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ORIGINAL RESEARCH

# Objective Income But Not Subjective Social Status Predicts Short-Term and Long-Term Cognitive Outcomes: Findings Across Two Large Datasets

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**Abstract**
Little evidence exists to determine whether individual variations in objective income versus subjective social status would more strongly predict cognitive outcomes in adulthood. In the present study, we contrast the predictive validity of objective income against subjective social status on cognitive outcomes using two large-scale, general public samples. In Study 1, we cross-sectionally examined a sample of Singaporean adults ($N$ = 848; 379 males; $M_{age}$ = 37.19) to determine whether income or subjective social status would predict reasoning ability. In Study 2, we examined a sample of American adults ($N$ = 1476; 694 males; $M_{age}$ = 53.70) across approximately ten years using latent variable cross-lagged panel modelling to determine whether income or subjective social status would predict long-term episodic memory and executive function after accounting for baselines. Age, gender, education, employment status, and household size were controlled for. Results indicated that objective income predicted all cognitive outcomes in both studies, whereas subjective social status did not. Additionally in Study 2, reverse-causal pathways in which cognitive functioning was specified as a predictor of later income were not supported. Overall, the results suggest replicable, unidirectional links between objective income and multiple indices of cognitive functioning that were not found for subjective social status.

**Keywords** Income · Subjective social status · Reasoning ability · Executive function · Episodic memory · Cognitive functioning

Social scientists have long pursued the empirical question of how individual differences in markers of social status may be predictive of diverging outcomes in adult development. For example, while early work has focused primarily on objective levels of income, some researchers argue that subjective perceptions of social status matter as much as or even more than objective levels of income in adult development (Singh-Manoux et al., 2005). Although the distinction between objective and subjective status is both theoretically

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and practically important (Adler et al., 2000), there is presently little evidence to determine whether individuals' short-term and long-term cognitive functioning would be more strongly explained by objective income levels or subjective perceptions of status. We address this question using two large-scale general-public datasets. In Study 1, we contrasted the predictive validity of objective income levels against subjective social status in predicting cognitive reasoning ability among a cross-sectional sample of Singaporean adults. In Study 2, we performed cross-lagged panel modelling to examine long-term directional relationships between objective income, subjective social status, and cognitive functioning among a sample of American adults assessed approximately 10 years apart.

Whereas income is conceptualized as an objective indicator of one's status, subjective social status has been conceptualized as a psychological evaluation of one's status relative to either one's community or society and represents a subjective perception of whether one's position is high or low compared to important others (e.g., Curhan et al., 2014). By and large, individual differences in income have been found to be practically important for outcomes such as psychological well-being (Diener et al., 2010) as well as health (Williams et al., 2016), and studies have also provided support for the practical utility of subjective social status in predicting similar important outcomes (Callan et al., 2015; Cohen et al., 2008). Moreover, there is evidence that higher status is generally associated with improved cognitive development in childhood (e.g., Moriguchi & Shinohara 2019; Tucker-Drob, 2013), and researchers have argued that similar processes should influence cognitive development in childhood and adulthood (Bialystok & Craik, 2010). However, the empirical picture of how income and subjective status in adulthood relates to adult cognitive development is less clear. Some evidence suggests that having more income should be beneficial for the cognitive development of adults—for example, whereas having more income is typically linked to improved cognitive function (Mani et al., 2013), individuals with lower income tend to exhibit poorer cognitive performance (Turrell et al., 2002). However, other findings have been mixed (Lee et al., 2003; Yang et al., 2016), and further work is required to clarify the relationships between income and cognitive outcomes in adult development.

Moreover, almost no work to date has examined how individual differences in subjective social status could be linked to cognitive functioning. Only one recent study has provided some evidence that subjective status may have positive links with cognitive outcomes, but this study was limited only to memory (Zahodne et al., 2018), which limits the generalizability of its findings. Indeed, a major limitation of past work is that few studies have examined how income may be linked to adult development in the executive function, which consists of a set of generalizable cognitive abilities that are critical to performing numerous complex behaviors in daily life (Banich, 2009). Similarly, few studies have examined whether variations in income may predict the ability to demonstrate reasoning skills on complex problems (e.g., Schooler et al., 1993). As different measures of cognitive functions may tap upon interrelated but nevertheless distinguishable aspects of cognitive health (Ritchie et al., 2016), empirical examinations which span multiple indices of cognitive functioning would provide more comprehensive and conclusive findings concerning whether objective income and subjective social status would predict cognitive functioning, but such an analysis has not yet been performed.

One perspective argues that subjective social status provides a psychological reality that has implications for psychosocial outcomes over and above objective income levels (Glei et al., 2018). From this viewpoint, subjective perceptions of individuals' social standing have a more important role than their material reality in explaining the lived experience of their daily lives and in turn in predicting life outcomes. For example, there is evidence showing that subjective status is reliably linked to better physical health outcomes (Cundiff & Matthews, 2017), and several studies have shown that associations between subjective social status and life outcomes occur independently of objective indicators of income (Doshi et al., 2016; English et al., 2019). Extending this to cognitive outcomes, subjective social status may similarly have alleviative psychological benefits against debilitative negative states (Rahal et al., 2020) and buffer against negative emotional states which may otherwise have deleterious effects on cognitive functioning (Lupien et al., 2009). From this perspective, one may therefore suggest the hypothesis that subjective social status should have independent contributions to cognitive outcomes over and above objective income levels.

However, the same psychological benefits that have been found for subjective social status have also been linked to objective indicators of income (Cohen et al., 2006; Sacks et al., 2012), which makes it unclear whether subjective social status would have additional predictive validity over and above objective income levels. There is suggestive evidence that higher status in general may promote psychological outcomes that are thought to be antecedents to positive cognitive functioning, but it is again unclear whether these outcomes are unique to subjective status or objective income levels. For example, having a higher socioeconomic status may increase the capacity of individuals to focus on positive aspects of their personal goals and motivations (Kraus et al., 2012) as well as increase their sense of control, agency, persistence, and sense of power (Lachman & Weaver, 1998; Vohs et al., 2006), which in turn should free up cognitive resources that permit better executive functions and reasoning ability (Schmeichel et al., 2003; Yin & Smith, 2020). No evidence to date exists to determine conclusively whether these outcomes are relatively unique to the material reality offered by objective income levels, or if subjective perceptions of social standing can sufficiently account for them, which complicates predictions on whether either one would predict cognitive outcomes independently of the other.

