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An independent academic psychologist, based in England, who has written extensively on different areas of psychology with an emphasis on the critical stance towards traditional ideas.

A complete listing of his writings at http://psychologywritings.synthasite.com/. See also material at https://archive.org/details/orsett-psych.

CONTENTS

1. WORM-FREE POPULATIONS

1.1. OVERVIEW

Buonfrate et al (2023) explained: "The nematode genus Strongyloides consists of more than 50 different species that are all small intestinal parasites of vertebrates other than fish and are of variable veterinary and medical importance. The threat for human health caused by the species Strongyloides stercoralis is increasingly appreciated after it had been grossly neglected for a long time" (p1). Part of the neglect is that this parasite tends not to be fatal to the estimated 600 million infected people [1], and "most infections only mild or no clinical symptoms and if there are symptoms, they are rather unspecific" (Buonfrate et al 2023 p1).

The life cycle of Strongyloides includes female larvae entering the host via the skin, for example, and migrating through the blood system to the small intestine of the host, where the life cycle is completed (ie: becoming reproducing adults) (Buonfrate et al 2023).

The species vary in development, but Buonfrate et al (2023) listed four options:

i) Leave the host as female eggs (eg: via faeces) and search for a new host (direct or homogonic development). This is an asexual reproductive cycle.

ii) Leave the host as female eggs and develop outside of a host (indirect or heterogonic development; asexual).

iii) Become male before leaving the host and developing outside of a host including mating (indirect or heterogonic development). This is a sexual reproduction cycle [2].

[1] Jaleta et al (2017) commented: "The medical relevance of this parasite has probably been grossly underestimated due to difficulty of diagnosis" (p2).

[2] Jaleta et al (2017) found clear evidence of sexual reproduction in Strongyloides stercoralis, but the researchers "postulated that males do not contribute genetic material to the progeny and that sperm are merely required to trigger parthenogenetic embryonic development" (p2). This is known as "pseudogamy" (Jaleta et al 2017).

iv) Female eggs develop into adults in the host and reinfect them (auto-infective cycle; asexual).

Strongyloidiasis (the infection caused by the nematode worm Stronglydoides stercoralis) is mostly found in tropical and sub-tropical parts of the world, but sometimes in temperate areas, as in Australia. "In Australia, strongyloidiasis primarily affects returned travellers, Vietnam veterans and refugees or asylum seekers, and First Nations people. First Nations remote communities have some of the highest rates of strongyloidiasis in the world" (Ross 2023 p1). Talukder et al (2022) reported prevalence rates between 5-42% (average 27%) in seven remote Australian communities, for example [3].

Transmission occurs via contact with human (and possibly dog) faeces (appendix 1A) (eg: due to inadequate sewerage systems), and human-to-human transmission is "low or non-existent" (Ross 2023 p1). Ross (2023) stated: "The high rates of strongyloidiasis in First Nations communities in Australia are a result of longstanding, systemic inequalities. For decades, these communities have faced the challenges of housing overcrowding, inadequate housing maintenance including of water and wastewater hardware, and inadequate waste management, all of which contribute to the transmission of strongyloidiasis" (p2).

1.2. PRIMATES

Pathogens are easily transmitted between humans and non-human primates (NHP). NHP are the source of one-fifth of human infectious diseases, for instance, while respiratory diseases like tuberculosis can transmit from humans to free-ranging and captive NHP (Noskova et al 2023).

Species of Strongyloides can occur in both humans and NHP. For example, Strongyloides fuelleborni is commonly found in African and Asian NHP, but also in humans "mainly in the tropics, exclusively in areas where humans share their habitat with NHP" (p3) (eg: one-quarter of Babinga hunter-gatherers in the Central African Republic) (Noskova et al 2023). One mechanism proposed was that "hunted monkeys were eviscerated and the gut contents contaminated areas where humans lived" (Noskova et al 2023 p3).

[3] Strongloidiasis has been reported in remote communities throughout Australia, including the Northern Territory, Queensland, Western Australia, and North South Wales (Beknazarova et al 2019).

Strongyloides stercoralis, on the other hand, leads to mild infection in humans, but could be fatal to NHP (eg: young chimpanzees and gorillas at the San Diego Zoo in the last century) (Noskova et al 2023).

1.3. APPENDIX 1A - DOGS

Beknazarova et al (2019) pointed out: "Despite initially successful intervention programmes targeting treatment to eliminate human strongyloidiasis in remote Australian communities, the disease remains endemic. Reappearance of the infection could possibly be as a result of zoonotic transmission from dog reservoirs given that dogs and humans share a close and intimate cultural bond in rural and remote Indigenous communities of Australia" (p2). This was confirmed in the DNA analysis of human and dog faeces from communities in the Northern Territory by Beknazarova et al (2019).

Based on data from Cambodia and Myanmar, two genetically different strains of Strongyloides stercoralis have been found from DNA analysis; one strain is dog specific, but the other infects dogs and humans (Beknazarova et al 2019).

In their Northern Cambodian data, Jaleta et al (2017) admitted that they "did not directly demonstrate transmission from dogs to humans and therefore cannot exclude that the transmission is mostly or exclusively from human to dog. Nevertheless, our results strongly suggest that there is a considerable risk for dog to human transmission" (p15). This is contrary to other research, like Takano et al (2009) in the Amami Islands, Japan, who found that "humans in households with Strongyloides-infected dogs were not more likely to be parasitised by S. stercoralis than those with parasite free dogs and concluded that natural transmission does not occur between humans and dogs" (Jaleta et al 2017 p15).

Jaleta et al (2017) argued that sanitary conditions in Japan were better than in Cambodia, and only five infected dogs were found by Takano et al (2009). A study in Southern China (Steinmann et al 2007) did not find zoonotic transmission. Jaleta et al (2017) observed that "this conclusion was based on only 21 infected individuals (11.7% of the tested), and no details about the exposure to dogs are given. In rural settings dogs are usually semi-domesticated and roam freely such that the risk of exposure to contamination by canine faeces among people who do not own a dog themselves might be

approximately equal to the risk among people who do. Therefore, the lack of statistical significance cannot be taken as evidence against zoonotic transmission" (p15).

Jaleta et al (2017) accepted the possibility of other non-human carriers of Strongyloides stercoralis.

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2. EATING DISORDERS IN THREE LESS STUDIED GROUPS

2.1. TRANS INDIVIDUALS

Trans individuals experience eating disorders at a higher rate than the general population (eg: meta-analysis; Rasmussen et al 2023) [4]. In the general population worldwide, up to one-fifth of young women receive a diagnosis of an eating disorder, and less than 5% of young men compared to one-third of trans students in the USA (Simone et al 2022), for example, classed as high risk of eating disorders. These figures are not necessarily directly comparable because of the different measures, and the limited number of studies on trans individuals. Table 2.1 gives an example of the different ways of measuring eating disorders and of studies with trans individuals.

A number of explanations have been proposed for the higher rate of eating disorders among trans individuals, including (Keski-Rahkonen 2023):

i) High mental health burden - Trans individuals report high levels of other mental health problems, like mood and anxiety disorders (Pinna et al 2022).

ii) Higher likelihood of being diagnosis by healthcare professionals - eg: Nunes-Moreno et al (2022).

iii) High burden of discrimination, violence, and poverty - eg: Reisner et al (2016).

These factors fit with a "minority stress model" which sees the internalisation of discrimination and stigma as the basis of mental health problems. Add to this the distress of gender dysphoria (a discrepancy between one's assigned gender at birth and one's gender

[4] "Trans" is used to cover "transgender" and "gender diverse". ''Transgender' is a broad umbrella term that refers to people whose gender identity or expression does not correspond with gender assigned at birth. 'Gender diverse' describes a huge variety of gender identities, expressions, and gender minority communities" (Keski-Rahkonen 2023 p412).

MEASURE	STUDY	DETAILS
Eating disorder symptoms	Hallward et al (2023)	Among Canadian adults, trans individuals reported more symptoms, and so had higher EDE-Q scores *
Disordered eating	Pham et al (2023)	40% of trans individuals reported some form of this behaviour (eg: binge eating; food restriction)
Self-reported diagnosis	Simone et al (2022)	10% of gender diverse and trans-masculine students and 6% of trans-feminine students reported a diagnosis by a healthcare professional in the USA **
Diagnosis by healthcare professional	Ferrucci et al (2022)	Using US health insurance data, 2.4% of people seeking gender-affirming care were diagnosed with an eating disorder

(* EDE-Q = "Eating Disorder Examination Questionnaire"; commonly used 28-item measure of individual symptoms)

(** Trans-masculine refers to trans individuals with predominantly masculine identity (usually a trans-man, ie: a man assigned as female at birth), and trans-feminine is a broader term for predominantly feminine identity (usually a trans-woman, ie: a woman assigned male at birth) (Keski-Rahkonen 2023))

Table 2.1 - Different ways of measuring eating disorders.

identity). "Disordered eating, particularly food restriction, may be a strategy of dealing with gender dysphoria and a changing body" (Keski-Rahkonen 2023 p416).

2.2. AUTISTIC WOMEN

There are approximately three males to one female among autistic individuals (technically, autism spectrum disorder), and the global prevalence of autism is about 1% (Schroder et al 2023). So autistic women is a very small group in the population, and among them those with eating behaviour-related problems.

Among autistic individuals generally, problem behaviours like food refusal, food selectivity, or abnormalities in dieting intake ("autistic eating behaviours"; Schroder et al 2023) range from nearly half to almost all (ie: 44%-96%) (Schroder et al 2023). Such behaviours increase the risk of "developing feeding- and eating disorders such as avoidant restrictive food intake disorder (ARFID), and can lead to potentially severe physical problems, such as nutrient deficiencies, gastro-intestinal problems as well as being overweight,

underweight or obese, with all physical consequences that result from this. For instance, weight problems through poor nutritional health have been linked to an increased risk of other serious health co-morbidities in autistic individuals, including Type II diabetes and cardiovascular conditions" (Schroder et al 2023 p420).

Concentrating on autistic women, where the research is limited, such individuals without intellectual disabilities "seem to not only present with high levels of autistic eating behaviours, but also report high levels of disordered eating behaviours, which are related to more 'traditional' eating disorder behaviours. Such behaviours include the avoidance of certain (fattening) foods (eg: foods with a high carbohydrate or with a high sugar content) because of a fear of gaining weight or a desire to be thin, as well as bulimic behaviours such as bingeing and purging" (Schroder et al 2023 p420).

Autism-related characteristics could account for problematic food behaviours. For example, sensory processing difficulties - avoidance due to sensory overload (hyper-reactivity) (eg: avoiding certain foods) or sensation seeking for under-stimulation (hypo-reactivity) (eg: over-consumption of certain foods) (Schroder et al 2023).

Another characteristic of autism can be emotion regulation difficulties, and this is associated generally with "emotional eating" (eg: binge and purge episodes). While restricted and repetitive interests is another characteristic common in autism, and this may be focused on food and cooking. "This interest is then repeatedly engaged in and can therefore pose a risk for increased problematic eating behaviours" (Schroder et al 2023 p421).

Cognitive flexibility, for instance, is seen in both autism and eating disorders. It is difficult, however, to establish a direction of causation, or whether there is a common neurobiological basis to both (Schroder et al 2023). Brede et al (2020) proposed a model where the characteristics of autism provide direct and indirect routes to disturbed eating behaviours.

In terms of specific research studies, Nielsen et al (2022) followed fifty-one women with adolescent-onset anorexia nervosa and fifty-one matched controls over thirty years. Among the former group, women with diagnosis of autism had "worse outcomes in psychiatric, psycho-sexual and socio-economic state..." (compared to non-autistic women) (Schroder et al 2023 p422).

One general problem with research is the use of "appropriate autism assessment" (Schroder et al 2023 p423).

In summary: "Autistic women with an eating disorder seem to suffer from more complex eating disorders and seem to not benefit from current treatment modalities" (Schroder et al 2023 p419).

