

(Some of) The New Science of Stress

Bogdan Vasilescu
SSSG, 17 February 2020

Academia can be stressful

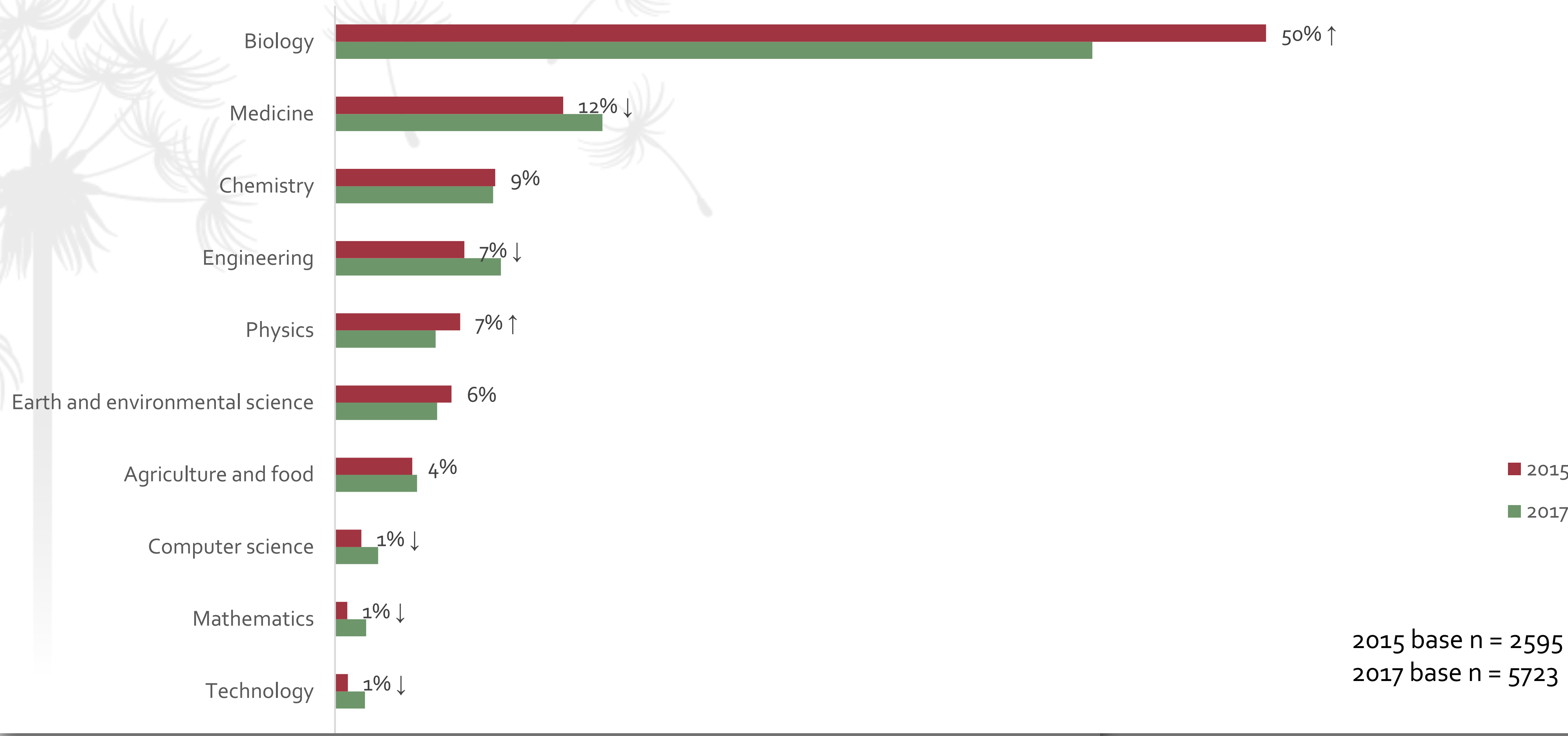
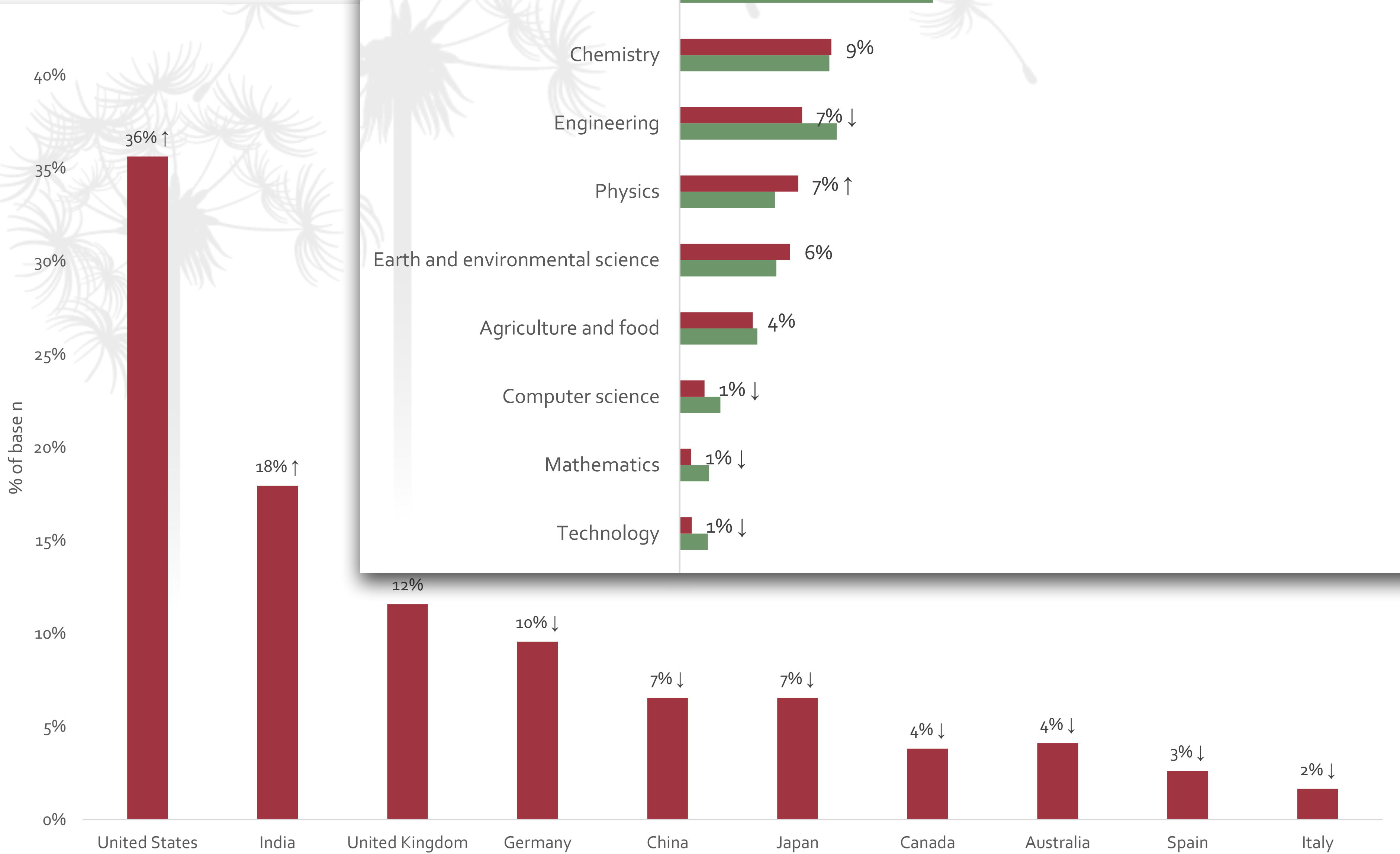
- Many sources of **mundane** stress:
 - ▶ Debugging code
 - ▶ Preparing a talk
 - ▶ Homework
 - ▶ Paper rejection
 - ▶ ...
- Plus occasional **long evenings / weekends**:
 - ▶ Trying to get an experiment to work
 - ▶ Finishing a paper for submission
 - ▶ Writing the thesis
 - ▶ ...
- Plus more **existential** sources:
 - ▶ Unsuccessful project
 - ▶ Pressure to succeed
 - ▶ Uncertain career path
 - ▶ Job market
 - ▶ ...

