




Dark Chocolate for HEOR employees Global Value Dossier


This dossier is intended for illustrative purposes only, and our interpretation of the pragmatic non-blinded clinical trial is prone to substantial bias.


Executive summary


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HEOR employees subjected to demanding working conditions may **develop various mental health conditions** as a result.
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The development of such conditions subsequently leads to increased costs associated with **productivity losses and increased health care utilisation**.
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There are currently **no licenced all-in-one interventions** to treat or prevent HEOR employees from experiencing these complications.
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The **flavonoids in cocoa** have numerous health benefits including anti-oxidant and anti-inflammatory mechanisms.
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Dark chocolate, with its high cocoa content, **improves cognitive performance and mental wellbeing**, as well as having multiple other health benefits.
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Dark chocolate is **widely available and accessible** to HEOR employees and presents a marvellous opportunity to **prevent the negative health effects of demanding workloads**.

All evidence for this global value dossier
can be found in the online Evidence Map:
<https://www.evidencemapper.co.uk/demos/>

SCAN ME



1 HEOR employees subjected to demanding working conditions may develop mental health problems as a result.

Evidence Mapper

Value statements:
1. Population in need

Topic:
Population features;
Work productivity

Review category:
Background information;
Prevalence of burnout

Researchers working in health economics and outcomes research (HEOR) face a challenging, ever evolving landscape. Informing healthcare decisions is a demanding role with high levels of occupational stress and it often necessitates working long, unsociable hours.

Burnout is a common consequence of high-pressure working environments. This increases employees' risk of worsening existing medical conditions, such as mental disorders, and developing new conditions, such as high blood pressure or sleep disorders¹⁻³ which can impact work productivity due to increased presenteeism and absenteeism⁴⁻⁶. Furthermore, working in non-daylight hours is associated with circadian desynchrony, metabolic disease and cancer⁷.

Burnout is common globally and may be increasing over time (see Table 1), and although there are no formal statistics on the size of the HEOR sector, one of the key societies (ISPOR) has more than 20,000 members worldwide⁸, thus the size of the potential vulnerable population is substantial.

Table 1. Prevalence of burnout by country and population

Location	Year	Population	Sample	Prevalence
United States	2020	Any	1,136	76%
	2020	HCPs	170	31%
	2019	HCPs	4,999	51%
	2019	HCPs	1,563	51%
	2016	HCPs	131	54%
	2015	HCPs	783	57%
	2014	HCPs	938	27%
	2012	HCPs	7,179	17%
India	2020	Any	6,165	29%
Korea	2019	HCPs	67,000	71%
Japan	2016	HCPs	85	24%
	2013	Professionals	nr	12%
	2013	HCPs	nr	36%
	2013	Civil servants	nr	18%
United Kingdom	2021	Any	nr	46%
	2020	Any	1,000	22%
	2020	HCPs	2,045	23%
France	2021	Any	nr	45%
Germany	2021	Any	nr	51%
Italy	2021	Any	nr	49%
	2014	HCPs	60	50%
	2014	High-stress	882	8%
Spain	2021	Any	nr	51%
	2020	HCPs	452	48%
International	2017	HCPs	nr	50%

HCPs = Health care professionals; nr = not reported

2 Mental health consequences of burnout lead to increased costs associated with productivity losses and health care utilisation.

Evidence Mapper

Value messages:
2. Disease burden

Topic:
Work productivity

Review category:
Background information;
Prevalence of burnout

A cost evaluation of the impact of burnout in four pharmaceutical companies in Japan found that the costs due to absenteeism totalled \$520 per person per year, with an additional \$3055 for presenteeism and \$1165 for associated medical/pharmaceutical expenses⁹.

In the USA, annual cost consequences of burnout were estimated at around \$1.46 billion in 2003 in the long-term care industry¹⁰ and \$213.1 million in 2012 for practising physicians in Canada⁴.

3 There are currently no licenced all-in-one interventions to treat or prevent HEOR employees from experiencing burnout.

Recommended treatments exist for the complications of burnout, however there is no single treatment recommended to treat or prevent all of these conditions.

Preventive measures to reduce the risk of burnout would subsequently reduce the risk of these complications, with substantial benefits to employees and employers, and reduced direct and indirect costs.

4 The flavonoids in cocoa have numerous health benefits including anti-oxidant and anti-inflammatory mechanisms.

Evidence Mapper

Value messages:
4. Flavonoids

Topic:
Mechanisms of action;
Mental/cognitive function

Review category:
Background information

Cocoa contains flavonoids, a secondary metabolite found in many plants^{11,12}. These metabolites have the ability to modulate protein and lipid kinase signalling pathways including ERK and PI3-Kinase/Akt pathways. Direct interactions with the pathways improve neuronal connectivity and increase neuromodulatory protein expression¹¹. The antioxidant mechanism is found to reduce cell dysfunction and apoptosis resulting in reduced depressive states and cognitive dysfunction^{13,14}.