2.3. OLDER ADULTS

Mangweth-Matzek et al (2023) stated: "Older persons with eating disorders are hardly seen in specialised care, and there are still almost no clinical studies on eating disordered patients in middle or older age, although it is empirically evident that eating disorders and disordered eating do occur in these cohorts" (p406).

Most studies of older women and eating disorders have been case reports, or with small samples until recently. Reviews of older female sufferers (Samuels et al 2019), and of both sexes (Mangweth-Matzek and Hoek 2017) do exist.

Mangweth-Matzek et al (2023) updated Mangweth-Matzek and Hoek (2017) cover the period 2017 to mid-2023. The prevalence diagnoses using DSM-IV and DSM-5 categories for middle-aged and older women are "Other Specified Feeding and Eating Disorder" (OSFED), "Eating Disorder Not Otherwise Specified" (EDNOS), and "Binge Eating Disorder" (BED).

"It is still very difficult to assess exact prevalence rates of any eating disorders or the various diagnoses because of the small number of studies, the different sample characteristics, assessment instruments, methodological approaches, different age groups and genders. Therefore, presented numbers should be received as trend ranges rather than exact numbers" (Mangweth-Matzek et al 2023 p406). Having said that, prevalence rates for full diagnoses of eating disorders range from 2% to 7% in recent studies (Mangweth-Matzek et al 2023). Table 2.2 lists three interesting studies.

One issue for older women is the menopausal transition. Mangweth-Matzek et al (2013) reported higher rates of eating disorders among peri-menopausal women (ie: during the period of change) compared to pre-menopausal or post-menopausal women. Subsequent studies, however, varied in their findings (Mangweth-Matzek et al 2023). Mangweth-Matzek et al (2021) did find that high menopausal symptoms was associated with eating disorders

STUDY	DETAILS
Preti et al (2009)	4139 women and men in six European countries of different ages. Lifetime risk of DSM-IV eating disorder: 18-29 years (5.1%), 30-44 years (2.4%), 45 years and above (1.3%)
Presskreischer et al (2022)	11 962 287 "Medicare" enrollees (all adults 65 years, and above and any age with disabilities) in USA: 0.15% eating disorder diagnosis
Brown et al (2020)	900 college students followed for 30 years. Prevalence of any eating disorder among women decreased from 19.4% at baseline (20 years old) to 8% (40-50 years old)

Table 2.2 - Three interesting studies on the prevalence of eating disorders in older adults.

compared to low symptomatology. Mangweth-Matzek et al (2023) commented that "menopausal stages, especially peri-menopause, lacks specific biological markers for exact diagnosis and, therefore, rating overlaps do occur; and not all women suffer menopausal symptoms during the transition, and it seems obvious that those experiencing various complaints are also more vulnerable for developing disordered eating" (p407).

There are conditions called "severe and enduring eating disorders" (SEED) (though with "no definitive criteria"; Mangweth-Matzek et al 2023 p407). Other terms include "longstanding, complex eating disorder" and "long-lasting anorexia nervosa" (Mangweth-Matzek et al 2023). SEED include chronic symptoms that persist for 10, 20, 30 or 40 years, mostly with adolescent-onset (Mangweth-Matzek et al 2023).

As for eating disorders and older men, there is even less research than for women. In one Swiss cohort (Mohler-Kuo et al 2016), for example, covering 15-60 year-olds, the lifetime prevalence of anorexia nervosa was 0.02% and 0.9% for bulimia nervosa (Mangweth-Matzek et al 2023). An Austrian study (Mangweth-Matzek et al 2022) found a prevalence rate of 7% for disordered eating among older men. Research on this sample also found "individuals scoring high on the Ageing Males' Symptoms (AMS) scale showed higher prevalence rates of eating disturbances than low-scoring men. The AMS scale is a tool to assess symptoms of ageing, and high scores on the AMS scale have been shown to be indicative of a possible testosterone deficiency. An age-related decline in testosterone could, therefore, be responsible for men developing eating disorders or associated symptoms at

older age" (Mangweth-Matzek et al 2023 p409).

Mangweth-Matzek et al (2023) ended: "Eating disorders do occur in middle and older age of both sexes; shame and stigmatisation have decreased and medical awareness of explicit assessment of eating behaviour in all age groups has developed. Existing data show that it is a complex process when new diagnoses enter new age cohorts, such as the recognition of eating disorders among older people. There is still a lack of treatment studies, because they are always at the very end of scientific assessments, after the knowledge of the new disorder has arrived in the public perception" (p409).

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3. TRADITIONAL AND FAITH-BASED HEALTHCARE

Psychotic disorders in sub-Saharan Africa are likely not to be treated by biomedical healthcare (eg: psychiatrists; anti-psychotic medications) due to a combination of lack of such care, and cultural preferences for "traditional and faith-based healers" (TFH) (van der Zeijst et al 2023).

van der Zeijst et al (2023) defined TFH as "healthcare providers who derive their practice from African traditional or religious beliefs and principles. In the context of Africa, traditional healers can usually be divided into two sub-types: herbalists and diviners. Faith healers will often belong to one of the two major religions on the African continent, either Christianity or Islam. The sub-types of traditional and faith healers are not mutually exclusive, and some healers combine practices" (p338).

The limited research on anti-psychotic drugs with African patients found that symptoms are reduced, but "side effects, non-adherence and anti-psychotic polypharmacy occur frequently, and the access to and availability of anti-psychotics is very limited. Also, other forms of psychiatric treatment are often discontinued due to perceived ineffectiveness, high costs and the experiences of insulting remarks by biomedical practitioners" (van der Zeijst et al 2023 p338). TFH can be more successful in these latter issues (eg: 80% adherence to treatment by schizophrenic patients; van der Zeijst et al 2023).

Integration of biomedical and TFH is a possibility for mental health problems. In a previous review, Ojagbemi and Gureje (2020) found that "several African TFH not only recognise spiritual but also biopsychosocial causes of mental illness, use history taking, signs and symptoms for diagnoses and apply social and pharmacological interventions" (van der Zeijst et al 2023 p338).

van der Zeijst et al (2023) performed an updating review of TFH for psychosis in Africa, finding eighteen articles published in English, Afrikaans, Dutch, and German between 2020 and 2023. Six themes were distinguished:

1. Causal models - TFH often have supernatural explanations for psychosis (eg: witchcraft; ancestral spiritual forces), though there is some overlap with biomedical explanations (eg: head injuries; "thinking too much"). There was evidence that "in present-day Africa,

there is a certain degree of fluidity, intermixing and assimilation within and between the three aetiological categories of psychosis: supernatural, psycho-social and biological" (van der Zeijst et al 2023 p339).

On the positive side, some TFH did see psychotic-like experiences as a supernatural gift (eg: hearing voices of ancestors). For example, in South Africa, individuals with psychotic experiences were trained to become TFH (van der Zeijst et al 2022).

2. Help-seeking behaviour - In one study in Egypt (Ibrahim Awaad et al 2020), nearly half of over 200 patients with schizophrenia had visited a TFH before a psychiatrist. Consulting different treatments concurrently was common in a West African study (Ayinde et al 2023).

3. TFH practices - Treatments involved combinations of rituals, prayers, and herbal medications. The latter may have some biological anti-psychotic potential (van der Zeijst et al 2023).

4. Effectiveness and perceived effectiveness - "Whether a certain treatment is evaluated as effective, depends on how effectiveness is defined. Biomedical psychiatry evaluates the effectiveness of an intervention on the basis of symptom reduction as measured on a validated psychiatric rating scale. This approach focuses on quantitative changes, rather than on qualitative changes in meaning, perception of self, patient role and social interactions" (van der Zeijst et al 2023 p340). TFH fared better on the latter (perceived effectiveness) than the former (actual effectiveness).

5. Harmful TFH practices - For example, chaining or locking up of psychotic patients was reported in one-half to two-thirds of 85 cases in Nigeria, Kenya, and Ghana (Ayinde et al 2023).

6. Collaboration between psychiatrists and TFH - Most of the former are not open to collaboration, while others are, though there are concerns. "In Ghana, TFH, patients and caregivers mentioned fear of disrespect and undue criticism by biomedical practitioners as important obstacles, while primary health providers mentioned the potential harm of traditional treatments [Nyame et al 2021]" (van der Zeijst et al 2023 p341).

van der Zeijst et al (2023) summed up: "Rather than

harmonising the two healing paradigms, synergistic collaboration between traditional/faith-based and biomedical mental healthcare in the management of individuals with psychosis seems to be possible within certain limits. Synergistic collaboration is more culturally syntonic and may actually contribute to bridging the treatment gap for mental disorders in present-day Africa" (p337).

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4. STAGE MAGIC AND GAMES AS TREATMENT

4.1. MAGICINE

Magic, in terms of illusions, is well known for entertainment, but it can also be used in healthcare. For example, "Tricks for the Trenches and Wards" was published in 1915 to show simple magic tricks that nurses and soldiers could use for entertainment and rehabilitation in World War 1. More formal application appeared in the later 20th century, like "Project Magic", and "MagicAid" (Lee et al 2024).

In a scoping review, Lam et al (2017) distinguished five applications of magic in healthcare - in occupational and physical therapy, clinical communication, humour therapy, psychotherapy, and dexterity training. Different aspects of magic have different impacts - for example, witnessing it creates curiosity, uncovering the secrets brings happiness, performing it enhances motor skills, and teaching it gives a sense of achievement (Lee et al 2024).

Lee et al (2024) coined the term "magicine" "to encapsulate the expanding role of magic within the healthcare realm. This innovative terminology represents the evolution of magic from mere entertainment to a form of intervention that integrates the concepts of magic and medicine" (p2). In their systematic review of the literature, Lee et al (2024) found eighty-two articles, which they categorised into nine areas where magic can be applied to healthcare (termed the "magicine ennead" [5]).

1. For the general population:

i) Physical rehabilitation - Learning the physical and motor skills in performing magic can help in physical rehabilitation, especially for children.

ii) Cognitive training - eg: use with children with ADHD (attention deficit hyperactivity disorder), and older adults with cognitive impairment to improve cognitive function.

[5] "The origin of the word ennead comes from the Greek word 'ennea' for nine, and in ancient Egyptian mythology, it also represents a group of nine gods" (Lee et al 2024 p4).

iii) Psychotherapy - To help in doctor-patient communication, and/or boost the self-esteem and self-confidence of patients.

iv) Humour therapy - To encourage positive emotions and their benefits to health.

v) Distraction therapy - eg: to help young patients anxious in medical settings, or reduce perceptions of pain as in dentistry.

vi) Social skills - The benefits here of learning to perform magic to others.

2. For healthcare professionals:

i) Health education - eg: as part of health education on child nutrition, AIDS prevention, and dental health.

ii) Doctor-patient relationships - "By adopting strategies used by magicians to attract and maintain attention, physicians can improve their communication skills with patients" (Lee et al 2024 p12).

iii) Surgical techniques - eg: practicing magic could enhance the dexterity of surgeons.

4.2. DUNGEONS AND DRAGONS

"Dungeons and Dragons" (D&D) is a fantasy role-playing game first published in the 1970s. It involves players interacting in a collaborative narrative (Heinrich and Worthington 2023).

D&D may be beneficial for mental health through "therapeutic role-playing". This "has been defined to create an imaginary reality... and is a type of experiential technique that involves a re-enactment of real or imaginary situations from a person's past, present or the future... As such, it is commonly used to improve a person's ability to understand emotions, and how they are related to current triggers... or to model ideal behaviours and practising skills in a safe environment" (Heinrich and Worthington 2023 p384). Other benefits include facilitating attitude change, developing interpersonal skills, and increasing self-awareness, and empathy. Though not everybody benefits from therapeutic

role-playing (eg: individuals who cannot work collaboratively; those who become too immersed in role) (Heinrich and Worthington 2023).

