Mental health and health behaviors following an economic collapse

The case of Iceland

Christopher B. McClure

Thesis for the degree of Philosophiae Doctor
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Doctoral committee: Unnur A. Valdimarsdóttir, David Stuckler, Ichiro Kawachi, Sigurður Rúnar Sæmundsson

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Andleg líðan og heilsutengd hegðun í kjölfar efnahagsþrenginga
Áhrif á Ísland

Christopher B. McClure

Ritgerð til doktorsgráðu
Umsjónarkennari: Arna Hauksdóttir
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Ágrip

Bakgrunnur (og markmið:. Efnahagshrunið á Íslandi í október 2008 var að mörgu leyti sérstakt í umfangi og hraða og eru enn ófyrirséð þau áhrif sem efnahagshrunið mun mögulega hafa á heilsufar þjóðarinnar. Fyrri erlendar rannsóknir hafa gefið vísbendingar um neikvæð áhrif en einnig jákvæð áhrif. Markmið þessarar rannsóknar var að rannsaka áhrif efnahagshrunsins á Íslandi á andlega líðan og heilsutengda hegðun.

Aðferðir: Allar rannsóknirnar voru unnar úr stórri heilsufarsrannsókn sem framkvæmd var á vegum Embættis landlæknis árin 2007 og 2009. Upphaflegt þýði rannsóknarinnar var byggt á lagskiptu slembiúrtaki íslensku þjóðarinnar. Helstu útkomubreyturnar voru andleg líðan (streita (N=3755) og þunglyndiseinkenni (N=3783)), reykingar (N=3755) og tannheilsa (N=4100). Streita var mældi með íslenskri útgáfu af Perceived Stress Scale (PSS-4) og þunglyndiseinkenni voru mæld með WHO-5 spurningalistanum.

Rannsóknarniðurstöður:

Andleg líðan (Streita og þunglyndiseinkenni):

Samanburður á streitu leiddi einnig í ljós aukningu á háu streitustigi milli 2007 og 2009 (líkindahlutfall 1,29; 95% öryggisbil 1,14-1,45), sérstaklega fyrir konur (1,37; 1,16-1,61). Þessi kynjamunur kom einnig fram við skoðun á streitustigum, þar sem konur upplifðu aukna streitu frá 2007 til 2009 ($p < 0,01$) en ekki karlar. Í samanburði við árin fyrir efnahagsþrengingar, upplifðu konur (1.22; 1,04-1,44) aukna áhættu á þunglyndiseinkennum. Einnig kom fram marktæk aukning á líkum á þunglyndiseinkennum hjá atvinnulausum af báðum kynjum (1,87; 1,06-3,31) árið 2009 í samanburði árið 2007.

Heilsuhegðanir (Reykingar og tannhirða):

Frá 2007 til 2009 kom fram minnkun á algengi reykinga hjá bæði körlum og konum. Niðurstöður sýndu einnig að karlkyns fyrrverandi reykingamenn sem upplifðu launaskerðingu á þessum tíma voru ólíklegri til að byrja að reykja aftur borið saman við þá sem upplifðu engar tekjubreytingar (0,37; 0,16,0,85). Varðandi tannheilsu, þá bentu niðurstöður ekki til fækkunar á eða minnkandi líka á tannlæknaheimsóknum. Karlar voru líklegri til að bursta tennur (1,42; 1,05-1,93) og nota tannþráð (1,20; 1,30-1,42) daglega á kreppuárum miðað við fyrri ár.

Lokaorð:

Niðurstöðurnar benda til þess að efnahagsþrengingarnarárið 2008 hafi haft neikvæð áhrif á andlega líðan fullorðinna á Íslandi, þá sérstaklega meðal kvenna. Á hinn bóginn komu í ljós jákvæðar breytingar í heilsutengdri hegðun, t.d. með lægra algengi reykinga og hegðun sem gæti leitt til betri tannheilsu. Frekari rannsóknir ættu að beinast að langtíma eftirfylgd á þróun andlegrar líðanar og samspili við heilsutengda hegðun.

Lykilorð: efnahagsþrengingar; þunglyndi; streita; reykingar, tannheilsa; heilsutengd hegðun.

Abstract

Background and aims: Few comprehensive epidemiologic studies exist on the effects of the 2008 economic recession on health outcomes. With Iceland as a prime candidate for examination, the aims of the studies were to explore the effects of the 2008 economic collapse on the mental and behavioral health of an entire population.

Methods: All aims were ascertained using a cohort of respondents to a mail health survey conducted by the Public Health Institute of Iceland, titled *Health and Well-being in Iceland*. This survey was conducted in two-assessments: (1) between October and December of 2007, (2) between November and December of 2009. The initial study population was based upon a stratified random sample of the Icelandic population. Primary outcome variables were mental health (i.e. psychological stress (N=3755), depression symptoms (N=3783)), smoking status (N=3755), and dental behaviors (N=4100). Psychological stress was measured using the four-item Perceived Stress Scale; depression symptoms were measured using the five-item WHO-5 questionnaire.

Results:

Psychological health (Stress & Depression Symptoms):

Compared to before the start of the crisis (in 2007), there was an increased risk of developing high stress levels in 2009 (odds ratio (OR) 1.29; 95% confidence interval 1.14-1.45)). However, this increase was only observed in women, (1.37; 1.16-1.61), and not men. Additionally, women who were either unemployed (3.38; 1.09-10.49), students (2.01; 1.23-3.28) or from the middle socio-economic class (2.01; 1.23-3.28) experienced higher likelihoods of unhealthy stress levels. Stress findings indicate that women, as a group, were more likely to develop increased depressive symptoms. Compared to before the economic collapse, women (1.22; 1.04-1.44) – not men – experienced an increased risk of depressive symptoms during recession years. Regardless of sex, a significant increased likelihood of depressive symptoms was observed in the unemployed (1.87; 1.06-3.31) during the recession compared to before.

