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Lifespan Topics

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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/.

CONTENTS

1. PERSONALITY CHANGES OVER TIME

1.1. OPTIMISM

Dispositional optimism is "the generalised expectation that good things will happen" (Chopik et al 2020 p1). But does it change with age, and life experiences?

Optimism is partly heritable (around 25%), but also learned and shaped by the environment (Chopik et al 2020).

Chopik et al (2020) hypothesised that "as people age, their increased focus on maintaining emotional balance and well-being might lead them to attend more strongly to positive information—leading to the prediction that optimism increases across the lifespan" (pp1-2). This has been observed in some studies, while others have suggested "that optimism increases throughout life, reaches a plateau between ages 55 and 70, and declines in older adulthood" (Chopik et al 2020 p2). However, these patterns are averages, and individuals may vary depending on their experiences of positive and negative life events. Though Schwaba et al (2019), in a seven-year longitudinal study of 1000 adults of different ages, found that the level of optimism was associated with number of positive events, while there was no relationship to number of negative events experienced (Chopik et al 2020).

There is a confounder where optimism may influence the life events experienced, so Chopik et al (2020) in their data analysis examined both "(a) how optimism predicts the onset of life events and (b) how optimism changes in response to life events" (p2) [1]. These researchers analysed publicly available data from three large longitudinal studies in the Netherlands (Dutch Longitudinal Study for Social Sciences; LISS; 10 045 x 16 to 101 year-olds), the USA (Health and Retirement Study; HRS; 22 150 x 18-104 year-olds), and Germany (German Socio-Economic Panel; G-SOEP; 42 691 x 16-96 year-olds).

Optimism was measured by a single-item in the G-SOEP - "When you think about the future, are you..."

[1] (a) is the "selection effect", and (b) the "socialisation effect" (Chopik et al 2020).

(optimistic/more optimistic than pessimistic/more pessimistic than optimistic/pessimistic) on four occasions. The other two studies used the Life Orientation Test-Revised (LOT-R) (Scheier et al 1994) with six items, like "I rarely count on good things" on three occasions. Sixteen life events were coded as yes or no (eg: childbirth; marriage; divorce; change in health; retirement).

Two of the datasets (LISS and HRS) supported a curvilinear relationship for optimism and age - "Younger adults were lower in optimism compared to middle-aged adults. Then as people aged and approached older adulthood, they began declining in optimism" (Chopik et al 2020 p9). The G-SOEP data supported an increase in optimism with age (linear relationship).

Optimism predicted positive life events (eg: fewer chronic illnesses) and negative events (eg: unemployment) depending on the dataset. Chopik et al (2020) possible reasons for this inconsistency, including the measurement of life events (ie: limited to sixteen), and their conceptualisation as positive or negative. Luhmann et al (2020) has argued that life events vary on other dimensions, like emotionally significant or not, or controllable/uncontrollable. So, "having qualitative information about the life events from a participants' perspective is clearly valuable" (Chopik et al 2020 p11).

Chopik et al (2020) also "looked at the onset of each life event as occurring once over the course of the study (eg: getting married over the course of the study) rather than sequential or multiple life events (eg: getting married or divorced twice during follow-up)" (p12).

1.2. BIG FIVE

Concentrating on personality as a whole over adulthood, Graham et al (2020) described how approaches had "whipsawed" in recent years from "one extreme perspective (personality is unstable for nearly everyone) in the 1970s..., to its opposite (personality is stable for nearly everyone) in the 1980s and 1990s... Over the last 10–15 years, a more integrative view has emerged, recognising that personality does change, but likely in systematic ways, and that in any population or sample there will almost certainly be individual differences in change; that is, while some individuals may change, others may remain stable" (p302).

Using data from sixteen longitudinal samples of the

Integrative Analysis of Longitudinal Studies of Ageing and Development (IALSA) project, Graham et al (2020) analysed "Big Five" personality trait [2] trajectories for over 60 000 participants. All the samples measured the Big Five in some way.

What about the theoretical predictions? Roberts (eg: Roberts et al 2005), for instance, proposed that £trait changes in adulthood tend to reflect an increase in socially acceptable characteristics (ie: maturity)" (Graham et al 2020 p302) (eg: increased conscientiousness, decreased neuroticism with age). On the other hand, Baltes (eg: 1987) described ageing as gains and losses, and, in fact, predicted increased neuroticism with growing health problems and financial uncertainty in later life, while conscientiousness declined as work-related goals become less important (Graham et al 2020).

Graham et al (2020) found declines in conscientiousness, extraversion, and openness with age, and late-life increases in neuroticism. But the personality changes were "somewhat heterogeneous" (Graham et al 2020 p301).

Studies like this one "capture how a given trait changes over time in a given sample, in contrast to how different persons change with time. They may be termed 'meta-trajectories' when they refer to population-level estimates of change" (Graham et al 2020 p302).

1.3. PARENTHOOD

Roberts and Wood (2006) proposed the "social investment principle", which suggested that the demands of parenthood "should promote more mature behaviour and lead to an increase in conscientiousness, agreeableness, and emotional stability" (Asselmann and Specht 2021 p85) [3].

Is there evidence to support this idea? Studies suggest that personality changes around parenthood differ for men and women, for younger and older parents, and for single parents (Asselmann and Specht 2021).

Longitudinal studies that have investigated changes in the "Big Five" personality traits include (Asselmann and Specht 2021):

[2] The Big Five = Neuroticism (N), Extraversion (E), Openness (O), Conscientiousness (C), and Agreeableness (A).

[3] This combination of changes has been called the "maturity principle" (Asselmann and Specht 2021).

- The Longitudinal Internet Studies for the Social Sciences Panel (Denissen et al 2019) - eg: parents lower openness and conscientiousness than non-parents.

- Household Income, and Labour Dynamics in Australia Survey (van Scheppingen et al 2016) - eg: men and women with lower openness and more extraversion, and more conscientious women more likely to become parents.

Longitudinal studies vary in their methods, including the number and timing of personality assessment, and whether to include first-time parents only, for example (Asselmann and Specht 2021).

Asselmann and Specht (2021) analysed data from the Socio-Economic Panel Study (SOEP) in Germany for 2005, 2009, 2013, and 2017. The main finding can be summed up as "becoming a parent was primarily associated with differences in openness and extraversion. Specifically, less open and more extraverted individuals were more likely to start a family, and parents were less open in the first year and subsequent years of having a child than before. Besides, extraversion tended to decrease after becoming a parent" (Asselmann and Specht 2021 p97). Furthermore, Asselmann and Specht (2021) stated: "Mothers tended to be more agreeable, whereas father tended to be more conscientious after the birth of their first child, and especially younger, but not older parents were more conscientious in the first year of having a baby. Finally, our findings were primarily driven by parents living with but not without a partner" (p99). There was not support for the social investment principle.

But one critic noted: "The changes are small... It's not as if you become a completely different person" (Manon van Scheppingen in Hamzelou 2020).

The SOEP involved nearly 20 000 participants, of which around one-third became parents during the time period studied. But personality was not a major focus of the study, and a potentially less reliable measure of personality traits was used (Asselmann and Specht 2021).

There was no matching of parents and non-parents on socio-economic and demographic variables. Not all participants completed the four waves of data (Asselmann and Specht 2021).

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2. MENOPAUSE TWO DISCIPLINES

2.1. BIOLOGY

"Age at natural menopause" (ANM) (or "reproductive senescence") is 50-52 years old on average (Rush et al 2021). It is "determined by the non-renewable ovarian reserve, which is established during foetal development and continuously depleted until reproductive senescence" (Rush et al 2021 p393).

Rush et al (2021) identified 290 genetic determinants of ovarian ageing from analysis of the genomes of over 200 000 women of European ancestry. Differences were observed, in particular, between the two extreme 1% of women (ie: ANM in mid-30s, and over sixty years old).

In terms of human outcomes, later ANM was associated with greater risk of several hormone-sensitive cancers, but beneficial for bone mineral density, fracture risk, and risk of type 2 diabetes. There was "no evidence to support causal associations between ANM and cardiovascular disease, lipid levels, Alzheimer's disease, body mass or longevity" (Rush et al 2021 p396). However,
"genetically mediated increases in alcohol consumption and tobacco smoking were associated with earlier ANM" (Rush et al 2021 p396).

Earlier menarche was associated with earlier ANM.

2.2. SOCIOLOGY

van de Wiel (2014) pointed out that: "[A]ge, like other systems of separation, can function as an 'instrument of regulatory regimes' [Butler 1990] and shows similarities to gender in its body-bound, surface-focused, and morally coded position in the socio-medical sphere" (p75). Relevant to this is the phrase of life called the menopause.

Tilt's "The Change of Life in Health and Disease" in 1857 can be described as pivotal in the medicalisation of the menopause, and the making "legitimising discourses explicit that position menopause as a recognisable pathology in need of medical management, a clinical

specialty, and 'a subject of legitimate knowledge' [Foucault 1973] in gynaecological research" (van de Wiel 2014 p75). Foucault (1973) introduced the idea of the "medical gaze" to describe the medicalisation of aspects of develop and behaviour [4]. Applying this to the menopause, van de Wiel (2014) saw the medicalisation of the menopause in the nineteenth century as "concurrent with the medicalisation of female midlife, in which the 'change of life' became positioned as a significant moral and social crossroads for women" (p76).

van de Wiel (2014) outlined four dimensions of "medical gaze" in relation to the medicalisation of the menopause:

i) Normalised constructions of anatomy (spatial) – New ways of seeing the body, specifically in relation to what is normal (eg: that women will have health crises at certain times in their lives).

ii) The relation to ageing (temporal) – How older are to be perceived.

iii) Normative frameworks of meaning (moral) – Value judgments about what is right or wrong (eg: "good" lifestyles and health).

iv) "The promotion of (self-)surveillance by anticipating physical futurity" (p77) – eg: lifestyles that will lead to "good" post-menopausal health.

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[4] "A Foucaultian reading avoids simple oppositions between oppressive medicine men and victimised patients, but looks at knowledge practices and the discursive power distributed through them. For Foucault, power is not localised 'in anybody's hands', but, rather, individuals are 'the elements of its articulation' and are 'always in the position of simultaneously undergoing and exercising this power (Foucault 1980)" (Van de Wiel 2014 p76).

3. LIFE COURSE

3.1. CHILDHOOD ADVERSITY

Childhood adversity (eg: abuse; family violence) is a risk factor for poor adult health. But "conceptual limitations of research in this area constrain full understanding of the extent to which childhood family violence operates as a risk factor for poorer adult health" (Greenfield and Marks 2009 p944). Key limitations include one-time measurement of health, how family violence is operationalised, and the non-probability samples based on those who seek medical help. Greenfield and Marks (2009) addressed these issues in their research.

The life course perspective is the conceptual basis to this research. "A primary insight of the perspective is that individuals' past experiences can cumulatively and interactively influence future outcomes through complex life histories, or sequences of experiences within interrelated life domains..." (Greenfield and Marks 2009 p945). But what is the mechanism(s) through which childhood adversity leads to poorer adult health? Kendall-Tackett (2002) proposed four pathways:

i) Behavioural pathways - Poor health behaviours by individuals (eg: substance abuse).

ii) Social pathways - Multiple experiences of disadvantage (eg: homelessness; revictimisation).

iii) Cognitive pathways - How individuals think about their life and the decisions made.

iv) Emotional pathways - eg: depression.

"These pathways, taken together, indicate several interconnected domains of individuals' complex life histories that might underlie linkages between childhood

family violence and poorer adult health" (Greenfield and Marks 2009 p945). A specific version of the life course approach is "cumulative advantage/disadvantage" (Dannefer 2003). Adversity and disadvantage tend not to be singular, but individuals experience multiple and cumulative such events, and poorer health exacerbates them all and creates even poorer health. Cumulative advantage can work in the opposite way.

In their research, Greenfield and Marks (2009) used data from two waves of a longitudinal study (appendix 3A), the 1995-2005 National Survey of Midlife in the United States (MIDUS). A national probability sample was recruited in 1995 of adults aged 25 to 74 using random telephone dialling (Time 1; T1). There was a follow-up in 2004-5 (Time 2; T2) of the original 3024 respondents. In total, 1745 were surveyed at both time points.

The outcome variable of adult health was measured in three ways:

- Overall self-rated health (on scale of 0 to 4, where a higher number is better subjective health) (mean for sample at T1 = 2.57).

- Functional health - the ability to perform various everyday activities, like dressing oneself, walking short distances, and climbing one flight of stairs (scored as 0 or 1 for each activity, where 1 is a limitation) (mean at T1 = 1.20).

- Experience of 29 chronic conditions (eg: asthma; hypertension) in the last year (scored up to 9) (mean = 2.55).

The explanatory variable of family violence as a child was scored with nine profiles based on type and frequency (eg: "pushed, grabbed, or shoved you; slapped you; threw something at you") (table 3.1).

Greenfield and Marks (2009) proposed two hypotheses:

- H1 - Adults reporting violence in childhood will have poorer adult health than those who did not experience violence.

- H2 - Adults experiencing violence in childhood will show a greater decline in health between T1 and T2 than those who did not report violence in childhood.

(1) never physical or psychological violence
(2) never physical and rare psychological violence
(3) never physical and frequent psychological violence
(4) rare physical and never psychological violence
(5) rare physical and rare psychological violence
(6) rare physical and frequent physical violence
(7) frequent physical and never psychological violence
(8) frequent physical and rare psychological violence
(9) frequent physical and frequent psychological violence.

(Source: Greenfield and Marks 2009 p953)

Table 3.1 - Nine profiles of family violence.

The data supported H1 as "reports of having experienced both frequent physical and frequent psychological violence in childhood from parents were consistently associated with poorer adult health" (Greenfield and Marks 2009 p959). Such individuals had more rapidly decreasing levels of health on all three measures, which supported H2.

However, the chronic conditions-measure of health was a more robust indicator. "Adult health status in terms of functional limitations and self-rated health were only associated
with reports of both frequent physical and frequent psychological violence, whereas adult health status in terms of chronic conditions also was associated with reports of rare physical and frequent psychological violence" (Greenfield and Marks 2009 p960). The researchers could not explain this specific finding.

The following key methodological limitations need considering:

i) The study did not control for all potential confounders, like genetic factors and health, or other family adversities.

ii) Childhood violence was measured by adult recall. Along with the reliability of retrospective studies, there is the possibility of reverse causality, where "individuals' poorer health causes them to more readily recall negative interpersonal interactions from childhood" (Greenfield and Marks 2009 p962).

iii) No assessment was made of the reason for the violence (eg: unprovoked rage of parent; corporal punishment).

iv) Large drop-out between T1 and T2 (ie: 38%). Analysis determined that the non-respondents at T2 had lower levels of education and income, and were more likely to be ethnic minority individuals (Greenfield and Marks 2009).

3.1.1. Midlife Stress and Pain

The experience of pain is more than the physical process, and non-physical factors influence it, like socio-economic ones. Put simply, economic insecurity and financial stress can exacerbate pain.

Wickrama et al (2021) proposed that this relationship is via a low sense of control. These researchers used longitudinal data covering 1991 to 2017 for 508 middle-aged husbands and wives in the USA (Iowa Youth and Family Project; IYFP). It was expected that family financial stress (FFS) in the 1990s would predict low sense of control and physical pain in the 21st century.