You are not alone

2017 survey by the journal Nature
on the lives and career aspirations of
~5,700 PhD students worldwide

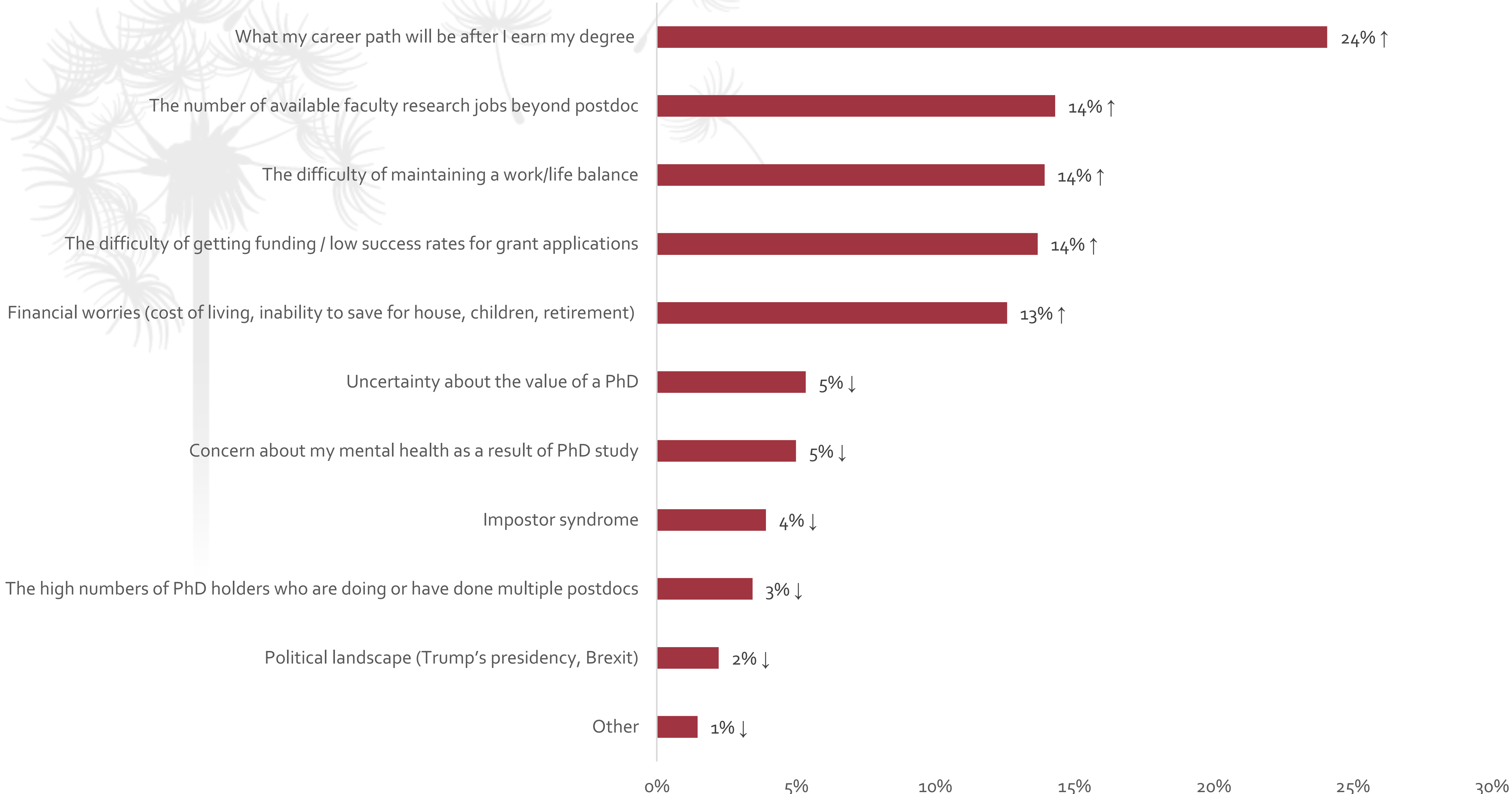
Slides and data CC BY 4.0 from https://figshare.com/articles/Nature_Graduate_Survey_2017/5480716

Which of the following most closely represents your primary subject area? (2015/17)