Health behaviors (Smoking & Dental):

From 2007 to 2009, a significant reduction in the prevalence of smoking was observed in both men and women. At the individual level, male former smokers who experienced an income reduction (0.37; 0.16, 0.85) during the same period were less likely to relapse compared to those with a stable income. There was no evidence for a reduction in or decreased likelihood of visiting a dental health practitioner. Men were more likely to brush (1.42; 1.05–1.93) and floss (1.20; 1.03–1.42) daily during recession years compared to before.

Conclusion: The results indicate that the economic collapse and recession in 2008 negatively affected the mental health of the adult population in Iceland, specifically women.

While mental health was impaired, the economic downturn indicates a counter-cyclical relationship with health outcomes. A reduction in the overall prevalence of smoking was observed, which may indicate the role of the economic recession. Additionally, an increased likelihood of practicing healthy, daily dental habits was observed; most specifically, among men. Future research, however, will need to follow this trend to understand if it is the result of ongoing secular trends or economic changes.

Keywords: economic recession; depression; stress; smoking; dental health; health behaviors.

Acknowledgements

If my successes were dependent variables then my supervisors, colleagues, co-authors, institutions, funders, friends, and families are the independent variables.

I have to start off by thanking Arna Hauksdóttir and Unnur Valdimarsdóttir for serving as the catalysts for my professional and personal life. Without the ongoing feedback and opportunities to learn, teach, and better myself, I wouldn't be on my current trajectory of success. It's rare to find advisors that provide such high level of support in all aspects of their students' lives. I'm endlessly grateful for having them supervise my work for all these years, and I look forward to working with them for years to come.

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There are countless events that led me to carrying out this work. And it was with all of your support that helped make the events and this work successful for me. You are all highly significant and positively related to the outcome variable to me. It would be an R^2 of 1.0 ($p < 0.001$) for sure. So, thank you. I am forever grateful.

Contents

List of abbreviations

ALMPs, Active Labor Market Programs

ANOVA, analysis of variance

f, fixation indices

FSA, Financial Supervisory Authority

GDP, global domestic product

GEE, generalized estimation equation

n, sample size

OOP, out-of-pocket costs

OR, odds ratio

p, probability

PSS-4, Perceived Stress Scale (4 items)

SD, standard deviation

USD, United States Dollar

WHO-5, World Health Organization Well-Being Index

List of figures

This thesis is based on the following original publications, which are referred to in the text by their Roman numerals (I-IV):

I. Hauksdottir A, McClure C, Jonsson SH, Olafsson O, Valdimarsdottir U. Increased stress levels in women following an economic collapse – a prospective cohort study. *American Journal of Epidemiology* 2013;177(9):979-988.

II. McClure C, Stuckler D, Valdimarsdottir U, Gudmundsdottir D, Hauksdottir A. Depression following financial crisis in Iceland: Results from a prospective cohort. Submitted for publication.

III. McClure C, Valdimarsdottir U, Hauksdottir A, Kawachi I. Economic crisis and smoking behavior: Prospective study in Iceland. *British Medical Journal Open* 2012;2:e001386.

IV. McClure C, Saemundsson SR. Effects of a national economic crisis on dental habits and check-up frequency: Prospective cohort study in Iceland. *Community Dentistry and Oral Epidemiology* 2014;42:106-112.

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Declaration of contribution

Christopher B. McClure (CM) planned the research work for papers I-IV, conducted the statistical analyses, drafted the manuscripts, and wrote the following thesis. All of this work was accomplished with guidance and feedback from his supervisors, the doctoral committee, and study co-authors.

Paper I: CM and Arna Hauksdóttir (AH) contributed equally to the work. CM, Örn Ólafsson (OO), and Stefan Hrafn Jonsson (SJ) were responsible for the statistical analysis. CM, AH, SJ, and Unnur Valdimarsdóttir (UV) contributed to the interpretation of the data, as well as drafted the manuscript.

Paper III: CM and Ichiro Kawachi were responsible for the design of the study. All authors contributed to the interpretation of the data, as well as the drafting of the manuscript.

Paper II: CM was responsible for the statistical analysis. CM, David Stuckler (DS), Dóra G. Guðmundsdóttir, UV, and AH were all responsible for the study design. CM was responsible for the statistical analysis. All authors contributed to the interpretation of the data, as well as the drafting of the manuscript.

Paper IV: CM was responsible for the statistical analysis. Both authors were responsible for the study design, data interpretation, and the drafting of the manuscript.