Data were collected in 1991, 1994, 2001 and 2017. FFS was self-rated from 1 to 4, while sense of control was measured by Pearlin's Mastery Scale (Pearlin et al 1981) (items eg: "I have little control over the things that happen to me"). Physical pain was self-rated on a six-point scale for the preceding month, and physical illnesses (out of 46 listed) in the last year.

The overall findings can be summed up thus: "Respondents' FFS trajectories (ie: initial level and rate of change) in their early middle years was related to sense of control trajectories, which, in turn, contributed to the escalation of physical pain in later years" (Wickrama et al 2021 p797). But a bidirectional relationship between FFS and physical pain was also find – that is, FFS in midlife and physical pain in later life, and physical pain in midlife and FFS in later life.

Declining finances was associated with declining sense of control, irrelevant of the initial level of FFS.

The key measures were self-reported, and collected at unevenly spread periods from a European-American rural sample.

3.2. SUBJECTIVE AGE

"Subjective age" (SA) (ie: "how old or young individuals feel relative to their chronological age"; Yannick et al 2018) (appendix 3B) can have an impact on

health and longevity. "A lower subjective age is correlated with better health, longevity and general well-being, while people with a greater subjective age have higher levels of inflammation, a marker of general ill health, and older-looking brains" (Lawton 2021 p37). Research has covered hospitalisation, cognitive impairment, depression, and stress, for example (Yannick et al 2018).

Yannick et al (2018) investigated SA and mortality with data from 17 000 people over twenty years. The data came from three US longitudinal studies, each measuring SA with a slightly different question:

i) Health and Retirement Study (HRS) - over 50s and their spouses; data for 2008-2014 used; "Many people feel older or younger than they actually are. What age do you feel?".

ii) National Health and Ageing Trends Study (NHATS) - cohort of Medicare enrollees aged 65 and over; data from 2011-14; "Sometimes people feel older or younger than their age. During the last month, what age did you feel most of the time?".

iii) Midlife in the United States (MIDUS) [5] - data from 1995 to 2014 used; "Many people feel older or younger than they actually are. What age do you feel most of the time?".

During the follow-up period (up to April 2015), around 2700 participants had died.

Overall, participants reported a SA around 15% younger than their chronological age (ie: 8-12 years), but about 10% of the samples had an older SA. It was calculated that the risk of mortality increased by one-fifth for an older SA of ten years, while the difference between the two extremes was two-fold. In other words, individuals with the oldest SA were twice as likely to have died than individuals with the youngest SA.

The findings were observed in both middle-aged and older adults, and in the different, large samples.

The relationship between SA and mortality is probably via multiple pathways, including (Yannick et al 2018):

a) SA is an indicator of physical and mental health problems (eg: chronic health conditions; depression).

[5] MIDUS 1 data collected 1995-6; MIDUS 2 2002-2009; MIDUS refresher 2011-2014.

b) SA is an indicator of behaviours that increase mortality (eg: long-term sleep problems).

c) SA linked to health behaviours (eg: exercise).

d) SA is a sign of behaviours that cumulate across the lifespan (eg: physical inactivity).

Self-reported SA can vary with mood and circumstances, and thus has limitations. An alternative measure is "visually perceived age", which is the age estimated by observers using photographs. It was used in the Longitudinal Study of Ageing Danish Twins (Uotinen et al 2005).

However, individuals have SA "baselines" that they consistently return to (Lawton 2021). Zhavoronkov et al (2020) used AI to spot individuals' baselines (called "SubjAge") in data from MIDUS. A deep neural network was trained to predict chronological age (PsychoAge) from fifty factors of psychological ageing along with SubjAge. Certain responses to the MIDUS questionnaires were found to be the most important in the algorithm's estimate of PsychoAge and SubjAge. These related to "closer relationships" (eg: marital status; rating of sex life), and "health" (eg: "health limits on vigorous activity"; "prescription medications for blood pressure"). Specific to PsychoAge were variables like "neuroticism personality trait", and "control over life in general", while for SubjAge, the variables included "extraversion personality trait", and "rate current work situation".

So, for example, an individual with baseline low SA rates their current sex life positively, has few medications or health limitations, and is more likely to be an extravert. Put simply, healthy, happy and satisfied individuals have a lower SA. But the direction of the relationship is unclear.

3.3. EMPLOYMENT HISTORY AND HEALTH

Both cross-sectional and longitudinal studies show a relationship between employment history and health. In the former case, "at any given point, employed individuals report better health than the unemployed individuals or those out of the labour force" (Di Gessa et al 2020 p793).

Using the longitudinal method, the employment history is associated with long-term health. For example,

"men with continuous labour market attachment across the 'working years' report more favourable health than their counterparts with relatively weak ties" (Di Gessa et al 2020 p793). While women who spend more time in paid employment are healthier in their mid-50s, say, than those who have spent long periods out of the labour market (Di Gessa et al 2020).

But longitudinal studies often measure health at one point in time, and so this "precludes the possibility of understanding the longer-term influence of work experience on dynamics in health as individuals age" (Di Gessa et al 2020 p794). Also men and women are treated differently in analysis because of the time out of the labour market for women with family responsibilities, and data are not collected after state pension age (SPA) (Di Gessa et al 2020).

Hoping to overcome these limitations, Di Gessa et al (2020) analysed data from the English Longitudinal Study of Ageing (ELSA) (third wave: 2006-7 (their baseline) and eight wave: 2016-17). In total, 1310 individuals aged 65-74 years for men and 60-69 years for women at baseline.

Three outcome measures were used:

a) Quality of life (QoL) - CASP-19 (Hyde et al 2003) (eg: "I feel that the future looks good for me"; "I feel that my life has meaning"; "I enjoy the things I do"; each rated "often", "sometimes", "not often", or "never").

b) Somatic health - A combination of self-rated health and limitations with daily living (subjective measures) and walking speed (objective measure).

c) Depression - Centre for Epidemiologic Studies Depression (CES-D) scale (Radloff 1977) (eg: "I felt everything I did was an effort"; "my sleep was restless"; "I felt fearful"; each rated "rarely or none of the time (less than 1 day)" to "most or all of the time (5-7 days)" in the past week).

Employment history was categorised into five "ideals" for men and seven for women (table 3.2). Socio-economic and health circumstances in childhood were among the variables controlled for.

It was found that men without continuous full-time employment history (ie: weak labour market attachment) reported poorer somatic health and QoL at baseline than mostly full-time employed. "However, at the end of the 10-year period considered, those who exited early had

MEN	WOMEN
• Mostly full-time employed throughout 16-64 years. • Mostly not employed. • Full-time employment up to 59 years old (early exit). • Full-time up to 49 years old (very early exit). • 23 - 60 years old (late start/early exit).	• Mostly full-time employed throughout 16-59 years. • Mostly part-time throughout. • Mostly not employed. • Early exit at 48 years. • Short career break between 26 and 30 years old and then part-time employment. • Long career break between 26 and 41 years old and then part-time. • Medium career break between 26 and 34 years old and then full-time.

Table 3.2 - "Ideal" employment histories used by Di Gessa et al (2020).

similar health outcomes to those who had continuous attachment to the labour market until SPA. This suggests that for men in poor health, leaving employment before SPA may slow down further declines in somatic health and QoL at older ages" (Di Gessa et al 2020 p797). Those in the late starter/early exit group had "better somatic health and a significantly slower decline of QoL than men with continuous labour market attachment up to SPA. This is not unexpected as these men were in the most socio-economically advantaged group, and likely to have had better access to health services and material resources relevant for health throughout their lives, as well as the opportunity to retire earlier through choice" (Di Gessa et al 2020 p797).

Concerning women, poorer somatic health and QoL at baseline were reported by full-time employed and not employed throughout compared to those women taking career breaks. "Women who had taken breaks from paid work also reported higher QoL and somatic health over the 10-year follow-up period compared with women who had been continuously employed until SPA, even when selection effects, material and social resources were taken into account" (Di Gessa et al 2020 p797).

There was no relationship to depression for either men or women and any employment category.

Except walking speed, all data were self-reported, and work history may have included a recall bias. Some of the categories of employment history were small (eg: men mostly not employed throughout = 28 individuals), and no information was available on work-related characteristics

(eg: physically demanding; stress).

Reflecting on health post-SPA, three main conclusions can be drawn related to employment history:

i) Health disparities throughout life related to employment history continue post-SPA (with limited exceptions).

ii) Men in poorer health who retire early benefit most (ie: decline of age-related health reduced).

iii) Women with family-related career breaks and work have better health in later life (compared to always and never employed groups).

3.4. APPENDIX 3A - LONGITUDINAL STUDY

Strengths

1. The development of specific individuals can be followed.

2. Can study past events and future developments.

3. Useful to follow through an intervention and treatment, and the effects (particularly longer term).

4. Possible to establish the direction of a relationship (and causality).

5. Study trends over time.

6. Participant variables controlled - ie: overcomes the problem of "group equivalence" because the same participants are measured on repeated occasions (Coolican 2004).

Weaknesses

1. Time consuming (and expensive compared to one-shot studies) - A long wait for results (Coolican 2004).

2. Often small sample used.

3. Attrition/drop-out rate.

4. Reactivity - The participants can "become

conditioned to the study, and even learn the responses that they believe are expected of them (as they become familiar with the questionnaire); they may remember, and repeat, their previous responses; they can become sensitised to the research topic and hence altered (biased) in some way; there can be a reactive effect of the research arrangements – the 'Hawthorne' effect – as people change in some way simply as a result of being studied (Roethlisberger and Dickson 1939)" (Bowling 2014 p219).

5. Change may occur "simply owing to the ageing of the sample" (Bowling 2014 p223). This relates to the problem of distinguishing real change ("alpha change") from "beta or gamma changes" (Bowling 2014 p223).

6. Cohort effect: certain characteristics relevant to certain generations; eg: experience of World War II. This may confound any comparison between development studies (known as the "cross-generational problem") (Coolican 2004).

7. Recall bias with retrospective studies.

8. "Healthy survivor effect" - "the most vulnerable and ill members of a sample have died or dropped out, leaving the healthiest sample members for study, which will inevitably bias results. This can be an enormous problem with all topics (eg: people who are depressed may be more likely to drop out, thus leaving the most psychologically healthy in the sample and thus artificially improving post-baseline psychological measurements; people who die by the time of follow-up in clinical trials thereby leave the healthiest remaining in the sample, again artificially improving follow-up results)" (Bowling 2014 p229).

9. Stopping rules - When to stop the study or whether to publish interim results. "A policy on publication should be stated at the outset of research, and adhered to unless exceptional circumstances dictate otherwise, in order to avoid publication of misleading results. The policy should include the rules for the reporting of interim results (eg: taking into account the significance level required, and confirmation of results by triangulated methods)" (Bowling 2014 p232).

10. Regression to the mean - This "occurs when participants have an extreme measurement on a variable of

interest, which is short-lived and may simply be owing to an unusual and temporary distraction. For example, an extremely poor depression score at pre-test may perhaps be entirely because of a sleepless night. On subsequent measurements, this value will tend to return to normal, and thus, in this example, the score appears to have improved at post-test but in fact has simply reverted to normal. Some respondents, then, may be at the upper or lower end of a measurement scale simply because of regular individual fluctuations. There may also be normal fluctuations in levels of the variable of interest, which makes the careful selection of measurement instruments, multiple data collection periods, the timing of data collection periods and comparison with control groups (natural controls in the case of longitudinal surveys and randomised control groups in the case of experiments) essential" (Bowling 2014 p229).

11. Any mistakes at start of study cannot be removed or decisions made reversed (eg: unrepresentative sample), and modifications made mid-way "might ruin the potential for objective comparison" (Coolican 2004 p203).

12. Problems of generalising results

13. Difficult to replicate

14. Obsolescence in very long term studies

Prospective studies:

(+) Factors of interest are ascertained before the outcome of interest. This makes it possible to investigate causal hypotheses.

(+) Incidence and prevalence rates can be calculated.

(-) Data analysis cannot take place until enough "events" or 'outcomes' have occurred, so time must elapse.

(-) The process of following participants requires more resources than other types of study. The logistics are more complicated.

(-) Analysis may be complicated by attrition of

study participants.

Retrospective cohort studies:

(+) Are particularly useful for unusual exposures or occupational exposures.

(+) Can be very efficient because they take much less time and cost much less than prospective cohort studies.

(-) Might use whatever data available as exposure because the data being used was not designed to be used in a study. There might be lack of accurate information on other risk factors.

(-) May have recall errors.

(-) Might "miss" some of the population – e.g. already dead.

3.5. APPENDIX 3B - "AGEING WELL"

"Anti-ageing technoscience" describes the interest and research into "artificial healthspan [the period of life lived in good health] and lifespan extension" (Fletcher 2020). It encompasses a wide range of practices from anti-ageing skin creams to cryo-therapies (eg: freezing the body until future science has the appropriate knowledge to prolong life). Fletcher (2020) noted that "[A}s a social entity, anti-aging technoscience is intriguingly ambiguous, on the one hand resembling a social movement advocating utopian societal transformation, and on the other representing a form of biotech venture capitalism chasing a rapidly growing market" (p2).

The shared assumption is that ageing is a pathology. Not that individuals age and some develop pathologies like Alzheimer's Disease, but that "senescence" (physiological deterioration and functional decline over time) is the problem (Fletcher 2020).

A separate trend in social science in recent years is the "biological operationalisation of ageing", and the attempt to quantify the difference between individuals of the same chronological age. Take this example quoted by Fletcher (2020) of John and Kevin: "John, a wealthy 70-year-old who plays tennis at his local club and organises

fundraisers for a local charity, is unlikely to be the same social or biological age as Kevin, a poor 70-year-old who is limited to his flat by morbidity and rarely socialises beyond 15-min visits from carers. John and Kevin share a chronological age, but their biological and social ages are dissimilar. As a result, the respective influences of age, broadly conceived, within their lives are also dissimilar. Kevin is more likely to be the subject of negative age-based appraisals because he seemingly personifies negative imaginings of dependency, abjectness and decrepitude in old age... Kevin is an aged subject in ways that John is not" (p3).

Such heterogeneity between individuals has led to ideas like "biological age" and "subjective age". But what the example above and observations in everyday life show is the impact of "cumulative inequality" (ie: inequalities that increase over the lifespan) (Fletcher 2020).

Despite anti-ageing technoscience and the social science biological operationalisation of ageing being different strands of activity, Fletcher (2020) argued that they have an affinity in their defining of normal ageing as "healthy ageing" (or other terms like "successful ageing" or "active ageing"). But this "project" is seen as an individual thing. The focus is upon what the individual can do and has done, or can and has purchased to help in their ageing. In this sense, "cumulative inequality" becomes the individual's own fault. So, ageing is a moral event, and individuals can be judged as "good" or "bad" people depending on how they age. A behaviour like smoking over the lifetime leads to a "bad" ageing of illness as does being a member of a low socio-economic group.

Variations in life expectancy within societies or between societies are a product of phenomena that involve social interventions not individual products/solutions.

3.5.1. Biological Age

"Computational ageing clocks" based on various biomarkers may be possible to show how biological age has accelerated or slowed relative to chronological age in different individuals. For example, the composition and function of the gut microbiome varies with age, and aspects of the genetics of the microbiome is thus used as a computation ageing clock (Gopu et al 2020).