Additionally, an alternative argument could be made that the material reality of individuals' lives as reflected in objective income levels could have a more direct and powerful role in shaping their environment and their lived experiences, in turn more strongly explaining variation in cognitive outcomes. Whereas objective income levels represent the concrete and factual availability of material resources which can directly contribute to successful cognitive development, subjective social status may only provide a perception that one is of high status without necessarily implying that one has access to material resources. These material resources could be more directly implicated in meeting one's physiological needs, such as addressing health difficulties which may otherwise have detrimental effects on long-term cognitive health (McNaull et al., 2010), or obtaining adequate nutritional quality in one's diet (French et al., 2019), which is a key predictor of cognitive functioning in adult development (Scarmeas et al., 2018). Simply evaluating one's social standing positively may not directly act in service of these objective environmental conditions which require the purchasing power that is provided only by objective income levels.

Following from the above point, lifestyle activities that produce cognitive benefits in adult development may also be more accessible to individuals with higher income. For example, leisure-time physical activities and other socially-engaging activities which are cognitively beneficial (Hultsch et al., 1999; Mandolesi et al., 2018) are more accessible to high-income individuals who do not need to spend as much time addressing concerns with inequality or finances (Giles-Corti, 2002; Lancee & Van de Werfhorst, 2012). Moreover, many activities which have been found to produce cognitive benefits, such as nature experiences (Bratman et al., 2012), taking overseas vacations (Jia et al., 2009), or the use of technology (Tun & Lachman, 2010) require monetary investments and are more affordable and accessible to individuals with higher income. While individuals with higher subjective social status may psychologically see themselves as being of respectable status within their communities, they may nevertheless lack the material wealth required to engage in these lifestyle activities and may thus be less able to reap their cognitive benefits. Thus, long-term cognitive benefits could accumulate from these lifestyle differences that may be relatively specific to individuals with higher objective income levels. From this view, an alternative hypothesis can be suggested, such that objective income levels should be more strongly predictive of cognitive outcomes than subjective social status.

Summarizing the above, two competing hypotheses can be suggested. The first, based upon the perspective that subjective perceptions should have stronger implications for one's lived experience than material reality, is that subjective social status should independently predict better cognitive outcomes over and above objective income, while objective income may either be a non-significant or weaker predictor. The second, based upon the perspective that the material resources associated with objective income should have larger and more direct implications with environmental and lifestyle factors that influence cognitive outcomes, is that objective income levels should predict better cognitive outcomes more strongly than subjective social status, which should instead be a weaker or non-significant predictor. Given that there is preliminary support for both of the conflicting perspectives, we make no a priori predictions regarding which perspective would be more likely to be supported. Rather, our main focus is to provide empirical clarification of this poorly-understood and contentious question using two large-scale general public datasets, thus allowing naturalistic and ecologically valid examinations of which hypothesis is more likely to be supported, both in the short-term and the long-term.

Specifically, we examined a large sample of adult participants from Singapore, an East Asian culture, at a single time point in Study 1, while in Study 2, we examined a large sample of adult participants from the U.S.A., a Western culture, across two time points spaced approximately ten years apart. Of note, cross-cultural conclusions from the present studies are preliminary. Singapore is a heavily Westernized East Asian culture, which complicates generalizability to other East Asian cultures, and the two samples also differ in other demographic characteristics other than culture, which complicates precise interpretations on why similarities or differences between the two samples may occur. Thus, the two samples are not aimed at providing a rigorous cross-cultural comparison. Nevertheless, while making conclusive cross-cultural comparisons is not the central aim of the present research, the examination of two countries which differ demographically and ethnically allow us to provide a preliminary test of whether the findings could be replicable and robust across different populations. Together, the two studies thus allow replication of the findings both cross-sectionally and longitudinally, as well as across two diverse samples.

Additionally, we examined this issue across a total of three distinct cognitive measures. Specifically, in Study 1 we administered a task measuring insightful and deductive reasoning ability (Fisher, 1981; Schooler et al., 1993), which is thought to be strongly related to use of the working memory (Chuderski & Jastrzębski, 2018) and has implications for achievement outcomes (Lawson et al., 2007). In Study 2, we assessed both the episodic memory and executive function, which together provide a broad and generalizable examination of cognitive functioning (Cacciaglia et al., 2018). Indeed, the episodic memory is important for anticipating future events and for planning (Klein et al., 2002), while the executive function is a crucial marker of successful ageing (Phillips & Henry, 2010) and is related to the ability to attain positive outcomes in later life such as self-control (Diamond, 2013), good health (Davis et al., 2010), and the ability to function well in daily life (Coppin et al., 2006). Empirical examinations of the factors that are relevant to healthy cognitive functioning across these indices would be integral to a scientific understanding of successful ageing, especially for policy-makers in the current social context of a rapidly ageing population (Fiocco & Yaffe, 2010). Together, the measures provide a comprehensive assessment of cognitive functions that have strong practical implications for real life outcomes, and allow for conceptual replication of the findings across distinct aspects of cognitive functioning.

## 1 Study 1

In Study 1, we performed cross-sectional analyses testing whether objective income levels or subjective social status would be associated with reasoning ability among a sample of adults in Singapore. We also controlled for key demographical variables that may influence cognitive functioning. Specifically, given previous work on age declines in cognitive functions (McArdle et al., 2007) as well as potential gender differences in cognitive performance (Maitland et al., 2000), we adjusted for demographical variability in age and gender. Furthermore, given that education level is itself often conceptualized as an indicator of objective status (Curhan et al., 2014) and given that there are well-established links between education and better cognitive performance (Falch & Massih, 2011; Guerra-Carrillo et al., 2017; Lee et al., 2006; Lövdén et al., 2020), we controlled for education level to determine whether income could have an independent and unique explanatory role in predicting cognitive functioning. Employment status was also controlled for given previous evidence that occupational factors could influence cognitive outcomes in adulthood (Pool et al., 2016). Finally, given that the utility of income may be bounded by the number of people in one's household, household size was adjusted for.

## 2 Method

### 2.1 Participants

Data for Study 1 comes from a large-scale cross-sectional survey conducted in 2019 on an unrelated topic on positive emotions conducted among the general public in Singapore. Participants for this study were drawn from Qualtrics' panel database, and were recruited via an email invitation with a link to the online survey. Participants were drawn from multiple market research panels and different incentives were provided (e.g., gift cards, redeemable points, vouchers). The study was conducted across two consecutive days. Participants were required to complete one set of measures that would need about one hour to complete. Given that it could be too demanding to complete one hour's worth of measures, the measures were split into two halves to be completed on two different days. For the purpose of the larger research, the first half (completed on the 1st day) comprised mainly emotion and demographic measures which included income and subjective social status, and the second half comprised various outcome measures that included the current cognitive tasks. In total, data for the key variables was available for 848 participants (379 males, 469 females; $M_{age} = 37.19$, $SD_{\text{age}} = 9.16$, age range: 20–55 years). Power analyses indicate that the present sample size would permit even small effect sizes to be detected with a high power of 0.88. Data and analysis codes for this study are uploaded at https://osf.io/2ebs9/?view_only=3e4dfe0a998e4497b26837ecb33f663a.