1 Introduction

1.1 The 2008 economic collapse of Iceland

When the global economic collapse began in the year of 2008, it hit nations and regions in varying degrees. Some nations were marginally affected, like Australia and Sweden, while many were hardly hit, like Ireland, Greece, and Spain. In addition, Iceland, the small country of approximately 320,000 people began one of the swiftest and most severe economic collapses and subsequent crises in October 2008. The collapse, which began in a short time period, was marked by the nationalization of the major banks – resulting in a severe currency crisis, rising unemployment rates (figure 1) and interest rates (figure 2), runaway debts (national and household), and decreased purchasing power of all citizens. (Jackson, 2008) (The Central Bank of Iceland, 2008)

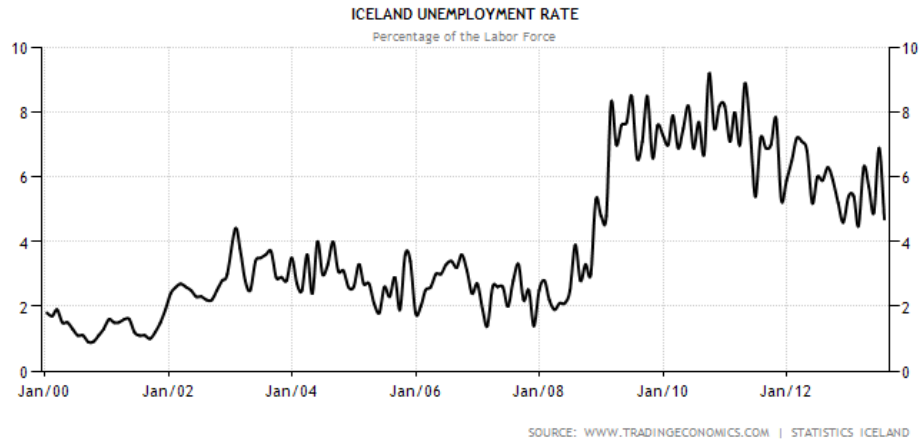

Figure 1. Unemployment rate in Iceland since 2000.

Prior to the collapse, Iceland experienced an erratic period of economic prosperity, defined by a newly liberalized economy and increased consumer purchasing power. In addition to these new agreeable consumer-terms, the commercial banks no longer required a real estate purchase as a precondition for a new loan. Now homeowners could therefore refinance their existing mortgages and access the equity in their current real estate for consumption and investment purposes. This in turn caused credit expansion and soaring real estate prices, while increasing threats of inflation and rising interest rates. (Jackson, 2008) This period of prosperity led to greater growths in consumer spending that were additionally accelerated by

reduced government tax rates (i.e. direct and indirect). The result caused runaway inflation and an even larger trade deficit. (Jackson, 2008)

While these erratic domestic financial behaviors continued, foreign investors began seeking Icelandic bonds. As these bonds were issued in Icelandic currency (*krona*) and based upon high domestic interest rates (figure 2), foreign investors could then borrow from financial institutions outside of Iceland at comparatively low interest rates - placing more pressure on the value of the krona and making the trade deficit even worse.

The next step was the deregulation of the commercial banks by the government, which included the three largest banks - with assets in 2007 equaling $168 billion (more than 14 times GDP). (Jackson, 2008) The deregulation caused banks to shift their operations abroad (i.e. foreign commercial bank subsidiary acquisitions and brokerage insecurities). To put this shift into prospective, in the few short months before the collapse the largest commercial banks (a) held almost half of their total assets in foreign institutions and subsidiaries, and (b) were receiving approximately 58% of their total income from these outside subsidiaries; all the while (c) having to finance approximately 75% of their funds through short-term finances (i.e. money market and short-term interbank market borrowing). Consequentially, the large funding that the Icelandic banks now required to survive, along with their drastic dependence on short-term money market funds, made foreign investors uneasy and weary of future dealings in the Icelandic market. Thus, even before the collapse began, the Central Bank of Iceland predicted a significant contraction in the annual rate of economic growth in 2008 and 2009 as foreign investors would begin to pull-out of their investments out of Iceland.

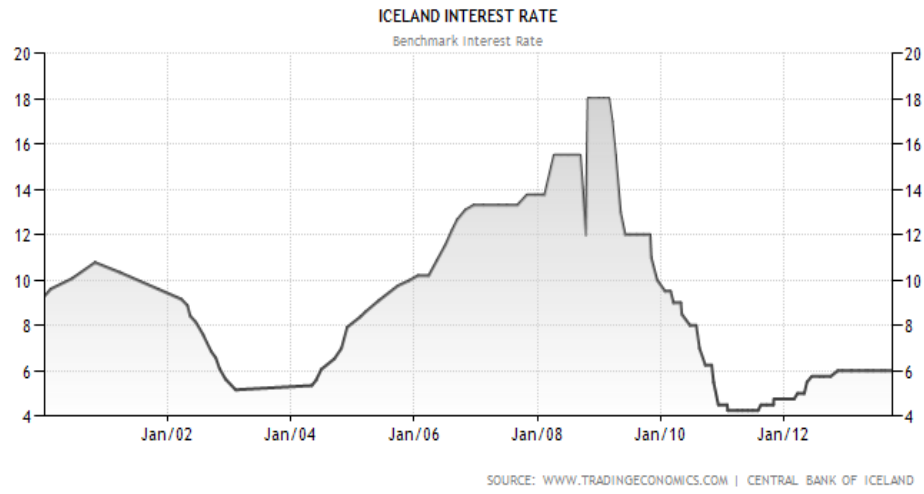

Figure 2. Benchmark interest rates in Iceland since 2000.