2015 base n = 2595
2017 base n = 5723

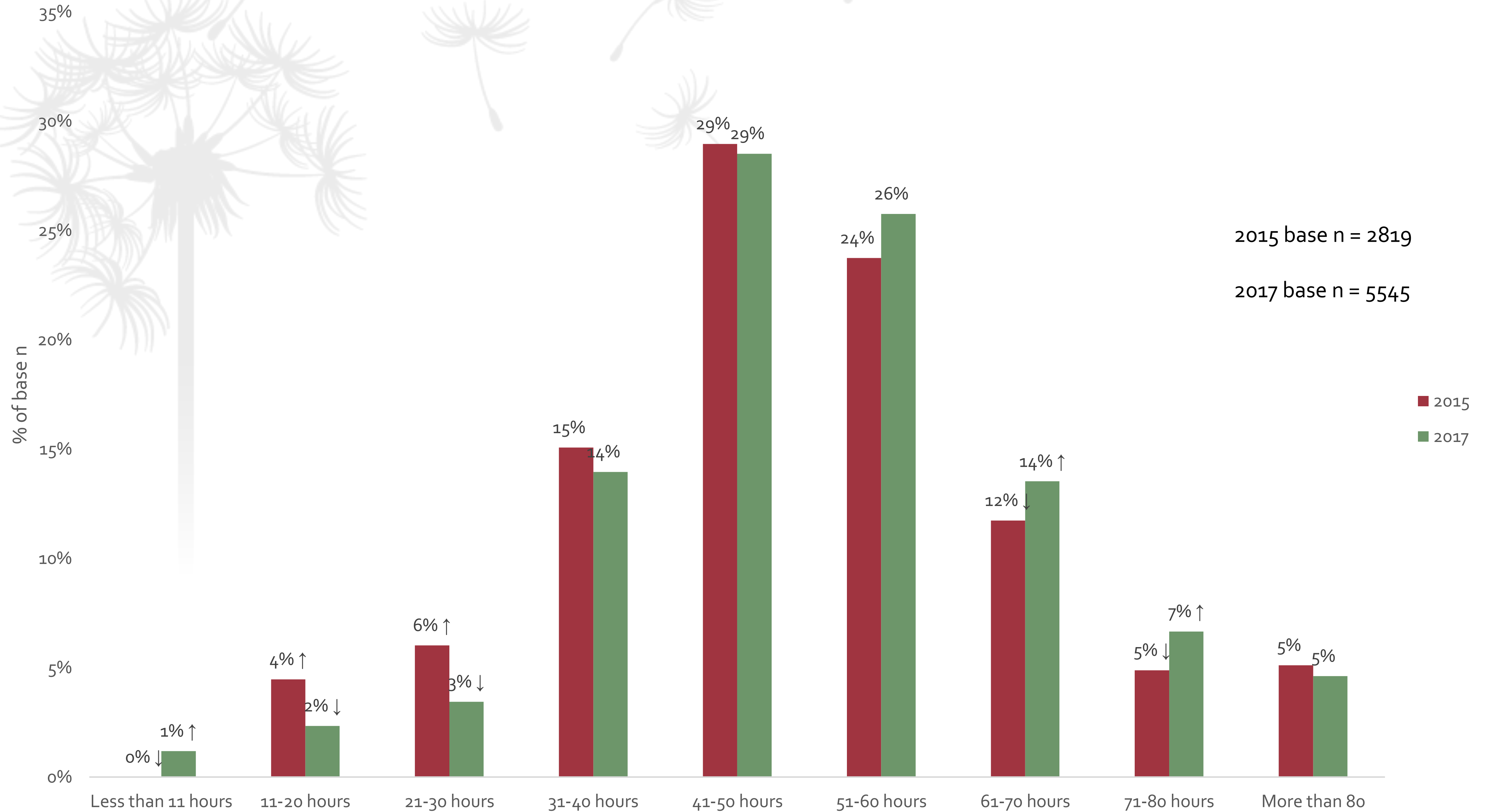
Derived variable: Area of most concern since starting PhD (2017)



