Supplementary information for: Well-being and ill-being on campus

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Supplement 1: Recruitment and tests of sample bias in the YOU Student Wellbeing Survey

This first supplement is in three parts: background, recruitment and tests of sampling bias.

1.1 Background

Preparation of the YOU Student Wellbeing Survey at Victoria University of Wellington Te Herenga Waka began in 2018 with the assembly of the research team, several focus groups with students, and consultation with student leaders and their association (VUWSA). A draft survey was prepared collectively by the academics, university health professionals and student representatives. The questions were compiled and reviewed by representatives from the Schools of Health, Psychology, Human Geography, Economics, Education and Nursing. A short pilot survey was carried out late in 2018.

The proposal for an independent research-based survey of student mental health received approval from the university's Senior Management Team in November 2018 as well as the students' association. The resulting YOU survey was granted Human Ethics Approval on 18 December 2019 (approval number 27290) and the Data Management Plan was approved on 8 March 2021. An initial grant of $10,000 was offered in 2018 by the university in addition to ongoing support with communications, scheduling of the surveys and the funding of prizes for student participation. The survey team were also granted access to the university's student administrative data (contingent on obtaining individual student approval to use). The research itself is independent of the university and its own student well-being and student health related programmes.   The financial cost associated with individual projects based on the YOU survey are funded from the investigators' own research budgets.

Our account of recruitment and exploration of sampling bias begins by comparing selected details of students who enrolled by March 2019, the subset who answered the baseline YOU survey in April 2019 and those who completed the first follow-up survey in September, 2019, the panel.
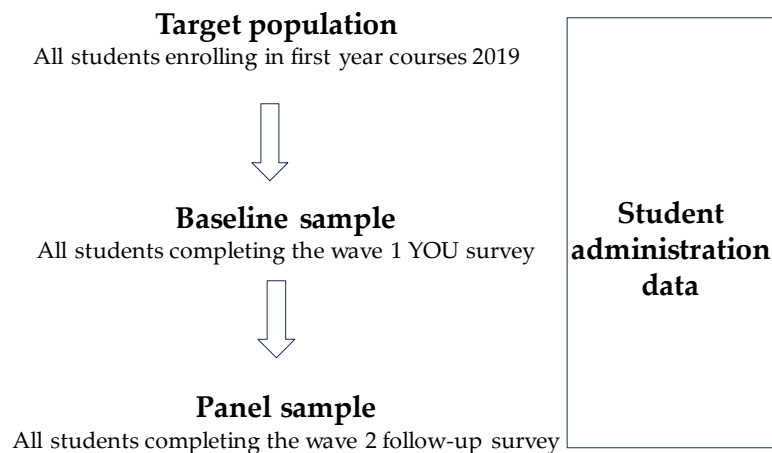
This supplement addresses the 2019 cohort only, in keeping with the coverage of the paper itself. The April 2019 YOU survey was offered electronically (via Qualtrics) to all students who enrolled (full-time or part-time) in first year courses. The roll out was preceded by an advertising campaign as part of a comprehensive communication plan directed at students and staff. Several university funded vouchers for goods ranging from NZ$50 to NZ$200 were drawn at random as

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prizes following the return of completed surveys.[1] Follow-up surveys were sent in September and each 6 months thereafter until the cohort had reached four years. Only the first two waves of the 2019 cohort are addressed here.

1.2 Recruitment

The target population consisted of the 4,682 students enrolling in first year courses at Victoria University in 2019. All these students were given an opportunity to participate in the survey. Those who responded in April 2019 made up the baseline sample of 1,591 students. Those who completed the baseline survey were invited to join the panel and were sent follow-up surveys every six months for up to four years. A total of 388 students accepted this invitation and answered the September 2019 follow-up survey however only reduced number actually completed the follow-up survey. The follow-up survey repeats the same mental health questions together with several demographic questions and asks about changes in the student's circumstances (health, finance, accommodation etc). Administrative data on all first-year students were released by the university (under strict anonymity conditions) and is updated by the university on an on-going basis (e.g. recording grades, change of courses, early withdrawal etc.) and made available to the research team as required. The resulting design allowed sample bias to be assessed (subject to available variables) for the duration of the student's enrolment. The selection stages are summarised in Figure S1.

Figure S1. The YOU sample selection stages

Target population
All students enrolling in first year courses 2019

Baseline sample
All students completing the wave 1 YOU survey

Panel sample
All students completing the wave 2 follow-up survey

Student administration data

This supplement addresses three questions:

1. How does the baseline sample compare to the target population, that is, how do the characteristics of students at enrolment compare with those who completed the baseline survey?

2. How does the panel sample compare with the baseline?

3. How does the panel compare with the target population?

We begin our tests using age and sex as recorded by the target population on the enrolment form,

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[1] The New Zealand academic year begins in late February or early March (end of summer) and finishes in November (spring). Most of the universities in New Zealand operate on a semester system, although a few operate on a trimester or quarter system.

and compare them to those who completed the baseline YOU survey. We begin with sex followed by age and then ask whether the relationship between the two changes within each of the three data sets.

