPT5E18	Optimism scale (move away) - elder
OPT5Y18	Optimism scale (move away) - younger
OPT6E18	Optimism scale (money) - elder
OPT6Y18	Optimism scale (money) - younger
OPT7E18	Optimism scale (family) - elder
OPT7Y18	Optimism scale (family) - younger
OPT8E18	Optimism scale (background) - elder
OPT8Y18	Optimism scale (background) - younger
OPT9E18	Optimism scale (work hard) - elder
OPT9Y18	Optimism scale (work hard) - younger
OPT10E18	Optimism scale (older) - elder
OPT10Y18	Optimism scale (older) - younger

Subjective social status

SIFAMILYE18	Status within family task - elder
SIFAMILYY18	Status within family task - younger
SIPEERSE18	Status within peers task - elder
SIPEERSY18	Status within peers task - younger
SIWORKE18	Status within work task - elder
SIWORKY18	Status within work task - younger
SICOUNTRYE18	Subjective social status ladder task - elder
SICOUNTRYY18	Subjective social status ladder task - younger

Loneliness

| LONELYE18 | Loneliness scale - P18 - Elder |
| LONELYY18 | Loneliness scale - P18 - Younger |

Mental health and functioning covariates

| MDESXE18 | Depression symptoms scale - P18 - Elder |
| MDESXY18 | Depression symptoms scale - P18 - Younger |

GADSXE18	GAD symptoms scale - P18 - Elder
GADSXY18	GAD symptoms scale - P18 – Younger
BFINE18	Neuroticism subscale (BFI) – Interviewer – P18 - Elder
BFINY18	Neuroticism subscale (BFI) – Interviewer – P18 - Younger
PARENTE18R	Early pregnancy (parent or pregnant at 18) - Elder
PARENTY18R	Early pregnancy (parent or pregnant at 18) - Younger
ANYCRIME18	MoJ - any criminal offence - P18 - Elder
BMIE18	BMI – P18 - Elder
BMIY18	BMI – P18 - Younger
AUDSXE18	Alcohol use disorder symptoms scale (DSM5) - P18 - Elder
AUDSXY18	Alcohol use disorder symptoms scale (DSM5) - P18 - Younger
IMDDECILE_P18	Index of Multiple Deprivation Decile, age 18, IMD2015
IMDDECILY_P18	Index of Multiple Deprivation Decile, age 18, IMD2015
COHABE18	Twins living together at age 18 - Elder

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Data Security Agreement

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Proposing Author	Bridget Bryan
Today's Date	21 September 2022

Please keep one copy for your records
(Please initial your agreement)

X   I am familiar with the King's College London research ethics guidelines (https://www.kcl.ac.uk/innovation/research/support/ethics/about/index.aspx) and the MRC good research practice guidelines (https://www.mrc.ac.uk/research/policies-and-guidance-for-researchers/good-research-practice/).

X   My project has ethical approval from my institution.

X   I am familiar with the EU General Data Protection Regulation (https://mrc.ukri.org/documents/pdf/gdpr-guidance-note-3-consent-in-research-and-confidentiality/), and will use the data in a manner compliant with its requirements.

X   My computer is (a) encrypted at the hard drive level, (b) password-protected, (c) configured to lock after 15 minutes of inactivity, AND (d) has an antivirus client which is updated regularly.

X   I will treat all data as "restricted" and store in a secure fashion.

X   I will not share the data with anyone, including students or other collaborators not specifically listed on this concept paper.

X   I will not merge data from different files or sources, except where approval has been given by the PI.

X   I will not post data online or submit the data file to a journal for them to post.
Some journals are now requesting the data file as part of the manuscript submission process. The E-Risk Study cannot be shared because the Study Members have not given informed consent for unrestricted open access. Speak to the study PI for strategies for dealing with data sharing requests from Journals.

X   Before submitting my paper to a journal, I will submit my draft manuscript and scripts for data checking, and my draft manuscript for co-author mock review, allowing three weeks.

X   I will submit analysis scripts and new variable documentation to project data manager after the manuscript gets accepted for publication.

X   I will delete the data after the project is complete.

N/A   **For projects using location data:** I will ensure geographical location information, including postcodes or geographical coordinates for the E-Risk study member's homes or schools, is never combined or stored with any other E-Risk data (family or twin-level data)

N/A   **For projects using genomic data:** I will only use the SNP and/or 450K data in conjunction with the phenotypes that have been approved for use in this project at the concept paper stage.

Signature: *BBryan*