### 2.2 Measures

*Income* Monthly household income (in Singapore dollars) was measured over 51 income brackets ranging from 1 (*Less than $1000*) to 51 (*More than $50,000 a month*).

*Subjective social status* Subjective social status was assessed using the MacArthur Scale (Adler et al., 2000; Cundiff et al., 2013). The variant of the scale which refers to one's community was measured in the present dataset.[1] Participants were asked to define community in the way most meaningful to them, and then rank their standing in their community on a ladder from 1 (*bottom rung*) to 10 (*top rung*). The MacArthur Scale is widely used in studies of subjective social status and has been strongly supported as a validated scale used in previous studies (e.g. Zahodne et al., 2018, English et al., 2019).

*Reasoning ability* A set of 11 questions adapted based on established scales of insightful and syllogistic reasoning (Fisher, 1981; Schooler et al., 1993) were administered to measure performance on a task requiring the use of cognitive reasoning skills such as insight (e.g., "*In a certain lake, the water lilies double in number every 24 hours. At the beginning of summer there is one water lily on the lake. It takes 60 days for the lake to become completely covered with water lilies. On which day (pick one day between Day 1 to Day 60) is the lake half (i.e., 50%) covered?*") and logical deduction (e.g., "*Premise 1: No C are B. Premise 2: A are not B. Pick one option that follows from the two premises.*"). Each question was scored against an answer sheet, such that correct answers were coded '1' while wrong answers were coded as '0'. The total number of correct answers were then summed to determine participants' overall reasoning ability. The full set of questions are provided under supplementary materials.

*Demographics* Age, gender (1 = *male*, 0 = *female*), education level (from 1 representing "*no education or some grade school*" to 12 representing "*professional qualification*"), employment status (1 = *employed*, 0 = *unemployed*) and household size were included as demographical covariates.

## 3 Results

Descriptive statistics and inter-correlations between all variables are presented in Table 1. A simple linear regression was performed with household income and subjective social status as the focal predictors, while age, gender, education level, employment status, and household size were included as demographical covariates. There was no evidence of multicollinearity (VIF = 1.16 for income and VIF = 1.07 for subjective status) or endogeneity

[1] The society variant of the scale measures a similar construct to the community variant used in the present research, but instead instructs participants to rank their standing in terms of their money, education, and jobs in comparison to their society. Previous work in which both variants of the MacArthur's ladder were included found that the two variants were positively correlated with reasonably high magnitudes that suggest some overlap (Camelo et al., 2014; Cundiff et al., 2013), and meta-analytic evidence has also found that the two variants independently predicted the same constructs in the same directions with the same magnitudes, suggesting that they are similar, albeit independent constructs (Zell et al., 2018). Indeed, previous research has also utilized the community variant on its own as an indicator of subjective status in contrast to objective indicators such as income (e.g., Curhan et al., 2014; English et al., 2019). As such, the evidence generally suggests that the community variant of the scale can be used as a valid indicator of subjective social status in comparison with income. Nevertheless, we discuss potential limitations to this measure in the 6 section.

**Table 1** Descriptive statistics and correlation matrix for all key variables in Study 1

| | M | SD | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|---|
| 1. Age | 37.19 | 9.16 | – | | | | | | |
| 2. Gender | 0.45 | 0.50 | 0.09** | – | | | | | |
| 3. Education | 8.17 | 1.82 | –11** | 0.03 | – | | | | |
| 4. Employment | 0.85 | 0.36 | 0.07* | 0.14*** | 0.23*** | – | | | |
| 5. HH size | 3.55 | 1.49 | – 0.19*** | – 0.05 | – 0.09* | – 0.05 | – | | |
| 6. Income | 9.30 | 6.38 | 0.01 | – 0.01 | 0.28*** | 0.15*** | 0.11** | – | |
| 7. Subj. status | 5.74 | 2.04 | 0.10** | – 0.03 | 0.11** | 0.10** | 0.04 | 0.21*** | – |
| 8. Reasoning | 5.24 | 2.02 | – 0.18*** | 0.13*** | 0.27*** | 0.01 | 0.05 | 0.14*** | – 0.02 |

Gender was coded with "1" representing males and "0" representing females, while employment status was coded with "1" representing employed and "0" representing unemployed. Descriptive statistics for these variables hence respectively represent proportions of individuals who are male and proportions of individuals who are employed

*HH Size* household size; *Subj. Status* subjective social status.

**p* < .05, ***p* < .01, ****p* < .001

**Table 2** Linear regression coefficients predicting reasoning ability

| | Reasoning ability | | | |
|---|---|---|---|---|
| | *b* | *SE* | *β* | 95% CI |
| Income | 0.03* | 0.01 | 0.09 | [0.01, 0.05] |
| Subjective status | – 0.05 | 0.03 | – 0.05 | [– 0.12, 0.01] |
| Age | – 0.03*** | 0.01 | – 0.14 | [– 0.05, – 0.02] |
| Gender | 0.58*** | 0.13 | 0.14 | [0.31, 0.84] |
| Education level | 0.28*** | 0.04 | 0.25 | [0.20, 0.35] |
| Employment status | – 0.36 | 0.19 | – 0.06 | [– 0.74, 0.01] |
| Household size | 0.06 | 0.05 | 0.04 | [– 0.03, 0.14] |

**p* < .05, ***p* < .01, ****p* < .001

(correlations between the model residuals and the key predictors were extremely small, *r*s < 0.001, *p*s = 1.00). Results indicated that controlling for all demographical variables, household income was associated with better performance on the reasoning task ($b = 0.02$, $SE = 0.01$, $p = .011$, 95% CI [0.01, 0.05], $\beta=0.09$). In contrast, subjective social status was not significantly associated with performance on the reasoning task ($b = -0.05$, $SE = 0.03$, $p = .11$, 95% CI [– 0.12, 0.01], $\beta = -0.05$). Coefficients for the linear regression are presented in Table 2.