The survey includes 139 questions under 28 topics and was sent electronically via Qualtrics to all the first-year students in April 2019, two months after the start of the first term. Students were given two weeks to complete the survey and they did so in an average elapsed time of about 20 minutes.[2] A total of 1,591 students from the 2019 cohort completed the questionnaire - a response rate of 34 percent (1,591/4,682). All students who completed the baseline survey were offered a place in the panel and yielded a 24.4 percent response rate (388/1591). (Missing values in the selected variables reduce the effective panel sample to 381 in the paper itself). The panel for each cohort runs for four years (8 waves) or until the student graduates or otherwise leaves the university.

1.3 Tests of sampling bias

Studies based on sample surveys in which students have an equal probability of responding have a clear intent to generalise to their target or parent population. Since completing the baseline and panel surveys were both voluntary, participation is subject to selection bias and may not end up being representative of the target population. Nathan Berg defined bias as, "the expected difference between an estimated characteristic of a population and that population's true characteristic", and therefore, "all response/missing data problems address a common issue: "trying to learn about a population based on a non-representative sample" (Berg, 2010: 9).[3]

There are three broad sources of bias in sample surveys: non-random selection into the sample (uneven non-response and hence selection bias), non-random performance within the instrument (item response bias) and distortion of response. The first results in a composition of respondents which is not representative of the target population. The second, which may or may not accompany the first, means responses to specific questions are not representative. The third source of bias, distortion, can apply without selection or item-response bias being present and can include satisficing to ease cognitive burden (Krosnick, 1991, Krosnick et al., 1996), social desirability bias (Caputo, 2017)[4] or cultural differences (Lai et al., 2013). Our attention in this supplement is confined primarily to selection bias and hence to the possibility that students who volunteered for the well-being study were not representative of the target population.

Voluntary recruitment is of particular concern when it comes to estimating the distribution of mental health over the target population because the condition of interest can affect the

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[2] Our collection of start, finish and elapsed time will later allow us to test for differences in the speed of uptake and time to complete, both of which are measures of engagement; see BECKER, R. 2022. Gender and survey participation. An event history analysis of the gender effects of survey participation in a probability-based multi-wave panel study with a sequential mixed-mode design. *Methods, data, analysis,* 16**,** 3-32.

[3] For an early discussion of tertiary student response bias in a health behaviour survey in New Zealand (and the value of identifying early and late responders) see KYPRI, K., SAMARANAYAKA, A., CONNOR, J., LANGLEY, J. D. & MACLENNAN, B. 2011. Non-response bias in a web-based health behaviour survey of New Zealand tertiary students. *Preventative Medicine,* 53**,** 274-277. For an early treatment of non-response see GOYDER, J. 1987. *The silent minority: Non-respondents on sample surveys,* Oxford, Polity Press. and the later treatment by GROVES, R. M. 2006. Nonresponse rates and nonresponse bias in household surveys. *Public Opinion Quarterly,* 70**,** 646-675, and GROVES, R. M., DILLMAN, D. A., ELTINGE, J. L. & LITTLE, R. J. A. (eds.) 2002. *Survey nonresponse,* Canada: John Wiley & Co..

[4] Margolis et al. goes as far as suggesting that, "All forms of wellbeing seem to be associated with socially desirable responding, suggesting that socially desirable responding may be unavoidable in wellbeing research." (MARGOLIS, S., SCHWIZGEBEL, E., OZER, D. J. & LZUBOMIRSKY, S. 2021. Empirical relationships among five types of well-being. *In:* LEE, M. T., KUBZANSKY, L. D. & VANDERWEELE, T. J. (eds.) *Measuring well-being: Interdisciplinary perspectives from the social sciences and the humanities.* New York City: Oxford University Press. p. 398

propensity to take part in the survey. Two hypotheses have been advanced: the first is that well-being is positively related to selection, and the second is that it is negatively related to selection. The dominant narrative holds that those with poor mental health will be *less* inclined to participate leading to over-estimation of those with positive mental health.[5] The reverse hypothesis also holds, namely that those experiencing lower well-being will be *more* inclined to respond because they have more to gain - either to learn more about their condition or increase their chances of being directed to help modules. If the findings of the first set of studies are adopted then resources allocated in response may be lower than required. If the second bias prevails then resources could be over allocated.

1.4 The YOU baseline and panel

The questionnaire was introduced as follows:

> This project is aimed at understanding and improving the well-being of undergraduate students enrolled in first year courses at Victoria University of Wellington. The well-being of tertiary students throughout the world is not as high as it should be and we are contributing to an international effort to understand why and what can be done.

> This survey will give us a comprehensive picture of your well-being, as well as other characteristics of your life as a first-year student: your finances, your accommodation, social connections, and support. We will also explore other aspects of your life, such as how much quality sleep you get and how you feel about seeking help.