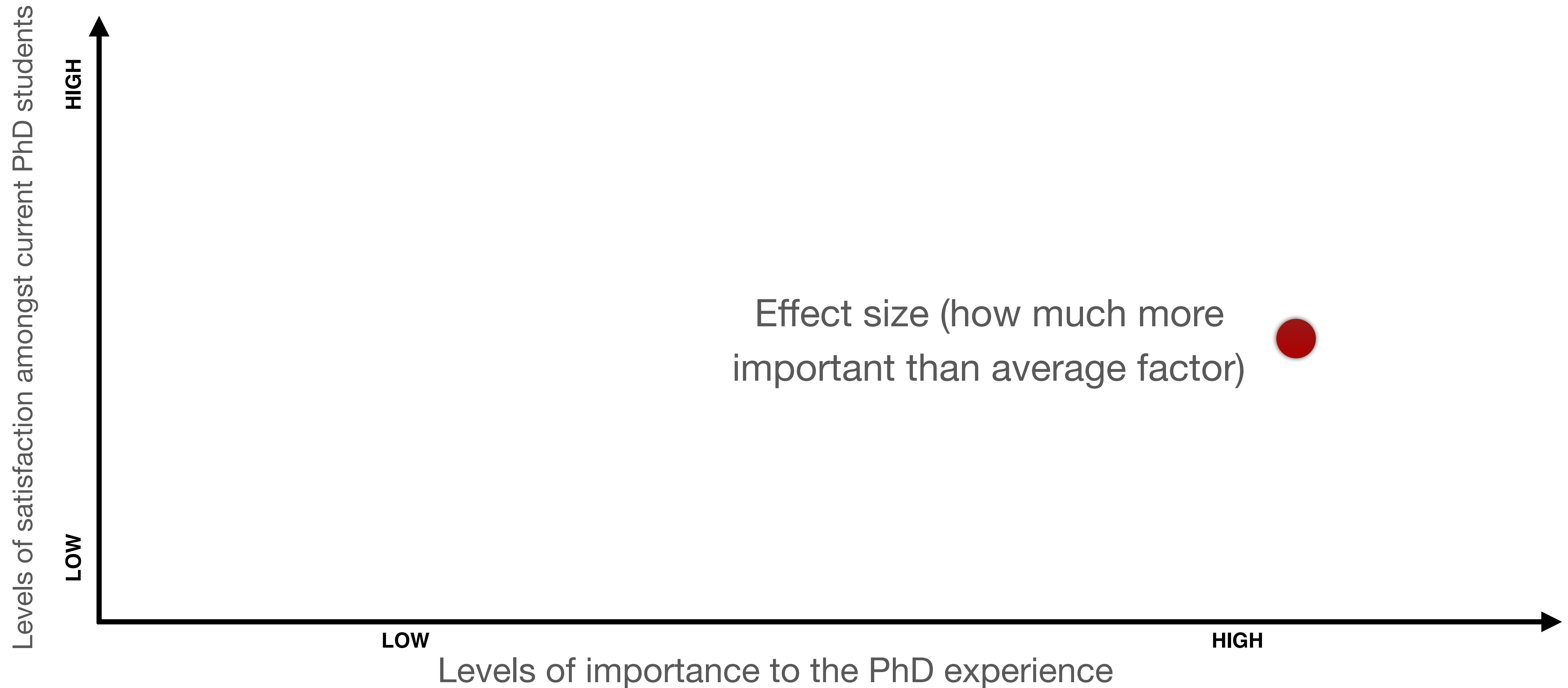
base n = 5721

% of base n

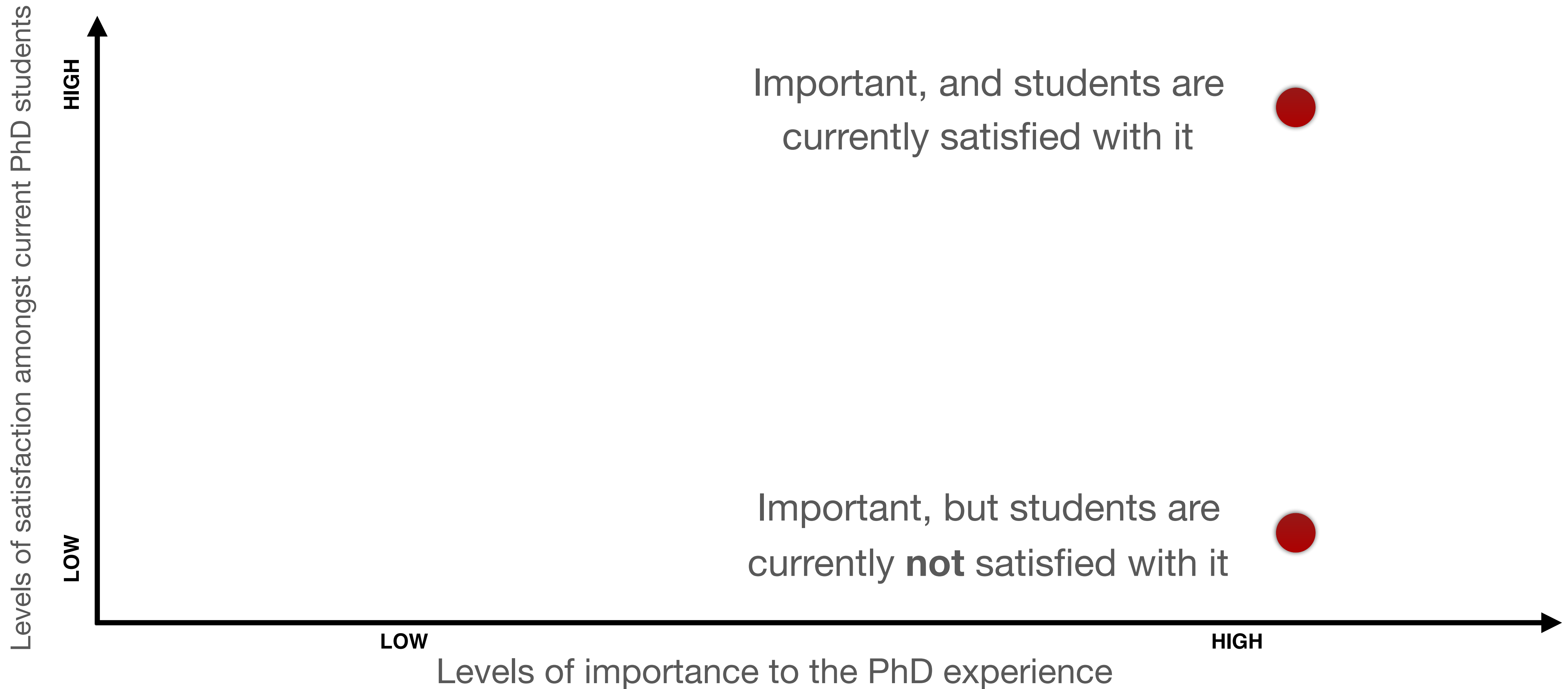
On average, how many hours a week do you typically work?