Heinrich and Worthington (2023) performed a literature review of published studies on D&D as role-playing therapy. Thirteen studies in English published before September 2020 were found, and four themes emerged from them:

i) "No unified personality type of D&D players" - Eight studies compared players to a control sample (non-players) on personality measures, and only one of them found a difference.

ii) "Stakeholders' attitude about D&D" - Two studies reported the attitudes of service providers towards using D&D in therapy. Social workers, and psychiatrists were surveyed, and most had a positive attitude towards D&D, but the individual's knowledge of the game was a key variable.

iii) "Lack of maladaptive coping associated with D&D" - Three studies explored the potential negative impact of playing D&D (eg: criminality; depression; alienation). No relationships were found with playing when comparing players and non-players.

iv) "Potential psychological benefits of D&D" - Four studies investigated this topic [6]. Increased creativity, empathy, spirituality, and moral development was found among players.

The researchers concluded that D&D has potential for therapeutic use, but they also recognised "the research basis is limited, with mostly low-level quality studies available" (Heinrich and Worthington 2023 p393) [7]. Only studies in English were included, and half overall took place before the year 2000.

There were a number of key methodological issues with the studies in the review, including:

a) Correlational data mostly. One study (Wright et al 2020) had controls, and pre and post measures that would allow conclusions about causality.

b) Measures used (eg: personality).

[6] Some studies covered more than one theme.

[7] One study was rated as top methodological quality, while six studies had the next to lowest rating.

c) The control group/non-players (eg: general population; students).

d) The players sample (eg: age; gender; experience of D&D). Older studies were more likely to have White males as the sample.

e) Game variables (eg: frequency of playing; length of games).

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5. MEASURING IRON DEFICIENCY AND IRON DEFICIENCY ANAEMIA IN THE POPULATION

5.1. MEASUREMENT

Iron deficiency anaemia (IDA) is estimated to occur in up to 5% of adults in high-income countries, and "if left untreated, significantly impair quality of life or decompensate chronic illnesses" (Brookes et al 2021 pp363-364). High risk groups include those with chronic inflammation (eg: inflammatory bowel disease), or blood loss (eg: heavy menstrual bleeding) (Brookes et al 2021).

Hospital records are a key source of information here. For example, Brookes et al (2021) analysed data for 2012 to 2018 from the Hospital Episode Statistics (HES) database. This database contains information about all admissions to National Health Service (NHS) hospitals and NHS outpatient appointments in England. IDA was categorised based on the World Health Organisation's "International Classification of Disease" (ICD-10) codes (WHO 2010).

There were nearly 100 000 patients with a primary diagnosis of IDA, and around 160 000 with a secondary diagnosis. During the study period, hospital admissions with a diagnosis of IDA increased by around 70%.

HES data depend on the accuracy and completeness of the coding by clinicians and hospital administrators. But, Brookes et al (2021) defended: "HES data are analysed and audited regularly to ensure consistency and compliance to national regulations" (p368) [8]. The data were "pseudo-anonymised" to prevent individual patients being identifiable (Brookes et al 2021) [9]. Non-NHS hospitals were not included.

Concentrating on iron deficiency (ID) generally, Beattie et al (2020) investigated its complex "incompletely understood" relationship with heart failure

[8] One study (Nouraei et al 2016) found coding error rate of 1-10% depending on the diagnosis (Beattie et al 2020).

[9] "HES data are pseudo-anonymised, manifest in the generation of a bespoke set of 32 alphanumeric characters by the application of a three-pass algorithm to a cluster of patient-specific information field" (Beattie et al 2020 p2).

(HF). Using "HES Admitted Patient Care" (HES-APC) data [10], the researchers performed a retrospective cohort study of adults admitted to NHS hospitals in England with HF.

During the study period April 2015 to March 2016 (ie: the financial year 2015-16), 78 805 adults were admitted to 177 NHS hospitals with a primary diagnosis/ coding of HF. Seven ICD-10 codes were categorised as HF in this study (eg: "hypertensive heart disease with congestive heart failure"; "left ventricular failure"). Each patient was also categorised as a secondary diagnosis of ID/IDA (based on four ICD-10 codes) or not. Around one-third of the cohort (33.7%) were classed as ID/IDA.

Compared to the non-ID/IDA and HF group, individuals with ID/IDA and HF were significantly more likely to be female, older, have an emergency admission (rather than elective/planned admission), a longer stay in hospital, a higher readmission rate to hospital for HF-related or any condition, and in-hospital mortality.

Diagnosis of ID depends on the "type" - absolute or functional. The former is depleted iron stores, while functional ID involves sufficient iron stores, but a problem in transporting the iron to cells, for instance (Beattie et al 2020). This distinction is not necessarily detailed on hospital records.

The retrospective cohort method allows researchers to look after the event (eg: leaving hospital), and find differences between the two groups (ID/IDA vs non-ID/IDA HF). The data in this study were from "everyday practice" (Beattie et al 2020), and included a large sample size.

But, Beattie et al (2020) admitted, "given the complexity of the typically multi-morbid HF population, we cannot presume a causal relationship for ID or IDA and the disparities we have described between the patient groups with and without these documented diagnoses" (p7).

HES-APC data are dependent on local clinicians in that there was "no information on how comprehensively this admitted HF cohort was screened for these co-morbidities, which laboratory tests were employed and their timing in those subject to investigation, or whether these conditions were pre-existing or newly diagnosed" (Beattie et al 2020 p7).

[10] "For inpatients, as well as admission and discharge dates, this comprehensive data set includes individual patient-level demographics and clinical information such as age, gender and ethnicity, place of residence, diagnoses and any relevant diagnostic, medical or surgical procedures" (Beattie et al 2020 p2).

SCREENING

With ID/IDA being a concern for women and girls of reproductive age, MacLean et al (2023) advocated screening. They found no official guidance in their literature review on the subject, so they applied the World Health Organisation's ten principles of screening (Wilson et al 1968):

1. ID is an important problem - eg: 1 in 3 women experience anaemia at some stage in their lifetime.

2. ID has recognisable early and latent symptoms - eg: "brain fog", fatigue, tiredness, dizziness.

3. The natural history of ID involves a development from latent symptoms to overt disease.

4. There is agreed treatment for ID - eg: oral iron supplementation.

5. There is an accurate test for ID - eg: blood test.

6. Testing for ID is acceptable to the population at risk and/or general population - eg: finger prick blood sample.

7. There is agreement on whom to class as a patient - WHO definition of ID as ferritin level of less than 15 µg (micro-gram)/L(litre).

8. ID diagnosis and treatment is available.

9. The cost of screening less than burden of untreated disease.

10. Screening is a continuous process rather than "once and for all" - "Without screening, ID is not preventable. Once corrected, an ID can recur, particularly where routes of deficit have not been addressed or where these routes are not feasibly attenable" (MacLean et al 2023 p63).

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6. ADDICTIVE MUKBANG WATCHING

"Mukbang" is a popular worldwide online activity that originated in South Korea in 2009 (Kircaburun et al 2024). It involves watching "eating broadcasts", "where mukbangers (ie: individuals in the broadcasts) eat a large portion of food while interacting with the viewers" (Kircaburun et al 2024 p1).

In relation to disordered eating, researchers had noted negative consequences for regular mukbang watchers: "(i) increased consumption of food because of social comparison or mimicry, (ii) alteration of viewers' perception of food consumption and thinness, eating, health, table manners, and eating manners because of modelling of bad behaviours, and (iii) obesity and different eating disorders because of the glorification of binge eating" (Kircaburun et al 2024 p1). Also for certain individuals mukbang watching may be addictive.

For example, Kircaburun et al (2022a) found that, among 222 university students, certain personality traits (conscientiousness, sadism, and extraversion), and procrastination were positively correlated with addictive mukbang watching (AMW). While Kircaburun et al's (2022b) study of 170 young adults found that "eating gratification (eg: watching mukbang to satisfy eating needs) but not social gratification (eg: watching mukbang to satisfy social interaction needs) was positively associated with addictive mukbang watching" (Kircaburun et al 2024 p1).

Other studies by Kircaburun et al (2021a and 2021b), of 140 young adults and 217 university students respectively, have shown a positive association between AMW and internet addiction, YouTube addiction, disordered eating, and loneliness.

In these studies, AMW was measured by the "Mukbang Addiction Scale" (MAS) (Kircaburun et al 2021c), which was developed with university students in one country.

An alternative way to conceptualise AMW is to use the criteria of "internet gaming disorder" (IGD) as developed by the American Psychiatric Association (APA) in DSM-5. IGD is a "'persistent and recurrent use of the internet to engage in games, often with other players, leading to clinically significant impairment or distress' (APA 2013). According to the APA, an individual should endorse five out of nine symptoms over a 12-month period (APA 2013). These symptoms include (i) being excessively preoccupied with gaming, (ii) having withdrawal symptoms when not gaming, (iii) spending more and more time gaming, (iv) failed attempts to reduce or quit gaming,

(v) losing interest in other hobbies apart from gaming, (vi) engaging in gaming despite its adverse consequences, (vii) deceiving others about gaming duration, (viii) achieving a positive mood by gaming, and (ix) risking, jeopardising, or losing a job or relationship because of gaming" (Kircaburun et al 2024 p2).

These criteria were used in Kircaburun et al's (2024) study of eight regular mukbang watchers, who were interviewed on detail about their viewing habits. The researchers then performed a content analysis on the transcripts in relation to the adapted criteria of IGD:

1. Preoccupation (when not watching mukbang, thinking about it) - eg: "Mostly [I think about mukbang] when I go to a restaurant or one of these fast food outlets, and then I buy the food and while I'm eating it... when I go to purchase food at a supermarket and then when I get home, I actually want to start repeating what the guys in the mukbang videos do" ("PA (Participant) 8"; p4).

2. Withdrawal (negative feelings when unable to watch mukbang) - eg: "When I haven't watched it, if, I'm too busy to watch it, then I feel angry, I feel frustrated, I feel some sort of anxiety because I want to watch it. It's something that I feel like I have to do... Yes, I must watch it. If I don't watch it, then I won't be all right. I won't be okay" (PA1; p4).

3. Tolerance (spending increasing time mukbang watching) - eg: "If I watch shorter videos, I have to watch multiple [videos] to actually try and fill in all the time that I actually usually watch it... So, I have to watch it for longer periods of time than when I first started, I wouldn't say I was addicted immediately. It took time. So now I watch it more than I used to... In order to feel satisfied" (PA1; p4).

4. Inability to stop (eg: failed quitting attempts) - eg: "There was a time when I tried and I didn't watch mukbang for the whole day. And then during the night, I started watching" (PA7; p5).

5. Loss of interest (in other activities) - eg: "I could take breaks when I'm studying. I used to write because I love writing. I used to write. But now the breaks that I take, I take to only watch mukbang. So, I think I'm no longer participate in things that I like" (PA2; p5).

6. Continuing despite the behaviour causing problems in different aspects of life - eg: "For instance, it affects my work a lot because I find that when I have to rest, I'm watching mukbang videos. So, now when I get to work, I'm exhausted, I'm tired, I can't really focus. I can't put in that full attention to my work because of watching mukbang videos... So, now I watch mukbang late at night and then I can't get enough sleep" (PA1; p5).

7. Deceiving family/friends about how much time spent mukbang watching - eg: "If I'm around my family, I'm even sure that I think my mom thinks that I just don't watch mukbang. I don't think she knows that I do watch mukbang... they even questioned me to say 'Okay, what are you watching anyway?' I just hide it but not lie about it" (PA4; p5).

8. Relieving negative mood (mukbang watching changes mood to positive) - eg: "Especially when I'm sad it washes away my sadness. I'll have something to focus on, definitely" (PA4; p6).

9. Risking relationships from excessive mukbang watching - eg: "I've lost some of my friends, Actually, they just gave up. So, I've lost some of my friends because of [mukbang watching] because they can't keep up with this... Not all of them. Some of them I still have, but some they actually stopped talking to me. I lost them. They are not really my friends anymore because of this" (PA1; p6).

The participants had volunteered to participate in previous research by Kircaburun et al, and scored high on the MAS. They lived in South Africa, except from one individual from the UK and one from the USA. They were all aged between 21 to 33 years old, and five interviewees were female. The data were self-reports with no independent verification. No information was collected on psychiatric conditions (ie: officially diagnosed).