> Once you've completed this survey, we'd like to keep in touch with you to see how your well-being changes as you advance in your studies at Victoria University. So, we will be running follow-up surveys twice a year throughout your degree. What you share with us about your well-being will be used to help improve the learning environment and support services at Victoria University. The findings will also be used for academic journal papers and presentations at conferences (YOU Survey Research Team, 2019).

Students were advised,

> If at any stage in the survey, or at any time afterwards, you feel concerned and would like support, please click the 'NEED SUPPORT' button (located at the top of each page). This will take you to a range of self-help and counselling support options.

Particular attention was paid to confidentiality. Students were assured:

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[5] This concern reflects the well-known finding that respondents whose participation is hardest to elicit on a voluntary basis are also more likely to report risk behaviour and this potentially leads to underestimation of risk factor prevalence, see CHEUNG, K. L., KLOOSTER, P. M., SMIT, C., DEVRIES, H. & PIETERSE, M. E. 2017. The impact of non-response bias due to sampling in public health studies: A comparison of voluntary versus mandatory recruitment in a Dutch national survey on adolescent health. *BMC Public Health,* 17. p.1. Also see discussions of non-response to quality of life measures in COSTE, J., QUINQUIS, L., AUDUREAU, E. & POUCHOT, J. 2013. Non response, incomplete and onconsistent responses to self-administered health-related quality of life measures in the general population: patterns, determinants and impact on the validity of estimates - a population-based study in France using the MOS SF-36. *Heath and Quality of Life Outcomes,* 11. and the discussion of response rates in the web survey by FAN, W. & YAN, Z. 2010. Factors affecting response rates of the web survey: a systematic review. *Computers in Human Behavior,* 26**,** 132-139.

Your answers in this survey won't be shared with anybody outside of the
Research Team. Whether you answer or not, and what you say, won't have an
impact on your grades at university. If you say yes to linking your enrolment
record, none of your answers from this survey will be in that record. The answers
you provide, and any linked records will be held securely on a university server,
accessible (in de-identified form) only to members of the Research Team. When
we report on what we've found in the survey, you won't be able to be identified.
We are committed to ensuring that the responses you share with us are protected
and held in confidence, and only used for the purposes of this research.

In the remainder of this supplement differences between the target, baseline and panel will be
explored using four variables: sex, age, socio-economic status and first-in-family (first
generation) students (to attend university).

1.5 Sex

The following question was asked in the undergraduate enrolment form *(6.9) Gender: [ ] Male [ ]
Female [ ] Gender diverse.* Over 12.5 percent of enrolling students failed to answer the question and
less than half a percent gave a non-binary response.[6] Our analysis of sample bias is based on
those who responded male or female.

Based on their enrolment form only, females made up over half the population enrolling in
2019 (57.5 percent), compared to over three quarters in the YOU survey (69.2 percent) and over
three quarters in the panel (77.2 percent). At each selection stage the proportion of female
students rose, and the sex ratio became less representative of the target population. A logistic
regression of sex at birth (0= male, 1 = female) on sample membership confirmed the statistical
significance of the higher female response of those completing the baseline survey and the panel
follow-up survey ($p < 0.05$).[7]

Such a bias in favour of female students was not unexpected. It is well known that women
are more likely to participate in surveys than men (Curtin et al 2000; Moore & Tarnai, 2002; Singer
et al 2000) and therefore survey data typically reflect their higher share of female students (see
Tinto, 1993 and Fan et al.,2019).[8] Despite the abundant empirical evidence, no theory
explaining gender differences in survey participation has yet been advanced (Becker, 2022: 24).

Male and female students also differ in their response to most well-being instruments,
reporting lower scores on well-being instruments and higher on ill-being measure (Nolen-
Hoeksema and Rusting, 1999, Oliver and Toner, 1990, Wiseman et al., 1995, Becker, 2022).
Therefore, any unadjusted sample means of well-being will be deflated (biased downward) by
the enlarged proportion of female students.

1.6 Age

To obtain a same date comparison of ages at enrolment, the baseline and panel, we use only the

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[6] This is likely to be an underestimate. Although not addressed in our paper or supplement we flag the
importance of this gender diverse response group who typically return low scores on instruments
measuring mental health. Their responses will be covered in future research from this project.

[7] All comparisons of the sex ratio in this supplement are based on the question asked in the enrolment form
only. We do not consider the question asked in the YOU survey, which was *'What sex was documented at
birth on your original birth certificate: male, female, indeterminate'* or the separate question on sexual
orientation.

[8] For a further discussion see https://files.eric.ed.gov/fulltext/ED501717.pdf

age given at enrolment. While this gives a consistently dated variable when comparing those in the target population, baseline, and panel samples, the enrolment base does carry a higher proportion of missing values, over 12 percent in the administrative (enrolment) data set. In the absence of other information, we assume these are missing at random.[9]

Members of the target population, baseline and panel all returned the same median age at enrolment of 18 years. The ages supplied by enrolling students show that the majority of first year students were between 17 and 25 years old. The rest occupy a long tail stretching into their late 60s as shown in Figure S2. The YOU survey was more likely to be answered by a more homogeneous set of younger students who returned a *mean* age of 18.95 (+/- 3.0) which is lower than the target population of 19.26 (+/- 3.48). Those in the panel were slightly *older* than the baseline average recording an intermediate mean age of 19.11 (+/- 2.89) although the difference was not statistically significant.