Gopu et al (2020) used a dataset of 90 000 stool samples from a Californian company, “Viome” (Le Page

2020). These were the stool microbiome measured for customers of Viome's "Gut Intelligence" product.

Sub-groups of the sample were distinguished based on special diets (vegan, vegetarian, organic, paleo, ketogenic) (compared to no special diet), self-reported Irritable Bowel Syndrome (IBS), and diabetes (compared to healthy individuals), and heavy drinkers (fifteen or more drinks per week for men and eight or more for women) (vs non-drinkers).

Individuals eating a "paleo diet" (supposedly based on early hunter-gatherers) had an older biological age (than their chronological age) of about two years. Other patterns included low-carb, high-fat ketogenic diet and older biological age, also organic food-eaters, and high alcohol consumers. Vegetarians and vegans, however, had a younger biological age (Le Page 2020).

The findings are associations, so it is not possible to establish causation between diet and biological age.

Analysis of human genes in capillary blood was also used (based on a cohort of 1494 customers of Viome's "Health Intelligence" product).

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4. DEMENTIA VERSUS SUPER-AGERS

4.1. DEMENTIA AND ACTIVITY

The search for associations and causes of dementia require large population-based longitudinal studies of risk factors and variables. One such study is the UK Million Women Study (Floud et al 2021) (table 4.1).

- The UK Million Women Study involves 1.3 million women who were invited for breast cancer screening by the NHS at sixty-six centres in England and Scotland in the late 1990s (mean age 60 years old at that time). Participants were asked in the early 2000s about participation in adult education, art, craft, music, and singing groups, and sports clubs, yoga, and dancing. Time spent reading was also surveyed. The outcome measure of dementia was based on hospital records. Follow-up averaged sixteen years.

- Around one-third of the women reported participation in at least one of the cognitive and social activities, and these individuals were less likely to receive a dementia diagnosis in the first decade of follow-up compared to non-participants. The difference was lost in the second decade of follow-up. Likewise for reading versus non-reading.

- Floud et al (2021) concluded that their findings provided "strong evidence that, several years before dementia is diagnosed clinically, there is a progressive reduction in participation in various mental and physical activities, and that the activities themselves have little or no causal relevance to the incidence of dementia. In other words, the mental and physical activities assessed by our questions have, in themselves, no material protective effect against the development of clinically apparent dementia" (pe121).

Table 4.1 - Details of Floud et al (2021).

Floud et al (2021) reported that "the association between dementia risk and non-participation in adult education, cultural or art activities, and voluntary work was attenuated with time, indicating that changes in pre-clinical dementia states could cause increasing

inactivity as people age, rather than inactivity being a risk factor for later, clinically-diagnosed dementia" (Selbaek 2021 pe85) (appendix 4A). Selbaek (2021) raised concerns about the self-reported nature of explanatory variables in this study (table 4.2).

Strengths	Weaknesses
1. Prospective design means no recall problems. 2. Long-term study with little drop-out (only 1%). 3. Large number of dementia cases (over 31 000).	1. No information about duration and frequency of participation in cognitive and social activities. 2. Reading categorised as "none" or "any", and did not distinguish heavy or light readers, say, or type of material read. 3. Depended on accuracy of hospital records: "not all women with dementia will have been admitted to hospital, and some women with dementia must have been admitted to hospital without this being recorded" (Floud et al 2021 pe122).

Table 4.2 - Key strengths and weaknesses of Floud et al (2021).

Bloomberg et al (2021) investigated cognitive ageing and educational level. In particular, the rise of educational opportunities and attainment among women in recent cohorts and how this could reduce dementia risk (appendix 4B).

Selbaek (2021) noted: "Most studies on prevalence and incidence of dementia indicate that a higher proportion of women have dementia compared with men, but whether this difference can entirely be explained by women having longer life expectancy than men remains controversial" (pe85). But studies on dementia "usually include sex as an adjustment co-variate, but rarely stratify according to sex" (Selbaek 2021 pe85).

Another issue is the outcome measure, namely memory, and how it is tested. For example, immediate recall and semantic fluency (measures of verbal memory) are common, whereas delayed recall could be as relevant (with its close association with Alzheimer's Disease) (Selbaek 2021).

4.2. NOISE AND DEMENTIA

Transportation noise generally has been "consistently linked" to health problems like coronary heart disease, via stress reactions, while such noise at night impacts sleep and the immune system (Cantuaria et al 2021).

A study in Denmark by Cantuaria et al (2021) has added the risk of dementia to the associations with long-term exposure to transportation noise exposure. Data on the whole population over sixty years old covering 2004 to 2017 were available from different sources. Firstly, individuals with a diagnosis of dementia came from the Danish National Patient Register or the Danish Psychiatric Central Register.

Road traffic and railway noise were modelled for the whole country (ie: each house) from samples taken between 1994 and 2017. Co-variates like neighbourhood level socio-economic status, proportion of green spaces, and individual demographics were collected.

The risk of all types of dementia increased with exposure to louder transportation noise, but Alzheimer's disease had the highest risk of the different types of dementia.

In terms of co-variates, less population density was a greater risk, as well as living in detached homes, but less risk for higher income. Cantuaria et al (2021) commented that "the presence of many competing noise sources in highly populated areas from, for example, community life, might lead to masking of the association between transportation noise and dementia" (p9).

This prospective study had a large sample (1.94 million individuals), long follow-up (13 years), and "high quality assessment of noise exposure" (Cantuaria et al 2021 pp6-7). But the researchers "lacked information on factors that might affect personal exposure to noise, such as sound insulation in homes, which increases the risk for exposure misclassification" (Cantuaria et al 2021 p7). Other sources of noise, like airports and construction sites, were not included. However, Cantuaria et al (2021) pointed out another strength: "Most studies on transportation noise and health have assessed noise only at the most exposed façade of a building. In our study we also assessed exposure at the least exposed façade, which we hypothesise to better describe noise exposure during sleep, given that bedrooms are often located at quiet sides of the buildings" (p8).

There was no information on lifestyle factors which could impact dementia. Finally, the use of national registers of diseases "cannot rule out that outcome misclassification was a problem, mainly for definition of sub-types [of dementia]" (Cantuaria et al 2021 p7).

In comparison to previous research, Cantuaria et al (2021) noted three similar studies:

a) Carey et al (2018) - 130 000 adults in London using medical records over nine years. Road traffic noise level calculated at postal code level.

b) Yuchi et al (2020) - 678 000 Canadian residents. Also road traffic noise calculated at postal code level.

c) Andersson et al (2018) - 1721 adults in Sweden. Diagnosis of dementia by specialists. Noise exposure was categorised into two groups only for analysis.

"In all the studies, researchers found no indications
of an association between transportation noise and risk of dementia" (Cantuaria et al 2021 p7).

4.3. SUPER-AGERS

The Northwestern University SuperAging Programme has found that "Super-Agers" (adults over eighty years old) have episodic memory performance on tests as good as individuals aged 50-65 years old (eg: Rogalski et al 2013), but their non-memory cognitive performance is typical of their chronological age (Cook Maher et al 2017).

The Rey Auditory Verbal Learning Test (RAVLT) (Schmidt 2004) is a standard measure of episodic memory. The individual listens to a list of fifteen words and then, after a short delay, recalls them. The Super-Agers had a median score of eleven compared to seven for same-age controls (Cook Maher et al 2017).

Brain scans of Super-Agers (eg: Harrison et al 2012) found that they had "a significantly thicker brain cortex than their cognitively average, same-age peers and did not show significant cortical thinning compared to cognitively average middle-age adults. Super-Agers also had a significantly larger left anterior cingulate than both the cognitively average-for-age elderly and middle-age groups. This cortical preservation is unusual as age-

related cortical atrophy is well documented beginning in early adulthood" (Cook Maher et al 2017 p2).

Post-mortems found a higher density of von Economo neurons (VENs) in the anterior cingulate area of Super-Agers' brains. VENs are believed "to play a role in complex social cognition, intuitive assessment of complex, often uncertain, situations, and facilitation of fast communication with other brain regions" (Cook Maher et al 2017 p2).

The picture emerging is that Super-Agers have "unique biological characteristics" (Cook Maher et al 2017).

Gefen et al (2021) reported data from post-mortem studies of the brains of seven SuperAgers and six controls (mostly female). The key finding was that neurofibrillary tracts (NFTs) in the entorhinal cortex was significantly higher in the controls. NFTs are a hallmark of Alzheimer's disease. SuperAgers appear to be resilient to the effects of cognitive decline, which would also explain their superior memory performance.

Cook Maher et al (2017) surveyed 31 Super-Agers from the Northwestern University SuperAging Programme and nineteen same-age controls on psychological well-being using the Ryff 42-item Psychological Well-Being Questionnaire (PWB-42) (Ryff 1989). The PWB-42 covers six domains of well-being: environmental mastery, personal growth, positive relations with others, self-acceptance, autonomy, and purpose in life (table 4.3). Each statement is rated from 1 (strongly disagree) to 6 (strongly agree), and a higher score indicates better psychological well-being.

The only significant difference found was the domain of positive relations with others, where Super-Agers scored higher than controls. This finding "could conceivably have a biological relationship to the greater thickness of the anterior cingulate gyrus and higher density of von Economo neurons previously reported in Super-Agers" (Cook Maher et al 2017 pp1-2).

Both groups scored high on the PWB-42 domains, and that explains the lack of significant differences.

PWB-42 Subscales	Definition & Sample Item
Autonomy	Independence, self-determination; ability to resist social pressures. *"I have confidence in my opinions, even if they are contrary to the general consensus." "It is difficult for me to voice my own opinions on controversial matters."*
Positive Relations with Others	Satisfying, warm, trusting, high-quality relationships with others. *"I know that I can trust my friends and they know they can trust me." "I often feel lonely because I have few close friends with whom to share my concerns."*
Environmental Mastery	Mastery and competence in managing one's life and environment. *"I am quite good at managing the many responsibilities of my daily life." "I often feel overwhelmed by my responsibilities."*
Personal Growth	Feeling of continued development; being open to new experiences. *"It is important to have new experiences that challenge how you think about yourself and the world." "There is a truth in the saying that you can't teach an old dog new tricks."*
Purpose in Life	Belief that one's life is meaningful; aims and objectives for living. *"I have a sense of direction and purpose in life." "My daily activities often seem trivial and unimportant to me."*
Self-Acceptance	Positive attitude towards, and acceptance of, one's self and past. *"When I look at the story of my life, I am pleased with how things have turned out." "My attitude about myself is probably not as positive as most people feel about themselves."*

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(Source: Cook Maher et al 2017 table 2)

Table 4.3 - Details of domains of PWB-42.

4.4. APPENDIX 4B - PHYSICAL ACTIVITY

A number of studies have suggested a protective effect of physical activity for dementia, though other studies are inconsistent in such findings (Sabia et al 2017). One problem is the length of the study, "typically less than ten years", which Sabia et al (2017) overcame with data from the Whitehall II study.

The Whitehall II cohort involves over 10 000 middle-aged and older adults who worked for the British Civil Service in London in 1985-88. Subsequently, data were collected every five years.

Cognitive function was tested in different ways, like the cued recall of twenty words, and as many words beginning with a certain letter in a set time ("phonemic fluency"). A global cognitive score was calculated. Dementia was measured by diagnosis on an individual's medical record, while physical activity was self-reported for frequency and duration (eg: general housework; cycling; running), and converted into metabolic equivalent (MET) value (where 1 = lying quietly and 3 = mild physical activity, for example). Data were also available on health behaviours and socio-demographic variables, which could be confounders.

Over approximately 26 years of follow-up, 329 cases of dementia were identified, and these individuals were

compared to the rest of the sample.

There was no association between physical activity in 1985-88 and subsequent dementia diagnosis. Sabia et al (2017) explained: "Physical activity levels were lower in the years leading up to diagnosis of dementia, suggesting that changes in physical activity might simply be part of the pre-clinical symptoms of dementia. We found no evidence of a slower rate of cognitive decline in people doing more physical activity" (p6).

Key strengths of study:

- Repeated measures of physical activity over many years.
- Long follow-up period.

Key limitations of study:

- Dementia measured by official diagnosis which misses undiagnosed and milder cases.
- Small number of dementia cases for comparison with rest of cohort.

4.5. APPENDIX 4B - BLOOMBERG ET AL (2021)

Bloomberg et al (2021) analysed data from two prospective cohort studies in the UK - the English Longitudinal Study of Ageing (ELSA) and the Whitehall II study. The ELSA involves adults over fifty years old recruited in 1998-2001, and interviewed approximately every two years (up to 2014 in this study). The primary outcome measure was memory.

Women had better memory than men, after adjusting for age, ethnicity, birth cohort, and level of education. Memory decline was faster in men than women among the over 15 000 participants born between 1930 and 1955 over the twenty years of follow-up approximately.

Level of education was a key variable for the gender differences with younger-old females, who had received better educational opportunities, having a greater memory advantage over men of the same age, than older-old (70 years and above). Bloomberg et al (2021) observed: "Continuing secular increases in access to education among women and the subsequent impact on cognitive function could change late-life cognitive outcomes for women in the future" (pe114).

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5. PROBLEM BEHAVIOUR

5.1. THREE TREATMENTS

The desire to address childhood problems has led to many different treatments. Here are three examples of different problems.

1. Parent-Child Interaction Therapy (PCIT) and oppositional behaviour.

PCIT combines the relationship of the parent (usually the mother) and the child with the principles of reward and punishment. At the core is the parent's attention which is given as the reward for appropriate behaviour and withdrawn as punishment. It also encourages the parent to interact positively with the child (Wickelgren 2016).

PCIT is attributed to Eyberg and Matarazzo (1980). There are two phases:

i) Child-directed interaction (CDI) - parents learn non-directive play skills to help the development of the quality of the parent-child interaction.

ii) Parent-directed interaction (PDI) - this focuses on the child's compliance, and "parents learn to direct the child's behaviour with clear, age-appropriate instructions and consistent consequences: praise for compliance and time-out for non-compliance" (Schuhmann et al 1998 p35).

Schuhmann et al (1998) reported a small randomised trial of PCIT with pre-school children.

- Participants - 64 families of 2-6 year-olds referred to a clinic in Florida for treatment of conduct problems. The children had an official diagnosis of "oppositional defiant disorder" (ODD).

- Design - An independent conditions study where 37 families were randomly assigned to immediate treatment (IT) and 27 to the wait-list group (WL).

- Measures - Multiple standardised measures of behaviours including parent-reported frequency and duration of problem behaviours, parent-child social interaction scored in a five-minute observation, parental stress, and observer-reported children's behaviour. Measures taken at baseline (Assessment 1) and four months later (during treatment; Assessment 2) [6].

- Treatment - One-hour sessions of CDI coaching where the parent is instructed on how to play with the child, and later, sessions of PDI until the parents have mastered the skills. The mean number of weekly sessions was thirteen.