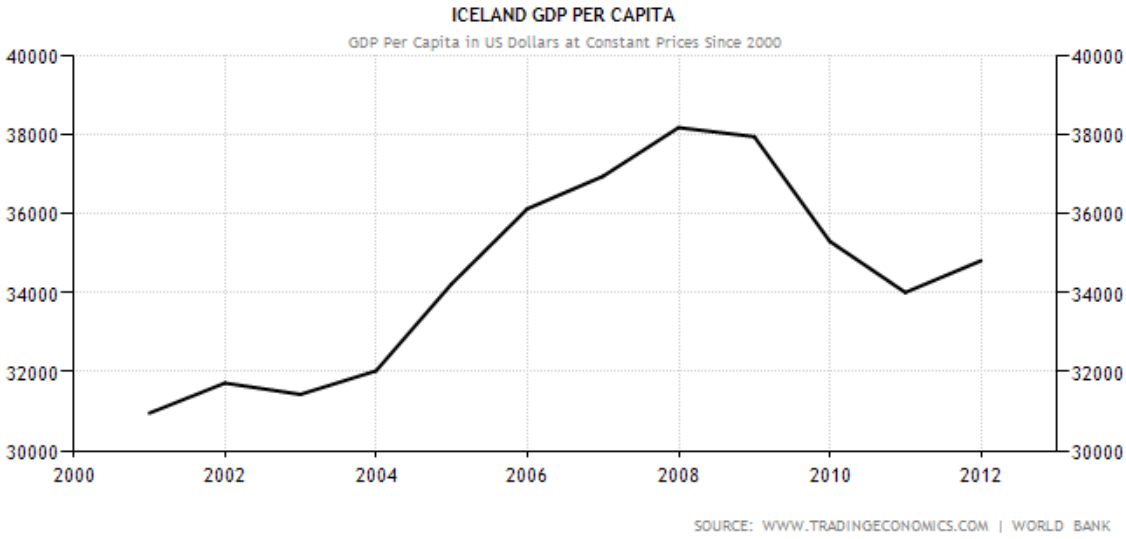

Figure 3. Iceland GDP per capita (in US dollars) since 2000.

Then between the period of January and July 2008, the krona began a drastic depreciation. As the national economy relied mainly on foreign trade, this drastic depreciation of the krona increased the costs of imports, while adding to inflation concerns. (Jackson, 2008) In order to stave-off a further depreciation in the exchange value of the krona, three of the largest domestic banks were taken over by the Icelandic Financial Supervisory Authority (FSA), a state-entity responsible for the regulation and supervision of the domestic markets (e.g. insurance, pensions, and securities). This take-over, though not an actual act of nationalizing, took place as the Icelandic stock exchange was suspended for a 48-hour period. Thus, it is the culmination of these aforementioned consequences that catapulted Iceland into one of the deepest economic recessions in modern history.

The collapse was defined as one of the worst economic downturns in modern economics, with sweeping unemployment, a severe currency crisis, deep national and household debts, significantly decreased purchasing power of all citizens, and severe capital income loss (figures 3 and 4). (OECD, 2013) Very much like a canary in the economic coal mine for the rest of the world, Iceland's improvement has shown to be more sensitive than other nations, due to its size. For instance, as the global economy began to deteriorate in 2007 – 2008, the Icelandic economy collapsed severely and swiftly. Similarly, as the global economy began to show glimpses of light, the Icelandic economy already began to stabilize. (Thorgeirsson & van den Noord, 2013)

The economy, which experienced consecutive contraction years around the collapse (by approximately 4 - 6.6 percent), began to stabilize in 2011 and then to grow (by 2.5 percent) in recent years. (Jackson, 2008) And in 2011, Moody's upped Iceland's sovereign debt to stable. (Moody's Investors Service, 2013) Unemployment has decreased from 8 percent (2009) to 4 percent (2012). However, not all macro-level indicators are showing to be favorable, e.g. public debt. (Thorgeirsson & van den Noord, 2013) In 2009, the public debt share grew to 88 percent of GDP then to 118.9 percent of GDP in 2011. The public debt is now 128.6% of GDP (2012). (CIA, 2013)

These economic austerity cuts were accompanied by marginal healthcare austerity measures. A drastic reduction in spending (as a percentage of gross domestic product) was observed among public health expenditures[1] from the 2008 (7.54%) to 2012 (7.17%) period. (Statistics Iceland, 2013) However, the year encompassing the collapse (from 2008-2009) did observe a large increase in public health expenditures (7.54 – 7.90%). Similarly, the percentage of healthcare expenditure supported by the government has slowly decreased since the collapse, while the burden of healthcare financing has been shifting to the private sector (e.g. citizens) during that same period (from 17.49% in 2007 to 19.63% in 2011). This increase translates to a rise in private healthcare expenditure (as a percentage of gross domestic product) from 1.59% (2008) to 1.75% in 2012, with the biggest spike of this time

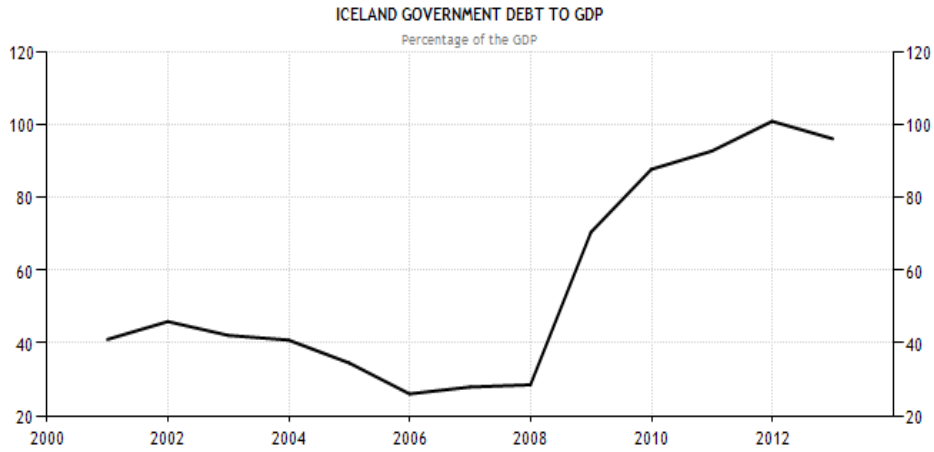

Figure 4. Icelandic government debt to GDP since 2000.