Rates of response to the YOU survey also vary systematically with the (known) age of the student, being highest among the youngest of the first-year students and lower thereafter, bottoming out at 20 percent among 22 year olds and rising slightly thereafter. This age difference is also important to know because levels of *well-being* also vary with student age and therefore age bias can skew the mean just as it does in the case of sex.

In summary, there was an uneven response to the age question at enrolment, baseline and panel, although there was no bias apparent in the median age across the three sets of students, the population and the two samples display very similar age profiles.

Figure S2. The age of students at enrolment, 2019
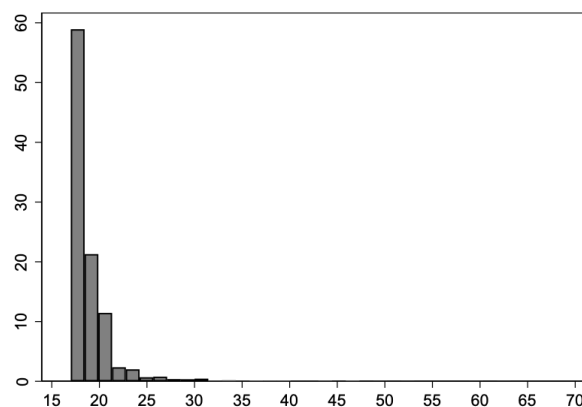
Age of student at enrolment
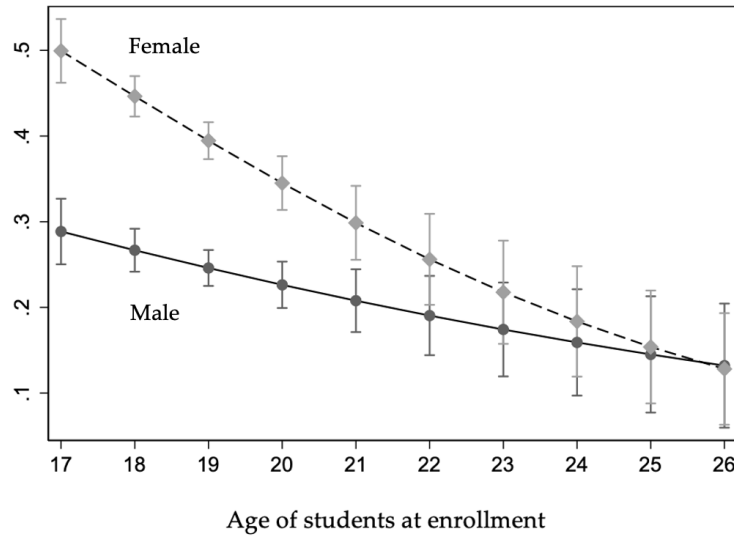*Source*: Enrolment form

1.7 Age x sex bias

The probability of first year students responding to the YOU survey was post-estimated from a logit model in which sex and age were interacted. The example is based those under 24 years old

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[9] The proportion with age missing at enrolment was 12.5 percent, 11.37 percent at baseline (not a significant difference) but only 5.15 in the panel (a proportion that was significantly different from the baseline but not the target population). Those who failed to give their ages at enrolment were slightly less likely to answer the YOU survey and half as likely to volunteer for the panel, suggesting they were more likely to be older students rather than missing at random. The regression of age at enrolment on membership of the YOU survey yielded the coefficient β= -0.464, t = 4.06, N=4,097), reflecting a widespread finding that younger people are more likely to participate in surveys than older people.

who make up 96% of first year students. Figure S3 shows that when it comes to responding to the survey the two student attributes did interact; the highest response by female students was at age 17 and the difference gradually shrank to an insignificant difference from age 22 onwards.

Figure S3. The probability of answering the YOU baseline survey by age and sex. April 2019

Age of students at enrollment

Source: Enrolment form and YOU Student Wellbeing Survey
Note: Confidence intervals, 95%.

In summary, the response bias in favour of female students is confined primarily to the younger first year students and largely disappears among the older students enrolling in first year courses.

1.8 Socio-economic indices

As a preliminary guide to possible socioeconomic bias in the YOU survey, we compared the target population, baseline and panel samples using two additional variables from the enrolment form - their secondary school decile and whether the student was the first in their family to attend university. The students' secondary school decile measures the extent to which their school's catchment draws on low socioeconomic or poorer communities (1= lowest, 10 = highest).[10] As the term implies, 10 percent of New Zealand schools are in each decile.[11]

Figure S4 documents the tendency for the university to draw students from secondary schools in higher socioeconomic areas, and is a pattern common to universities in general (Goyder et al., 2002).[12] If students were drawn with equal probability from each school decile all the points in Figure S4 would lie along the horizontal dashed line. Clearly this is not the case; while half the schools in the Victoria University catchment were classified as decile 5 or below, they supplied less than five percent of enrolling students. Figure S4 shows that the chances of a student enrolling in first year courses at an increasing rate with the decile rating of their secondary school.