The following hypotheses were tested:

a) Parents would interaction more positively with their children after PCIT - It was found that parents in the PCIT group praised their children significantly more in the WL group at Assessment 2, for example, and criticised them significantly less.

b) Parents would report less negative feelings after PCIT - Parental stress, for example, declined in the IT group between Assessment 1 and 2, but not in the WL group.

c) The child would show fewer parent-reported behaviour problems after PCIT - The scores of the IT group dropped while the WL group were unchanged.

d) The child would be more compliant with parents' commands after PCIT - This remained unchanged in the WL group, but increased significantly in the IT group.

In summary, "following PCIT, parents of pre-school children with conduct problem behaviour effectively changed their interactional style with their children and, as a result, children showed improvements that were both statistically and clinically significant" (Schuhmann et al 1998 p40). At Assessment 2, so far so good.

Table 5.1 summarises the key strength and weaknesses of this study.

STRENGTHS	WEAKNESSES

[6] Subsequently measures were taken at 8 months (end of treatment; Assessment 3) and twelve months (follow-up; Assessment 4). Boggs et al (2005) reported a long-term follow-up.

1. Sample of clinic-referred children with conduct problems from diverse socio-economic backgrounds. 2. Use of official diagnosis of ODD (DSM-IIIR). Most children had a co-morbidity (eg: ADHD), which is "typical of children referred for behaviour problems" (Schuhmann et al 1998 p42). 3. Both mothers and fathers involved in the study. Previous studies had tended to focus on mothers only (Schuhmann et al 1998). 4. Standardised measures of outcomes.	1. Only referrals or treatment-seekers at one clinic in the USA. 2. Despite random assignment, the IQ of the WL group was significantly lower than the IT group. So, this is a potential confounders. 3. Fifteen of the families in the IT group dropped out. So, it is possible that the success of therapy was due to more committed parents (ie: failures dropped out). 4. Due to it being a study, the therapy was free and unlimited, which is not the same as real-life where treatment sessions are restricted by funding.

Table 5.1 - Key strengths and weaknesses of Schuhmann et al (1998).

Reviews have found behavioural parent training interventions to be effective as a generalisation, but rarely have different interventions been compared (Thomas and Zimmer-Gembeck 2007).

Thomas and Zimmer-Gembeck (2007) performed a meta-analysis comparing PCIT and "Triple P - Positive Parenting Programme" [7]. Triple P has been developed to promote positive parenting by providing information and behaviour management strategies in a variety of ways (eg: Standard Tripe P: working with single families; Group or Enhanced Triple P: groups sessions) (eg: Turner et al 1998). The programme can be self-directed (eg: self-help manuals) or media-based (eg: television programmes).

Thomas and Zimmer-Gembeck (2007) found twenty-four studies published between 1980 and 2004 covering the application with 3-12 year-olds and their families. Overall, both interventions were found to "improve parenting, such as improving parental warmth, decreasing parental hostility, increasing parental self-efficacy, and reducing parental stress. Most versions of these interventions also reduce negative child behaviours, such as aggression and extreme tantrums and opposition" (Thomas and Zimmer-Gembeck 2007 p491). There was limited evidence on the long-term benefits (eg: three months after completion of intervention), and follow-up data were lacking.

[7] "The interventions were chosen for this review due to their similar theoretical foundations, and their wide-spread dissemination, popularity and significant level of government funding in both the USA and Australia, but their differing modes of delivery" (Thomas and Zimmer-Gembeck 2007 p490).

Comparing the two interventions, Thomas and Zimmer-Gembeck (2007) summarised the main findings thus: "Standard PCIT tended to have larger effects than Triple P when compared to wait-list and when outcomes were based on parent report of child negative behaviours and observed parent negative behaviours. In contrast, there was no effect size difference when findings were based on observed child behaviours and only one difference (Standard PCIT vs Media Triple P) for parent report of parenting. In addition, Standard PCIT did not have a larger effect than Enhanced Triple P, except when comparing observed parent negative behaviour" (p491).

The outcome measures used were important in terms of the success of the interventions. For example, treatment effects based on female caregiver reports were larger than from teacher-reported measures.

The methodological quality of the studies varied. For example, "the demographic characteristics of families included in many of the studies were unclear or may have been limited to moderate or higher income families" (Thomas and Zimmer-Gembeck 2007 p491). Thus, Thomas and Zimmer-Gembeck (2007) advised caution in generalising the findings to low income/socio-economic status, or high-risk families for either intervention.

Recruitment of families involved mostly volunteers/self-referrals or clinic-referrals, but, contrary to previous studies, Thomas and Zimmer-Gembeck (2007) found no effect on treatment outcomes of recruitment method.

The use of standard measures of parent-reported child behaviour was common, but there were differences in observational measures of children and parents, and the researchers could not "rule out the possibility that differences are due to the use of different measures" (Thomas and Zimmer-Gembeck 2007 p492).

Thomas and Zimmer-Gembeck (2007) ended that "we tentatively conclude that PCIT meets the criteria for a 'well-established treatment' and Triple P meets the criteria for a 'probably efficacious treatment'. We were precluded from describing Triple P as a well-established treatment, because our search revealed that Triple P evaluations have not yet been conducted by two independent investigators or investigatory teams" (p493).

2. Early Start Denver Model (ESDM) and autism spectrum disorder (ASD).

Individuals with ASD struggle with social cues and hence have problems with social interactions. ESDM encourages the child to focus attention, say, on a toy, and develops "interactive play" between the adult and the child. This requires long-term and intensive training (eg: 2000 hours) (Lange and McDougle 2016).

In a randomised controlled trial, Dawson et al (2010) found that ESDM led to significant improvements in IQ, language, adaptive behaviour, and autism diagnosis among toddlers with ASD. The researchers also reported, in passing, changes in electroencephalograph (EEG) activity in response to faces, which intrigued the researchers. So, Dawson et al (2012) focused on this change in brain activity patterns.

Dawson et al (2012) randomised 48 18-30 month-olds with ASD in the USA to receive ESDM or community intervention. ESDM involved trained therapists working individually with the children for two hours, twice a day, five days a week, for two years, using behavioural techniques, as well as training the parents. The community intervention was mostly support to the parents. As well as EEG readings in response to faces and patterns, behavioural measures were taken.

The ESDM group showed significant improvements in all behavioural measures compared to the control group. The EEG measurements were found to correlate with social behaviour improvements. Dawson et al (2012) explained that ESDM has "a strong focus on promoting social engagement through relationship- focused activities that the child finds rewarding. It is possible that such activities, which are designed to enhance the reward value of social interactions and thereby increase attention and engagement with the social environment, contributed to the pattern of greater cortical activation when viewing social stimuli found in this study" (p1158). In effect, ESDM was associated with "normalised brain activity patterns" in the children with ASD.

Dawson et al (2004) has suggested that "decreased social attention and social motivation during the infant-toddler period have secondary consequences on brain and behavioural development of young children with ASD, exacerbating the social impairments characteristic of ASD. Early intervention that promotes attention to people and increases the motivation to engage in social interactions may serve to mitigate the emergent effects of ASD on later behavioural and brain development" (Dawson et al 2012 p1158).

3. Anxiety and cognitive-behavioural therapy (CBT).

CBT is based on the assumption that "faulty thinking" underlies maladaptive behaviour, and so by changing the thinking, the behaviour will follow (Bubrick 2016).

Around 10% of children experience some form of anxiety disorder, some of which are "long lasting and interfere with their development and functioning" (Reynolds et al 2012 p252).

CBT has been found to reduce the symptoms in studies and meta-analyses (Reynolds et al 2012). But many of the latter cover only certain anxiety disorders, and Reynolds et al (2012) argued for a meta-analysis of all childhood anxiety disorders and all psychological therapies.

Reynolds et al (2012) did this, and factored in the age of the child, and the mode of delivery of the treatment (eg: parental participation). Fifty-five randomised controlled trials were found (published up to 2011). Most of them involved CBT (n = 45).

Overall, psychotherapy was better than no psychotherapy (whether the control group was a wait-list (passive) or supportive counselling (active)). CBT was effective in reducing symptoms for anxiety disorders generally, as well as for specific disorders (post-traumatic stress disorder (PTSD); obsessive-compulsive disorder (OCD); social phobia). There were insufficient trials with other anxiety disorders (eg: school anxiety).

In terms of the age of the child, where there were details (from 4-5 years upwards), all age groups benefited from psychological treatment (though there was great variety between the studies). Overall, the size of the benefits increased with age.

For the mode of delivery, parental involvement in the child's treatment was not associated with better outcomes, individual CBT produced greater benefits than group CBT, and more sessions of treatment were better (nine or more best).

The methodological quality of the studies in the meta-analysis improved with later publication date. However, there were "some elements of psychological therapy which preclude the use of the most stringent trial designs; ie: psychological therapy cannot be delivered by therapists who are blind to the treatment they are delivering and thus double-blind designs cannot be used" (Reynolds et al 2012 p259). Important details

needed were the process of the randomisation of participants to treatment or control, drop-out/attrition, adherence to treatment, and length of follow-up. Often the control group was offered treatment at the end of the study, and so long-term follow-up of treatment versus control was not possible. Denying individuals treatment beyond a certain period of the study is "a serious ethical and practical problem for which it is hard to find a solution but which may be partly ameliorated by the use of an active control condition (as opposed to a wait-list control condition" (Reynolds et al 2012 p260).

Outcome measures were often self-reported by the children and adolescents. Reynolds et al (2012) also noted that "the almost complete absence of reporting the adverse effects of psychological therapy. This is presumably due to the assumption that psychological therapy cannot be harmful to participants but this assumption is questionable and at the least requires confirmation" (p260).

5.2. PRE-NATAL EXPERIENCES

Longitudinal birth cohort studies follow groups of children from pre-birth for a number of years. Such studies have shown the association between pre-natal experiences and later problems (eg: starvation of the pregnant mother, and foetus, and psychiatric problems in young adulthood; Susser et al 1996).

"Everyday" events during pregnancy, like maternal infections, or substance use, can have an impact, but "dosing of exposure seems to matter" (Roffman et al 2021 p2) (eg: maternal heavy alcohol use has greater impact than moderate use).

What about multiple pre-natal insults? the cumulative effects of adverse post-natal experiences have been established (Roffman et al 2021). "Whether exposure to multiple common insults during pregnancy also exerts a dose-dependent risk for psychopathology remains unclear" (Roffman et al 2021 p2).

The Adolescent Brain and Cognitive Development (ABCD) Study (Garavan et al 2018) provides an opportunity to study this question. It involved 11 875 9-10 year-olds recruited in the USA, but Roffman et al (2021) used data for 9290 of the participants (ie: not twins). The main caregiver was asked about the child's pre-natal experiences, including maternal use of substances, pregnancy complications, birth complications, and pre-term birth. Analysis of the data distinguished between

children with siblings and without. This was done to control for potential family confounders.

The Child Behaviour Checklist (CBCL) was used to measure the child's current problems (eg: anxious/depressed; social problems; aggressive behaviour). A number of co-variates were also measured (eg: caregiver education; maternal age at birth; family conflict).

Two hypotheses were tested:

i) The association between individual adverse pre-natal experiences and psychopathology at ten years old.

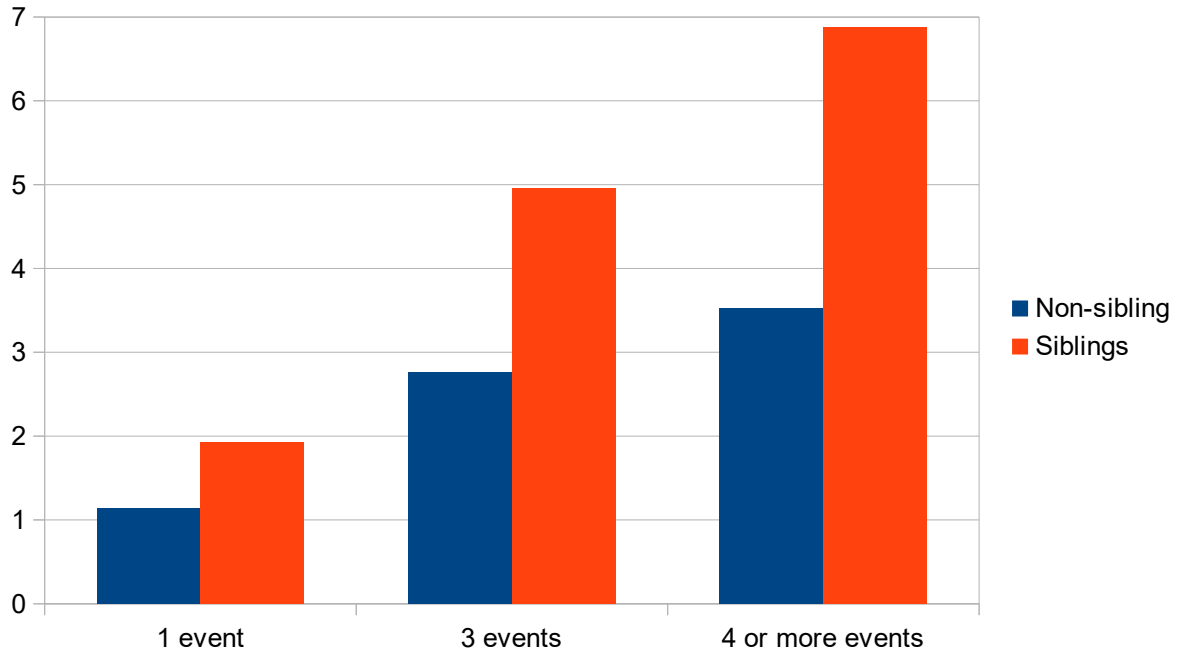
ii) The combined effect of individual adverse pre-natal experiences and psychopathology.

Among children without siblings, the hypotheses were supported. Six of eight pre-natal experiences (unplanned pregnancy; pregnancy complications; birth complications; maternal use of tobacco, alcohol, or marijuana in early pregnancy) were associated independently with a higher CBCL score. The combination of these experiences increased the risk of psychopathology at ten years old (eg: three events and an increased risk over twice that of zero events, while four or more pre-natal experiences increased the risk of psychopathology over threefold).

The pattern of findings was supported in the children with siblings group, and in some cases a stronger association (eg: four or more events and over sixfold risk of current problems) (figure 5.1).

This study could not explain the mechanism for the associations, but other work has suggested common biological pathways that, for example, "implicated the placenta in mediating the relationship between obstetric complications and offspring risk for serious mental illness" (Roffman et al 2021 p11).

The pre-natal data were retrospective reports, and though the prevalence rates were similar to averages, Roffman et al (2021) accepted that "the present design may have introduced recall error and bias that a fully prospective study with objective reporting from medical records could minimise. While some factors (eg: obstetric complications) have been shown to be robust to long-term recall in other studies, other factors vary in their reliability for complex reasons that could over- or underestimate the results. For example, substance use during pregnancy is commonly under-reported..." (p12).



(Data from Roffman et al 2021 tables 2 and 3)

Figure 5.1 - Fully adjusted odds of high CBCL score for children with and without siblings (where 1.00 = zero pre-natal events)

Roffman et al (2021) argued that any "limitations should be weighed against the many strengths of the ABCD Study: a cohort that is large, racially and socio-economically diverse, relatively homogenous with regard to age, and uniformly characterised; inclusion of a range of potential post-natal exposures that are known to influence psychopathology; and the opportunity to control for other unmeasured, family-level confounders through replication in a sibling cohort" (p12).