[1] This does not include household purchase of public healthcare.

being in 2010 (1.82%).

With disparate economic outlooks and substantial changes in healthcare expenditures/funding, it is unclear if there will be an impact on the health of Icelanders, in short- and long-term perspectives. The unique features of the Icelandic economic collapse in terms of magnitude and velocity provide excellent conditions for conducting internationally leading research in the domains of public health and health economics. And as the nation relies heavily on foreign markets and tourism, Iceland may continue facing a number of obstacles before their economic woes discontinue and they begin experiencing any signs of gross recovery - thus, extenuating any negative mental health consequences experienced by the collapse.

1.2 Macroeconomic contractions and health

Mortality:

In the broader literature on economic crises and population health it has been debated whether health moves in a procyclical (e.g. as the economy declines, so do health outcomes) or countercyclical (e.g. as the economy declines, health outcomes improve) direction to macroeconomic conditions. The work of Brenner beginning in the 1970s suggested that mortality is countercyclical, i.e. when the economy is down, mortality rates – in particular, suicides – rise. (Brenner, 1987) However, in more recent years, a series of econometric studies have suggested that mortality is procyclical, i.e. during economic contractions death rates decline (Tapias Granados, 2005; 2008; 2009; Stuckler, Basu, Suhrcke, Coutts, & McKee, 2009) There are plausible reasons for this unexpected finding – for instance, during the 1998 Korean financial crisis, economic activity was so depressed that there was a detectable decline in traffic-related mortality. Others have speculated – without direct evidence – that people are more likely to be over-worked and "stressed" during economic booms than during busts, having less time flexibility to engage in health promoting behaviors. (Ruhm, 2000; 2004)

A recent article by Lopez Bernal et al. (2013) found that in Spain there were no marked changes in deaths related to accidents in Spain during the recent economic crisis. While this does not show a decrease in accidental deaths, it does indicate support for a theory that individuals do not exhibit riskier behaviors during times of economic recessions. During the Great Depression there was strong evidence suggesting a reduction in all-cause mortalities related to a number of illnesses. (Stuckler, Meissner, Fishback, Basu, & McKee, 2012)

Counter to that reduction, a number of death rates (i.e. heart disease, cancer, diabetes) increased, with plausible ties to economic shocks. However, the biggest comparative points for today's crises and the Icelandic case are the findings that higher rates of bank suspensions are significantly associated with higher rates of suicide. With a small population it is difficult to statistically attribute any changes in suicide rates to economic changes or austerity cuts. However, the Icelandic government did intervene almost immediately by nationalizing the largest banks in the country. It becomes more imperative to monitor the risk factors for suicide at the micro-level (e.g. depression). (Hawton, Casanas i Comabella, Haw, & Saunders, 2013)

The mechanisms behind the effects of economic changes on mortality are centrally two-fold and relate back to the pro- and countercyclical relationship. Firstly, the risky behaviors that increase an individual's likelihood of – for example – accident-related mortality rates may be decreased through individual's desire to decrease cost-related behaviors. In the case of traffic-accidents, individuals may view their risky driving behaviors (e.g. speeding, recklessness) as increasing their risk of increased primary financial costs (i.e. traffic citations/fines, automotive repair), as well as increased secondary costs related to mortality and diminished health (e.g. medical-related costs, foregone income through inability to work). Secondly, a significant mechanism for the effects of certain increased mortality rates (e.g. suicide) during economic changes may be caused by decreased psychological health. For example, as economies (either national or personal) contract, the risk of suicide-related psychological illness (e.g. depression) also increases. These two dynamic mechanisms, decreased risky behaviors and increased psychological illness, begin to parse out the causes of observable elevations in certain mortalities (e.g. suicide), accompanied by reductions in other mortalities (e.g. accident-related).

Mental health:

Based upon the aforementioned studies, the central mechanisms between economic recessions and health changes may be multifold. Firstly, and in line with the procyclical theory, mental health (e.g. suicide, depression) may deteriorate as the economy begins to decline. This includes both macro- (i.e. increased public debt) and micro-level (e.g. income loss) economic changes. A defined process would be: as economic conditions deteriorate and

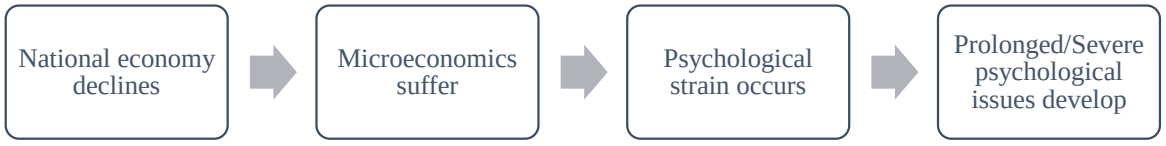

Figure 5. Role of macro-economic changes on mental health – hypothetical model.

individuals suffer increased economic strain (e.g. lowered disposable income), psychological stress could rise and lead to more severe mental health issues (e.g. depression). (Rahmqvist & Carstensen, 1998; Viinamaki, Hintikka, Kontula, Niskanen, & Koskela, 2000)