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[10]https://parents.education.govt.nz/secondary-school/secondary-schooling-in-nz/deciles/#:~:text=A%20school's%20decile%20measures%20the,from%20low%20socio%2Deconomic%20communities.

[11] Although school deciles were replaced by an alternative measure of the school's catchment in 2022-3 the decile rating remained in place for each of the three enrolment cohorts covered by the YOU survey (2019, 2020 and 2021).

[12] The figures below S3 are based on an eighty percent response rate and are based on the assumption that the remainder are missing at random.

Figure S4. Proportion of students at enrolment, at baseline and in the panel by secondary school decile, 2019[13]
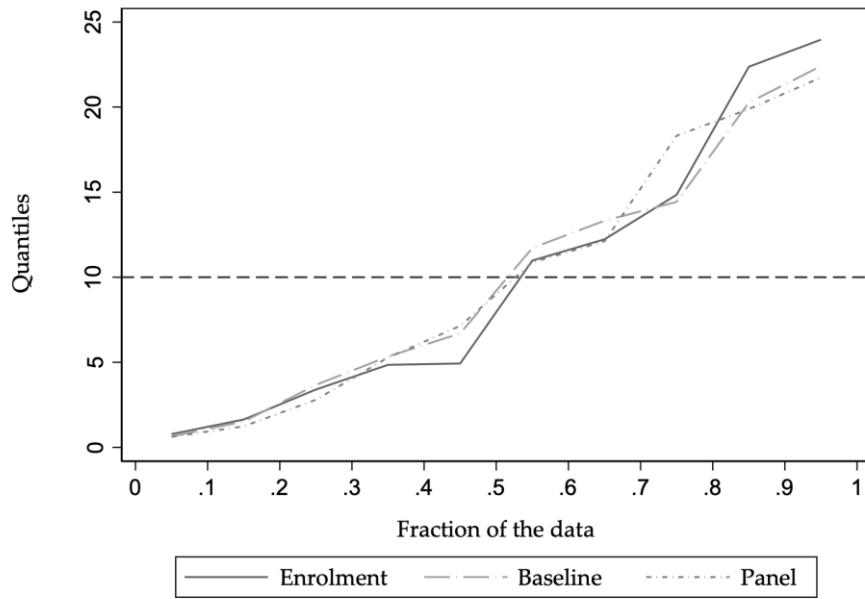
Source: Enrolment form, YOU Student Wellbeing Survey

A quite separate question is whether those participating in the YOU survey, the baseline and panel were more or less likely to be drawn from schools in successively higher socioeconomic catchments. For example, were students from higher decile schools more likely to participate in the YOU survey and answer the baseline survey? The evidence in favour of such a selection bias is weak. As Figure S5 shows, while the mean probability of participating in the baseline does appear lower for those from low decile schools, the standard errors are high and no particular decile shows a significantly higher or lower probability of answering the YOU survey.

Figure S5. The estimated probability of students answering the YOU survey, April 2019
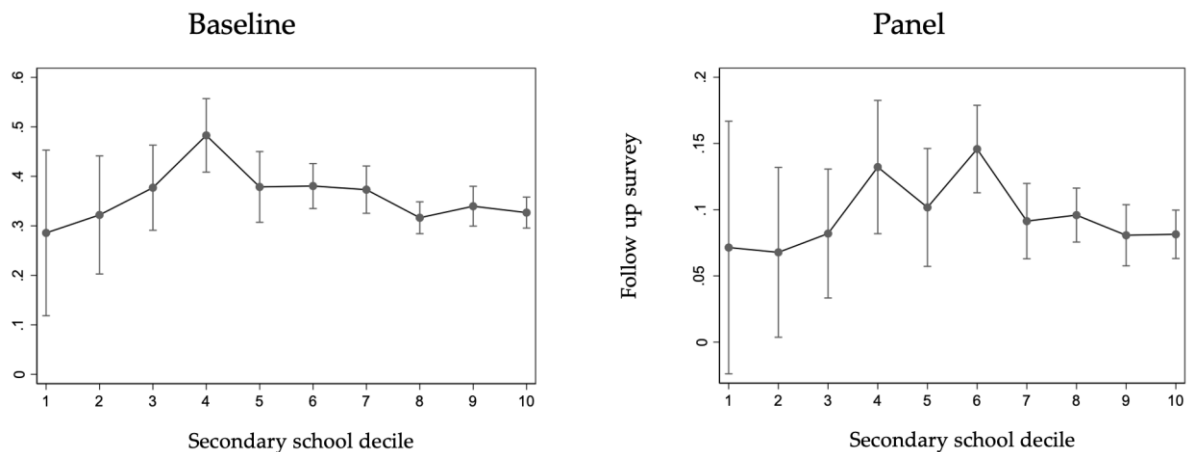
Source: YOU Student Wellbeing survey

In summary, while the chance of enrolling at university shows the well-known bias in favour of

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[13] This qplot (Stata 17) produces a plot of the ordered values of one or more variables against their so-called plotting positions, which are essentially quantiles of a uniform distribution on [0,1] for the same number of values. See COX, N. J. 1999. Quantile plots, generalised. *Stata Technical Bulletin*, STB-51, 16-18.

secondary schools which draw on higher socioeconomic catchments, the decile of the students' secondary school has little apparent influence on whether the student answered the YOU survey or not.