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6. SUPPORTING MOTHERS

6.1. INTRODUCTION

Emmott et al (2021) observed that certain "intensive mothering norms that are pervasive in the West co-exist with the expectations of maternal sacrifice: amplified by Bowlby and Ainsworth's Attachment Theory, maternal devotion is often assumed to be crucial for optimal child development, and putting their children first over and above their own well-being is fundamental to being 'good mothers'" (p2).

But historically, and outside the West today, childrearing is more widely supported (ie: beyond the nuclear family). "The assumption that mothers are, and evolved to be, sole caregivers, and that motherhood should come at the expense of all other domains of womanhood, contrasts and conflicts with the realities of raising children across the globe" (Emmott et al 2021 p4).

6.2. INTENSIVE MOTHERING

Motherhood is socially constructed as Dally (1982) explained: “There have always been mothers but motherhood was invented. Each subsequent age and society has defined it in its own terms and imposed its own restrictions and expectations on mothers. Thus motherhood has not always seemed or been the same” (quoted in Budds 2021). The model in the UK and the USA (and other high income countries) has been called “intensive mothering” (Hays 1996).

This describes the mother as the main caregiver, and despite social changes, motherhood is "tied to femininity" (Budds 2021). Increases in women working outside the home, and greater involvement of fathers in childcare has not changed the dominant ideological-based pattern, argued Budds (2021).

It is assumed that "the nuclear family 'continues to lie at the centre of national and international social policy in terms of defining relationships, responsibilities and economic futures' [Burden 2017] despite the fact that it increasingly fails to represent a typical family structure" (Budds 2021). While developmental psychology has focused on the mother for failings (Budd 2021). Budd (2021) stated: "Not only is the issue that women are required to take the lion's share of the parenting, but the way in which women are required to care has become increasingly problematic". This is "intensive mothering" that presents "good" mothering as "child-centred, expert-guided, emotionally absorbing, labour intensive and financially expensive" (Hays 1996 quoted in Budds 2021). Douglas and Michaels (2004) argued that "the ideology of intensive motherhood demands unrealistic and, for many, unreachable expectations of mothers. Intensive mothering foregrounds conservative feminine identities and 'redefines women, first and foremost, through their relationships to children'" (Budds 2021).

A practical issue is that providing social support (formal or informal) for mothers may threaten the "good" mother identity and ultimately be rejected. Budds (2021) explained that social support "needs to be permissible for women to seek support with childcare and prioritise their own well-being without it damaging their perceived access to a 'good mother' identity. This is important to ensure sharing childcare tasks enhance well-being, rather than cause further damage through self-apportioned guilt for not being always accessible".

More widely, the "male breadwinner-female homemaker nuclear family" is often presented as the traditional family in the West (or Global North), but Sear (2021) argued that evidence from a wide range of disciplines puts co-operative reproduction as the traditional human form (ie: multiple individuals beyond the mother help raise children).

Sear (2021) pointed out: "Inaccurate assumptions about the 'traditional' human family matter because they are reflected in academic research, policy and health interventions, and popular discussions, meaning they have

the potential to distort research, hamper attempts to improve health and well-being, and feed into problematic political narratives. These assumptions also spread into research and public health interventions in the Global South, given the loudness of the Global North's voice in these arenas". She blamed evolutionary research in particular for promoting the vision of an evolutionary past for humans with "man the hunter" and woman the carer. Other fields, like the social sciences, have built on such assumptions. "What all of these lines of research which emphasise the male breadwinner nuclear family have in common is that they arose shortly after the Second World War, as many academic disciplines burgeoned. It was during this time period that the idealisation of the male breadwinner nuclear family reached its zenith in the West" (Sear 2021).

Sear (2021) stated her view: "A more accurate picture of the human family is one of flexibility". Research on evolutionary and cultural differences in families show a core feature of pair-bonds, but in the context of wider involvement of the group/community (including intergenerational support).

6.3. NON-MATERNAL CAREGIVERS

Non-maternal caregivers (eg: non-related female juveniles; grandmothers; female siblings) (allomothering) lighten the mother's "workload". Page et al (2021) observed this among a foraging population in the northern Philippines (the Agta).

A large number of individuals were involved in providing childcare, but grandmothers and "collective playgroups" by non-relative juveniles were more beneficial for mothers' energetic burdens. The mothers had the option of re-investing the "saved" energy in the current child or preparing for the next one.

Meehan et al (2013) calculated that mothers, among the Aka hunter-gatherers, saved 150 kcal of daily energy expenditure where there was grandmaternal care.

Page et al (2021) argued that the "playgroups" "run" by older children showed the importance of children as caregivers: "While children caring for children is often conceptualised as harmful in the West, where children are 'forced' to care instead of play under disadvantageous circumstances, our results reiterate the important and positive role children can occupy as caregivers. Indeed, our findings suggest children can be competent caregivers without conflicting with play, challenging the Western

notion of the need to 'protect' children from caregiving responsibilities".

Maternal grandmother support in child care is particularly important for first-time mothers. "Rearing children is not instinctive, and first-time mothers may find it stressful due to the need to develop maternal skills, and their responsibility for the baby's well-being as well as themselves. In challenging environments, their lack of confidence and inexperience may contribute to higher levels of infant mortality, compared to mothers of higher parity. Moreover, difficulties rearing the first child may undermine the capacity to invest in future offspring, or delay the birth of the second child" (Vazquez-Vazquez et al 2021 p1).

For example, among Himba pastoralists in Namibia, new mothers receiving informational, emotional and practical support from grandmothers had better nutrition for themselves and their offspring (Scelza and Hinde 2019).

Vazquez-Vazquez et al (2021) reported similar benefits in a study of ninety Indigenous new mothers in Yucatan, Mexico (52 with grandmother support and 38 without [8]). Grandmothers providing advice on infant feeding was positively associated with healthy children (in terms of nutrition) at two years old. However, "direct support of grandmothers to mothers of two-year old children was not associated with differences in maternal stress, child temperament or maternal and child nutritional status, compared to mothers lacking such support" (Vazquez-Vazquez et al 2021).

The context is important as Sear (2008), for example, found greater child mortality when maternal grandmothers and maternal aunts supported the mothers in rural Malawi (Vazquez-Vazquez et al 2021).

6.4. PAID CHILDCARE

Supporting mothers with paid employment has "received relatively little attention to date" in relation to sub-Saharan Africa (SSA). This is partly because it is assumed that family members with provide free care, but "for many young children (especially those growing up in informal urban areas), other caregivers, including non-family members, play crucial roles too" (Hughes et al 2021 p2).

Urbanisation leads to smaller families (ie: less

[8] "Without support" was based on grandmother dead or living in another city.

adults available to provide free childcare), and to increased paid employment for both parents. "The absence of widespread paid maternity leave and effective social protection systems in urban informal settlements in SSA means that many working mothers need to return to work soon after childbirth. This is especially the case for the many parents who work in the informal economy, who are likely to have low and irregular earnings, and few if any labour rights" (Hughes et al 2021 p2).

Reviewing the "handful of studies" on paid childcare (especially in slums), Hughes et al (2021) found the estimate that nearly half of employed parents in the Korogocho slum in Nairobi, Kenya, used paid childcare as "the primary childcare strategy".

The quality of childcare provided varied, but was "frequently poor" (eg: few staff to many children; little training of staff; limited learning resources for children). "Conditions are often unsanitary and unsafe, and the first aid skills of providers have been found to be poor, risking the health and safety of children. Nutrition in informal paid childcare provision has been found to be poor where it has been studied (poor diets, little support provided to even young infants). Little is known about safeguarding risks in these settings, but numerous reports, including media reports of deaths in care, suggest that systems are absent or weak" (Hughes et al 2021 p3).

Hughes et al (2021) felt that "improving childcare may be an under-explored strategy to help some of the world's most disadvantaged children in the most important period of their lives..." (p1).

6.5. VOLUNTEER SOCIAL SUPPORT

McLeish and Redshaw (2021) explored the role of trained volunteers to provide social support to disadvantaged women during pregnancy and after in the UK. “There are significant health inequalities for disadvantaged mothers and their babies in the UK. They are both at increased risk of poor physical and mental health outcomes if the mothers are poor, migrants, from Black, Asian and minority ethnic communities, single or young. These outcomes may be influenced by poorer access to maternity and child health services and the effects of stressful life events or chronically stressful circumstances” (McLeish and Redshaw 2021 p1).

Social support can work with the latter, “directly with the stressor (problem-focused coping assistance),

help to cognitively redefine the stressor as less threatening (perception-focused coping assistance) or alter the person's reactive self-perception (emotion-focused coping assistance). In addition, social support may improve emotional well-being by offering companionship, a sense of belonging and mattering to other people" (McLeish and Redshaw 2021 p2).

McLeish and Redshaw (2021) interviewed 47 women who had received volunteer social support in 2013-14. Their disadvantage was characterised in different ways including long-term health conditions or disability (eg: living with HIV) (n = 9), poor mental health (n = 25), English not first language (n = 35), asylum seeker/refuge (n = 13), ethnic minority (n = 29), young (n = 10 under 25), and single parent (n = 21). The women had multiple disadvantages.

The interviews lasted up to 90 minutes, and five themes emerged related to the support provided by the volunteers:

i) "Structural support and companionship" – The volunteers provided basic support and companionship to socially isolated women. Interviewee M012, for example, described the importance of the relationship – "she come like sister to me" (p3).

ii) "Emotional support and emotion-focusing coping assistance" - "Visits from an unpaid volunteer gave vulnerable mothers the sense that they had an individual social value. All the volunteers were trained in the techniques of active listening, and their non-judgemental demeanour enabled mothers to speak freely, unburden themselves of thoughts they had been keeping to themselves, and experience unconditional acceptance" (McLeish and Redshaw 2021 p3).

iii) "Appraisal support and perception-focused coping assistance" – The volunteers were able to help the mothers reframe their experiences more positively, while non-directive information allowed the mothers to maintain their agency.

iv) "Informational support and problem-focused coping assistance" – The volunteers were trained to give evidence-based information about pregnancy, birth, and parenting, and practical advice (eg: free source of baby clothes in local area).

v) "Practical support and problem-focused coping

assistance" – eg: the volunteers accompanied the mothers to appointments.

Overall, the volunteers were able to provide many forms of coping assistance (table 6.1). "Many mothers described themselves in ways consistent with very low self-esteem and self-efficacy. These self-perceptions were modified over time, with mothers gradually feeling themselves worthy of attention and care" (McLeish and Redshaw 2021 p6).

McLeish and Redshaw (2021) ended: "Evidence from this study indicates that volunteer social support has particular salience for women who lack structural support and have complex needs that are not easily met within conventional care, for example, mothers who are recent migrants and those experiencing multiple complex disadvantages" (p7).

- "If she wasn't there I would feel like alone, crying every day" (M010) (social isolation).
- "When the problem is really, really much I feel depressed, I just smash everything on her and she listens to me" (M028) (lack of confidence).
- "They show me another way of looking at it, where sometimes I'm very narrow-minded" (M019) (negative thoughts).
- "She told me everything…When I went for labour, when I gave birth, when I had a baby, it was like it wasn't new to me" (M032) (lack of information).

(Source: McLeish and Redshaw 2021 table 2)

Table 6.1 – A selection of quotes from the mothers and types of stressors helped.

6.6. INVOLVING FATHERS

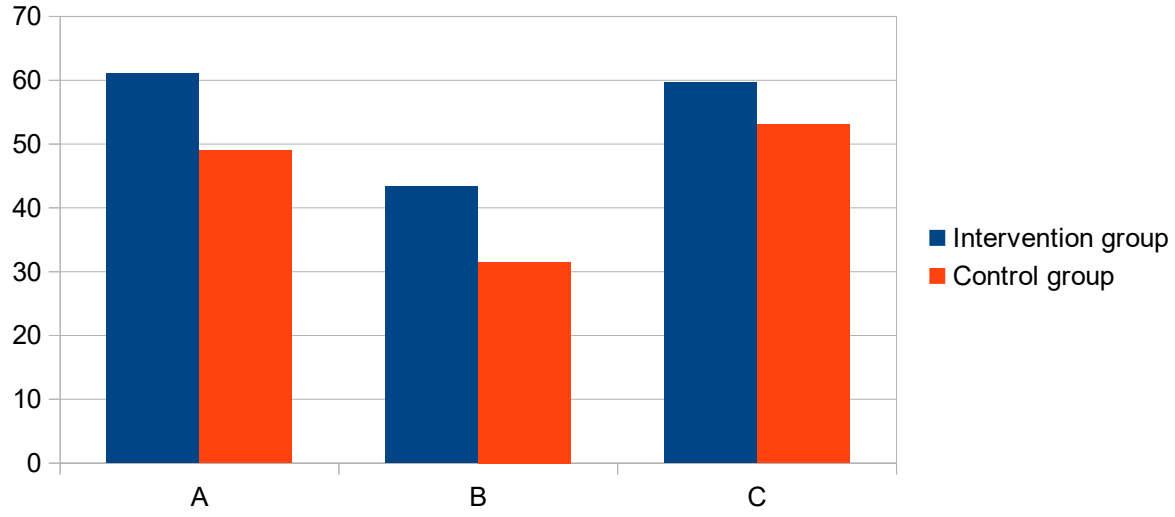
Daniele et al (2018) observed: "Ending preventable maternal and perinatal mortality necessarily involves engaging with families and communities. Male partners, in particular, exert a considerable influence on women's use of reproductive health services and participate in decisions that affect health outcomes" (p450). Concentrating on SSA, few men join their pregnant partners at health appointments, despite women wishing it in the main (Daniele et al 2018).

In the case of Burkina Faso, post-natal care is

limited, and women experience other health vulnerabilities (eg: the ability to initiate contraception after childbirth), which "reflect women's social and economic disadvantages in a country that is characterised by patriarchal family structures, polygyny and women marrying older men. Although childbearing and the care of young children are considered female domains, men are usually the ultimate decision-makers on care-seeking" (Daniele et al 2018 p450).

Daniele et al (2018) reported a study of an intervention to involve male partners of pregnant women in care-seeking in Burkina Faso. It was a randomised controlled trial. The women randomly allocated to the intervention group were invited with their male partners to three educational sessions during pregnancy and after. There were three primary outcome measures – women's attendance at post-natal clinics, exclusive breastfeeding for the first three months (appendix 6A), and the use of effective contraception after childbirth. Follow-up occurred three and eight months after birth, and 1144 women were involved.

The intervention group had higher numbers of women on the three outcome measures than the control group (figure 6.1).



(A = Women's attendance at ≥2 scheduled post-natal clinic appointments; B = Exclusive breastfeeding 0-3 months old; C = Use of effective modern contraception 8 months after childbirth)

(Data from Daniele et al 2018 table 5 p457)

Figure 6.1 – Percentage of women on three primary outcome measures.

Daniele et al (2018) offered some possible

explanations for the findings:

a) The educational sessions encouraged communication between spouses, and "the opportunity to start conversations about issues they were not used to discussing openly. Moreover, in a context where men are seldom exposed to advice from health workers, the intervention may have enabled them to be better informed when participating in these conversations" (p457).

b) Women felt more confident to initiate contraception because of their male partner's participation in the educational sessions.

c) Women are often pressurised by mother-in-laws to feed their babies with traditional herbal water, instead of breastmilk, and male partners in the intervention group were educated to challenge their mothers.

d) More frequent contact with health workers in the intervention group reinforced positive messages.