## 4 Study 2

Supporting the perspective that objective income levels would provide material resources that more directly implicate cognitive outcomes, we found in Study 1 that objective income levels were associated with better performance on a reasoning task among a sample of adults in Singapore, whereas subjective social status was not significantly associated with reasoning ability. These findings held after accounting for demographical variations in age, gender, education, employment status, and household size. However, given that Study 1 is a cross-sectional study, a major limitation is that the long-term predictive utility of income for cognitive functioning over a longer period of adult development cannot be determined. Furthermore, cross-sectional studies are also unable to draw conclusions about directionality, which raises the possibility that better cognitive functions may predict higher income instead (e.g., Ferris et al., 2001). For example, impairments in aspects of executive function have been linked to poorer occupational functioning (Barkley & Fischer, 2011) and job burnout (Schmidt et al., 2007), and cognitive ability is often found to be a strong predictor of job performance (Schmidt & Hunter, 2004). Thus, associations between income and cognitive functioning may represent the ability of individuals with better cognitive functioning to obtain more income. Tests of bidirectionality using longitudinal, cross-lagged designs are thus necessary to rule out this alternative interpretation and establish clearer directional links between economic variables with later cognitive outcomes.

We address these issues in Study 2 using a two-wave cross-lagged panel modelling approach with structural equation modelling to examine the directionality of the associations across a period of about ten years. While cross-lagged approaches do not provide conclusive indications of causality, it provides a strong method to establishing directional associations in the absence of experimental manipulations, which are ethically impossible for naturalistic examinations of income and adult development. Indeed, the use of a time-based design where baseline levels of the outcome variable are adjusted for provides an extremely stringent statistical test that allows clear conclusions of whether the economic variables explain additional variance in cognitive outcomes even after accounting for pre-existing levels of cognitive functioning—in turn, accounting for baseline thus also accounts for a wide range of explanatory variables that can contribute to starting levels of cognition, including dispositional factors and other early-life experiences, among others. Thus, Study 2 allows a reliable and ecologically valid examination of how income may show directional links to cognitive outcomes across about ten years of ageing. An implication of this is that we expected small effect sizes, given that small but nevertheless meaningful effects are often found in large-sample, time-based designs which rule out baseline levels of the outcome variable (Adachi & Willoughby, 2015; Kühberger et al., 2014).

Study 2 consists of two waves. The first wave—hereafter referred to as T1—consists of a measure of income, a measure of subjective social status, a baseline measure of executive function, and a baseline measure of episodic memory. The second wave—hereafter referred to as T2—consists of the key outcome variables of executive function and episodic memory, as well as measures of income and subjective social status to allow tests of bidirectionality. In addition to controlling for the same demographical covariates as in Study 1, namely age, gender, education, employment status, and household size, we included additional covariates to provide more stringent controls. Specifically, retirement status was also included as a covariate given previous evidence that retirement could be linked to cognitive outcomes (Xue et al., 2018). Changes in employment status and retirement status across the two waves were also coded and controlled for to account for the possibility that loss of employment or entering retirement between the two waves could account for both changes in income as well as changes in cognitive functioning. Finally, given the time-based design, we further also controlled for the baseline measures of episodic memory and executive function. Given the results of Study 1, we sought to replicate the finding that objective income levels would predict long-term episodic memory and executive function whereas subjective social status would not.

# 5 Method

## 5.1 Participants

Analyses were performed on participants from the Midlife Development in the United States (MIDUS) study, a multi-phase longitudinal study which drew from a nationally representative random-digit-dial sample of participants from the United States. Data from the MIDUS2 Main Survey and cognitive project, conducted between 2004 and 2006, served as the first time point (T1). Participants completed a phone interview, followed by a questionnaire that was sent via mail. Subsequently, starting from approximately two weeks later, trained interviewers conducted the cognitive tests over the phone. Participants who completed these measures in MIDUS2 received a US$60.00 incentive. Data from the MIDUS3 main survey and cognitive project, conducted between 2013 and 2017, served as the second time point (T2). Similarly to MIDUS2, participants completed a phone interview and a mailed questionnaire before being contacted about two weeks later for cognitive tests which were administered over the phone by trained interviewers. Participants who completed MIDUS3 received US$62.00 as incentive. In total, data for the key variables was available for 1476 participants (694 males, 782 females; $M_{age} = 53.70$, $SD_{age} = 10.48$, age range: 33–82 years). Power analyses indicate that the present sample size would permit even small effect sizes to be detected with a high power of above 0.99. Data for this study is available from http://www.midus.wisc.edu/, while analysis codes are uploaded at https://osf.io/2ebs9/?view_only=3e4dfe0a998e4497b26837ecb33f663a .

## 5.2 Measures

*Income* Annual household income (in U.S. dollars) was measured in values up to a maximum of $200,000—values above this were recoded as $200,000. Due to the large values of this measure, values were divided by 10,000 to improve the interpretability of all coefficients, as has also been done in past research (e.g., Côté et al., 2015).

*Subjective social status* Subjective social status was assessed using the same measure used in Study 1, specifically the community variant of the MacArthur Scale (Cundiff et al., 2013). Participants were asked to define community in the way most meaningful to them, and then rank their standing in their community on a ladder from 1 (*bottom rung*) to 10 (*top rung*).

*Cognitive functioning* Cognitive functioning was assessed using measures from the Brief Test of Adult Cognition by Telephone (BTACT; Tun & Lachman, 2006). Trained interviewers administered a total of seven sub-tests which were then used to form two composites: episodic memory and executive function. The BTACT has been found to have strong psychometric properties (e.g., Lachman et al., 2014). The two composites were assessed at both T1 (used as measures of baseline cognitive ability) and T2 (used as criterion variables).

*Episodic memory* Episodic memory was assessed using two sub-tests of the BTACT. The word list immediate subtest was the first sub-test to be administered, and interviewers recited a list of 15 words (e.g., '*flower*', '*truck*') after which participants were assessed on the number of words they correctly recalled. The word list delayed subtest was administered at the end of all the cognitive sub-tests, and respondents were instructed to recall as many words as possible from the same list of 15 words recited to them previously at the start of the cognitive interview. Scores for the above two sub-tests were z-scored and used as indicators of the latent factor for episodic memory.

*Executive function* A total of five sub-tests were used to measure executive function. In the digits backward subtest of working memory, participants were recited strings of 2 to 8 digits (e.g., "*7-1-3*"), and they were tested on the highest number of digits they were able to recite backwards. In the category fluency subtest of verbal ability and speed, participants were tested on the number of animal names they were able to produce within a minute. In the number series subtest of fluid intelligence, participants were tested on the total number of correct answers they were able to obtain on a series of number pattern completion questions (e.g., "*18, 20, 24, 30, 38,* ____"). In the backwards counting sub-test of processing speed, participants were tested on the total number of digits they were able to count backwards from 100 to 30 s. In the stop and go switch sub-test of attention and inhibitory control, participants received instructions to respond with either 'stop' or 'go' when respectively presented with 'red' or 'green' as well as instructions to reverse their responses to the same prompt, and their overall reaction time across all trials was measured. Scores for the five tests were z-scored and specified as indicators of the latent factor for executive function.