In the early 1980s, most of continental Europe underwent a less severe recession. However, a few comprehensive studies found that there were no significant changes in psychological health. (Van Der Velden, 1989; Ketting, 1989) Unlike the aforementioned recession of the 1980s, the recession that hit Sweden and Finland was marked by significantly higher incidences of psychological disorders, i.e. distress/anxiety; however, no changed risk of decreased sleep quality or increased suicidal behaviors were observed (even decreased for males). (Rahmqvist & Carstensen, 1998; Viinamaki, Hintikka, Kontula, Niskanen, & Koskela, 2000; Ostamo & Lonnqvist, 2001) Certain similarities may be drawn between the economic crises that occurred in Finland and Sweden in the 1990s – where unemployment rates rapidly rose – and the crisis in Iceland in recent years where unemployment rose from 2% in 2007 to a maximum of 9% in 2009. (The Central Bank of Iceland, 2008; Research Institute of the Finnish, 2008)

Recent data on the global 2008 economic crisis and psychiatric morbidity have indicated an increase in major depressive disorders in some countries (e.g. Hong Kong, Canada) (Lee, et al., 2010; Wang, Smailes, Sareen, Schmidt, & Patten, 2010), but not all (e.g. Australia). (Shi, et al., 2010) Lee et al. (2010) observed a 4.0% increase in the prevalence of depression from 2007 to 2009. This increase was observed in both males and females. Additionally, their findings indicate a few significant risk factors, including select age groups (55-65 years), those in the middle education bracket, and those employed or at-home. Surprisingly, their results indicate an increased risk of depression not in the middle income group, but the lowest and the highest. Wang et al. (2010) found similar overall findings. By examining the lifetime and 12-month prevalence of certain mental disorders, they found that among the working population there was an increase in the 12-month prevalence of major depressive disorder from 2008 to 2009. Additionally, they found no other changes in the 12-month prevalence of other mental disorders, i.e. anxiety disorders (social phobia, panic disorder, and generalized anxiety disorder). Counter to the studies by Lee et al. and Wang et al., Shi et al. (2010) found a decrease in the prevalence of psychological distress when comparing the period before the most recent economic crisis (2005/07) to the period during (2008/09). Their findings indicate no increase in mental health conditions overall during this period, however, certain subgroups,

like part-time workers, experienced significant increases. These studies highlight on the importance of examining at-risk subgroups of the population.

While findings do indicate some effects of the recent, as well as previous recessions, on the mental health of the population, the findings have been mixed. There is a definite scarcity of population-based data on the effects of economic recession on mental well-being, leaving lingering speculations of long-term effects on psychological morbidity (including depression). Even so, the literature is limited with regard to level of exposure to economic recessions, such as potential job loss, increase of debt, loss of money, etc.

Physical health and behaviors:

Recent studies on the Icelandic population indicate significant effects of the recent crisis on the physical health of the population. Eiríksdóttir et al. (2013) found indications for an increase in the risk of low birth weight infants in the period immediately after the collapse. The authors speculate that this increase was the potential result of higher stress levels, as other studies on the Icelandic economic collapse indicate a rise in unhealthy levels of psychological stress among women (Asgeirsdottir, Corman, Noonan, Olafsdottir, & Reichman, 2012) and previous research on low birth weight risk factors indicate increased stress as a large mechanism. (Hedegaard, Henriksen, Secher, Hatch, & Sabroe, 1996) Similar work by Asgerisdottir et al. (2013) offers up a similar relationship between the Icelandic crisis and the health of the population. By using the same cohort utilized in this thesis's studies, the authors found that the crisis was correlated highly with hypertension, though only in women. Furthermore, their evidence point to a significant role of stress levels, and an even greater role of smoking and body weight.

In Greece, researchers found a relative worsening of self-reported health status corresponding to the recent rise and fall of the economy. (Vandoros, Hessel, Leone, & Avendano, 2013) The study, quasi-experimental in structure, compared the trends in Greece to that of a control group, in this case Poland. In the classic case-control study inference practice, the authors find no differences in health status between Greece and Poland before the start of the crisis, only after. This pattern has been observed historically in other economic fluctuations, as well as other countries. By examining the fluctuations of housing prices in the United States from the 1990s through the early 2000s, Hamoudi & Dowd (2013) show a strong relationship between housing prices and health outcomes. By using housing prices as a

proxy for economic changes, both of the aforementioned studies indicate a significant procyclical relationship between economies and health outcomes, specifically physical health. Using U.S. data, Ruhm (2000) previously reported that economic recession was associated with a decline in the prevalence of cigarette smoking. A recent report from Gallus et al. (2011) found that the recent economic contraction in Italy has given rise to an increase in the percentage of current smokers – primarily for women.

Iceland, along with fellow Nordic nations, offers a universally comprehensive healthcare system funded almost entirely by general taxation. Yet what this universal system of healthcare lacks is basic dental health insurance for its adult population. (Kravitz & Treasure, 2009) Though partial reimbursements are in place for those under the age of 18 and other qualifying pension recipients (i.e. retired, disabled), dental care is, in essence, a luxury good for the majority of the population. In addition to this fee-for-service dental care system, private dental insurance plans are nonexistent, aside from limited accidental dental care. While existing research on the impact of the recent global economic crises on health outcomes is limited, epidemiological studies on dental care outcomes and behaviors are more limited. (Waldman, Chaudhry, & Cinotti, 2009)

1.3 Microeconomic changes and health outcomes

Though the focus of this thesis is on macroeconomic changes and health outcomes, e.g. national unemployment rates and rising national debt, health changes caused by personal economic strain and loss, i.e. microeconomic changes may give important background for the thesis' aims.