Studies have indicated that dietary flavonoids can pass the blood-brain barrier, influencing neural regions that are responsible for learning and memory, primarily the hippocampus, and possibly reducing neurodegeneration¹¹. Anti-inflammatory effects of cocoa flavonoids can improve endothelial function and peripheral blood flow,¹¹ leading to cardiovascular benefits and reduced mortality risk^{15,16}.

5 Dark chocolate, with its high cocoa content, improves cognitive performance and mental wellbeing, with multiple other health benefits.

Evidence Mapper

Value messages:
5. Cocoa benefits

Topic:
Mental/cognitive function
Cancer; Cardiovascular;
Mortality; Utilities;
Quality of Life

Review category:
Cocoa SLR

Many mental health benefits of cocoa have been reported. Dark chocolate is reported to improve symptoms of mild cognitive impairment and reduce the risk of age-related neurodegenerative disorders^{14,17-19}. Cocoa also protects against depression²⁰, improves symptoms of chronic fatigue syndrome²¹, counteracts the effects of sleep deprivation²² and prevents circadian desynchrony⁷.

Cocoa can also protect against serious physical disorders such as cardiovascular events by reducing blood pressure and cholesterol levels²³.

Adverse events associated with chocolate consumption related to it being a high-fat high-sugar snack, such as poor mental health and weight gain^{24,25}, are typically related to low-cocoa chocolate.

The Crystallise Chocolate Clinical Trial (CCCT)

A pragmatic, open-label, randomised-controlled, cross-over trial of the effects of high-cocoa chocolate on work-related performance and wellbeing was conducted among HEOR employees at Crystallise Ltd and JB Medical Ltd.

Method: Participants were randomised to consume either 32 g of $\geq 60\%$ cocoa chocolate daily or a calorie- or sugar-matched control snack for 3 weeks. Following a 2-week wash out period participants crossed over to the alternative intervention for the final 3 weeks. Outcomes measured were self-reported productivity and wellbeing, and cognitive performance measured by online reaction time and numerical reasoning tests.

Results: Generalised mixed effect regression analyses found participants were significantly more likely to report improvements in work productivity following consumption of dark chocolate compared to the control ($p < 0.05$). Dark chocolate was also shown to have a beneficial effect on reaction time, numerical reasoning (number of correct answers) and self-reported concentration and stress, but these were not statistically significant (all p values > 0.1)*.

Conclusion: Dark chocolate intake improves self-reported job performance.

6 Dark chocolate is widely available and accessible to HEOR employees and presents an innovative approach to preventing the negative health effects of demanding workloads.

Evidence Mapper

Value messages:

6. Accessibility

Topic:

Cost and resource use

Review category:

Cocoa SLR;

Background information

The potential cost savings from reduced burnout are substantial from both a societal perspective, with regards to productivity and unemployment, and a healthcare perspective, with regards to reduced resource use for comorbid conditions.

Health benefits are typically seen with flavonoid intake > 525 - 547 mg/day¹⁶. Based on a review of flavonoid content of commercially available dark chocolate ($\geq 60\%$ cocoa)²⁶ and sale prices of chocolate in UK supermarkets in March 2022, the non-discounted annual treatment cost per person per year would be around £2,536**.

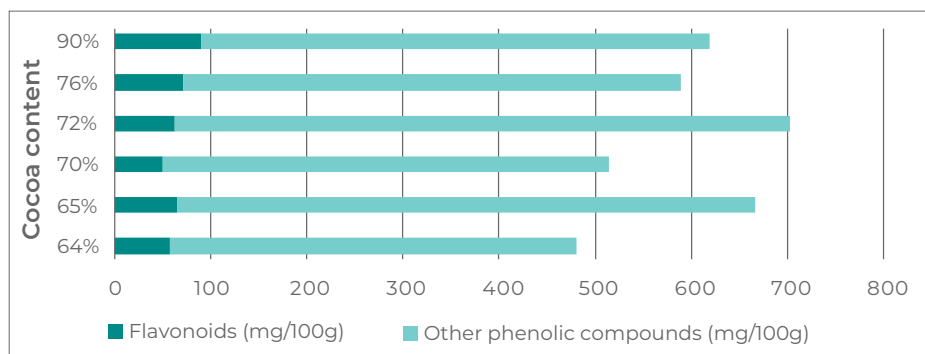


Figure 1. Flavonoid and polyphenol content of commercially available chocolate bars by cocoa content (adapted from Mikołajczak and Tańska, 2021)

* The results reported were for specific models, with no significant differences associated with chocolate consumption for the study population as a whole, without chocolate-covered or general cherry-picking.

** The necessary treatment dose is around 550 g/day of commercially available dark chocolate, equating to approximately 10 to 15 individual chocolate bars a day. No research was found on any negative health impacts of this level of consumption, and future research is needed to fill this evidence gap.

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