1.9 First in family

The second socio-economic indicator we have available on the enrolment form is the 'first in family' question *(19.4): Do any of your parents have a university qualification? Yes [ ] No [ ] Not sure [ ].* Over a fifth of those enrolling at Victoria University were unable to give a categorical answer to this question, and again we assume the 'missings' are a random drawing from all enrolments. Of those who did answer the question, nearly two thirds said yes (62.5 %) and over a third said no (37.5%). The latter compares to 34.5 percent who answered the baseline survey and 36.1 percent who entered the panel. A logistic regression of the binary response shows these differences were not statistically significant and hence that the samples were representative of student's socio-economic status.

While questions on demographics were included on the enrolment form no mental health questions were asked. Our understanding of bias in the two mental health instruments is therefore confined to comparing the panel with the baseline.

1.10 Well-being bias

We begin by asking whether the mean well-being and ill-being scores and distribution of the two differ between the panel and the baseline. We then ask whether the responses to the physical and financial health questions we ask in the paper differ significantly between the baseline and panel.[14]

The panel attracted students from across the well-being distribution roughly in proportion to their distribution at baseline. The WHO-5 distributions in Figure S6 both approximate the normal. The panel contained students with a slightly lower WHO-5 scores but the difference was not statistically significant and remained insignificant when controlling for age and sex. The dashed lines in Figure S6 show - 1, 0 and +1 standard deviations from the mean. Levels of both skewness and kurtosis were similar in the two graphs.

As we report elsewhere, the distribution of students over the WHO-5 index does not necessarily reflect their distribution over the five separate questions used in its construction (Liu et al., 2023); recall Appendix 1 of the paper, therefore, we compared the baseline and the panel on each of the WHO-5 questions separately. In only two of the five questions did the panel produce a significantly different response to the baseline, with the panel recording a smaller proportion of students feeling active and vigorous and a smaller proportion woke up feeling fresh and rested. However, these differences were not statistically significant.

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[14] While we confine our immediate comparisons to the variables used in the paper, tests for panel bias will also be required in future when other variables are employed. It is the possible for example that certain personality, values or resilience characteristics of the student could influence their decision to join and stay in the panel.

Figure S6. The distribution of WHO-5 percentage scores in the YOU baseline and panel, 2019
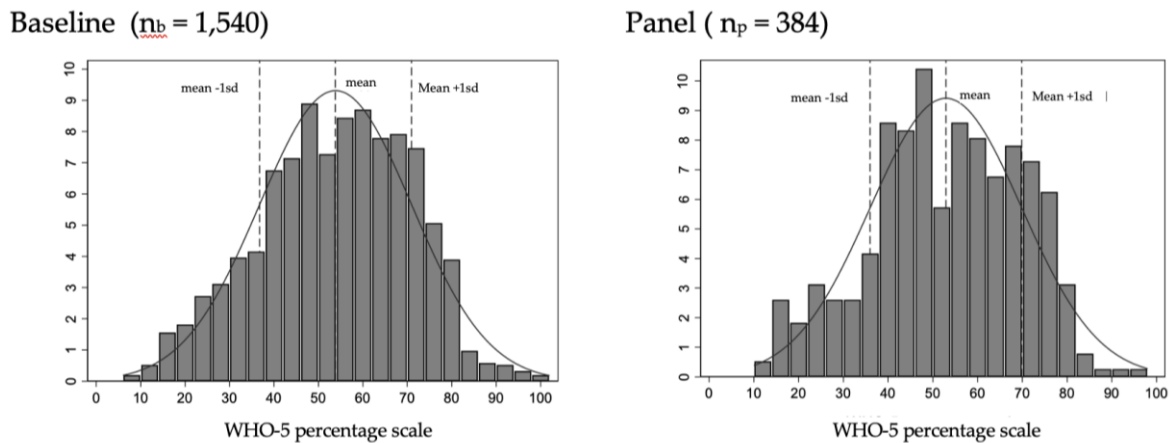
Source: YOU Student Wellbeing Survey, 2019

1.11 A robustness test using life satisfaction

As a robustness test of well-being bias we used an alternative measure of mental health also collected in the YOU survey, the satisfaction with life question (SWL).[15] The SWL value is the students choice from seven possible responses to the statement: *'I am satisfied with my life' : strongly disagree, disagree, slightly disagree, neither agree nor disagree, slightly agree, agree and strongly agree.* We use a regression model to test whether the mean response of the cardinal representation of these options (1, …, 7) differed between the baseline and the panel. Although the SWL at baseline was slightly lower compared to those who volunteered to enter the panel, the difference in their means was not significant at the 95 percent confidence level: **5.15** (5.07 – 5.24) > **5.12** (4.97 - 5.27). As such there was little evidence that those who had volunteered for the panel were experiencing higher or lower well-being as measured by SWL, a result that supports the conclusions based on the WHO-5 variable.