*Demographics* Age, gender (1 = *male*, 0 = *female*), education level (from 1 representing "*no education or some grade school*" to 12 representing "*PhD or other comparable qualifications*"), employment status (1 = *employed*, 0 = *unemployed*), retirement status (1 = *retired*, 0 = *not retired*) and household size at Time 1 were included as demographical covariates. Additionally, we also coded dummy variables for unemployment from Time 1 to Time 2 (1 = participants who changed from 'employed' at Time 1 to 'unemployed' at Time 2, 0 = participants who did not become unemployed between measurements) and retirement from Time 1 to Time 2 (1 = participants who changed from 'not retired' at Time 1 to 'retired' at Time 2, 0 = participants who did not retire between measurements). These variables were also included as covariates to account for change in occupational-related demographics.

## 6 Results

Descriptive statistics and inter-correlations between all variables are presented in Tables 3 and 4 respectively. Analyses were performed using the *lavaan* package on *R*. There was no evidence of multicollinearity (VIF = 1.54 for income and VIF = 1.13 for subjective status) or endogeneity (correlations between the model residuals and the key predictors were extremely small, *r*s < 0.001, *p*s = 1.00). We first examined the measurement model using confirmatory factor analyses. Income at both T1 and T2 was specified as a single-item latent variable represented by the measure of individuals' annual household income. Similarly, subjective social status at both T1 and T2 was also specified as a single-item latent variable represented by the MacArthur Scale. Episodic memory at both T1 and T2 was specified as a latent variable indicated by the z-scores of its two sub-tests, while executive function at both T1 and T2 was specified as a latent variable indicated by the z-scores of its five sub-tests. To account for the shared error variances of the repeated measures, covariances were also specified between the respective indicators of T1 episodic memory and T1 executive function with their corresponding indicators at T2. The results of the confirmatory factor analysis indicated that the measurement model fit the data well, $\chi^2$ (104) = 374.89, $p < .001$, CFI = 0.98, RMSEA = 0.042, SRMR = 0.039.

**Table 3** Descriptive statistics for all key variables in Study 2

| | M | SD |
|---|---|---|
| T1 age | 53.70 | 10.48 |
| T1 gender | 0.47 | 0.50 |
| T1 education level | 7.91 | 2.44 |
| T1 employment status | 0.60 | 0.49 |
| T1 retirement status | 0.21 | 0.41 |
| Unemployment from T1 to T2 | 0.20 | 0.40 |
| Retired from T1 to T2 | 0.19 | 0.39 |
| Household size | 0.92 | 0.63 |
| T1 income | 66529.13 | 56308.07 |
| T2 income | 61702.74 | 63729.22 |
| T1 subjective social status | 6.58 | 1.76 |
| T2 subjective social status | 6.62 | 1.77 |
| T1 episodic memory | 0.23 | 0.92 |
| T2 episodic memory | 0.10 | 0.94 |
| T1 executive function | 0.39 | 0.85 |
| T2 executive function | 0 | 0.69 |

Gender was coded with "1" representing males and "0" representing females. T1 employment status was coded with "1" representing employed and "0" representing unemployed. T1 retirement status was coded with "1" representing retired and "0" representing not retired. Unemployment from T1 to T2 was coded with "1" representing participants who changed from 'employed' at T1 to 'unemployed' at T2 and "0" representing participants who did not become unemployed between measurements. Retirement from T1 to T2 was coded with "1" representing participants who changed from 'not retired' at Time 1 to 'retired' at Time 2 and "0" representing participants who did not retire between measurements. The descriptive statistics for these variables hence respectively represent proportions of individuals who are male at T1, proportions of individuals who are employed at T1, proportions of individuals who are retired at T1, proportions of individuals who changed from employed to unemployed from T1 to T2, and proportions of individuals who changed from not retired to retired from T1 to T2

$*p < .05$, $**p < .01$, $***p < .001$

Having provided evidence to support the measurement model, we proceeded to test the structural model, in which cross-lagged panel modelling (CLPM) was used to examine directional as well as bidirectional relationships between income, subjective social status, and cognitive functioning. Firstly, autoregressive pathways were specified between each variable at T1 and their respective counterparts at T2 to adjust for baselines of the outcome variable. Secondly, T1 income and T1 subjective SES were each specified as predictors of T2 episodic memory and T2 executive function to examine their associations with later cognitive functioning. Thirdly, T1 episodic memory and T1 executive function were specified as predictors of T2 income and T2 subjective social status to examine bidirectional relationships between the social variables and cognitive functioning. Finally, the observed variables for age, gender, education level, employment status, retirement status, change in employment status, change in retirement status, and household size were specified as covariates in all pathways. Covariances were also specified between all predictor variables

**Table 4** Correlation matrix for all key variables in Study 2

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. T1 age | – | | | | | | | | | | | | | | |
| 2. T1 gender | 0.04 | – | | | | | | | | | | | | | |
| 3. T1 education | – 0.08** | 0.11*** | – | | | | | | | | | | | | |
| 4. T1 employment | – 0.40*** | 0.02 | 0.09*** | – | | | | | | | | | | | |
| 5. T1 retirement | 0.60*** | 0.01 | – 0.03 | – 0.50*** | – | | | | | | | | | | |
| 6. unemployed (T1–T2) | 0.10*** | <0.001 | – 0.02 | 0.40*** | – 0.14*** | – | | | | | | | | | |
| 7. Retired (T1–T2) | 0.18*** | – 0.001 | – 0.06* | 0.16*** | – 0.25*** | 0.58*** | – | | | | | | | | |
| 8. household size | – 0.10*** | 0.09*** | 0.03 | 0.02 | – 0.09*** | – 0.04 | – 0.004 | – | | | | | | | |
| 9. T1 income | – 0.36*** | 0.09*** | 0.30*** | 0.29*** | – 0.42*** | 0.05 | 0.05* | 0.18*** | – | | | | | | |
| 10. T2 income | – 0.53*** | 0.07** | 0.27*** | 0.25*** | – 0.41*** | – 0.19*** | – 0.26 | 0.10*** | 0.62*** | – | | | | | |
| 11. T1 subj. status | 0.21*** | 0.13*** | 0.21*** | – 0.06* | 0.10*** | – 0.03 | 0.004 | 0.05 | 0.12*** | 0.04 | – | | | | |
| 12. T2 subj. status | 0.15*** | 0.13*** | 0.22*** | – 0.03 | 0.06* | – 0.02 | 0.003 | 0.04 | 0.14*** | 0.09*** | 0.53*** | – | | | |
| 13. T1 ep. memory | – 0.20*** | – 0.26*** | 0.17*** | 0.06* | – 0.15*** | 0.02 | – 0.03 | – 0.004 | 0.13*** | 0.17*** | 0.01 | 0.05* | – | | |