All outcomes were self-reported, and Daniele et al (2018) admitted that an "inability to guarantee that outcome data collectors were fully blinded to the study allocation may have increased the risk of courtesy or social desirability bias in participants' responses" (p457). There was no control over interactions in the community between participants in the intervention and control groups (Daniele et al 2018).

From an evolutionary viewpoint, Gettler et al (2020) focused on male testosterone (T) and parental care. "In particular, males' T is often higher during periods in which they compete with other males for mating opportunities and for resources (eg: territory) that help them attract mates. In contrast, during periods when males partner with females to raise young, their T often declines, which helps divert limited time and energetic resources towards that cooperative parenting effort and away from competition. Consequently, in such species, T has the potential to shape variation between males in health, survival, and reproductive fitness" (Gettler et al 2020 p1).

Gettler et al (2020) compared T among 29 males of the BaYaka, who are an egalitarian people, and 16 males of the Bondongo society, where there is a patriarchal hierarchy (ie: fathers not involved in childcare). Both groups are living in the northern Republic of the Congo.

Co-operative BaYaka fathers had lower T than their peers, and the Bondongo men. T was measured from saliva samples.

6.7. PERINATAL DEPRESSION

Maternal mental health is an important issue. "The physical, psychological and societal adjustments that occur during pregnancy, labour and the transition to motherhood are extensive and can increase women's vulnerability to developing mental disorders" (Fellmeth et al 2021 p1). Depression is particularly common, and among women in poverty (Fellmeth et al 2021).

Even more specifically, pregnant women "who are migrants or refugees are at risk of developing mental disorders as a result of the multiple psychological and socio-economic stressors endured before, during and after migration. Access to healthcare — vital to ensuring a healthy pregnancy, safe delivery and postnatal support — is all too often lacking for migrant and refugee women who can remain marginalised in their destination settings. Social isolation and the loss of family and social networks may be further exacerbated by language and cultural barriers in destination countries" (Fellmeth et al 2021 p2).

Fellmeth et al (2021) reported a study of such women attending ante-natal clinics on the Thai-Myanmar border. Data were collected in the first, second, and third semesters of pregnancy, and one month after birth from 451 women (refugees and migrants) between October 2015 and January 2018.

Initial data analysis by Fellmeth et al (2020) found that social support was key to combating depression. But a single composite measure of social support was used. Fellmeth et al (2021) had three separate measures:

i) Received social support - A version of the Social Support in the Post-Partum Period Scale (Chen et al 2011).

ii) Perceived sufficiency of support - "Do you feel you have enough support?".

iii) Partner support - "Does your husband support, care for and understand you?".

Depression was assessed using the Structured Clinical Interview for the Diagnosis of DSM-IV Disorders

(SCID). Controlled variables included domestic violence, and prior trauma and depression.

The prevalence of perinatal depression (ie: during pregnancy) was 39% among migrants and 47% among refugees overall. Received and perceived social support were significantly associated with depression among migrants, but only insufficient perceived support was significant for refugees. After controlling for all variables, low received support among migrants was the only significant association between support and perinatal depression among both groups. Most important in predicting perinatal depression among both groups was prior history of depression and/or trauma.

The study did not distinguish the severity of perinatal depression , and used self-reports for prior depression. No distinction was made over when the depression was experienced during the pregnancy. It was not possible to establish causality, as Fellmeth et al (2021) explained: "We cannot determine whether low levels of social support might lead to depression because women find it difficult to cope without support, or whether depression might be negatively influencing women's perceptions of support" (p7).

6.7.1. Maternal and Paternal Depression

Negative affectivity (NA) is a bias towards negative mood, appearing in infancy, and underlying depression and anxiety in later life. Maternal and paternal internalising symptoms (eg: depression and/or anxiety) have been linked to the development of NA in an infant (Spry et al 2020).

Spry et al (2020) investigated three related issues using meta-analysis:

i) The size of the association between maternal and/or paternal internalising symptoms and offspring NA - There was an overall significant positive association between maternal internalising symptoms and infant NA, and a significant positive association between paternal internalising symptoms and NA. The former was slightly larger (r = +0.17 vs +0.13). However, there were more studies of mothers (forty-two vs six on fathers).

ii) The associations and the different facets of NA - This is because "infant NA is often treated as an homogenous construct, yet it covers a range of facets including fear, frustration, sadness, and slow recovery

from distress that may each be differentially associated with parent internalising distress" (Spry et al 2020 p1) (table 6.2).

Maternal internalising symptoms were associated with the individual facets of NA, particularly sadness. This was also the case with paternal internalising symptoms, but there were few studies again. "Taken together, these findings provide support for parental patterning of general distress-proneness in infants" (Spry et al 2020 p13).

Infant fear was associated with maternal anxiety, but not depression. However, generally the interaction between depression and anxiety and NA was not studied. "Further research is needed to elucidate unique and joint contributions of each" (Spry et al 2020 p13).

- Sadness - "Did the baby seem sad when the caregiver was gone for an unusually long period of time?"
- Fear - "How often during the last week did the baby startle to a sudden or loud noise?"
- Frustration/irritability - "When placed on his/her back, how often did the baby fuss or protest?"
- Slow recovery from distress - "When frustrated with something, how often did the baby calm down within 5 minutes?"

(Source: Spry et al 2020 table 1)

Table 6.2 - Facets of NA and examples of items used to measure them.

iii) The timing of parental symptoms and their impact on NA (ie: pre-conception, during pregnancy, and after birth) - "In mothers, associations between internalising symptoms and infant NA did not vary by timing of exposure across pregnancy and the post-partum, or by age of infant at time of NA assessment" (Spry et al 2020 p13). Based on few studies, paternal post-natal depression had the strongest association with infant NA for fathers.

This meta-analysis was based on 45 studies (up to early 2020), which varied in different ways, including measurement of NA and its facets (eg: Toddler Temperament Questionnaire; Early Infant Temperament Questionnaire), and the moderating variables (eg: age of child at assessment; mode of assessment of NA).

6.8. MATERNAL NUTRITION

Undernutrition is a risk for potential mothers in many low- and middle-income countries, as it increases the risk that infants will be born pre-term, small for gestational age, or dead (appendix 6B). At the same time, obesity and its health problems may co-exist in such countries (Shenk et al 2021).

Shenk et al (2021) investigated the factors that might protect women of reproductive age from both weight- and nutrition-related problems. Social support is seen to be key. Either directly, food is shared to help with undernutrition, or indirectly with childcare which reduces the mother's energy expenditure. Social support also reduces stress, and stress is known as a risk factor for obesity.

Shenk et al (2021) studied 677 randomly-sampled women in a rural area of Bangladesh. Women with larger social networks (ie: relatives nearby) were less likely to be underweight (based on body mass index; BMI), and also "marginally" more likely to be overweight (but not obese). This is "consistent with greater access to food or reduced workloads" (Shenk et al 2021).

The relationship between iron deficiency (taken as a measure of diet quality) and social support was not straightforward. "Receiving childcare/housework help from more social network contacts was associated with higher risk for iron deficiency anaemia, while providing childcare/housework help to more contacts was associated with lower risk of iron deficiency anaemia" (Shenk et al 2021).

Shenk et al (2021) made this overall point: "Although some of our findings support the hypothesis that social support can protect women in rural Bangladesh against undernutrition and improve their health, others emphasise that social relationships are not always supportive, but may often have neutral or negative effects". They emphasised these points:

a) Mothers with young children may also be providing grandmother care to the infants of their adult children – a "bind" for these women. Note that not all grandmothers are post-reproductive age.

b) The sharing of food may vary in terms of quantity (ie: reducing underweight) and quality (ie: does not reduce iron deficiency). Also the nature of the sharing –

eg: mothers (as grandmothers) share high-quality food with grandchildren, but receive low-quality food from their adult children.

c) The problems with measuring "social support" (eg: adult kin proximity; co-operative behaviour) (Shenk et al 2021).

6.9. MATERNAL MORTALITY

"Maternity is not a disease, yet it is one of the primary causes of death for women of reproductive age in much of the developing world" (Doyle 2021 p106).

Improvements in maternal deaths in SSA, for instance, has to be weighed against the changing definition. Once, "maternal death" was defined around the time of the birth, but it has now "expanded beyond deaths immediately connected to childbirth to include all deaths related to pregnancy and post-delivery complications within 42 days of a birth" (Doyle 2021 p106). Meanwhile, the priority given to maternal health has declined in the twenty-first century with international aid focusing on HIV/AIDS, malaria, tuberculosis, and the health of newborns and children (Doyle 2021).

"Africans' experience of maternity appears to fit uncomfortably with narratives of progress" (Doyle 2021 p107). For example, the Maternity Mortality Ratio (MMR) (ie: number of maternal deaths per 100 000 live births) in SSA has fallen by nearly half up to 2015, but these figures are still over thirty times higher than in Europe (Doyle 2021).

Childbirth in SSA has its own problems, as Doyle (2021) explained with a study of Kisumu County in Kenya: "Pregnancy in western Kenya is often the factor which leads to women discovering they are HIV positive; it is commonly expected that women continue with their normal work until childbirth; verbal and physical abuse of maternity patients is far from unusual; and most women know that emergency medical care is of uneven quality and availability. To go into labour at night when it is raining, a far from unusual situation, in many cases makes transportation impossible" (p117). Jane Plastow (quoted in Doyle 2021) found that fear and anxiety were the dominant response to pregnancy for women here.

These "ordinary" problems may be more important than non-communicable diseases (NCDs), though this is not to ignore them. "It should be noted though that, where NCDs do affect maternal health, their manifestation is often

indicated as an episode of crisis, rather than chronic illness..." (Doyle 2021 p116).

6.10. STEPFAMILIES

Loss of a parent through death has negative consequences for a child, which can differ depending on the parent lost, but the exact effect is difficult to pinpoint because of multiple factors in parental-loss households (eg: economic instability). Some of the negative consequences are overcome by remarriage by the surviving parent (Schacht et al 2021).

Schacht et al (2021) considered that any "gains may be overshadowed by the potential costs owing to the introduction of a step-parent into the household. This new family also often includes additional children who too require resources and attention from parents. Because not all family members are related, conflict within the household over resource allocation is anticipated, resulting in mortality differentials possibly emerging in step-structured households" (p2). It is predicted from an evolutionary perspective that each parent should prioritise investment in their biological child(ren). The consequent neglect of stepchildren has been called the "Cinderella effect" (Daly and Wilson 1999).

Using data from the Utah Population Database (UPDB), Schacht et al (2021) investigated the question, "do stepchildren experience more adverse outcomes compared to other children, or instead does remarriage and the presence of a step-parent offer benefits?" (p2). This was sub-divided into three areas of focus:

i) A comparison of children who had lost a parent to those who had not, and whether there was a difference for loss of a mother or a father.

ii) A comparison of children whose surviving parent remarried and those who did not.

iii) A comparison of stepchildren and half-siblings in the same household.

The UPDB is an extensive set of records of families in the state of Utah, USA, begun in 1847. Schacht et al (2021) concentrated on the period between 1847 and 1940 when families were large, and used survival of the children into adulthood as the main outcome measure (table 6.3).

- Children born between 1847 and 1940: 416 325
- Children who died before 18 years old: 25 968

- Loss of father: 36 993 (8.9% of total children)
- Loss of mother: 24 338 (5.9%)

Table 6.3 - Details of UPDB data analysed by Schacht et al (20201).

Concerning (i) above, children (both male and female) who had lost a mother were more likely to die themselves before eighteen years old than children who had not lost a mother. There was no significant relationship for loss of a father.

There was no difference in mortality of children who lost a parent and the surviving parent remarried or not (ii above).

In relation to (iii) above, it was found that stepchildren had a survival advantage over half-siblings in the same family, which is contrary to the "Cinderella effect".

Schacht et al (2021) offered some reasons for the last finding in particular:

a) "Apples and oranges effect" - The problem of comparing children in stepfamilies to those in intact biological families (ie: two different things are being compared).

b) Response biases in reporting - "Behaviour between a parent and child that might seem appropriate to social and healthcare workers (eg: physical reprimands) may be reported as abuse if observed happening between a step-parent and stepchild" (Schacht et al 2021 p5).

Furthermore, when there is abuse in a stepfamily, "the researcher assumes that the step-parent is the perpetrator, yet all that is known for sure is that a step-parent is present" (Schacht et al 2021 p5).

c) The mixing of family breakdown and divorce with loss of a parent. The "literature rarely distinguishes between the two and, consequently, their relative effects have yet to be clearly disentangled" (Schacht et al 2021 p6).

d) The focus on Western, nuclear families - "For

example, in most agrarian economies children, both related and unrelated are necessary for household productivity. Not only do they serve as helpers in the field, they also serve as helpers in the home. Accordingly, stepchild investments can be fitness enhancing by way of fostering household productivity through stepchild labour and childcare" (Schacht et al 2021 p6).

6.11. APPENDIX 6A - BREASTFEEDING

The World Health Organisation, in fact, recommends exclusive breastfeeding for the first six months, but only 1% of mothers in the UK achieved this goal (though around three-quarters do breastfeed at some point) (Myers et al 2021).

Myers et al (2021) reported data on the experiences of 515 UK women with breastfeeding and social support [9]. Elsewhere, emotional support was positively associated with breastfeeding (eg: Canada), but practical support negatively associated (eg: Japan) (Myers et al 2021).

Myers et al (2021) used the theoretical framework of evolutionary life history theory, which sees organisms as maximising their genetic fitness (ie: offspring) by balancing "investment" in the present and future. So a mother must assess how much to invest in the current child while considering future reproduction. The level of investment is influenced by the amount of resources (eg: time; energy), which can be affected by social support. Myers et al (2021) explained: "Lactation is extremely energetically expensive for a mother, both in absolute terms and in comparison to formula feeding, as only the mother (typically) can breastfeed. Help with bottle feeding (either with formula and to a lesser degree expressed milk) alters the opportunity costs of maternal investment in infant feeding in a variety of ways, for instance: by reducing the energy expenditure associated with lactation; curtailing the mother's time and energy spent holding and feeding the infant; and, though expressing milk requires time and energy, infant feeding becomes more flexible. Such alterations may allow a mother to invest in other tasks, such as caring for other children or resting and recuperation. This contrasts with other forms of practical support, such as help with domestic chores, which subsidises the time and energy budget of mothers, affording mothers the option to

[9] The women were recruited in 2017-18 via social media and the Internet, and the survey was completed online.

channel additional resources into their infant – which may result in her breastfeeding for longer".

The behaviour of mothers to maximum fitness takes place in a social context of how breastfeeding is viewed (eg: "Breast is Best"). "Mothers who plan to breastfeed and cannot are at increased risk of post-natal depression and mothers who bottle feed often experience stigma. Mothers who do breastfeed are also not spared the experience of psycho-social stress, for instance experiencing judgement for doing so in public" (Myers et al 2021) [10].

Emotional support could reduce stress, which directly helps with milk flow (as stress hormones can inhibit production), and indirectly by increasing the "emotional energy budget" (Myers et al 2021).