The interviews involved describing each of the nine criteria of IGD, and the interviewees responded with relevant personal examples - eg: "Some people watch mukbang to relieve a negative mood (for instance helplessness, guilt, or anxiety). What do you think about this? Do you experience this too?" (p8).

In summary, "mukbang watching could be another online activity that may transform into technology-related behavioural addiction for a minority of viewers. Furthermore, some mukbang viewers may experience

addiction-like symptoms that have impairments to their mental, physical, and psycho-social health" (Kircaburun et al 2024 p8).

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7. AN ANGER CONTROL STRATEGY

There are situations where the control or suppression of anger after provocation is important. Kanaya and Kawai (2024) reported two experiments around a strategy to do this.

Experiment 1

Participants: 57 students in Japan.

Procedure: The participants were asked to write an essay on a topic like smoking in public, which received feedback on its quality. All participants received this comment (to provoke anger): "I cannot believe an educated person would think like this. I hope this person learns something while at the university" (p3). Then the participants were asked to write about their feelings in response to this comment. Half of them subsequently kept the paper (retention condition), and half threw it away (disposal condition). Measures of anger were taken at baseline, post-provocation, and post-writing.

Findings: Anger ratings increased post-provocation (compared to baseline) for all participants as would be expected, but the disposal group showed lower anger than the retention group post-writing (table 7.1).

Comment: Kanaya and Kawai (2024) explained: "These results suggest that the disposal of the paper containing ruminated anger into the trash can neutralise anger. Our interpretation is that the act of throwing the paper with ruminated anger into the trash can produces a feeling similar to the psychological existence (anger) being discarded, leading to anger elimination, since the psychological entity (anger) was disposed along with the physical object (anger-written paper)" (p4).

Experiment 2

Participants: 48 adults in Japan.

Procedure: The same as Experiment 1, but the post-writing disposal method was shredding the paper.

Findings/Comment: "The results were essentially the same as those of Experiment 1. The disposal group

significantly reduced their anger after disposing of the anger-written paper into the shredder. The retention group showed significantly higher anger than the baseline period and disposal group" (Kanaya and Kawai 2024 pp6-7).

		BASELINE	POST-PROVOCATION	POST-WRITING
Experiment 1	Retention	1.78	3.45	2.64
	Disposal	1.59	3.34	1.87
Experiment 2	Retention	1.64	3.24	2.75
	Disposal	1.57	3.14	1.98

Table 7.1 - Mean ratings of anger (out of 6).

Both experiments showed that writing down angry feelings after provocation and then disposing of the paper is a good strategy to control anger. Kanaya and Kawai (2024) offered this theoretical explanation for the findings: "Our results may be related to the phenomenon of 'backward magical contagion' [Rozin et al 1989], which is the belief that actions taken on an object (eg: hair) associated with an individual can affect the individuals themselves. Rozin et al [2018] discovered that individuals experience strong negative emotions when their personal objects are possessed by negative others (such as rapists or enemies). However, these emotions are reduced when the objects are destroyed, such as throwing them in a septic tank or burning them. The phenomenon of 'magical contagion' or 'celebrity contagion' refers to the belief that the 'essence' of an individual can be transferred to their possessions. This backward magical contagion operates in a reversed process, where manipulating an object associated with a person is thought to impact the individuals themselves. The current study's findings may be explained by the concept of backward magical contagion, which posits that negative emotions can be transferred from others to an individual through their possessions" (p7).

There are a number of limitations and issues related to the experiments, including:

i) The study took place in one country (Japan), where the suppression of anger may be viewed as important. Would the findings be similar in a culture that values expression of anger?

ii) The participants were asked to write down their feelings after provocation, and the experimenters did not see what was written. Did the participants write down about their "ruminated anger" (as assumed by the researchers) or something else? is the disposal of angry thoughts on paper different to non-angry ones?

iii) What about other methods of recording and disposal, like digital (eg: write a draft email and delete it), would the findings be similar?

iv) Individual differences (eg: in anger) of the participants were not measured. "Individuals with higher levels of trait anger tended to have prolonged experiences of induced state anger" (Kanaya and Kawai 2024 p7).

v) Three measurements of anger were taken in a relatively short time during the experiment. It is possible that the participants became aware of the purpose of the research. This opens the possibility of "participant reactivity", where participants change their behaviour due to some knowledge about the purpose of the experiment rather than having naturally.

vi) The feedback to the essay was anger provoking, but the participants may not have had an emotional investment in the essay, and so the feedback was not important. Does the disposal method reduce anger when provocation relates to to a high personally invested situation? Does the person doing the provoking influence the results?

vii) Anger was measured by five six-point scales, ranging from 1 ("not at all") to 6 ("extremely"). The five scales were measures in relation to the following adjectives - angry, bothered, annoyed, hostile, and irritated. An average score was created for each participant at each measurement point.

viii) The study involved the artificiality of the laboratory experiment relative to real life situations.

ix) Ethical concerns around the deception and insulting of participants. It is assumed that a debriefing at the end will resolve these concerns. Manipulation of emotions is common in experiments, and is assumed to be (relatively) harmless, but is this the case?

x) Methodological note:

Independent Variable - Whether the paper containing the feelings after feedback was retain or disposed of by the participant.

Dependent Variable - A composite measurement of anger post-writing (as compared to baseline and post-provocation).

Experimental Design - Independent (or between-participants) (ie: participants only performed in one of the two conditions - retention or disposal).

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8. STOCHASTIC BIOLOGICAL PROCESSES

Genetically identical cells exposed to the same environmental conditions often produce different outcomes (gene expressions), which has been called "gene expression noise" (sub-divided into intrinsic and extrinsic noise) (Jenkins et al 2024). Intrinsic noise refers to differences in expression between two identical genes, while extrinsic noise is difference between cells in "otherwise identical conditions" (Jenkins et al 2024 p1) [11].

An umbrella term is stochastic processes [12]. Put simply, unpredictable or random biological changes in a predictable system. "Stochastic effects have been invoked to explain processes ranging from the activity of individual ion channels to the emergence of cancer" (Jenkins et al 2024 p3), while, on the positive side, stochastic DNA recombinations permit evolutionary adaptation, for example.

van Heyningen (2024) commented: "The amazing thing about development is not that it sometimes goes wrong, but that it ever works. Successful development from fertilised egg to functioning multi-cellular organism requires precision. It may seem counter-intuitive, but precision can only be achieved through plasticity. Decision-making based on stochastic variability is used repeatedly to progress through early development and differentiation" (p1). She outlined stages in development where stochasticity could occur, including:

a) After fertilisation - The single cell of the fertilised egg sub-divides into identical daughter cells, but stochastic variation occurs.

b) On the X chromosome in females - eg: X-linked intellectual disability.

c) Genetic mutations - eg: deletions and

[11] For example, Fraga et al (2005) analysed the DNA profiles of lymphocytes of identical twin pairs, and found differences that increased with age. These differences appeared to be stochastic, and the researchers explained them by "epigenetic drift" (Teschendorff 2024).

[12] "The word 'stochastic' derives from the ancient Greek στόχος (stókhos) meaning 'to take a guess'. In biological sciences it is often used to refer to biological processes that by and large appear random. One of these biological processes that has gained significant attention from the community has been the gradual age-associated accumulation of molecular alterations in the normal cells of our bodies, which leads to cellular dysfunction and ageing. While the main focus has been on alterations to DNA, notably somatic mutations, over the last decades there has been an increased interest in epigenetic alterations, including those which involve a covalent modification of DNA, known as DNA methylation" (Teschendorff 2024 p1).

duplications of strands of DNA.

d) Random events in physical development - eg: "Photoreceptors for precision daylight vision and colour perception arise in the central area of the human retina. Which of the three wavelength receptors (Long, Medium and Short) is expressed in each cone as it develops is a stochastic event, and as a result the central retina is a random mosaic of red, green and blue cones" (van Heyningen 2024 p4).

e) Immune responses - eg: in anti-body-producing B-cells.

f) The phenotype - "Many aspects of phenotype are affected by random fluctuation of the biochemical background. A distinct mechanism that has been much studied recently is epigenetic change that is frequently triggered by stochastic variation and random events" (van Heyningen 2024 p6).

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9. ANTI-DEPRESSANTS AND LATE-LIFE DEPRESSION

Late-life (major) depression (LLD) is seen in around one in ten adults over sixty years old, and it is associated with cognitive impairment (Ainsworth et al 2024) (appendix 9A).

Do anti-depressants for LLD improve the cognitive deficits? Ainsworth et al (2024) performed a systematic review and meta-analysis to answer this general question. Three academic databases were searched up to the end of 2022. Twenty-two prospective studies covering anti-depressant treatment for LLD in adults aged 50 and older were found.

Thirteen of nineteen studies that provided enough information showed an improvement in one or more cognitive domains (eg: processing speed; memory; learning) after anti-depressant medication. Data from eight studies could be pooled for a meta-analysis, and this showed a statistically significant improvement in memory and learning with anti-depressants (compared to no anti-depressants). There was either no improvement or insufficient data for other cognitive domains.

In terms of specific anti-depressants, sertraline was most successful, particularly for memory and learning, and this may be due to it increasing serotonin, which has an impact on the hippocampus (the brain area associated with memory) (Ainsworth et al 2024).

Eight studies provided data on the association between improvements in depressive symptoms and in cognitive performance, of which six found a positive relationship.

The researchers were hampered by the poor methodological quality of the studies, and the variety between them (table 9.1). Each study was rated using the "Jadad scale" (Jadad et al 1996), which is a quality assessment method (ie: a five-point scale). Most studies (n = 160 were rated 1 to 3 (low to moderate quality), and three studies scored "4" and three studies "5" (high quality). The heterogeneity in statistical reporting of the findings meant that the meta-analysis was limited. Ainsworth et al (2024) explained: "Overall, we found limited data for some cognitive outcomes, in particular attention and working memory and verbal fluency, suggesting that these domains may be understudied in LLD. Data were also somewhat limited for executive function, relative to its importance in the LLD literature..." (p241).

In terms of general issues, the researchers included only studies written in English, and excluded individuals with psychotic depression "in order to mitigate the confounding effect of interference from psychotic symptoms on cognitive testing performance" (Ainsworth et al 2024 p235). Diagnosis of major depressive disorder was based on DSM or ICD criteria.

Overall, it was found that anti-depressants improved cognitive function in individuals with LLD, though there were differences in which cognitive domains improved.

- Anti-depressant prescribed, and dosage; whether second anti-depressant also used (13 studies).
- Cognitive tests used, and number of testing sessions - eg: "Controlled Oral Word Association Test" (COWAT), "Rey Auditory Verbal Learning Test" (RAVLT), "Digit-Symbol Substitution Test" (DSST).
- Cognitive domains assessed - global or specific.
- Follow-up length - six to 26 weeks.
- Sample size - thirteen to 452.
- Demographic information - eg: percentage of females in sample, at least half but as high as 88%.
- Mean age - 64 to 80 years.
- Measurement of depression.
- Comparison/placebo group or not (13 studies no comparator).

Table 9.1 - Key methodological differences between the studies in the review by Ainsworth et al (2024).

APPENDIX 9B - BRAIN VOLUME

LLD has been linked to smaller volume of the brain area called the hippocampus in a number of studies, and to longer duration of episodes and more frequent depressive episodes. But the data are mostly correlational or associations (Monereo-Sanchez et al 2024).

"The Maastricht Study" is a prospective population-based cohort study, which may help in establishing causality. It involves over 4100 40-75 year-olds in the Netherlands. Brain scans were taken at baseline and at follow-up over seven years, as well as measures of

depression.

There was no relationship between total hippocampus volume and depressive symptoms, but there was an association between specific differences in parts of the hippocampus (sub-fields) (eg: lower volume in left hippocampal amygdala transition area (HATA) and depression).

In terms of causation, the findings suggested, according to the researchers, that "changes in hippocampus sub-field volumes may co-occur or follow the onset of depressive symptoms, rather than precede it. We found limited evidence to support that specific volume changes could precede the onset of (chronic) depressive symptoms" (Monereo-Sanchez et al 2024 p71).