1.12 Ill-being bias

We argue in the paper that ill-being is not simply the reverse of well-being and that the two constitute a dual-continua rather than simply being two ends of a bi-polar measure of mental health. Given that assumption, we also need to ask if our distribution of psychological distress (ill-being) in the panel differed from that of the baseline. The distributions of scores also turned out to be very similar; the mean level of psychological distress was lower in the panel, but not significantly so (33.1 < 33.7). We found that only one of the nine individual questions which make up the PHQ-9 was significantly different. Panel members were more likely to say they experienced poor appetite or over ate, a feature which may be of interest in subsequent analysis (see Momen et al., 2020).

In summary there is little evidence to suggest our panel sample differed in its distribution of well-being or ill-being compared to the baseline sample. Our final test of bias concerns the relationship we explore in the paper, between the mental health indices and the students' physical and financial health.

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[15] For an overview of the life satisfaction scale see. OECD 2023. Measuring population mental health. Highlights. P. 79

Figure S7. The distributions of psychological distress (PHQ-9 scores), the baseline and panel in April 2019

Baseline (n_b = 1,485)   Panel (n_p = 373)
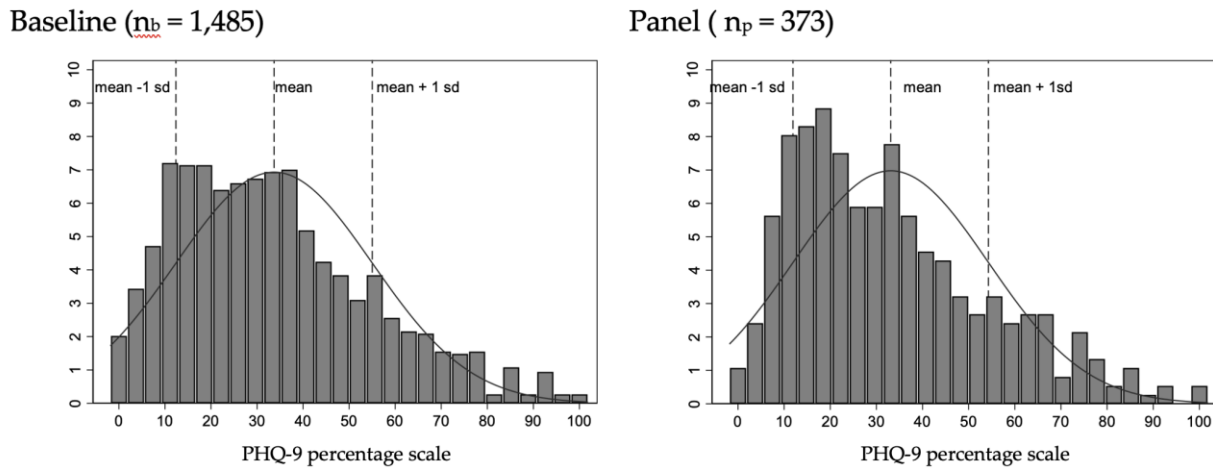
Source: The YOU Student Wellbeing Survey, April 2019

1.13 Physical and financial health bias

There is little evidence of a systematic difference in the distribution of physical health evaluations between the baseline and the panel sample. The panel returns a slightly higher mean physical health score but the standard errors are high: **3.53** [3.44-3.61 > **3.51** [3.46-3.55] and the difference is not statistically significant at the 95 percent confidence level.

Similar results apply when it comes to financial health although whereas physical health was nominally higher in the panel, its mean financial health was lower. However here too, the difference is not statistically significant: **2.39** [2.23 – 2.5] < **2.52** [2.45-2.58]. We conclude therefore that there was little sampling bias the physical and financial health variables.

1.14 Summary

Table 1 compares the above variables from enrolment data base, baseline and panel samples. The measures age and sex are those recorded on the student's enrolment form while the remaining variables come from the YOU survey. The variables, other than age, sex and satisfaction with life variables are defined in the paper. The number of missing values and hence sample size differs depending on the variable with the proportions highest in the enrolment form and lowest in the panel. The results confirm the similarity in variable means and medians across the target and sample populations, the exception being sex-at-birth.