Mortality:

In Sweden, researchers examined the effects of closures and job loss on differing mortality rates. (Eliason & Storrie, 2009) Using micro-level data, they found that the overall mortality risk for men increased dramatically within the first few years following job loss. However, the same findings were not found for females or in long term job loss. For both genders, they found that there was a systematic increase in suicides and alcohol-related deaths in the short term. Borrowing from these findings, it can be hypothesized that the initial shock of job loss is substantial for individuals' mental health. In the long run, however, the biggest health effects of being unemployed have been observed among men. Thus, the increased mortality rates observed in men – not women – (including alcohol-related) should not be viewed as a proxy for mental health affect, as women could very well be affected by job loss.

Microeconomic changes and strain have been linked to mortality and loss. For example, McCormick et al. (1984) examined infant death in the United States according to socio-demographic information and, of particular importance, annual family income. Those mothers at the highest risk of infant loss were more likely to be in the lower income levels, comparatively speaking. Similarly, a recent study in Italy found strong evidence for the role of income and unemployment at the individual level on varying cause-specific mortality rates. (Dallolio, et al., 2012) Their findings are threefold; mortality is related to (1) income distribution, (2) absolute income, (3) and unemployment. Variation in mortality may be a micro, and not macro-economic issue. For instance, in a systematic review of 152 different countries by Schell et al. (2007) found no evidence between general mortality and income changes/inequality in high-income countries. However, as this study was at the macro-level, not micro, they found the converse of Dallolio et al. (2012) and McCormick et al. (1984). This paradox is exemplified by findings showing income effects at the micro-level, but not at the macro-level, like Schell's systematic review of 152 different countries. Recently, Catalano et al. (2010) explored this paradox. While their findings were not overwhelmingly conclusive, they do show evidence that general mortality rates are unaffected by macro-economic changes, while micro-economic changes (i.e. job-loss) for individuals does produce an association with rising mortality.

Mental health:

A recent article by Agudelo-Suarez et al. (2013) explored the associations between the mental health and personal socio-economic characteristics of Spanish migrant workers. While the findings were found primarily in men, there were indications in women as well. Their results indicate that the most significant detriment to mental health was the result of personal job loss and low income, compared to their counterparts. Furthermore, their findings point more to the role of microeconomic changes than macro for the significant mechanism behind health changes, as those unemployed or low income individuals, and not their employed or higher income counterparts, were affected. Agudelo-Suarez et al.'s findings indicate an increase in poor mental health for women, but found no specific associations within subgroups of women.

A recent study on a sample of British couples found that job loss to be a significant driver of poor mental health for men, as well as their wives. (Mendolia, 2012) It may be more than loss of income, as the author theorizes it, a husband's job loss may cause significant role shifts, offsetting the mental health of both individuals. Understanding this economic strain at

the micro-level is crucial to understanding what occurs at the aggregate. Similar studies have produced comparable results. (Marcus, 2013) Exploring further the role of job loss on the familial unit, researchers have found strong evidence for a negative effect of paternal job loss on children's school performance, linking to the decreased psychological health. (2011) However, this significance was not observed in maternal job loss. Taken together, it seems that job loss, especially by men, plays a large role in the psychological health of the family unit.

A cohort study in Sweden, which is similar in structure to the cohort used in this thesis, found that unemployment impacted men, not women. (Backhans & Hemminsson, 2012) Their findings also revealed that those with low tier occupations, low wages, and low control of their current job were more likely to be mentally distressed. During this period of time, Sweden was not experiencing systematic changes at macro-level for income or job loss. Thus, it can be inferred, that this study lends strong support for the role microeconomic changes on mental health. More importantly, as a drastic economic recession did not occur during this period in Sweden, it demands a thorough investigation of what changing microeconomics had on the Icelandic population during drastic macroeconomic changes.

In Europe, the effects of economic changes at the micro-level are beginning to leak into the realm of providers. For instance, Gili et al. (2013) found that the recession in Spain is causing more than just rising rates of mental disorders at the aggregate level and the individual level, but the mental health deteriorations are increasing at such a high frequency that they are affecting even primary care providers. The effects are marked by significant increases in major depression, anxiety, and alcohol-related illnesses. This is a cause for alarm, as the authors found that these changes are being caused by micro-level changes, i.e. household unemployment and personal debt.

Physical health and behaviors:

Similar to Giovennelli's (2013) methodology, Gallus et al. (2013) utilized the Behavioral Risk Factor Surveillance System surveys to ascertain the effects of unemployment and socioeconomic factors on smoking behaviors. Using a sample of almost 2 million US adults over the course of half a decade surrounding the recent economic collapse, the study authors found a net increase of 0.6 million new smokers. Though this was a macro-study, the increase was primarily observed at the micro-level among those unemployed, where there was a steady high prevalence of smoking post-crisis. Though secular trends indicate an ongoing decrease in smoking, these findings point to a stable increase in smoking among those recently

unemployed. (Statistics Iceland, 2013) Other empirical evidence points to psychological stress (e.g. economic strain being the cause) as the central mechanism for an increased risk of smoking. (Herbig, Dragano, & Angerer, 2013; Gallus, et al., 2011) Similarly, at the micro-level, Shaw et al. (2011) found a direct association between economic hardship and a propensity to smoke.

A recent examination of the Great Recession period of the US, found a net decrease in alcohol consumption, similar to what Gallus et al. (2013) found in smoking behaviors. While alcohol consumption diminished over the period of the collapse at the macro-level, at the micro-level those who recently become unemployed were at a markedly higher risk of binge drinking than before the collapse. The macroeconomic changes that occurred in the US caused marginal improvements in smoking and alcohol behaviors. However, at the micro-level, there were profound negative effects of becoming unemployed, i.e. increased risk of smoking and binge drinking. As the US launched a large-scale financial stimulus to halt the economic deterioration and shows strong signs of economic recovery, most of Europe adopted strong austerity cuts and measures. (McKee, Karanikolos, Belcher, & Stuckler, 2012) This approach has resulted in rising public debt and stagnate economies, as seen in Iceland, UK, Ireland, Greece, and Spain. (Statistics Iceland, 2013) To this extent, it becomes important to quantify the proper consequences of these measures in Iceland.