**Table 4** (continued)

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 14. T2 ep. memory | − 0.33*** | − 0.30*** | 0.14*** | 0.15*** | − 0.22*** | − 0.01 | − 0.07** | 0.002 | 0.21*** | 0.27*** | − 0.03 | 0.03 | 0.53*** | – | |
| 15. T1 ex. function | − 0.30*** | 0.12*** | 0.41*** | 0.14*** | − 0.18*** | − 0.04 | − 0.08** | 0.06* | 0.30*** | 0.33*** | 0.08** | 0.11*** | 0.33*** | 0.29*** | – |
| 16. T2 ex. function | − 0.41*** | 0.12*** | 0.34*** | 0.25*** | − 0.30*** | <0.001 | − 0.06* | 0.10*** | 0.35*** | 0.35*** | 0.03 | 0.11*** | 0.27*** | 0.35*** | 0.76*** |

*Unemployed (T1–T2)* became unemployed between T1 and T2; *Retired (T1–T2)* retired between T1 and T2; *HH size* Household Size; *Subj. Status* Subjective Social Status; *Ep. Memory* Episodic Memory; *Ex. Function* executive function

*$p < .05$, **$p < .01$, ***$p < .001$

and between all outcome variables to account for their theoretical overlap. Results showed that the structural model fit the data well, $\chi^2$ (186) = 862.87, $p$ < .001, CFI = 0.96, RMSEA = 0.050, SRMR = 0.052.

More specifically, results indicate that controlling for baseline episodic memory, baseline executive function, and all demographic covariates, T1 income significantly predicted both T2 episodic memory ($b$ = 0.01, $SE$ = 0.004, $p$ = .006, 95% CI [0.003, 0.02], $\beta$=0.07) as well as T2 executive function ($b$ = 0.01, $SE$ = 0.002, $p$ = .044, 95% CI [0.0001, 0.01], $\beta$=0.04). Furthermore, pathways in the opposite direction from T1 episodic memory to T2 income ($b$ = 0.15, $SE$ = 0.17, $p$ = .38, 95% CI [− 0.19, 0.49], $\beta$=0.02) as well as from T1 executive function to T2 income ($b$ = 0.47, $SE$ = 0.29, $p$ = .11, 95% CI [− 0.11, 1.04], $\beta$=0.05) were not significant, suggesting that the associations between income and cognitive functioning are unidirectional. In contrast, T1 subjective social status did not significantly predict T2 episodic memory ($b$ = 0.01, $SE$ = 0.01, $p$ = .55, 95% CI [− 0.02, 0.03], $\beta$=0.01) or T2 executive function ($b$ = − 0.002, $SE$ = 0.01, $p$ = .77, 95% CI [− 0.02, 0.01], $\beta$ = − 0.01). T1 episodic memory ($b$ = 0.11, $SE$ = 0.06, $p$ = .069, 95% CI [− 0.01, 0.23], $\beta$=0.05) and T1 executive function ($b$ = 0.09, $SE$ = 0.10, $p$ = .38, 95% CI [− 0.11, 0.29], $\beta$=0.03) did not predict T2 subjective social status. Path coefficients predicting T2 outcomes are summarized in Tables 5 and 6, while the primary results of the cross-lagged panel model are depicted in Fig. 1.

## 7 General Discussion

Overall, the evidence is consistent with the notion that objective income more strongly explains differential outcomes in cognitive functioning compared to subjective social status, thus supporting the perspective that material resources associated with income may have stronger implications than subjective perceptions for environmental and lifestyle factors that are relevant for positive cognitive outcomes. Specifically, in Study 1, we found that income predicted better performance on a reasoning task among Singaporean adults, whereas subjective social status did not. In Study 2, we provided conceptual replication of this finding among American adults, showing that income predicted better episodic memory and executive function nearly ten years later after adjusting for baselines, while subjective social status did not reliably predict either indices of cognitive functioning. Of note, the findings in Study 2 held despite stringent controls applied by specifying autoregressive pathways between cognitive functioning at T1 and T2—hence, the results reflect the unique explanatory power of objective income on subsequent cognitive functioning even after ruling out baseline levels of cognitive functioning. Finally, cross-lagged analyses also supported unidirectional associations between objective income and later cognitive functioning, thus ruling out the alternative interpretation that baseline cognitive functioning may predict later income levels.

Although previous research has argued that subjective perceptions of status may provide a psychological reality that could have implications over and above the material reality provided by income (Glei et al., 2018), our findings suggest that this may not apply to cognitive outcomes. Rather, our findings support the idea that there are likely to be unique material benefits to drawing a higher income that are unlikely to be accounted for simply by one's subjective perceptions of social status. For example, the mere psychological perception that one is of high status cannot adequately provide the actual material resources that enable more optimal life conditions which promote

**Table 5** Latent variable path coefficients predicting T2 episodic memory and T2 executive function

| | T2 episodic memory | | | | T2 executive function | | | |
|---|---|---|---|---|---|---|---|---|
| | *b* | *SE* | *β* | 95 % CI | *b* | SE | *β* | 95 % CI |
| T1 Income | 0.01** | 0.004 | 0.07 | [0.003, 0.02] | 0.01* | 0.002 | 0.04 | [0.0001, 0.01] |
| T1 Subjective Status | 0.01 | 0.01 | 0.01 | [– 0.02, 0.03] | – 0.002 | 0.01 | – 0.01 | [– 0.02, 0.01] |
| T1 Age | – 0.02*** | 0.003 | – 0.19 | [– 0.02, – 0.01] | – 0.01*** | 0.002 | – 0.11 | [– 0.01, – 0.004] |
| T1 Gender | – 0.38*** | 0.04 | – 0.22 | [– 0.47, – 0.29] | – 0.02 | 0.03 | – 0.02 | [– 0.07, 0.03] |
| T1 Education Level | – 0.003 | 0.01 | – 0.01 | [– 0.02, 0.02] | – 0.001 | 0.01 | – 0.01 | [– 0.01, 0.01] |
| T1 Employment Status | 0.07 | 0.05 | 0.04 | [– 0.03, 0.16] | 0.03 | 0.03 | 0.02 | [– 0.02, 0.09] |
| T1 Retirement Status | 0.04 | 0.07 | 0.02 | [– 0.10, 0.18] | – 0.05 | 0.04 | – 0.03 | [– 0.12, 0.03] |
| Unemployment from T1 to T2 | 0.01 | 0.06 | 0.003 | [– 0.11, 0.13] | 0.04 | 0.03 | 0.02 | [– 0.03, 0.11] |
| Retired from T1 to T2 | – 0.06 | 0.07 | – 0.03 | [– 0.19, 0.07] | – 0.03 | 0.04 | – 0.02 | [– 0.10, 0.04] |
| Household Size | – 0.03 | 0.03 | – 0.02 | [– 0.09, 0.03] | 0.02 | 0.02 | 0.02 | [– 0.02, 0.05] |
| T1 Episodic Memory | 0.45*** | 0.03 | 0.44 | [0.39, 0.51] | – 0.03 | 0.02 | – 0.03 | [– 0.06, 0.01] |
| T1 Executive Function | 0.17** | 0.05 | 0.13 | [0.07, 0.27] | 0.92*** | 0.03 | 0.89 | [0.85, 0.98] |