Table S1. Variables response to selected variables in the enrolment form, YOU baseline survey and panel, April 2019

Variable	Enrolment					Benchmark					Panel				
	# cases	Missing	% missin	Mean	Median	# cases	Missing	% missin	Mean	Median	# cases	Missing	% missin	Mean	Median
Sex (1=female)	4,074	608	12.99	0.575	1	1,391	192	12.13	0.69	1	364	24	6.19	0.77	1
Age	4,097	585	12.49	19.2	18	1,403	180	11.37	18.95	18	368	20	5.15	19.11	18
WHO-5						1,540	43	2.72	53.86	56	384	4	1.03	52.92	52
SWL						1,538	45	2.84	5.15	6	388	6	1.52	5.12	6
PHQ-9						1,485	98	6.19	33.71	29.6	373	15	3.87	33.10	29.63
Physical health						1,529	54	3.41	3.51	4	381	7	1.80	3.53	4
Financial health						1,509	74	4.67	2.49	2	380	8	2.06	2.39	2

Source: Undergraduate enrolment form and YOU Student Wellbeing Survey, 2019

1.15 Conclusions

The purpose of this first supplement has been to background the YOU survey, outline the method of recruitment and test whether those who chose to participate in the YOU survey and panel were representative samples of the target population. We found that the proportion of females in the samples increased at each recruitment stage, enrolment, baseline, and panel. With respect to sex composition the YOU survey was not representative of the target population and nor was the panel representative of the baseline and nor did the panel reflect the gender mix of the target population. Since several mental health variables such as well-being and psychological distress have been shown to exhibit distinct differences by sex, we recommend that future analyses control for sex.

We also asked whether entry to the panel was influenced by the socioeconomic background of the student and we employed the decile of their secondary school's catchment and whether the students' parents had a university degree as proxies for socioeconomic status.[16] While enrolment in university courses was much more likely among students from secondary schools with high decile catchments, this background did not affect their probability of volunteering for the panel.

Of particular interest, given our focus on well-being, was whether those who volunteered for the panel exhibited the same level of well-being as the baseline. The panel exhibited slightly lower well-being and lower ill-being and a slightly more positive slope when well-being was regressed on ill-being. However, none of these differences were statistically significant and our conclusion did not change when the same comparison was made controlling for sex. Therefore, our paper has proceeded on the assumption that the panel did not attract a disproportionate number of students with high or low well-being or psychological distress or physical or financial health and that the students in the two samples came from similar socio-economic backgrounds.

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[16] For an argument in favour of using parental socioeconomic status as a proxy for student income see CVETKOVSKI, S., REAVLEY, N. J. & JORM, A. F. 2012. The prevalence and correlates of psychological distress in Australian tertiary students compared to their community peers. *Australian & New Zealand Journal of Psychiatry*, 46**,** 457-467.

Supplement 2. Estimates tables

Table S2.1. Cross-section regression estimates table behind the margins plots in Figure 4

	Well-being (WHO-5)	**Ill-being (PHQ-9)**
Physical health relative to Fair (base)		
Bad	**-11.32***	**17.09***
	(2.78)	**(3.49)**
Good	**8.17***	**-8.97***
	(1.82)	**(2.3)**
Financial health relative to Neutral		
Disagree	**2.72***	**-5.38***
	(1.58)	**(2.0)**
Agree	**-5.4***	**8.68***
	(1.86)	**(2.33)**
Physical x Financial health relative to Fair & Neutral		
Bad x Disagree	3.72	-1.21
	(3.42)	(4.31)
Bad x Agree	**7.37***	-3.09
	(3.76)	(4.75)
Good x Disagree	-.13	.78
	(2.14)	(2.71)
Good x Agree	**5.1****	-5.36
	(2.59)	(3.27)
Constant	**49.43***	**38.22***
	(1.28)	(1.63)
Observations	1507	1477
R-squared	.16	.21

Standard errors are in parentheses

*** p<.01, ** p<.05, * p<.1

Table S2.2. Panel regression estimates table behind margins plots in Figure 7

	(1)	(2)
	Change in well-being	**Change in ill-being**
Change in physical health relative to Stable		
Deteriorated	2.22	1.46
	(5.09)	(5.24)
Improved	-2.31	**-13.96****
	(5.96)	**(6.13)**
Change in financial health relative to Stable		
Deteriorated	-.07	.65
	(3.53)	(3.69)
Improved	.97	-2.1
	(2.9)	(3.05)
Change in both physical and financial health relative to Stable in both		
Both deteriorated	-6.06	5.3
	(7.24)	(7.55)
Deterioration in physical but improvement in financial health	-3.78	-.55
	(5.99)	(6.23)
Improvement in both	**14.11***	-11.52
	(8.23)	(8.44)
Improvement in physical but deterioration in financial health	10.82	6.07
	(6.96)	(7.21)
Constant	-4.09	3.97
	(2.56)	(2.71)
Observations	364	350
R-squared	.04	.09

Standard errors are in parentheses

*** $p<.01$, ** $p<.05$, * $p<.1$

Conflict of interest statement

The authors report no conflicts of interest.

Data availability statement

N/A.

Author contributions statement

Philip S. Morrison, Chair of the YOU Student Wellbeing project, proposed the idea of developing a multidimensional measure of student mental health by interacting the well-being and ill-being responses and testing their properties against the dual-continua model. Ivy Liu suggested and developed the cluster methodology and Dylon Zeng undertook the coding for the LPA, created the cluster graphics and prepared their initial interpretation. All three authors were engaged in the editing and revisions.

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