Practical support (eg: feeding the infant - allofeeding), Myers et al (2021) found, predicted shorter breastfeeding durations. Myers et al (2021) pointed out: "Allofeeding, at least with formula, may encourage breastfeeding cessation because it allows mothers to avoid incurring the energy and time costs of breastfeeding. However, the cessation of breastfeeding may also encourage offers of help with infant feeding; prospective data is required to understand the direction of causality, though it seems likely to vary by individual. It is a limitation of our data that we do not know whether allofeeding was with expressed milk or formula".

The relationship between breastfeeding and other types of support was complex. For example, emotional support was associated with not finding breastfeeding "emotionally draining", while receiving domestic support from fathers and siblings was associated with draining.

Myers et al (2021) accepted weaknesses in their measures of social support [11], and a lack of diversity of the sample (eg: White, university-educated, partnered). Also, Myers et al (2021) observed, "our participants overwhelmingly planned to breastfeed, meaning we can say little about the experiences on women who never intended to breastfeed. Such women may be more exposed to stigma surrounding formula feeding and have poorer feeding experiences as a result; alternatively, they may be more confident in their decision not to breastfeed and more likely to positively experience feeding".

[10] Wilson (2020) noted the problem of mothers on low-income affording formula milk, especially when "food banks" are advised by health authorities not to stock it in the UK.

[11] For example, emotional support was measured by one item.

Furthermore, it was not clear how support as a resource manifest - ie: what investment the women made with the time and energy gained.

An important point from the study was social support should not be treated as a univariate entity, with uniform outcomes..." (Myers et al 2021).

Chang et al (2021) performed a review of 76 papers on 74 studies of the views and experiences of partners and other family members who provided support for a breastfeeding relative. Forty-two papers involved high-income countries, and 47 papers investigated the views of partners only.

The findings were synthesised into five categories:

i) Knowledge, experiences and roles of family members - A wide range of views and experiences were found. Most respondents saw breastfeeding as positive (eg: more "natural" than formula milk feeding).

"In low-income settings, water or formula were offered to infants due to the perceptions of insufficiency of EBF [exclusive breastfeeding], related to a lack of money for good food for the woman to produce sufficient breastmilk, concerns of an increased risk of dehydration in hotter climates, and EBF viewed as a 'western' practice. Contrastingly, in high-income settings, when insufficiency of EBF was discussed, this raised concerns about an infant's poor weight gain, and uncertainty over the quantity of milk the infant took" (Chang et al 2021).

Partners, in particular, were surprised by the reality of breastfeeding (eg: cracked nipples; sleep disruption; emotional toll on mothers).

Partner support included practical (eg: household chores), emotional (eg: reassurance and praise), and technical (eg: information about techniques).

ii) Complexity of infant feeding decision making - Women were often the decision maker about breastfeeding, though there was sometimes pressure to do so.

"Gender roles largely factored into infant feeding decision making with many partners believing this was not their role and was predominantly the woman's, as it was her body. Many partners presumed their child would be breastfed and some partners had not discussed this with the woman. Some grandmothers considered a woman's partner should have no say in infant feeding decision as it was a woman's choice to breastfeed or not" (Chang et al 2021).

iii) Breastfeeding in front of others - This was

controversial. "Some family members were concerned about sexualisation of breasts and protecting a woman's privacy, while others supported women breastfeeding in public" (Chang et al 2021). This difference is seen in two quotes used by Chang et al (2021):

- A father in Ireland: "Some people can act very strangely if a woman breastfeeds in public" (Bennett et al 2016).

- A father in the USA: "In a mall, I'm not going to let my kid go hungry just because someone's offended" (Schmidt and Sigman-Grant 2000).

iv) Impact of breastfeeding on family - Both positive and negative impacts as perceived by the partner and family members:

- Positive - eg: brought couple closer; confidence in bond between infant and mother.

- Negative - eg: intruding on couple's relationship; reduced sex appeal; partner jealousy.

v) Support for family members - eg: ante-natal classes; online resources.

Chang et al (2021) concluded: "Partners' and family members' views and experiences of breastfeeding support reflected multi-faceted personal, social, financial, cultural, religious, emotional, psychological, and societal factors of the support they provided (or not). Healthcare professionals should engage them in breastfeeding discussions with the woman, and offer tailored and practical guidance relevant to help them to appropriately support the woman" (p1).

6.12. APPENDIX 6B - UNDERNUTRITION

It was estimated that prior to covid-19, 55 million children globally were classed as underweight for their height, and seven million more have been added since March 2020 (Parikh 2021).

"Current global food stocks are higher than previous years, so a food shortage alone is unlikely to be driving this" (Parikh 2021 p21). One explanation for undernutrition relates to water and sanitation. Poor sanitation leads to common water-borne diseases, which

include chronic diarrhoea (and this limits the ability of the body to absorb nutrients from food).

Lack of water limits the cooking of food that is available. For example, Parikh (2021) reported her study of villages in rural India that found that women spent up to two hours per day collecting water. Thus, the time for cooking was severely reduced when other household chores also needed completing.

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7. AGEING AND EUSOCIALITY

Korb and Heinze (2021) began: "Why organisms age, and why they do so at different paces, still remains a major question in ecology and evolution. Comparative analyses across animals suggest that lifespans co-evolve with various life-history traits, such as body mass, metabolic rate, growth rate and the timing and age-specific trajectory of reproduction, but also with external mortality risks from predators, pathogens or environmental stress. For example, large vertebrates tend to live longer than smaller ones, and animals that can escape from predators by flight or burrowing live longer than more vulnerable species that are bound to the Earth's surface" (p1).

The search for patterns of ageing across organisms is challenged by examples like this, where, among certain eusocial termites and ants, reproductive individuals could live for twenty years while the non-reproductive workers die after a few months. Also eusocial species "often live significantly longer than their non-social relatives. While group life might negatively affect individual health through social stress and the transfer of contagious diseases, socio-positive behaviour, eg: mutual grooming, social immunity, and in particular life in stable, well-defended nests protect reproductives from predation, parasites and pathogens" (Korb and Heinze 2021 p2).

In relation to the difference in longevity between reproductive and non-reproductive individuals, Korb et al (2021) explored the physiology of social insects, and described "a re-wiring of the interrelations between nutrient-sensing pathways (insulin/insulin-like growth factor 1 signalling (IIS)/target of rapamycin (TOR)), juvenile hormone (JH) and vitellogenin, which are known to regulate lifespan and the trade-off between longevity and fecundity in solitary insects" (Korb and Heinze 2021 p2). Differences between individuals were idiosyncratic (Korb and Heinze 2021). Kramer et al (2021) found no consistent patterns in terms of oxidative stress and ageing, which "again indicates species-specific ways of evolving long lifespans in reproductives" (Korb and Heinze 2021 p2).

Kennedy et al (2021) found that reproductive workers were better protected against oxidative stress than non-reproductive workers when experimentally stressing honeybees with a virus and treatment. Reproductive individuals had an upregulation of certain genes.

From a different angle, non-breeders could die earlier because of increased stress from aggression by breeders, as observed in the eusocial giant mole-rat (Begall et al 2021).

Korb and Heinze (2021) outlined three points for discussion about ageing and eusociality:

i) The causal link between eusociality and lifespan - One possibility is that eusociality evolved first and this caused the extension in lifespan, which is supported by experimental manipulations of who can reproduce. Individual eusocial insects arbitrarily chosen to reproduce live longer.

ii) The genetic pathways of longevity - There are data that "reveal commonalities but also many idiosyncrasies in the processes underlying ageing and lifespan variation across the studied taxa" (Korb and Heinze 2021 p5).

iii) Gaps in research knowledge - eg: ageing as a gradual or sudden process; whether non-reproductives are sterile.

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8. GENDER IN TWO AREAS

8.1. EMPATHY

The idea that women experience more empathy for others than men is well-established. Theoretically, it fits with evolutionary differences between males and females. Females, among mammals say, tend to care for offspring and the female's reproductive success is linked to survival of these offspring. So, females should be more sensitive to negative events that befall genetic kin (Benenson et al 2021).

In terms of research with humans, "several large studies demonstrate that when an adverse event befell a family member, a social network member, or a patient, both female family members and female professionals reported experiencing more frequent and severe distress than their male counterparts" (Benenson et al 2021 p1). Meta-analyses support these findings as well as studies using specialist questionnaire like the Empathy Quotient (EQ) (Benenson et al 2021).

But "sex differences in non-self-reports of empathy typically are not found" (Benenson et al 2021 p1). These are behavioural and physiological measures. Faced with the contradiction in findings, one conclusion is that "universal sex-typed expectations pressure females into reporting greater empathy than males" (Benenson et al 2021 p2).

However, there are two lines of evidence where there is not a contradiction in findings (Benenson et al 2021). Firstly, neuroimaging studies have found that certain areas of the brain are larger in individuals reporting empathy – eg: females have more cells in the human mirror neuron system (an area involved in matching others' emotions and actions) (Benenson et al 2021).

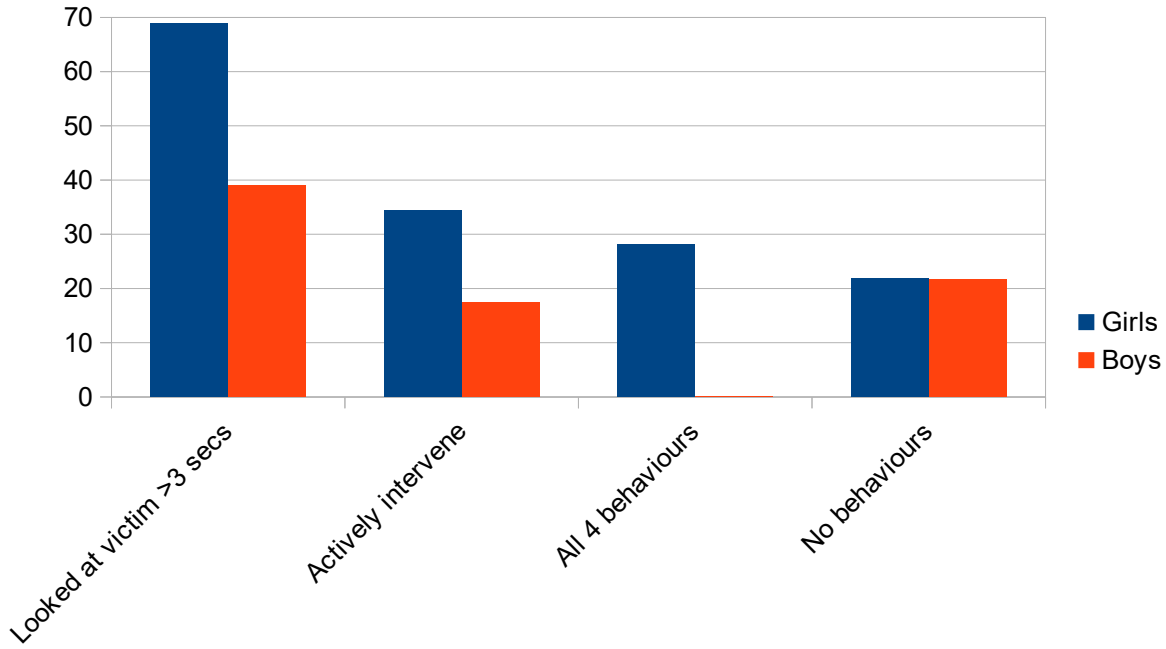
Secondly, studies of infants and young children responding to real life victims find that girls experience greater empathy. For example, when 14-20 month-olds witnessed a female adult hurting her knee (Zahn-Waxler et al 1992), "female infants were more likely than males to express verbally or non-verbally their concern and or negative emotions, attempt to figure out what happened, or exhibit prosocial behaviour as rated by trained coders, whereas boys were more likely to

not respond at all" (Benenson et al 2021 p2).

Benenson et al (2021) reported a similar type of study with 5-7 year-olds in Montreal, Canada. An experimenter (male or female) invited two same-sex children to build a tower of blocks. The children working separately or together had to carry a basket of blocks each to the play area to begin. One of the baskets was designed to break in transit and the blocks to fall out. How would the bystander respond to the victim and the event?

Four behaviours were scored as signs of empathy – looking at the victim for at least three seconds, stopping their activities for at least one second, and/or until the victim had regained the blocks, and active intervention (ie: help to pick up blocks). There were 32 female pairs and 23 male pairs.

Significantly more girls engaged in all four empathic behaviours than boys (figure 8.1).



(Data from table 1 Benenson et al 2021)

Figure 8.1 – Selected measures of empathy and gender differences (%).

This study had a number of strengths over previous work – an accident that was "naturalistic yet standardised" (p5) (ie: not staged), the victim was same-sex and a classmate of the bystander (rather than an

adult stranger), and no adults were present during the accident, "thereby reducing demand characteristics pressuring females to behave in stereotyped ways or providing authority
figures who could be perceived as better able to respond to a victim's distress" (Benenson et al 2021 p5). Four behavioural measures of empathy were used, rather than self-reports or facial expressions.

However, the accident was only one event by which to assess empathy, and the number of participants was small. Benenson et al (2021) admitted: "Inclusion of more participants from a wider age range, and replication with a new task would enhance the study's validity. Finally, it is possible that boys experience empathy in a way that has not been measured. In this study, most boys did cease their ongoing activity following the accident, but they engaged in few other empathic activities that we could measure" (p5).

To sum up: "after observing their partner's accident, female bystanders demonstrated greater empathy than males" (Benenson et al 2021 p5).

8.2. WRITING

"Children are susceptible learners, absorbing information and forming concepts from a variety of sources. Text is often a vehicle for this. Well before they can read themselves, children experience vast amounts of written language via being read to... Even books written for pre-school children provide exposure to language and information well beyond the everyday 'here and now'" (Hsiao et al 2021 p1). These texts include gender stereotypes.

This may manifest in content (eg: men depicted as working outside the home and women in the home), and in frequency (eg: more males in stories) (Hsiao et al 2021). Weitzman et al (1972), for example, found that popular and prize-winning pictures for children had fewer female characters, names, and as central characters than male ones. This pattern of androcentrism has been observed in more recent research.

Hsiao et al (2021) investigated the personal names of characters in books for 5-13 year-olds (using the Oxford Children's Corpus [12]). Over 4000 unique personal names were found occurring over 630 000 times in over 13 000 documents. Male names occurred more often (62% of total), and a greater number of different male names

[12] More information at https://readoxford.org/our-research/leverhulme.

compared to female ones. Male authors were more likely to use male names for their characters (71% of names) compared to female authors (55%).

In their second study, Hsiao et al (2021) looked at the story writing of the same age group in the corpus. This included an annual national writing competition in the UK run by BBC Radio. In 2019, there were over 105 000 entries. Male names appeared more often overall (56% of the total), but specifically, boys only had 15% of their characters with female names compared to 61% in girls' writings. Older children used more males names than younger ones.

These findings could fit with the gender schema theory of gender development (eg: Bem 1981), where "one's own gender shapes how information is organised and remembered... Children are sensitive to gender schema from a young age. For example, stereotypically feminine activities and female characters are better remembered by girls, whereas activities and characters associated with males are better remembered by boys" (Hsiao et al 2021 p8).

On the other hand, androcentrism in children's literature could mean that gender bias in society is shaping children's cognitions about gender. However, Hsiao et al's (2021) methodology did not allow the establishing of a causal link between what is read and what is written by children.