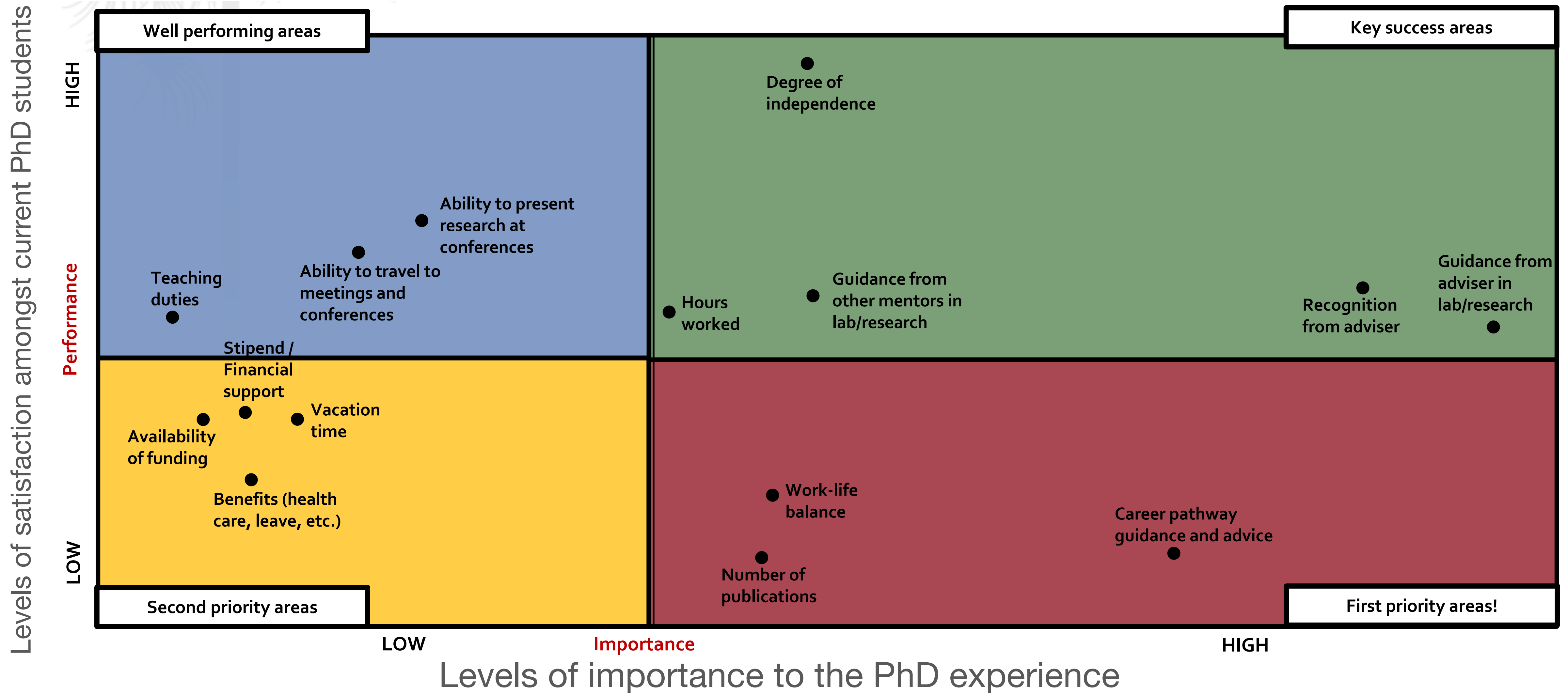
Regression analysis ($R^2 = 45\%$): Satisfaction with PhD experience



Regression analysis ($R^2 = 45\%$): Satisfaction with PhD experience



Regression analysis ($R^2 = 45\%$): Satisfaction with PhD experience



Comparison with original expectations – summary of open responses

- We coded the responses which fall into one of four categories: Exceeded expectation, met expectation, lower than expectation and unsure.

Lack of support and guidance

- The most common reason that the PhD experiences fell short of respondents' expectation is that their advisors did not offer them the support and guidance that they expected.
- *It has been below my expectations so far. I feel as though I am having to be entirely self-directed in my learning and am not gaining any knowledge from my advisors.*

Mental health issues

- **Mental health issues** as a result of PhD study was also mentioned here. Stress and isolation were cited as concerns earlier in the survey and we have seen that many respondents reported experiencing mental health issues as a result of their study.
- *Much lower. I did not expect to have additional mental health problems due to my PhD*
- *It was not as expected. Initially, the hardships were believed to be incubation period, but it worsened day by day. Lack of mental health support adds to the already burdened mind.*

Exceeded expectations in terms of intellectual stimulation and interest

- However, there were many respondents who felt that their PhD positively exceeded their expectations in terms of providing intellectual stimulation and interest in their subject. A common comment was that the work was harder than they expected. It is unclear whether this is positive, due to the rigour of the work required or, as previously stated, this is due to the lack of guidance received in their study.
- *Harder and more challenging, but more exciting as well*

Other sources also raise the issue of mental health

- 2017 survey of 3,596 PhD students in Flanders, Belgium (<http://doi.org/b4wm>)
 - “A third of respondents were at risk of having or developing a common psychiatric disorder, such as depression.”
- 2014 study at UC Berkeley (<http://go.nature.com/2HwIL4v>)
 - High levels of depression among 790 postgraduate students
 - “47% of PhD students meeting the criteria to be classified as depressed.”

Today's topic is
stress

Quiz

If you had to **sum up how you feel about stress**, which statement would be more accurate?

A:

Stress is **harmful** and should be avoided, reduced, and managed.

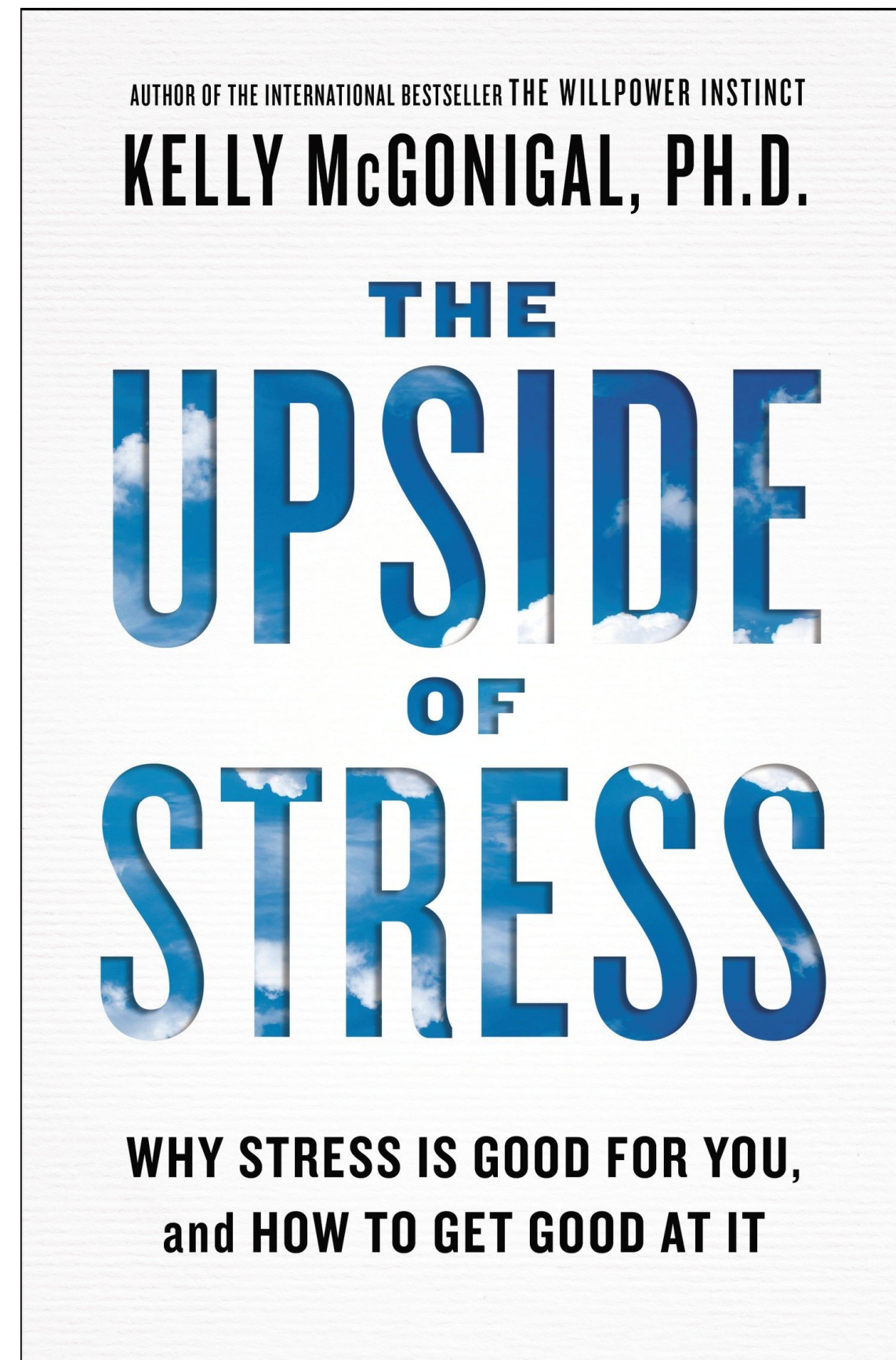
B:

Stress is **helpful** and should be accepted, utilized, and embraced.

Before we continue

- My interest in stress follows some of my recent research on open-source communities.
- I am not a mental health specialist, nor do I have any relevant (formal) training in this area.
- I am not advocating for stress.

Today's talk



There is more to the stress story than
“stress is bad.”

(All of the following are selective quotes from the book)

Claim: Stress is harmful only when you believe it is

- 1998 study of **30,000 adults** in the US, asking:
 - **How much stress** have you experienced in the past year?
 - Do you **believe stress is harmful** to your health?
- Findings from **follow-up 8 years later**:
 - High levels of stress **increased the risk of dying by 43%**
... but **only for people who also believed that stress was harming their health**
 - People who reported high levels of stress but who did not view their stress as harmful were less likely to die than those who reported experiencing very little stress
- The study controlled for gender, race, ethnicity, age, education, income, work status, marital status, smoking, physical activity, chronic health condition, and health insurance

Aside: On the importance of mindset

Housekeepers study (at 7 hotels across the US)

By psychologist Alia Crum (Behavioral Research Lab at Columbia University)

- Housekeeping is strenuous, burning 300+ calories per hour (office work ~100 calories per hour).
- Pre-study:
 - **Two-thirds** of the housekeepers **believed they weren't exercising regularly**. One-third said they got no exercise at all. Blood pressure, waist-to-hip ratio, and body weight reflected a sedentary lifestyle.
- Intervention:
 - At 4/7 hotels: told housekeepers that they were **clearly meeting or exceeding the surgeon general's recommendations** for physical exercise and should expect to see the health benefits of being active.
 - At the other 3/7 hotels: told housekeepers about how important physical exercise is for health, but not that their work qualified as exercise.
- Four weeks later:
 - Those who had been informed that their work was exercise had **lost weight and body fat**, had **lower blood pressure**, and **liked their jobs more**.
 - No change in control group.
- Conclusion:
 - **When two outcomes are possible, a person's expectations influence which outcome is more likely.**

The shake tasting study

- Bring hungry participants in the lab at eight in the morning after an overnight fast.
- First visit: **milkshake labeled “Indulgence: Decadence You Deserve,”** with a nutritional label showing 620 calories and 30 grams of fat.
- Second visit, one week later: **milkshake labeled “Sensi-Shake: Guilt-Free Satisfaction,”** with a nutritional label showing 140 calories and zero grams of fat.
- Intravenous catheter to **measure changes in blood levels of ghrelin** (“hunger hormone”):
 - When blood levels of ghrelin go down, you feel full; when blood levels go up, you feel hungry.
 - Eating something high in calories or fat makes ghrelin levels drop dramatically.
- Outcomes:
 - Drinking the **Sensi-Shake** led to a **small decline** in ghrelin
 - Drinking the **Indulgence shake** produced **3x the drop**
- But: Both times, participants had been given the same 380-calorie milkshake!
- When people’s perceptions changed, their bodies’ responses changed.

End aside on the importance of mindset

Conclusion:

Mindset interventions can be effective

(Recall the earlier claim: Stress is harmful only when you believe it is)

What about
stress mindset interventions?

Aside:
On the biology of stress

Cortisol and DHEA (dehydroepiandrosterone)

- Both are **released during times of stress**.
- **Cortisol** helps turn sugar and fat into energy and improves the ability of the body and brain to use that energy. Cortisol also suppresses some biological functions that are less important during stress, such as digestion, reproduction, and growth.
 - Higher levels of cortisol are associated with **impaired immune function and depression**.
- **DHEA** (a neurosteroid) helps the brain grow stronger from stressful experiences. It also counters some of the effects of cortisol. For example, DHEA speeds up wound repair and enhances immune function.
 - Higher levels of DHEA are associated with **reduced risk of anxiety, depression, heart disease, neurodegeneration**, and other stress-related diseases.

Cortisol and DHEA (dehydroepiandrosterone)

- The balance is important, especially when stress is chronic.
- The ratio of DHEA to cortisol is called the **growth index** of a stress response.
- A higher growth index predicts:
 - **Academic persistence and resilience** in college students, as well as **higher GPAs**.
 - During military survival training, **greater focus, less dissociation, and superior problem-solving skills**, as well as **fewer post-traumatic stress symptoms** afterward.
 - The growth index even predicts resilience in extreme circumstances, such as recovering from child abuse.