*$p < .05$, **$p < .01$, ***$p < .001$

**Table 6** Latent variable path coefficients predicting T2 Income and T2 subjective status

| | T2 income | | | | T2 subjective status | | | |
|---|---|---|---|---|---|---|---|---|
| | *b* | *SE* | *β* | 95% CI | *b* | *SE* | *β* | 95% CI |
| T1 Income | 0.52*** | 0.02 | 0.45 | [0.48, 0.57] | 0.02** | 0.01 | 0.08 | [0.01, 0.04] |
| T1 Subjective Status | 0.09 | 0.07 | 0.02 | [– 0.04, 0.22] | 0.48*** | 0.02 | 0.48 | [0.43, 0.52] |
| T1 Age | – 0.13*** | 0.02 | – 0.22 | [– 0.16, – 0.10] | 0.02*** | 0.01 | 0.13 | [0.01, 0.03] |
| T1 Gender | 0.34 | 0.25 | 0.03 | [– 0.15, 0.83] | 0.20* | 0.09 | 0.06 | [0.03, 0.37] |
| T1 Education Level | 0.15** | 0.06 | 0.06 | [0.04, 0.26] | 0.05** | 0.02 | 0.07 | [0.01, 0.09] |
| T1 Employment Status | 0.25 | 0.28 | 0.02 | [– 0.30, 0.79] | 0.07 | 0.10 | 0.02 | [– 0.12, 0.26] |
| T1 Retirement Status | – 2.04*** | 0.41 | – 0.13 | [– 2.84, – 1.25] | – 0.02 | 0.14 | – 0.01 | [– 0.30, 0.26] |
| Unemployment from T1 to T2 | – 1.25*** | 0.35 | – 0.08 | [– 1.94, – 0.57] | – 0.12 | 0.12 | – 0.03 | [– 0.36, 0.12] |
| Retired from T1 to T2 | – 3.73*** | 0.38 | – 0.22 | [– 4.47, – 2.98] | – 0.02 | 0.13 | – 0.004 | [– 0.28, 0.24] |
| Household Size | – 0.31 | 0.18 | – 0.03 | [– 0.65, 0.04] | 0.004 | 0.06 | 0.001 | [– 0.12, 0.13] |
| T1 Episodic Memory | 0.15 | 0.17 | 0.02 | [– 0.19, 0.49] | 0.11 | 0.06 | 0.05 | [– 0.01, 0.23] |
| T1 Executive Function | 0.47 | 0.29 | 0.05 | [– 0.11, 1.04] | 0.09 | 0.10 | 0.03 | [– 0.11, 0.29] |

$^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$

positive cognitive functioning during adult development (e.g., Scarmeas et al., 2018). Furthermore, the greater purchasing power enabled by income also directly grants greater accessibility to a productive and engaging lifestyle which is likely to be beneficial for cognitive health (Park et al., 2014). Our findings supported this view and were conceptually replicated across three distinct measures of cognitive functioning, and both when examining cross-sectional relationships in 2019 and when examining longitudinal relationships from the 2000 s to the 2010 s. Furthermore, given that the two studies utilized participants from two countries, the present findings also provide preliminary evidence that the findings here could be robust and replicable across diverse populations. Our findings hence provide an important theoretical and practical distinction between objective income and subjective social status in explaining differential cognitive outcomes during adult development, such that cognitive benefits are localized primarily to objective income and not subjective perceptions of social status.

In both studies, we found small but reliable effect sizes of income which remained robust even when stringent statistical analyses were performed accounting for autoregressive pathways, and indeed, researchers now recognize that even small effect sizes from such designs tend to have substantial practical implications (Adachi & Willoughby, 2015; Funder & Ozer, 2019). It is also noteworthy that education level, which is well-established as a strong predictor of cognitive outcomes (e.g., Guerra-Carrillo et al., 2017), no longer had a significant association with later cognitive functioning after adjusting for baseline in Study 2, whereas income continued to show a robust association with cognitive functioning. Moreover, although past studies suggest the possibility

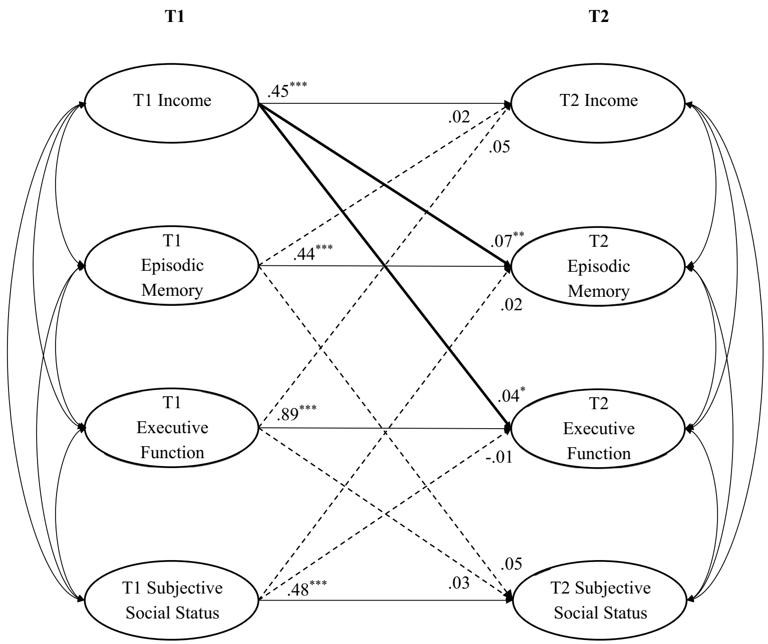


**Fig. 1** Longitudinal cross-lagged panel model of the associations between income, subjective social status, episodic memory, and executive function. Bolded lines represent significant non-autoregressive paths, while dashed lines indicate nonsignificant paths. *$p < .05$, **$p < .01$, ***$p < .001$. Age, gender, education level, employment status, retirement status, unemployment from T1 to T2, retirement from T1 to T2, and household size were controlled for in all pathways

of reverse-directional links from cognitive functioning to income (Schmidt & Hunter, 2004), our findings again specify the directionality of these associations as being from income to later cognitive functioning. While these findings do not rule out the possibility that education may influence baseline levels of cognitive functioning or that cognitive functioning may influence baseline levels of income, they suggest that during adult development, individual differences in income have an especially major role in accounting for variation in adult cognitive development. Although researchers have theorized that income should have long-term effects on cognition, relatively few longitudinal tests of the income-cognition link have been performed, and even fewer have examined a time span as long as the analyses in Study 2. The present findings thus have strong practical implications in showing that the benefits of income on cognitive functioning are likely to be substantive and long-lasting.