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9. STUDYING MATHEMATICS

Formal education has a long-term impact on an individual's life, and specifically mathematical education and attainment, which "has been associated with several quality-of-life indices, including educational progress, socio-economic status, employment, mental and physical health, and financial stability" (Zacharopoulos et al 2021 p1). Adkins and Noyes (2016), for example, found that studying mathematics at "A-level" in the UK led to an 11% increase in later life income as compared to not studying the subject.

Zacharopoulos et al (2021) investigated the brain development of mathematics education using single H-magnetic resonance spectroscopy (MRS), which is able to show functional connectivity and activity in areas of the brain. The researchers scanned 87 A-level students (mean age 17 years old) (49 studying mathematics and 38 not), and 42 pre-A-level students (mean age fourteen years old) (21 who were thinking of studying A-level mathematics and twenty-one who were not).

A clear difference in the neurotransmitter gamma-aminobutyric acid (GABA) in the middle frontal gyrus area of the brain was found between the mathematics students and others. This area of the brain is involved in reasoning and cognitive learning (Zacharopoulos et al 2021). Low concentrations of the neurotransmitter were associated with not studying mathematics. "Notably, this finding was specific to math education and was not explained by other A-level subjects that are usually taken by those who are enrolled in math education such as biology, chemistry, and physics, or by the number of A-level subjects studied by the individuals" (Zacharopoulos et al 2021 pp4-5).

The study of pre-A-level students showed the above findings "were not due to pre-existing differences before a mathematical education ceased" (Zacharopoulos et al 2021 p1).

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10. PRESENTING THE SELF

Friedman et al (2021) asked this question: "Why do people from privileged class backgrounds often misidentify their origin as working class?" (p716).

The researchers set about answering this question with 175 semi-structured interviews with individuals working in the media, accountancy, and architecture in the UK. Based on occupation, the class background of the interviewees was categorised as "middle-class", "working-class" or "intermediate".

The key questions in the interviews were, "What did your parents do for a living when you were growing up? And do you think of yourself as coming from a particular social class?".

Most answers were direct - eg: "So, my dad is a carpenter... So, I'm from a very working-class background, basically" ("Ben"; p732). But the interviewees whose "objective" class background was middle class, and they subjectively identified as coming from working-class backgrounds, gave longer answers.

Friedman et al (2021) explained: "Here answers differed in two key respects. First, these interviewees typically sidestepped, or only briefly addressed, the question about parental occupation. Instead, they placed their background within the context of a much longer family history, incorporating grandparents and sometimes even great-grandparents. They narrated their sense of self, then, as shaped less by what analysts conventionally think of as own class origin and more by parental or even grandparental class origin. Second, and connected to this, their answers were markedly more elaborate" (p722). Fivush et al (2008), for example, talked of the "intergenerational self", which is anchored "as much by one's place in a familial history as a personal past" (quoted in Friedman et al 2021).

For example, accountant "Matthew" said: Background, yes parents were, well my dad worked for the MOD [Ministry of Defence], he's sort of like a telecoms engineer chap. My mum had a shop... But before that, before that my grandfather was actually born in a workhouse so the generation... was very much... upwards in a sense" (p723).

So, what was going on in these answers? "By positioning themselves as ascending from humble origins, we show how these interviewees are able to tell an upward story of career success 'against the odds' that simultaneously casts their progression as unusually meritocratically legitimate while erasing the structural

privileges that have shaped key moments in their trajectory" (Friedman et al 2021 p716). The researchers coined the phrase "meritocratic hubris".

The financial support given by parents was played down. "Yet it was not that interviewees did not recognise this 'bank of mum and dad'. Instead, what was striking was the way they deployed stories about the source of family money as a way of deflecting presumptions about ascribed privilege. Particularly important here were careful expressions of how family wealth (that they had subsequently benefited from) had been accumulated. Many highlighted a particular family 'ethos' that had flanked wealth-building, including of course hard work but also a certain shrewdness, frugality or self-sacrifice" (Friedman et al 2021 p727).

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11. SOME HEALTH ISSUES

11.1. BLOOD PRESSURE

The reduction of blood pressure with medications is "an effective strategy to reduce the risk of cardiovascular events in a range of at-risk populations" (The Blood Pressure Lowering Trust Trialists' Collaboration 2021 p1626). But there are two issues of controversy - who is "at-risk", and what is "normal" blood pressure?

Concerning the first issue, put another way, do individuals with no history of cardiovascular disease benefit from blood pressure-lowering medications? The issue of blood pressure level can be rephrased as is reducing blood pressure always better?

A "J-shaped" association between cardiovascular events and blood pressure has been reported with the lowest risk at blood pressure of 130/75mm Hg (eg: Vidal-Petiot et al 2016). So, cardiovascular event risk is increased both below and above this blood pressure level.

The Blood Pressure Lowering Trust Trialists' Collaboration (2021) sought evidence on the two issues via a meta-analysis of forty-eight randomised controlled trials of blood pressure and major cardiovascular events (eg: fatal or non-fatal stroke). The data covered nearly 345 000 individuals, both with and without previous cardiovascular disease. The trials compared blood pressure-lowering drugs with placebos, drugs with drugs, or more vs less intensive treatment (Kahan 2021).

Overall, it was found that a 5mm Hg reduction of systolic blood pressure reduced the risk of major cardiovascular events by 10% for both individuals with and without previous cardiovascular disease, and at all blood pressure levels. This challenged the "J-shaped" association, and suggested that reducing blood pressure to 120mm Hg or less was beneficial. As The Blood Pressure Lowering Trust Trialists' Collaboration (2021) stated, their findings "dismiss the suggestions that blood pressure-lowering treatment is only effective when blood pressure is above a certain threshold" (p1631). In England at this point, for instance, blood pressure-

lowering treatment is not recommended below 140mm Hg (The Blood Pressure Lowering Trust Trialists' Collaboration 2021), while in the USA, it is 130/80 mm Hg (Kahan 2021).

This was "the largest meta-analysis so far of individual participant-level data for the effects of anti-hypertensive treatment stratified by initial blood pressure and prevalent cardiovascular disease" (Kahan 2021 p1598).

But the study did not include potential treatment harms, nor data on non-major cardiovascular events (eg: valvular heart disease).

Any meta-analysis is dependent on the studies included. The Blood Pressure Lowering Trust Trialists' Collaboration (2021) searched the MEDLINE database covering the period 1966 to September 2019 using terms like "blood pressure", "hypertension", and "anti-hypertension agents". The data from the studies were stratified into seven baseline systolic blood pressure categories (<120 to ≥170mm Hg) for re-analysis.

Most of the studies had a comparison group with no previous history of cardiovascular disease. The mean age of participants was 65 years old, and the median follow-up period was 4.1 years.

11.2. ALCOHOL AND HEART

Atrial fibrillation (AF) is the most common problem related to erratic heart rhythm (or arrhythmia), and its occurrence is increased by greater amounts of long-term alcohol consumption (Marcus et al 2021).

This is a general association, and Marcus et al (2021) sought to establish the relationship of high alcohol consumption a few hours before an AF episode. One hundred patients with a history of AF were recruited from outpatient clinics in San Francisco for the study. Individuals with alcohol use disorder, and teetotallers were excluded.

The participants wore a "smart watch" that included electrocardiogram (ECG) recording, and were told to press a button every time they had a "standard alcohol drink" (equal to one glass of wine or a can of beer or a shot of spirits). The participants also wore a SCRAM (Secure Continuous Remote Alcohol Monitor), which detects alcohol in the bloodstream through the skin. The study lasted four weeks.

During the study period, the ECG data showed that 56 participants had experienced at least one AF episode, and

these individuals were compared to the forty-four with no episodes.

An AF episode was twice as likely after one alcoholic drink in the preceding four hours, and three times as likely after two or more drinks. The risk of AF was not significant for twelve hours or longer before (though the risk was higher than no alcohol consumption).

The risk of AF was also increased with greater blood alcohol concentration (based on SCRAM data). "The relationship seemed to be fairly linear — the more alcohol consumed, the higher the risk for an acute AF event — without clear evidence of a threshold effect" (Marcus et al 2021 p4).

Previous studies have tended to use self-reported retrospective data, whereas Marcus et al (2021) collected real-time self-reports, and objective measures of alcohol consumption. Also other studies showed a long-term relationship between alcohol consumption and AF, whereas this study showed the short-term relationship.

In terms of self-reporting alcohol consumption, Marcus et al (2021) accepted that "some participants may have forgotten to press the button or may have minimised the number of button presses because of embarrassment or shame" (p5).

Marcus et al (2021) also admitted: "We could not identify a clear and consistent relationship between the timing of alcohol consumption and AF episodes, although most alcohol–AF associated pairs occurred within a few hours of each other. This may reflect variability in alcohol metabolism. Of note, the effect did not generally seem to be immediate, favouring a consequence of alcohol or its metabolites rather than, for example, some instantaneous phenomenon related to oesophageal exposure" (p5). This is important because the "mechanism by which alcohol ingestion might lead to AF remains largely unknown" (Marcus et al 2021 p4).

This study challenged the idea that "heavy drinking" is the problem, or that moderate alcohol consumption is "cardioprotective" (Whitman et al 2015). "However, the protective effects of moderate alcohol consumption are predominately in the context of coronary artery disease and myocardial infarction" (Marcus et al 2021 p5).

The sample of the Marcus et al (2021) study was relatively small, and included individuals already diagnosed with paroxysmal AF. So, "the risk for a discrete AF event among the general population consuming similar amounts of alcohol cannot be directly extrapolated from these data. Risk for an acute AF event

in the setting of a drinking episode likely has multi-factorial determinants, including the amount of alcohol and the individual's underlying propensity to AF" (Marcus et al 2021 p6).

The study paid little attention to other factors that could be associated with AF (eg: smoking).

Exact measures of alcohol consumption would have been ideal.

11.3. INCLISIRAN AND CHOLESTEROL

Inclisiran is a RNA-based agent that reduces low-density lipoprotein (LDL) cholesterol levels, and in consequence cardiovascular problems. The ORION-10 and ORION-11 trials have produced data to establish the benefits (Ray et al 2020).

Early results showed the LDL cholesterol was lowered by over 50% over 180 days after two doses of inclisiran (Ray et al 2017). Follow-up to 360 days reported sustained benefits with inclisiran once every six months (Ray et al 2019).

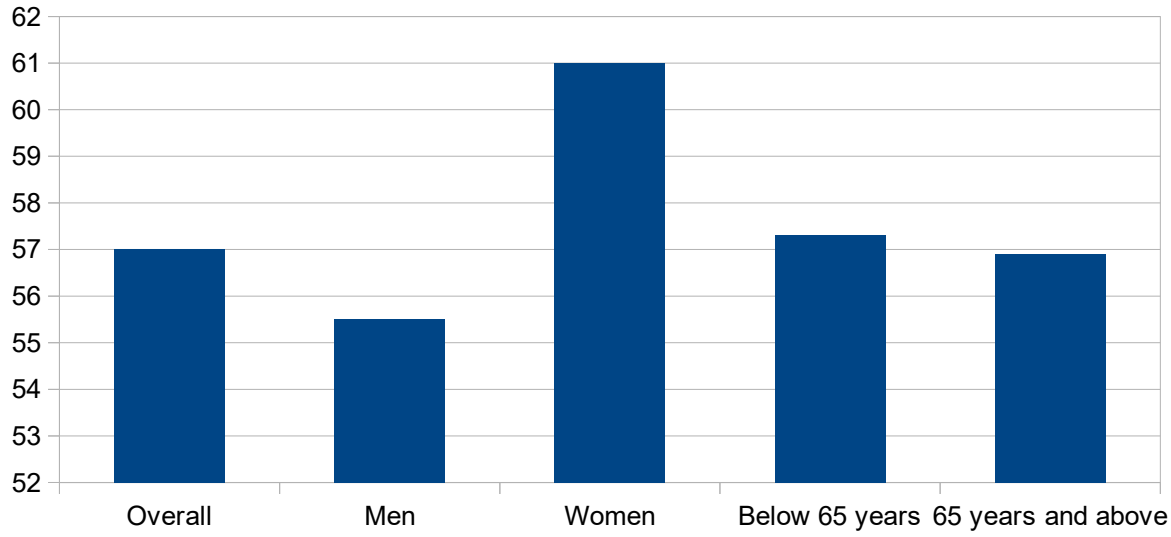
ORION-10 and ORION-11 trials are randomised, double-blind, placebo-controlled phase 3 trials, which continued investigations mentioned above to eighteen months. ORION-10 took place in the USA with 1561 high LDL cholesterol-level adults, and ORION-11 involved 1617 similar adults in Europe and South Africa.

The randomised participants received an injection of inclisiran or placebo on days 1, 90, 270 and 450 of the trial. The trial ended on day 540. The main outcome measure was the change in LDL cholesterol level between baseline and end of trial.

Overall, reductions in cholesterol levels of around 50% were found (figure 11.1). "Adverse events were generally similar in the inclisiran and placebo groups in each trial, although injection-site adverse events were more frequent with inclisiran than with placebo (2.6% vs. 0.9% in the ORION-10 trial and 4.7% vs. 0.5% in the ORION-11 trial); such reactions were generally mild, and none were severe or persistent" (Ray et al 2020 p1507) [13].

Statins are currently used to reduce LDL cholesterol levels. Ray et al (2020) compared infrequent inclisiran injections with the daily tablet-taking of statins favourably - namely in adherence to treatment. "Complete adherence might be feasible if this therapy were administered by a health care professional,

[13] Ongoing long-term open label studies are being performed (eg: Stoekenbroek et al 2018).



(Data from Ray et al 2020 figure p1514)

Figure 11.1 - Mean percentage reduction in LDL cholesterol level in inclisiran group between baseline and day 510.

thus potentially helping address an existing challenge to contemporary prevention strategies — namely, how to maintain reductions to adverse exposures such as LDL cholesterol over the long term" (Ray et al 2020 p1518).

11.4. TYPE 2 DIABETES AND MULTI-MORBIDITY

Type 2 diabetes is often associated with other illnesses at the same time - ie: "multi-morbidity" ("the presence of two or more long-term conditions within an individual"; Hanlon et al 2021 p2). Frailty, defined as "a dynamic state of increased vulnerability to decompensation in response to physiological stress, characterised by the reduced physiological reserve" (Hanlon et al 2021 p2), can also be an associated risk.

Hanlon et al (2021) used UK Biobank data to quantify the above risks. The UK Biobank began in 2006-10 with around 500 000 adults in twenty areas of England, Scotland and Wales. Over 20 000 individuals (aged 40-72 years old) were identified with type 2 diabetes.

Multi-morbidity was measured with a list of 42 long-term conditions, and various standard measures of frailty were used at baseline (eg: slow walking speed; low hand-grip strength).

Nearly half of the sample were frail or multi-

morbid, and these individuals had a higher risk of mortality (and being hospitalised) than the rest of the sample with type 2 diabetes (and the general population).

The data did not cover older adults, the measures were taken at baseline (many self-reported), and the overall UK Biobank sample is volunteer. It is "not a nationally representative sample. Participants were more affluent, more likely to be White, and have fewer long-term health conditions than the national average" (Hanlon et al 2021 p8).

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