Despite the size of the cohort, the number of depression cases was relatively small (190 at baseline, and 376 new cases at follow-up) (figure 9.1).

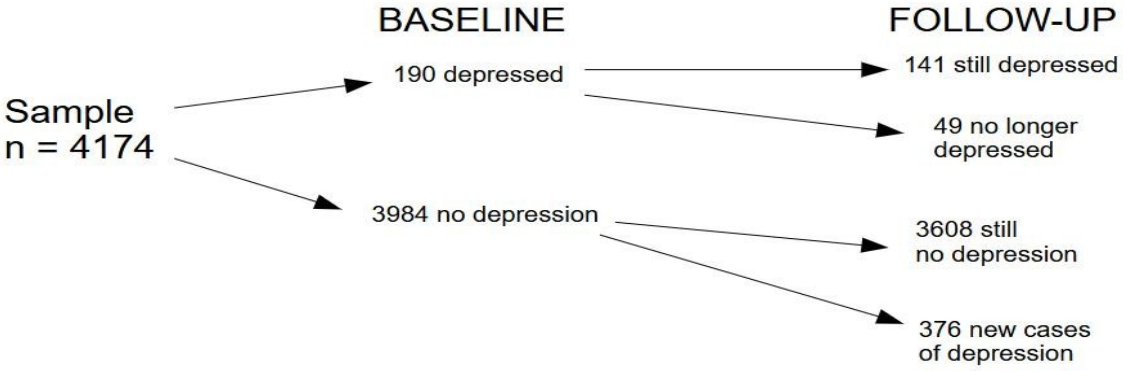

Figure 9.1 - Number of cases of depression in the Maastricht Study.

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10. GROWING AWARENESS OF MENTAL HEALTH PROBLEMS

10.1. GOOD AND BAD OF GROWING AWARENESS

Generally, it is felt to be a good thing to provide greater awareness and help for common mental health problems. One way is the "Mental Health First Aid" (MHFA) programme, which trains members of the public to support common mental health problems, offer non-judgmental listening, and direct individuals to professional help (table 10.1).

- MHFA was first developed in Australia in 2000. The original course involved twelve hours of face-to-face training.
- It was defined as "help provided to a person who is developing a mental health problem, experiencing a worsening of a mental health problem, or is in a mental health crisis" (MHFA Australia 2018 quoted in Richardson et al 2023).
- The main principles are "ALGEE" – Approach (assess), Listen, Give (support and information), Encourage (seeking appropriate professional help), and Encourage (seeking appropriate support) (Richardson et al 2023).

Table 10.1 – MHFA.

Trained individuals have been found to have improved knowledge about mental health, for example (Wilson 2023) [13]. In other words, "mental health literacy" (defined as "knowledge and beliefs about mental disorders, which aid their recognition, management, or prevention") was improved (Richardson et al 2023).

But Richardson et al (2023) found little evidence for the benefits of this programme for the individuals with mental health problems. These researchers found 21

[13] Eg: review by Hadlaczky et al (2014).

randomised controlled trials on MHFA compared to no intervention or an alternative mental health literacy programme. "When MHFA training was compared with no intervention, it may have little to no effect on the mental health of individuals at six to 12 months, but the evidence is very uncertain" (Richardson et al 2023 p2). Comparisons to other interventions were hampered by lack of adequate data at six or twelve months after MHFA. This ultimately led to authors to draw no conclusions about the benefits of MHFA training on "patients". Table 10.2 lists some of the key methodological variables in the studies reviewed by Richardson et al (2023).

- Comparison group (no or alternative intervention).
- Sample.
- Setting of MHFA (eg: school; work).
- Outcome measure (eg: mental health service use; validated questionnaire).
- Length of follow-up.
- Potential confounding variables controlled.
- Measurement of adverse effects of MFHA or not.

Table 10.2 – Key methodological variables in studies of MHFA.

Talking openly about mental health is more common today, but Foulkes (2023) worried that the everyday use of "therapy speak" can be unhelpful. Awareness campaigns may "encourage people to interpret essentially all negative thoughts and feelings as symptomatic of a disorder or a problem" (Foulkes 2023 p33).

"Concept creep" has occurred, argued Nick Haslam of the University of Melbourne, such that "terms relating to harm – like 'bullying', 'trauma', 'mental illness' – have become expanded and expanded, so that more and more mild experiences fall under this language. He argues that we are increasingly seeing harm everywhere – and seeing ourselves as being vulnerable to harm" (Foulkes 2023 p34).

But Foulkes (2023) emphasised the complexity of the situation – "I think multiple things can be true at once, so I think talking about mental health is really good for some people and possibly problematic for others" (p35).

This comment was aimed at countering the label "snowflakes" used in a derogatory sense for young people.

Using figure 10.1, it is possible to distinguish three general groups and their responses to health messages and media awareness campaigns:

Group 1: "Untouched hardcore" – Individuals who need help and the campaign is primarily aimed at them, but they do not hear the message or choose not to respond after hearing it.

Group 2: "Benefiters" – Individuals who respond to the health message and gain benefits from doing so, whether that be a health behaviour like smoking cessation or seeking help from healthcare professionals.

Group 3: "Worried well" – Individuals who apply the message to themselves and seek help though it is not necessary. For example, the increased awareness of depression as common is applied to their everyday unhappinesses.

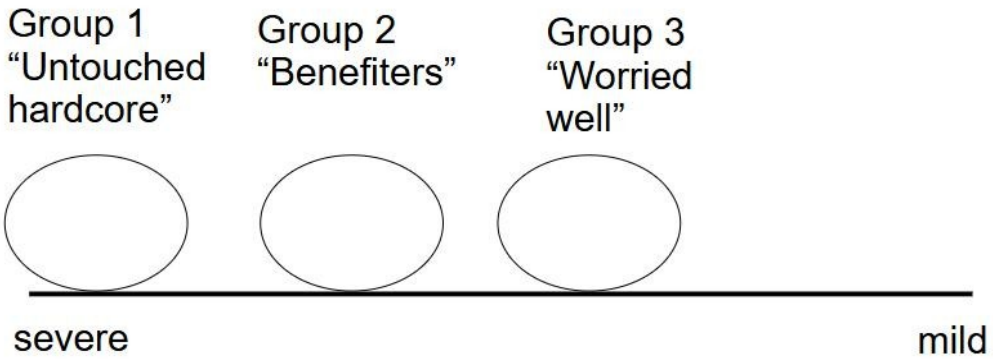

Figure 10.1 – A representation of three groups and health messages.

Universal classroom-based techniques to help adolescents with mental health problems (eg: using mindfulness; appendix 10A) can actually increase reports of symptoms like depression and anxiety rather than reduce them (eg: Kuyken et al 2022; table 10.3).

Universal school-based programmes encourage adolescents to notice negative thoughts and feelings with the aim of changing them, but these programmes "may be inadvertently teaching teenagers to ruminate on negative thoughts and feelings without giving them any real ability to manage these experiences, which could increase their distress" (Foulkes 2022 p25).

- "MYRIAD" ("My Resilience in Adolescence") was the name of a study of school-based mindfulness training (SBMT), comprising of ten lessons of psycho-education, and mindfulness practices, compared to "teaching as usual" (TAU) (standard socio-emotional teaching) in 85 schools in the UK.
- The primary outcome measures were self-reported depression, behavioural functioning, and mental well-being one year later. There was no difference between SBMT and TAU, though the latter group had marginal better scores on many outcomes.

Table 10.3 – Kuyken et al (2022).

10.2. PSYCHIATRISATION AND CONCEPT CREEP

Haslam et al (2021) linked concept creep with "psychiatrisation", which is the increasing importance of psychiatric ideas in society. It includes positive aspects of more people seeking help who need it for mental health conditions (and receiving appropriate help), but mostly psychiatrisation is used in a negative sense of "over-diagnosis, over-treatment, and over-prescription", and "the popular adoption of a psychiatric idiom to make sense of everyday experiences of deviance and distress" (Haslam et al 2021 p1) [14].

Concept creep in this context is attributed to Haslam (2016), to refer "to the gradual expansion of the meaning of harm-related concepts. Haslam argued that several prominent psychological concepts had undergone a process of semantic inflation whereby they had come to refer to an increasingly wide range of phenomena. That broadening occurs in two directions, he argued. Concepts creep horizontally by coming to refer to qualitatively new phenomena, and vertically by coming to refer to quantitatively less extreme phenomena" (Haslam et al 2021 p2). Haslam (2016) focused particularly on six creeping concepts – abuse, addiction, bullying, mental disorders,

[14] I have used the term "temporary state of undisease" to describe this situation. In other words, an individual is not "well" or "healthy", but simply in a temporary state before they are diagnosed with something.

prejudice, and trauma. Vylomova et al (2019) found an increased frequency of the use of these terms in psychology articles' abstracts between 1970 and 2018.

Looking at figure 10.2 as a way to represent psychiatrisation and concept creep, "A" is the "hardcore" of mental disorder, "B" refers to the cases "found" by increased awareness about it, and "C" is "concept creep". The width of the circles will vary in different situations. The point is that increasing interest and awareness of a mental disorder has both positive and negative effects. Individuals who previously went undiagnosed and/or without help are now seen ("B"), but others "jump on the bandwagon" ("C").

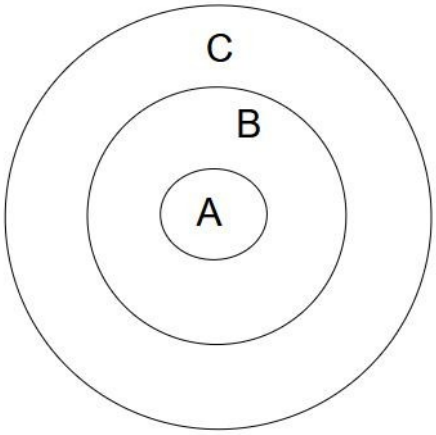

Figure 10.2 – A simple representation of psychiatrisation and concept creep.

10.3. BURDEN OF MENTAL ILLNESS

The "Global Burden of Disease Study" (GBD) is a large collaborative global project that estimates the prevalence of 369 diseases in 204 countries and territories.

GBD 2019 calculated the age-standard prevalence rate (ASPR) of depressive disorders at 3440.1 per 100 000 people, 3779.5 for anxiety disorders, and 489.8 for bipolar disorder (Lai et al 2024).

Concentrating on bipolar disorder, there were 24.8 million cases globally in 1990 and 39.5 million in 2019,

but the ASPR remained consistent at 490 per 100 000 (Lai et al 2024). The difference in figures can be explained in part by increasing general population size, by new cases, changing age distribution of the population, and the narrowing of the gender gap. But there is great variety between regions and countries, and differences by age, sex, and cohort (Lai et al 2024).

The key trends were (Lai et al 2024):

a) Highest number of new cases among 15-19 year-old group.

b) The narrowing of the gender gap in cases (ie: an increasing number of male cases relative to the higher female cases), which the researchers hypothesised "may be partially due to the increasing effects of non-biological factors over biological factors" (Lai et al 2024 p44).

c) Geographical – The Americas saw the highest ASPR by region, while New Zealand had the highest ASPR by country in the study period.

d) Other differences – eg: increased cases at outpatients clinics in the USA suggesting greater help seeking; differences between rural and urban populations in the same country.

Simplistically, males born after 1990 showed "an unfavourable trend" (ie: the largest increase of cases) (Lai et al 2024 p36).

10.3.1. Years of Potential Life Lost

Individuals with mental disorders have a higher risk of premature death, not just from suicide, but mainly from physical diseases. This is known as "differential mortality". One way to assess this is via life expectancy and years of potential life lost (YPLL). "Life expectancy refers to the number of years a person is expected to live based on the estimate of the average age at death of the standard population, while YPLL is a life expectancy-related metric denoting the difference between the average lifespan of people with the disease of interest and the general population" (Chan et al 2023 p2).