Remember:
Higher growth index
(ratio DHEA to cortisol) is better

Follow-up lab study (to Shake Tasting)

- Researchers manipulated participants' **views of stress** and then watched **how their bodies responded** to a stressful situation.
- **Mock job interview**, in which the interviewers gave **negative feedback** no matter what the participants said or did (to simulate a stressful situation)
- Intervention: every participant was randomly assigned to view one of two **three-minute videos about stress**.
 - Video 1: “Most people think stress is negative . . . but actually research shows **stress is enhancing**.”
 - Video 2: “Most people know **stress is negative** . . . but research shows that stress is even worse”
- Analyze participants' saliva for stress hormones: cortisol and DHEA.
- Outcomes:
 - **No effect on cortisol levels**. Everyone's cortisol went up during the mock interview, as expected.
 - Participants who had watched the **stress-is-enhancing video** before the interview released **more DHEA** and had a **higher growth index** than participants who had watched the stress-is-debilitating video.
- Viewing stress as helpful created a different biological reality!

Ok, what next?
How to cultivate a stress mindset?

Not every belief can become a mindset

- Placebo:
 - tends to have a **short-lived impact** on a highly **specific outcome**
- Mindset:
 - is a belief that **biases how you think, feel, and act** (a filter that you see everything through).
 - consequences snowball over time, increasing in influence and **long-term impact**
- Unimportant beliefs:
 - “chocolate is better than vanilla”
 - “it’s rude to ask somebody’s age”
 - “the world is round, not flat”
 - ...
- Important beliefs:
 - “the world is getting less safe”
 - “money will make you happy”
 - “everything happens for a reason”
 - “people cannot change”
 - ...

Recall our earlier quiz

If you had to **sum up how you feel about stress**, which statement would be more accurate?

A:

Stress is **harmful** and should be avoided, reduced, and managed.

B:

Stress is **helpful** and should be accepted, utilized, and embraced.

Current perceptions of stress are overwhelmingly negative

- Survey by Robert Wood Johnson Foundation and the Harvard School of Public Health:
 - **85%** of Americans agreed that **stress has a negative impact** on health, family life, and work
- Survey by the American Psychological Association:
 - most people perceive their own **stress levels as unhealthy**
 - over the years, people's perceptions of a healthy level of stress have actually gone down

The book (and researchers) argue the opposite

- Crum's research shows that people who believe **stress is enhancing**:
 - are **less depressed** and more satisfied with their lives
 - have **more energy** and fewer health problems
 - are **happier** and **more productive** at work
 - are more likely to view stressful situations as a **challenge**, not an overwhelming problem
 - have greater **confidence** in their ability to cope with those challenges
 - are better able to **find meaning** in difficult circumstances

What other evidence is there?

Alternative explanation #1

- Q: Is a positive view of stress the result of an **easier life**?
- A: Not really:
 - Only weak link between how people thought about stress and the severity of the stress they were under.
 - Very small correlation between the number of stressful life events (such as divorce, the death of a loved one, or changing jobs) that people experienced in the past year and how negative their views of stress were.

Alternative explanation #2

- Q: Is your stress mindset a **fixed personality trait**? Some people are more likely to take a positive view of everything, stress included; and optimists live longer than pessimists.
- A: Not really
 - People with a stress-is-enhancing mindset are more likely to be optimists (small correlation).
 - Mindfulness and the ability to tolerate uncertainty also correlate with a more positive view of stress.
 - But **none of these personality traits could account for the effects of stress mindset on health, happiness, or work productivity.**

(How) Can we use any of this?

Stress mindsets are powerful because they affect not just how you think but also how you act

- When you view stress as harmful, it is something to be avoided.
- People who believe that stress can be helpful are more likely to say that they **cope with stress proactively**. For example, they are more likely to:
 - Accept the fact that the stressful event has occurred and is real.
 - Plan a strategy for dealing with the source of stress.
 - Seek information, help, or advice.
 - Take steps to overcome, remove, or change the source of stress.
 - Try to make the best of the situation by viewing it in a more positive way or by using it as an opportunity to grow.
- When you face difficulties head-on, instead of trying to avoid or deny them, you build your resources for dealing with stressful experiences (e.g., confidence, strong support network). This way, the belief that stress is helpful becomes a **self-fulfilling prophecy**.

Stress mindset intervention

- Employees of the **global financial firm UBS** during the 2008 economic collapse.
- **388 participants** (balanced gender, avg age 38) randomly assigned to one of three groups
 - G1 (164 employees) received an online training (3 videos over 1 week) with the typical stress-management message, which reinforces the view that **stress is inherently negative**.
 - G2 (163 employees) received an online training (3 videos over 1 week) designed to give them a more positive view of stress; this was the **mindset intervention**.
 - G3 (61 employees) got **no training** at all.
- Outcomes:
 - The mindset intervention group developed a **statistically significantly more positive view of stress**
 - Employees who watched the negative videos became even more convinced that stress was harmful
- But also, in the mindset group (the other two groups showed no change):
 - **less anxious and depressed**
 - reported **fewer health problems**, like back pain and insomnia
 - reported **greater focus, engagement, collaboration, and productivity** at work

Stress mindsets are powerful
because they affect not just how you
think but also how you act

Aside: Placebos also work open-label

- For a long time, doctors and scientists thought the placebo effect required deception — A sugar pill would help only if patients were convinced they were taking a real drug.
- But it turns out that deception is not the active ingredient in placebos.
- They work even when patients know they are taking a placebo.

How to cultivate a more positive stress mindset?

- It helps to **reflect** on your own experiences with stress, including times when stress had been helpful.
- **Three-step process** for practicing the new mindset whenever you felt stressed:
 - **Acknowledge stress when you experience it.** Simply allow yourself to notice the stress, including how it affects your body.
 - Welcome the stress by **recognizing that it's a response to something you care about.** Can you connect to the positive motivation behind the stress? What is at stake here, and why does it matter to you?
 - **Make use of the energy that stress gives you,** instead of wasting that energy trying to manage your stress. What can you do right now that reflects your goals and values?

How does the stress energy help you?

Aside: more biology of stress

1. Stress gives you energy to handle life-threatening situations better

- When your survival is on the line, the biological changes come on strong, and you may find yourself having a classic **fight-or-flight response** (1936 Hungarian endocrinologist Hans Selye studied lab rats).
- When threatened, animals release **adrenaline** and enter a state of **heightened sympathetic activation**.
- Their **hearts race**, their **breathing quickens**, and their **muscles tighten**.
- Their digestion and other **non-emergency physical functions slow** or stop.
- The body prepares for battle by increasing energy reserves and mobilizing the immune system.
- All these changes kick in automatically during the struggle to survive.