As has been argued by other researchers, cognitive functioning is inseparable from successful ageing, and empirical evidence on the possible antecedents of cognitive functioning during adult development are crucial to policy-makers (Fiocco & Yaffe, 2010). For example, the finding that individual differences in objective income rather than subjective social status explain long-term cognitive outcomes suggests that policy-makers should not only focus on raising subjective perceptions that individuals are of high status, but should also pursue economic policies that enable actual increments in income during adulthood. Furthermore, other long-term life outcomes such as health and well-being which are predicated on cognitive functioning (e.g., Diamond 2013) are likely to in turn show benefits as a result of high income as well. For example, the episodic memory has been found to be strongly implicated in the development of cognitive diseases later in life (Tromp et al., 2015), and the executive function is an overarching cognitive capacity which is crucial across multiple aspects of successful ageing (Phillips & Henry, 2010). Our findings thus imply that policies aimed at creating long-term economic growth can have sustainable long-term impact in promoting successful cognitive ageing among individuals.

We note several limitations as well as future directions to the present study. Firstly, despite the use of a rigorous two-wave cross-lagged modelling approach in Study 2, the lack of an experimental study with random assignment prevents definitive claim of causality, and other unmeasured variables could potentially explain the findings. However, actual income levels are not easily amenable to experimental manipulation. Even studies which examine windfall gains such as lottery wins (e.g., Doherty et al., 2006) cannot be regarded as true experiments given the absence of random assignment. While not experimental, the present studies reported provide strong evidence which is both replicable and ecologically valid. Study 2 also provides evidence of directional associations that may be suggestive of causality, and previous quasi-experimental work has found that within-person increases in income indeed corresponded with within-person increases in cognitive performance (Mani et al., 2013), suggesting that unmeasured individual differences may be unlikely to account for the relationship between income and cognitive outcomes.

Secondly, subjective social status was only assessed via the community variant of the MacArthur Scale as the society variant was not available in the datasets analyzed. Important differences between these two variants should be noted in the interpretation of our findings. Whereas the community variant uses a self-chosen community as the reference for comparison and may tap on both subjective social status as well as subjective socioeconomic status, the society variant more explicitly refers to individuals' standing on money, jobs, and education in comparison with their society and may more directly assess subjective socioeconomic status. Indeed, the two variants have been found to independently predict later outcomes (Zell et al., 2018), suggesting that the measures are not identical. Nevertheless, as pointed out in Footnote 1, present evidence suggests that the two measures are similar and converge in the directionality and magnitudes with which they predict various outcomes (Zell et al., 2018), and previous empirical work has similarly utilized the community variant individually as an index of subjective social status (English et al., 2019). The community variant of the MacArthur scale thus remains a valid and empirically supported index of subjective status, though generalizations of our findings to the society-based measure cannot presently be made conclusively. A key future direction should thus be to compare whether the two variants of the MacArthur scale could exhibit meaningful differences in predicting cognitive outcomes.

Thirdly, the present findings provided no strong evidence that subjective social status would be linked positively to cognitive outcomes, both in the short term as well as the long term. However, it is possible that subjective social status could still in fact have unique positive associations with cognitive outcomes. For example, positive associations of subjective social status with certain aspects of cognitive functioning may only be robust within a shorter temporal period (e.g., Zahodne et al., 2018) and may not be detectable over a longer period, such as that examined in the analyses of Study 2, though the absence of short-term associations in Study 1 calls this possibility into question. Another possibility is that subjective social status could have more robust associations with certain types of cognitive abilities that were not assessed in the present studies, such as moral reasoning (McNair et al., 2019). This should be further examined in future research. Fourth, while we provide some preliminary evidence of replicability across countries, more rigorous cross-cultural examinations are required to conclude cross-cultural generalizability. Singapore is a heavily-Westernized East Asian country that is predominantly English-speaking, which makes it difficult to conclude that the findings here would necessarily generalize to other East Asian countries that are less exposed to Western language and culture. Thus, a key empirical question to be examined in future work is whether our findings would be generalizable to other East Asian countries such as Japan (e.g., Curhan et al., 2014).

A final point is that the possible mechanisms of these findings remain unclear. For example, we speculated that the material resources associated with higher income enables greater access to various lifestyle factors such as more enriching activities and better nutrition, which have been found to be key antecedents of positive cognitive outcomes (Scarmeas et al., 2018; Tun & Lachman, 2010). Rather than any single factor explaining the relationship between income and cognitive functioning, the cumulative benefits provided by the different aspects of a cognitively-enriching lifestyle might better account for why income is associated with better cognition. Biological or neural changes that are associated with these lifestyle factors (Scarmeas & Stern, 2003) may in turn also explain why income could be linked to healthier cognitive development—these speculations remain to be examined in future research.

Overall, we extend previous work distinguishing objective income levels from subjective social status by focusing on an important life outcome which has strong practical implications: cognitive functioning. We find replicable evidence across three cognitive indices and two diverse samples demonstrating that objective income levels are predictive of better cognitive functioning both in the short-term and the long-term, whereas subjective social status did not have comparable associations with cognitive outcomes. Furthermore, our evidence also suggests that links between objective income and later cognitive functioning are unidirectional, as analyses of bidirectionality were not supported. Overall, our findings have strong theoretical implications in clarifying the antecedents of positive cognitive functioning during adult development and are practically important for stakeholders invested in promoting successful ageing among an ageing population.

**Electronic Supplementary Material** The online version of this article (https://doi.org/10.1007/s11205-021-02844-y) contains supplementary material, which is available to authorized users.

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**Availability of Data and Material** Yes.

**Code Availability** NIL.

## Declarations

**Conflict of interest** None.

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