In terms of specific calculations, for example, Chan et al (2022) found 12.8 years shortened lifespan for individuals with bipolar disorder, and Hjorthoj et al

(2017) 14.5 years for schizophrenia.

Chan et al (2023) reported a review and meta-analysis for all mental disorders, and found 109 relevant studies that calculated life expectancy and/or YPLL. In total, there were over 12 million individuals with mental disorders (and 34 724 controls). Almost all studies were classed as high quality in terms of methodology.

The pooled (average) life expectancy of individuals with any mental disorder was 63.85 years (with a slightly longer life expectancy for women), and the pooled YPLL was 14.66 years (with a slightly higher figure for men). The shortest life expectancy was among individuals with substance use disorders (57.07 years), and the longest among individuals with neurotic (anxiety) disorders (69.51 years). The longest YPLL was calculated for substance use disorders (at 20.38 years), followed by eating disorders (16.64 years), and schizophrenia-spectrum disorders (15.37 years).

Chan et al (2023) concluded: "Mental disorders are associated with substantially reduced life expectancy, which is trans-diagnostic in nature, encompassing a wide range of diagnoses" (p1).

The studies in the review varied in their methodology in a number of key ways, including the recruitment and make-up of the sample (cases and controls), length of follow-up (between 1-36 years), diagnostic system (eg: clinical interview; questionnaire), source of data (eg: medical records; interviews), countries (24, mostly USA and Western Europe), and calculation of life expectancy and YPLL (eg: life expectancy at birth or at a specific age).

There was not enough data to calculate the cause-specific YPLL (eg: the physical diseases that individuals with mental disorders are most likely to die prematurely from).

10.4. COMMON MENTAL DISORDERS IN AUSTRALIA

"Psychological distress (PSYCH) and somatic distress (SOMA) commonly co-occur... PSYCH can be described as a negative feeling that affects a person's life. This discomfort is usually manifested as anxiety, frustration, hopelessness, sadness, or worthlessness. SOMA, also known as somatoform disorder or somatisation syndrome, can involve various bodily discomforts such as prolonged fatigue, pain, tiredness, or sleep disturbance" (Chang et al 2018 p347).

Concentrating on the prevalence rates in Australia,

high PSYCH has been reported in 11-13% of adults (18-65 years) in national health surveys between 2001 and 2014 (Harvey et al 2017; appendix 10B), but 9.5% of general practice attenders (Clarke et al 2008). The latter study recorded 18.5% for SOMA (table 10.4). But definitions and measures varied between the studies (Chang et al 2023).

- Nearly 12 000 patients from 340 general practitioners who volunteered for the study across Australia completed various questionnaires in 2004-6 (including K10).
- Patient Health Questionnaire (PHQ-15) (Kroenke et al 2002) – Fifteen items covering common somatic symptoms (eg: stomach pain; back pain) (scores range from 0-30, with a high score being ≥10).
- Whiteley Index (Whiteley-7) (Fink et al 1999) – Seven items measuring hypochondriasis (yes or no responses, with 3 or more out of seven classed as high scores). Eg: "Worries that there is something seriously wrong with your body"; "Worries you suffer a disease you have read or heard about".
- The mean PHQ-15 score was 7.6, and 30.7% of the sample classed as high scorers. The Whiteley-7 mean score was 1.8 with 30.7% high scorers, while K10 had 9.5% of the sample as high scorers with a mean score of 18.3.
- A "somatiser" was defined as PHQ-15 score ≥10 and Whiteley-7 score ≥3, and 18.5% of the sample fulfilled these criteria.

Table 10.4 – Clarke et al (2008).

K10 is a measure of non-specific psychological distress, and it is not the same as formally diagnosing anxiety and depression. In an analysis of "National Survey of Mental Health and Well-Being" (NSMHWB) data on older adults, Anderson et al (2013) found good correspondence. Data from 1997 and 2007 were analysed with the focus on 65 years and above adults (n = 3697). All participants had completed K10, and the "Composite International Diagnostic Interview" (CIDI), which allows formal diagnosis of mental disorders (based on DSM-IV criteria). Mental health service use, and days off normal activities with mental health problems were measured.

10.5. APPENDIX 10A – MINDFULNESS WARS

Gleig (2019) coined the term "mindfulness wars" to describe the debate over the use of mindfulness

interventions. "On one hand, mindfulness is advocated for as a practical intervention, supported by clinical evidence for the efficacy of mindfulness in a variety of settings including education... and sport... In part because of this clinical success, mindfulness-based interventions have become a significant part of a multi-billion-dollar mindfulness industrial complex... On the other hand, critics argue that most contemporary mindfulness interventions are technologies of social reproduction. In this sense, mindfulness is described as a coping mechanism for helping individuals ameliorate the effects of alienation, which explains the co-option of mindfulness by corporations, often shorthanded as 'McMindfulness'..." (Smith 2022 p1).

Roychowdhury et al (2021) were particularly critical of mindfulness in its migration from "East" to "West". It has been "translated, appropriated, universalised, and made fit for consumption. Key components of this process include stripping mindfulness of any overtly religious or spiritual references while using the authority of scientific inquiry to reinforce its efficacy, leading to its mainstream acceptance as a clinical intervention" (Smith 2022 p2).

One response was the so-called "second-generation mindfulness-based interventions" (SG-MBIs). These are presented as more "authentic" than "1st generation" MBIs, "through a more overt focus on the psycho-spiritual or spiritual nature of mindfulness, often by situating mindfulness within a 'traditional' Buddhist ethical system" (Smith 2022 p2).

10.6. APPENDIX 10B – HARVEY ET AL (2017)

The "National Health Survey" (NHS) and "Australian Health Survey" (AHS) are household-based face-to-face surveys every years. Data were analysed for NHS 2001, 2004, and 2007, and AHS 2011 and 2014. Each survey included between 14 000 – 20 000 households depending on the response rate. Common mental disorders (CMDs), primarily anxiety and depression, were measured by the ten-item "Kessler Psychological Distress Scale" (K10) (Kessler et al 2002)(table 10.5). A score of 30 or above (out of fifty) was classed as "probable CMD".

The prevalence rate remained relatively constant at 13.3% in 2001 to 12.2% in 2014. The data from the five surveys were based on the same sampling method, and measuring instrument, though the K10 is a self-report rather than formal diagnosis method.

- "During the last 30 days, about how often did you feel hopeless?" (1 = "none of the time", 5 = "all of the time").

- "During the last 30 days, about how often did you feel nervous?" (1 = "none of the time", 5 = "all of the time").

Table 10.5 – Example of items from K10.

Harvey et al (2017) summed up: "The data from repeated, nationally representative health surveys indicate that the prevalence of probable CMD among working age Australians has remained stable or even declined slightly between 2001 and 2014. This finding is contrary to the popular narrative of an increasing prevalence of mental health problems" (p492). Despite similar findings from other countries (eg: USA (Kessler et al 2005 [15]); Great Britain (Brugha et al 2004) [16]), there was a conflict with two previous studies in Australia. Goldney et al (2010) found a significant increase in major depression between 1998 and 2008 in South Australia (6.8% to 10.3%), while the official NSMHWB (cited in Harvey et al 2017) reported a significant decrease in CMDs between 1997 and 2007. Harvey et al (2017) explained the differences as due to the measuring instruments used.

Harvey et al (2017) also reported the number of people receiving disability support pensions (DSPs) for psychological or psychiatric primary medical conditions using official data. During the study period, there was a significant increase in such DSPs, though overall claims (ie: including physical health conditions) declined. "Despite this increase, the proportion of people receiving DSPs remained substantially lower than the prevalence estimates for even the most severe probable CMD, suggesting that most people with depression or anxiety continued to work in some capacity. The proportion of DSPs granted for psychological and psychiatric conditions rose from 23% in 2001 to 32% in 2014" (Harvey et al 2017 p491).

The researchers offered four possible explanations for these observations:

a) A greater willingness by healthcare professionals to give psychiatric labels to the working population.

[15] The prevalence of mental disorders using formal diagnostic criteria was 29.4% in 1990-2 (n = 5388 18-54 year-olds) and 30.5% in 2001-3 (n = 4319).

[16] Self-reported visits in general practitioners for a mental disorder did not change between 1993 and 2000, but prescription of psychotropic medication increased significantly.

b) Changes in Australian government policies (eg: the transfer of more individuals from unemployment-related benefits to DSPs).

c) A workplace environment that is less tolerant of CMDs, which forces individuals to leave their job and claim DSP.

d) An increase in the number of new cases of CMDs (ie: incidence), while treatment is effective for older cases, and thus the level prevalence rate.

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11. ARTIFICIAL INTELLIGENCE AND PREDICTION

11.1. ARTIFICIAL INTELLIGENCE

Monteith et al (2024) commented: "Although there is widespread excitement about the creative successes and new opportunities resulting from the recent transformative technological advancements in artificial intelligence (AI), one result is increasing patient exposure to medical misinformation" (p33).

"Traditional AI" seeks patterns and makes predictions from large data sets, for example, within decision boundaries, but "generative AI" (eg: large language models (LLMs) like "ChatGPT") can create content, particularly "produce text, audio and visual outputs that can easily be mistakenly attributed to human authors" (Monteith et al 2024 p33).

The sudden growth of generative AI is due to the vast amount of "training data" available on the internet (ie: text, audio, video, and images), the improvement in algorithms (as motivated private companies compete for dominance of their models), and the expansion of computing power (Monteith et al 2024).

"Generative AI can create the illusion of intelligence. Although at times the output of generative AI models can seem astonishingly human-like, they do not understand the meaning of words and frequently make errors of reasoning and fact. The statistical patterns determine the word sequences without any understanding of the meaning or context in the real world. Researchers in the generative AI field often use the word 'hallucination' to describe output generated by LLM that is nonsensical, not factual, unfaithful to the underlying content, misleading, or partially or totally incorrect" (Monteith et al 2024 p33). The main types of errors can be summarised as factually incorrect information, inappropriate or dangerous advice, nonsense, fabricated sources, and arithmetical errors. Output of generative AI may also contain "toxic language", including "hate speech", insults, and bias related to gender, race/ ethnicity, and other demographic characteristics.

Writing in relation to psychiatry, Monteith et al's (2024) concern about generative AI was around mental illness; in particular factual errors, nonsense,

fabricated sources, and dangerous advice. The authors quoted the example reported by "BBC News" in 2023 of a chatbot recommending calorie restriction and dieting for a user with an eating disorder on a website supporting such individuals (Monteith et al 2024).

11.2. PREDICTING OUTCOMES

Traditional AI has been used in "precision psychiatry", which "seeks to provide the right treatment to the right patient at the right time, using algorithms to predict disease trajectory or treatment response" (Sahin et al 2024 p55).

For example, not all individuals with depression respond to anti-depressant treatment. It would be very helpful if there was a way to predict treatment outcome.

Neuroimaging for brain differences has been tried (eg: Crane et al 2017), also self-reports of different variables (eg: Viglione et al 2019), and information in electronic health records (EHRs) (eg: Pradier et al 2020).

Xu et al (2023) investigated the use of machine learning with EHR data from an outpatient clinic in New York City. There were 3380 patients between June 2016 and June 2020 with "Patient Health Questionnaire-9" (PHQ-9) scores. The final analysis focused on 808 adults who had received anti-depressants.

Over six months, 243 of the sample "worsened" and 565 "recovered". Two key variables were linked to treatment outcome were co-morbidity of anxiety which predicted "worsening", and baseline depressive symptom severity score. The "recovering" group had a significantly higher score, and included more individuals with moderate and severe symptom severity.

An issue with the use of AI is "algorithmic fairness": "A prediction algorithm can be considered fair for a demographic attribute if the predictions do not systematically disadvantage any sub-groups regarding the respective demographic attribute (including but not limited to gender, education, age, race, ethnicity and socio-economic status)" (Sahin et al 2024 p55).

Sahin et al (2024) investigated this concept in the use of prediction algorithms for people with clinical high risk (CHR) for psychosis. Data on over 1700 such individuals in Europe and Australia were used (from the "Prognostic Tools for Early Psychosis Management"

(PRONIA) cohort). Fairness of prediction for thirteen models was assessed based on gender, and educational attainment.