When the stressful situation is less threatening: the challenge response

- Similarly gives you energy and helps you perform under pressure.
- Your heart rate still rises, your adrenaline spikes, your muscles and brain get more fuel, and the feel-good chemicals surge.
- But it differs from a fight-or-flight response in a few important ways:
 - You feel **focused but not fearful**.
 - You also release a different ratio of stress hormones, including **higher levels of DHEA**, which helps you recover and learn from stress.
- People who report **being in a flow state** (artists, athletes, surgeons, video gamers, and musicians) display clear signs of a **challenge response**.

2. Stress makes you social to encourage connection

- Primarily driven by the hormone **oxytocin**
- Elevated levels of oxytocin make you want to **connect** with others
- Oxytocin also makes your brain better able to notice and understand what other people are thinking and feeling. It enhances your **empathy** and your **intuition**.
- But also: oxytocin is a chemical of courage. It **dampens the fear response** in your brain, suppressing the instinct to freeze or flee.
- **Tend-and-befriend response:**
 - Unlike the fight-or-flight response, which is primarily about self-survival, the tend-and-befriend response motivates you to protect the people and communities you care about.

3. Stress helps you learn and grow

- The body relies on a pharmacy of stress hormones to help you recover.
 - **Cortisol** and **oxytocin** reduce inflammation and restore balance to the autonomic nervous system.
 - **DHEA** and **nerve growth factor** increase neuroplasticity so that your brain can learn from stressful experiences.
- People who release **higher levels of these hormones** during a stressful experience tend to **bounce back faster, with less lingering distress**.
- For several hours after you have a strong stress response, the brain is rewiring itself to remember and learn from the experience. During this time, stress hormones increase activity in brain regions that support learning and memory.
- Studies show that viewing a stressful situation as an **opportunity** to improve your skills, knowledge, or strengths makes it **more likely that you will have a challenge response instead of a fight-or-flight response**. This, in turn, increases the chance that you will learn from the experience.

Finding meaning in stress

Finding meaning in stress helps

- Gallup World Poll of 125,000 people, ages fifteen and up, from 121 countries.
 - High levels of stress are associated with both distress and well-being.
 - Importantly, happy lives are not stress-free, nor does a stress-free life guarantee happiness.
- In 2013, researchers at Stanford and Florida State asked a national sample of U.S adults, ages 18-78, to rate how much they agreed with the statement “Taking all things together, I feel my life is meaningful.”
- Outcomes:
 - every measure of stress that the researchers asked about predicted a greater sense of meaning in life
- Feeling stressed can be a barometer for how engaged you are in activities and relationships that are personally meaningful
 - raising a child under eighteen significantly increases the chance that you will experience a great deal of stress every day —and that you will smile and laugh a lot each day.
- Research also shows that a less stressful life doesn’t make people nearly as happy as they think it will. Although most people predict they would be happier if they were less busy, the opposite turns out to be true. People are happier when they are busier, even when forced to take on more than they would choose.
- When the most commonly reported sources of stress in people’s lives overlap with the greatest sources of meaning, stress may even contribute to well-being.

Bogdan's notes

- I wouldn't now encourage unnecessary and avoidable stress.
- Don't overload on commitments, do everything, because if you are not fully stressed out and enjoying it, you are not living a meaningful life.
- Personally I think there should be a balance; unfortunately the book isn't clear on what the balance should be.

Back to the book:
What it means to be good at stress

1. Engage: Welcoming stress can boost confidence and improve performance

- Imagine that you work for an organization with hundreds of employees and you're about to give a presentation to the entire group. The CEO and all the board members are in the audience. You've been anxious about this talk all week, and now your heart is pounding. Your palms are sweating. Your mouth feels dry.
- “What is the best thing to do in this moment: **try to calm down, or try to feel excited?**”
- Harvard Business School prof Alison Wood Brooks asked hundreds of people this question:
 - 91% thought the best advice was to try to calm down.
- Experiment:
 - tell half the people to say to themselves “I am calm”
 - tell the other half to say to themselves “I am excited”
- Outcomes:
 - Neither strategy made the anxiety go away. Both groups still had nerves before their speech.
 - However, the **participants who had told themselves “I am excited” felt better able to handle the pressure.** Despite feeling anxious, they were **confident** in their ability to give a good talk.
 - The excited speakers were rated as **more persuasive, confident, and competent.**

2. Connect

- Stress doesn't only motivate self-defense, as scientists had long believed. It can also unleash the **instinct to protect your tribe**.
- This instinct sometimes expresses itself differently in men than it does in women, but **the two sexes share it**.
- In times of stress, both men and women have been shown to become more **trusting, generous, and willing to risk their own well-being to protect others**.

3. Grow (“Whatever doesn’t kill us makes us stronger”)

- Mark Seery, 2010 paper titled “Whatever Does Not Kill Us”
 - Challenged the belief that traumatic events always increase the risk of depression, anxiety, and illness.
 - Instead, showed that a history of negative life events can actually protect against these outcomes.
Adversity can create resilience.
- Study that tracked **two thousand+ Americans** (nationally representative sample) **for four years**
- Researchers asked participants if they had ever experienced **negative life events**
 - serious illness or injury - the death of a friend or loved one - a major financial difficulty - divorce - living in an unsafe home or neighborhood - being the victim of physical or sexual violence - surviving a natural disaster like a fire or flood - ... (37 total)
- Outcomes:
 - **U-shape curve**: People who had experienced a moderate level of adversity had the lowest risk of depression, the fewest physical health problems, and the greatest satisfaction with life
 - The protective effect of adversity was true for men and women, all ages, and all ethnicities and races.
 - The effect could not be explained by differences in education, income, employment, marital status, or other social factors

Summary

- There is more to the stress story than “stress is bad.”
 - How we think about stress can affect how it impacts us.
- Mindset interventions can be effective.
 - Viewing stress as helpful creates a different biological reality.
 - Stress mindsets affect not just how you think but also how you act.
- New science of stress:
 - People who believe stress is enhancing are less depressed, more satisfied with their lives, have fewer health problems, are happier and more productive at work, are more likely to view stressful situations as an opportunity, have greater confidence in their ability to cope with those challenges, and are better able to find meaning in difficult circumstances.
- Three-step process for practicing the new mindset whenever you felt stressed:
 - Acknowledge stress when you experience it.
 - Recognizing that it’s a response to something you care about.
 - Make use of the energy that stress gives you.