Prediction of the outcome of the psychosis was less favourable for individuals with lower educational attainment by most of the algorithms, and by the human clinicians' judgments. "Interestingly, the bias patterns observed in algorithmic predictions were not significantly more pronounced than those in clinicians' predictions" (Sahin et al 2024 p55). There was a small favourable prediction for outcome of men over women by the algorithms and the clinicians.

The researchers admitted that the clinicians' bias based on education was a surprise: "Clinicians' educational bias is a phenomenon that has not been explored in this context before. There are studies showing bias in clinicians' behaviour in medicine, with the focus so far being on factors such as race, ethnicity, gender, age and weight (bias against obese patients). Specifically, in psychiatry, research on bias-related misdiagnosis shows that previous experiences and certain prototypes might bias psychiatrists' clinical decision-making while simultaneously being a source of expertise" (Sahin et al 2024 p62).

The fact that the algorithms' predictions were no more bias than that of clinicians can be seen as a good thing or a bad thing depending on how it is viewed. A good thing in that the algorithms are not exceptionally biased, but a bad thing as they mimic human biases. It could be that prediction of outcome is a difficult sport for machines and humans.

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12. EVOLUTION OF METABOLIC RATE

12.1. METABOLIC RATE

Pettersen and Metcalfe (2024) began: "Metabolic rate reflects energy turnover that fuels essential biological processes common to all life. This fundamental measure can scale from cells to ecosystems, providing a rate at which oxygen and resources are consumed from the environment" (p1). At the individual level, the metabolic rate is the "cost of living" (or "fire of life"; Lighton 2018), and it is affected by cell size, activity level, and life stage, for instance (Pettersen and Metcalfe 2024).

"Metabolism is the cumulative product of various biochemical processes that ultimately combine to determine the rate at which organisms power their biological work. Metabolism therefore depends strongly on body mass — the greater the mass of the organism, the greater the sum total of metabolic processes required to sustain it" (Cameron and Mitchell 2024 p2). Variations in metabolic level can be viewed in absolute or relative terms. A whale, for example, has an absolutely higher metabolic rate than a mouse, but "physiologists are interested in the evolutionary processes that led to whales having relatively lower metabolic rates than mice" (Cameron and Mitchell 2024 p2).

"However, it is important to recognise that there is not a single metabolic rate — over time, and depending on the animal's activity level, its metabolism will range between a minimal or resting level (ie: basal or standard metabolic rate) and the upper limit (maximum or summit metabolic rate), the difference between them being termed the aerobic scope; it is therefore important to clarify which metabolic rate is being considered" (Pettersen and Metcalfe 2024 p1).

A "pace-of-life" spectrum has been used to classify animals. "For example, higher resting metabolic rates have been associated with faster developmental and growth rates, earlier onset of reproduction and shorter

lifespan. Individuals with relatively higher metabolism are also sometimes found to be bolder, more aggressive and more able to compete for resources than individuals with lower metabolic rates. On the other hand, possessing a higher minimal metabolic rate also potentially indicates a higher cost of living (and thereby lower energetic efficiency)" (Pettersen and Metcalfe 2024 p1).

Resting metabolism can vary between individuals of the same species, for example, by up to threefold among those of equivalent body mass, age, sex, body temperature, and activity level, as well as in maximal metabolic rate and aerobic scope (Pettersen and Metcalfe 2024) (appendix 12A).

The environment also influences metabolic rates as seen in suppression during low food availability or increase in cold temperatures (appendix 12B). "Environments experienced during early development can also modify metabolic rate expressed later in life via developmental plasticity. It is therefore important to consider not only individual variation in metabolic rates, but also individual variation in phenotypic plasticity..." (Pettersen and Metcalfe 2024 p3).

Another factor is known as parental effects, where a parent can modify the offspring's metabolic rate. "Females exposed to environmental stressors have been shown to increase the metabolic rates of their offspring, such as via elevating egg yolk hormones" (Pettersen and Metcalfe 2024 p3).

Pettersen et al (2024) explained: "The majority of ectotherms undergo embryonic development in eggs, with a finite amount of energy reserves available to sustain cell division, differentiation and maintenance costs until post-hatching feeding. Hence, variation in metabolic rates will also determine how quickly energy reserves are depleted for these species, with important consequences for survival. It might be expected, therefore, that selection should act to suppress minimal rates of metabolism to conserve energy, yet variation in metabolism is ubiquitous — varying by up to threefold, even after accounting for embryo size and developmental temperature" (p1).

Pettersen et al (2024) gave details of parental effects thus: "Epigenetic inheritance across two or more generations (termed inter- and trans-generational plasticity, respectively) can be adaptive or maladaptive — acting as either a buffer or conduit to the effects of environmental stress. Adaptive parental effects arise when parents anticipate and respond to environmental cues, to produce shifts in their offspring's phenotype

that maximise their fitness in the offspring environment. For example, when exposed to cool temperatures, mothers tend to produce larger offspring, leading to enhanced offspring survival in that same environment. Alternatively, under a bet-hedging strategy, parents in stressful or unpredictable environments increase variance in their offspring phenotypes, with variable consequences for offspring fitness, but overall enhancing parental fitness" (p2) (table 12.1).

- Pettersen et al (2024) varied the temperature (24 °C or 30 °C) and feeding frequency (three times per day for five days per week vs once per day for four days per week) of parent zebrafish to see the impact on the offspring. It was found that "embryo size was larger, but survival lower, in offspring from the parental low food treatment. Parents exposed to the warmer temperature and lower food treatment also produced offspring with lower standard metabolic rates — aligning with selection on embryo metabolic rates. Lower metabolic rates were correlated with reduced developmental and growth rates, suggesting selection for a slow pace of life" (Pettersen et al 2024 p1).

- Pettersen et al (2024) concluded: "Our results show that intergenerational phenotypic plasticity on offspring size and metabolic rate can be adaptive when parent and offspring temperatures are matched: the direction of selection on embryo size and metabolism aligned with intergenerational plasticity towards lower metabolism at higher temperatures, particularly in offspring from low-condition parents. These findings provide evidence for adaptive parental effects, but only when parental and offspring environments match" (p1).

Table 12.1 – An experiment on parental effects.

A key question is whether variation in metabolic rate is adaptive. The answer to this question is hampered by research problems, like the difference between animals in the wild and those in controlled laboratory environments. So, "fitness or performance measured in the laboratory may not reflect those in the field" (p4), but also there may not be a consistent relationship between resting metabolic rate and reproduction or survival (Pettersen and Metcalfe 2024). Pettersen and Metcalfe (2024) offered the potential explanation that "the fitness benefits of a fast or slow metabolism change across spatio-temporal changes in the environment, also known as context-dependent selection. Previous work has shown that a high resting metabolic rate (associated with a fast pace of life) is beneficial in cool or high competition environments, but can be either beneficial or

costly in high predation environments" (p5).

Another possibility is that selection pressures on metabolic rates may be different depending on the life stage (Pettersen and Metcalfe 2024).

12.2. EVOLUTION AND PACE-OF-LIFE SYNDROME HYPOTHESIS

In reference to the evolution of metabolic rate, Crespel et al (2024) made this point: "For evolution to occur, specific phenotypes must be under selection and their genetic basis transmitted to the next generation. As individuals are the result of interactions among a large variety of traits, the phenotypic response to selection will depend not only on the genetic basis of independent traits but also on the genetic relationship among the traits. A selection pressure on one trait can then indirectly lead to selection and phenotypic change in a correlated trait, even if the correlated trait itself is not under direct selection. As selection acts on multi-variate phenotypes, it is necessary to document indirect selection pressures and correlation structures that different traits may experience, to better understand and predict the evolutionary potential of the phenotypes in a population" (p1).

Metabolic rate is associated with other key traits like growth, reproduction, digestion, movement, and behaviour. This is seen in the "pace-of-life syndrome" (POLS) hypothesis (eg: Reale et al 2010), which "describes co-variation among aspects of physiology, life history and behaviour, and therefore predicts that trait associations will define correlated evolutionary responses. In line with these predictions, individuals with higher metabolism tend to grow faster when there is sufficient food, reproduce earlier, take more risks and have shorter lifespans. This is because a high metabolic rate needed to support faster growth would also incur higher maintenance costs, with a need for high energy intake and thus riskier behaviour to access resources, leading to increased mortality risks" (Crespel et al 2024 p2).

The zebrafish is well studied in terms of genes and behaviour, and Crespel et al (2024) reported on their work with a population about five generations in captivity at the University of Glasgow in Scotland. Data on about 800 fish were available, including standard and maximum metabolic rates (SMR and MMR), growth, risk-taking behaviour (eg: number of emergences from a shelter into an open area), and sociability (eg: average distance

from conspecifics).

Some support was found for the POLS hypothesis, and "that selection on metabolic traits could result in indirect selection mainly on growth-related traits, owing to strong genetic correlations, but not on swimming or risk-taking and sociability behaviour even if they co-vary phenotypically" (Crespel et al 2024 p1). These researchers made a general point about the problems of accurately measuring genetic correlations.

12.3. MARINE ANIMALS

The level of oxygen in water limits the growth of ocean species according to the "Temperature-Size Rule" (eg: Atkinson 1994). Tolerance of hypoxia (low oxygen levels) is important, and is affected by metabolic demands among other factors (Penn and Deutsch 2024).

Analysing data from approximately 25 000 marine animal species, Penn and Deutsch (2024) found that "active hypoxia tolerance is greater and less temperature sensitive among tropical species compared to polar ones..." (p1).

12.4. APPENDIX 12A – AMONG-INDIVIDUAL VARIATION

Differences between individual animals of the same species and size (known as among-individual variation) in metabolic rate is "generally consistent (ie: repeatable)", and seen in high metabolic individuals outgrowing low-metabolic rate individuals "when food is plentiful and predictable, likely due to more efficient food processing associated with higher metabolic rates and larger meals, whereas low-metabolic-rate individuals can out-grow their high metabolic rate counterparts under restricted or unpredictable food availability, including in the wild" (Norin et al 2024 pp1-2).

Norin et al (2024) studied a marine fish called the cunner (Tautogolabrus adspersus) in captivity at the the University of New Brunswick, Canada. The metabolic rate of 75 individuals was measured as water temperature was lowered to mimic winter onset in the wild. The cunner becomes dormant in winter and reduces its activity in this situation. Metabolic rate was estimated by oxygen uptake rates, and voluntary movement (eg: average swimming speed) was calculated from video recordings. The speed of cooling was varied in the experiment, and the temperature of testing was 14, 11, 8, 5 and 2 °C. Slow

cooling reduced the temperature by 0.12 °C per day, while fast cooling reduced it by 2 °C per day.

Among-individual variation in metabolic rate was consistent, but only at warmer temperatures. Movement behaviour did not show similar repeatability. This suggested that "these key organismal traits are free to change independently of one another when environmental temperature changes at a seasonally realistic rate, at least in the winter-dormant species of fish investigated here. This contradicts the pace-of-life syndrome concept, which suggests that physiology and behaviour should be linked in a slow–fast continuum, with an active lifestyle correlating with high metabolic rates" (Norin et al 2024 p9). This may be a species-specific strategy for dealing with the environmental changes in temperature, admitted the researchers.

There was also evidence in favour of the POLS hypothesis, as the researchers explained: "We did, however, find a positive relationship between growth rate and day-time activity in the slow cooling experiment, as well as a positive relationship between day-time activity and food intake in the fast cooling experiment (food intake was only quantified in the fast cooling experiment), supporting pace-of-life syndrome predictions that more active individuals can grow faster in a given environment due to greater food intake" (Norin et al 2024 p9).

Put very simply, "the potential for metabolic rate to evolve under selection is temperature-dependent..." (Norin et al 2024 p1).

12.5. APPENDIX 12B - FOOD AND TEMPERATURE

Beginning with work on goldfish (Ege and Krogh 1914), research on environment temperature and metabolic rate between ectothermic species (ie: those who body heat is determined by the environment) has shown "metabolic rate typically increasing by a factor of 2–3 for every 10 °C increase in temperature (known as the Q_{10} value). While observing this strong acute effect of temperature on the metabolic rate of a goldfish, Krogh [1916] also noted that the goldfish became very sluggish at low temperatures. This led Krogh [1916] to speculate that at low temperatures, fish from polar environments should exhibit relatively high metabolic rates compared with fish from temperate or tropical environments because, unlike the goldfish, polar fish remain active at very low temperatures" (Alton et al 2024 p1).

This is known as "Krogh's rule", and "it is hypothesised that natural selection counteracts the acute effect of temperature on metabolic rate by favouring genotypes with relatively high metabolic rates at low temperatures and genotypes with relatively low metabolic rates at high temperatures" (Alton et al 2024 p2).

Laboratory experiments and field studies have investigated this prediction with varying degrees of support (Alton et al 2024). Alton et al (2024) added at extra variable in their research, namely food availability. They stated: "Metabolic rate is hypothesised to evolve in response to variation in the availability and quality of food. For example, environments with low food availability are expected to favour genotypes with relatively low metabolic rates because they are more resistant to starvation owing to their lower maintenance costs. By contrast, environments with high food availability are expected to favour genotypes with relatively high metabolic rates because they can maximise energy assimilation for growth and reproduction by having more metabolic machinery" (Alton et al 2024 p2).

These researchers studied fruit flies (Drosophila melanogaster) for 24 generations in the laboratory over two years (a laboratory natural selection study). Flies were bred in nine different environments based on temperature (18, 25, or 28 °C) and diet (low-calorie, low-protein, or control). The metabolic rate of adults was measured by carbon dioxide production at 25 °C. Differences in nutrition either alone or interacting with temperature had no impact on metabolic rate over the generations, which was contrary to expectations. While Krogh's rule was only supported for females at the lowest temperature, but "the effect was small" (Alton et al 2024 p8).

Alton et al (2024) ended: "The consensus emerging from laboratory natural selection experiments is that temperature alone does not consistently drive evolutionary responses in metabolic rate. Thus, the metabolic consequences of climate warming cannot be understood through simple manipulations of temperature alone. We instead hypothesise that to understand the metabolic costs of climate warming it will be necessary to understand how climate warming will shift life histories, and how these shifts will result in correlated changes in metabolic rate" (p8).

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13. CANCER TRENDS

13.1. UK DATA

Shelton et al (2024) analysed UK trends in 23 cancer types in adults aged 35-69 years old for the period 1993 to 2018. Bray (2024) described the findings as "generally encouraging": "Despite an ageing population, the number of cancer deaths in the UK has continually declined, while age standardised mortality rates per 100 000 for all cancers combined fell by 2% for men and 1.6% for women, per annum. Mortality rates for 14 cancer types in men and 17 types in women reduced significantly by at least 0.5% per year, 12 of which types are linked to smoking" (p1). Tobacco control measures in the UK during the study period were seen as important (eg: tax rises on tobacco products; smoke-free public places).

But there were increases in incidence rates of certain cancers, like liver cancer and colorectal cancer. Lifestyle factors were implicated here, including increases in alcohol consumption, excess body weight, and physical inactivity, as well as the use of anti-biotics affecting the gut microbiome in the case of colorectal cancer (Bray 2024) [17].

Bray (2024) noted other concerns like the heterogeneity in cancer mortality levels in England (eg: linked to social deprivation), and the impact of covid-19 on diagnosis and treatment of cancers.

Shelton et al (2024) used official data sources from the Office for National Statistics, and the public health authorities in the four countries of the UK, and the coding of cancer types was based on the commonly accepted ICD-10 categories of the World Health Organisation. The data were converted into standardised rates per 100 000 population. The study period began in 1993 because of the availability of comprehensive cancer registration data since then, while the age group was chosen as the trend data were "more reliable and easier to interpret in this age range" (Shelton et al 2024 p1). The researchers explained: "Diagnostic accuracy is better in this age range than in older patients who have a greater

[17] A 50% increase in 25-49 year-olds with bowel cancer since the 1990s in the USA, Canada, and Australia, for example, has been reported. An explanation linked to "affluent modern life" has been hypothesised (Wilson 2023).

proportion of clinical and uncertain diagnoses, as evidenced by the relatively low proportion of microscopically verified tumours, especially in the earlier part of the period analysed. By the age of 35 years, the pattern of cancer broadly represents the usual adult profiles because specific cancers that are observed in childhood, adolescence, and young people would not impact on the overall pattern. Trends in the 35-69 years age group are also reflective of causal factors in the more recent and medium term past rather than in the longer term and, therefore, will be more indicative of future patterns of cancer in the older populations" (Shelton et al 2024 pp1-2).

The data were classed as high quality with minimal changes in coding and registration practices during the study period. Some detail about specific cancers were not available (eg: oestrogen receptor-positive vs receptor-negative breast cancer), particularly for very rate conditions. There was not sufficient demographic information for analysis based on ethnicity nor social deprivation, for example. Undiagnosed cases were obviously not included in the data.

During the study period, a number of cancer screening programmes had been set up. Such programmes are a double-edged sword in terms of finding more cases, but allowing for early diagnosis and treatment. The latter outweighs the former in the main.

In summary, the "results substantiate the view that in this age group there is no generalised increase in cancer incidence, while there is a substantial decrease in cancer mortality in the UK over the 25 year study period" (Shelton et al 2024 p15).

13.2. SUNBURN

Sunburn can be a risk factor for skin cancer, though it is not necessary to burn for the risk (Moskowitz 2022). Holman et al (2021) surveyed over 4088 US adults on what they were doing when last sunburned. The most important activities in order were swimming and spending time in water (33% of sample), working outside for leisure (ie: not paid employment) (26%), and travelling for leisure (21%).

The sample had completed the "2018 SpringStyles Survey" with questions about sunburn (from the sun and not indoor tanning), including the most recent event, location on the body, activities when sunburned, and sun protection methods used.

Three-quarters of the sample recalled a recent sunburn event. The neck or shoulders was the most frequent body area reported followed by face or head, but there was a gender difference. Men reported more sunburn on face or head, and women chest or abdomen. Only 5% of the participants were trying to get a tan when the sunburn happened.

Around 80% of sunburned participants had been using sun protection when the event occurred; most frequently sunscreen/sun tan lotion.

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14. WIM HOF METHOD AND LIFESTYLE MEDICINE

Wim Hof is known for his ability to resist cold temperature (eg: world records for swimming 66 metres beneath the ice, and running a half marathon over the Arctic Circle) (Almahayni and Hammond 2024). He has proposed a technique with three pillars (the "Wim Hof Method"; WHM), which is argued to benefit health (Almahayni and Hammond 2024):

i) "Wim Hof breathing method" (WHBM) - hyperventilating 30-40 times before holding the breath at low lung volume.

ii) Cold therapy - daily cold showers or sitting in an ice bath [18].

iii) Commitment - persistence and patience in mastering the other two pillars.

Researchers at RMIT university in Australia (quoted in Almahayni and Hammond 2024) surveyed over 3000 people who had used the WHM, and the majority of responses were positive. "Respondents reported a good mix of physical and mental benefits such as an increase in their tolerance to resist cold, as well as an increase in energy, mood, mental focus, and general health. The survey findings also claimed that the WHM had benefits for specific conditions such as stress, tiredness and fatigue, anxiety, depression, back pain, insomnia, arthritis, and chronic pain" (Almahayni and Hammond 2024 p2). But the study was not peer-reviewed, and Wim Hof was involved in the research (Almahayni and Hammond 2024).

The WHM can be considered an example of "lifestyle medicine", which is "the study of how actions and habits affect illness prevention and treatment" (Almahayni and Hammond 2024 p2). Many celebrities, of which Wim Hof is an example, are presenting their advice in this area. Nunan et al (2021) warned of "the unintended consequences of uncritical endorsement and application of lifestyle medicine including the infiltration of pseudoscience, profiteering, and the potential for widening health inequalities by a continued focus on the 'individual'" (quoted in Almahayni and Hammond 2024).

[18] Cold temperature exposure can be a danger for at-risk individuals (eg: heart-related events) (Wong 2023).

Almahayni and Hammond (2024) performed a systematic review of peer-reviewed studies of the WHM (published in English up to mid-2022). Nine articles covering eight trials were found. Most findings were mixed, though there was evidence that "the WHM may reduce inflammation in healthy and non-healthy participants as it increases epinephrine levels, causing an increase in interleukin-10 and a decrease in pro-inflammatory cytokines" (Almahayni and Hammond 2024 pp1-2). This is important in conditions where reducing inflammation is beneficial (eg: rheumatoid arthritis; asthma; diabetes).

Almahayni and Hammond (2024) commented: "Despite the statistical significance observed in some studies, it must be noted that the quality of the studies is very low [table 14.1], meaning that all the results must be interpreted with caution. Additionally, the low sample size (15–48 individuals per study) and large proportion of males in the studies (86.4%) make the results non-generalisable to the public. Consideration should also be given that participants might experience the placebo effect, where improvements in patients' symptoms are due to their participation in the therapeutic encounter, with its rituals, symbols, and interactions" (p15). However, a clinical trial of the WHM is difficult as it is not possible to blind participants or researchers to the condition (ie: intervention or control). Similarly, what to use as a control condition is a problem. Studies in the review tended to use no WHM as the control, or sitting quietly and relaxing, or natural breathing.

- Randomisation of participants to control or intervention.
- Alterations from planned interventions after study began.
- Missing outcome data.
- Outcome measures used (eg: subjective).
- Selective reporting of results.

Table 14.1 - Domains for assessing methodological quality used by Almahayni and Hammond (2024).

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15. MISCELLANEOUS MENTAL HEALTH

15.1. CITIES AND MENTAL HEALTH

Collins et al (2024) observed: "Urban life shapes the mental health of city dwellers, and although cities provide access to health, education and economic gain, urban environments are often detrimental to mental health" (p137). Adolescents and young adults are the most likely age groups to move to cities, and so the issue is particularly relevant to them.

Collins et al (2024) reported a project began in April 2020 to answer the question, "What are the characteristics of a mental health-friendly city for young people?". Three digitally administered surveys were undertaken with a panel of 518 individuals (researchers, practitioners, advocates, and young people) in 53 countries. The responses were grouped and categorised to produce a final thirty-seven city characteristics across six socio-ecological domains:

1. Personal - eg: teaching life skills and providing opportunities for personal development.

2. Interpersonal - eg: respect for young people; opportunities for safe and healthy relationships.

3. Community - eg: access to safe spaces to gather.

4. Organisational - eg: employment opportunities with job security and satisfaction.

5. Policy - eg: design and planning of cities with youth input.

6. Environmental - eg: addressing adverse social determinants of health; affordable basic amenities.

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15.2. DISORDERED GAMBLING

"Disordered gambling" (DG) is characterised by difficulty controlling gambling behaviour, "chasing losses" (ie: taking more risky gambles as losses mount), and serious problems as a consequence of gambling (eg: financial; relationships) (Piasecki et al 2019).

DG is co-morbid with other psychiatric problems (eg: substance use disorder; obsessive-compulsive disorder; depression) (eg: Petry et al 2005).

Piasecki et al (2019) analysed data from the "National Longitudinal Study of Adolescent to Adult Health" (Add Health), which, began in 1994-5, follows a nationally representative US sample into young adulthood. Data used here were collected in 2008 when the participants were 24-34 years of age.

DG was measured by the question: "Has your gambling ever caused serious financial problems or problems in your relationships with any of your family members or friends?". Overall, 1.3% of 5215 participants were categorised as DG. DG was associated with an increased odds of schizophrenia, a decreased odds of bipolar disorder, and no relationship to major depressive disorder or attention-deficit hyperactivity disorder. DG and schizophrenia are both linked to impaired decision-making (Piasecki et al 2019).

DG was not formally diagnosed, but based on a simple yes/no self report.

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