The aforementioned studies on the US shed light on the need to differentiate health outcomes occurring at the macro- and microeconomic levels. The US – even with its large-scale economic stimulus legislation designed to stop the economic deterioration – experienced improved health as a whole, i.e. smoking, alcohol consumption, but then observed the simultaneous health deterioration of economically vulnerable groups. However, big obstacles in macro- and microeconomic health research are secular trends towards overall improvements of certain health behaviors, such as movements towards smoking bans in public areas (Barr, Diez, Wang, Dominici, & Samet, 2012; Gregg, et al., 2005) The effects of micro-economic health changes have been shown to affect the health of not just working age individuals, but children and the elderly. For instance, Lindo found that husbands' job loss had a significant negative effect on infant health, including reduced birth weight. (2011) While job loss may be an indicator of poor familial health, low income may be a stronger predictor of poor health outcomes for the family as a whole. Larson & Halfon (2010) found that children below poverty level were two to four times more likely to suffer from a host of poor health outcomes, compared to those above poverty level, including obesity, diabetes, and

psychological/behavioral problems. The effects of poor micro-economic conditions have also been shown to affect elderly. Using longitudinal data, Gallo et al. (2000) found evidence for the negative effects of involuntary job loss on physical functioning and mental health among older workers. Their findings held true after controlling for baseline health and socio-demographics, indicating another strong relationship between job loss and negative health. However, another study utilizing the same study data did not find these results, however they did find indications of reverse causality. (Salm, 2009) The differential findings may be the result of differing methodologies.

From fixed-effects analysis on micro-data from the Behavioral Risk Factor Surveillance System in the United States, Giovannelli (2013) found that health (i.e. health behaviors, exercise) at the personal-level is countercyclical to personal economics (e.g. job or income loss). Opposite to these findings, Jonsdottir & Asgeirsdottir (2013) found that for unemployed Icelandic women – not men – gained less weight compared to their stable employment counterparts. Their findings go against the grain of previous research on microeconomic changes and body weight gain, where a procyclical pattern is found. (Macy, Chassin, & Presson, 2013) While their findings on micro-data are novel, this novelty may be primarily due to the inherent large-scale and severe economic downturn that accompanied it. Thus, the macro changes in Iceland (e.g. systematic decreases in the purchase power of individuals) may trump the changes that occurred at the micro-level, as was the case in a recent study on the Great Recession period in the United States. Nandi et al. (2012) discovered that while at the aggregate (aggregated by region) no variations were seen between employment groups and health behaviors, individual-level unemployment status (not aggregated by region) was highly related to alcohol consumption, smoking, and obesity. Going further, they actually observed many decreases in heavy drinking during this period at the aggregate-level – which was not observed at the individual.

1.4 The role of economic strain and health

The previously referenced studies and lines of research elucidate the relationships between macro- and microeconomic conditions/changes and health changes. However, at the core of these relationships, stands the role of economic strain. Typically defined as financial strain, economic strain has been found to cause the greatest negative health effects in the long term, compared to short term. (Herbig, Dragano, & Angerer, 2013; Siahpush, et al., 2013)

Moreover, the economic strain could cause other physical and behavioral health changes, e.g. smoking, drinking, dietary habits, accidents, as previous findings elucidate.

(Asgeirsdottir, Corman, Noonan, Olafsdottir, & Reichman, 2012; Ruhm, 2000) It can be theorized that as individuals suffer increased economic strain, they opt for less risky behaviors and more health behaviors, marked by decreased smoking, decreased heavy drinking, as well as decreased car accidents. Individuals may view risky behaviors as being costly and, thus, forego participating in those behaviors more frequently compared to during times of economic upturns. For example, smoking is costly due to the costs of cigarettes and other tobacco products and, furthermore, could increase the likelihood of smoking-related diseases (also costly if treatment is needed); slower driving speeds and more cautious driving decreases an individual's likelihood of accidents or traffic violations, both of which could be economically costly. From deteriorated psychological health to smoking less to driving safer, economic strain is a large driver of many health changes during times of recessions.

Economic strain has been widely studied in middle to late life individuals. Using a national longitudinal cohort of American women – followed from 1967 through 2003 – researchers found that economic strain is associated with quick declines in health during middle to late life. (Pylypiv Shippee, Wilkinson, & Ferraro, 2012) It was found that reported recurrent strain served as a far worse mechanism for deteriorated health than the effects of income change. Pylypiv Shippee and colleagues' study was based on a cohort of women tested over three decades. More importantly, and adding significance to the role of prolonged economic strain, the cohort was exposed to a period of strain lasting over 8 years and marked by high inflation and unemployment. Similar studies have shown economic strain to be the central factor between socio-demographic status and limited physical functioning among middle to late life women. (Ylitalo, et al., 2013) Chiao et al. (2012) found older adults exposed to economic strain at a significantly higher likelihood of poor mental well-being compared to their non-exposed counterparts. Similar to the study by Pylypiv Shippee et al. (2012), Chiao et al. (2012) found comparable results using a longitudinal study. With this in mind, it was the goal of these studies to explore the role of the economic crisis on a longitudinal cohort of working-age Icelandic adults.

In line with the findings by Chiao et al. (2012) on older individuals, Okechukwu et al. (2011) found that depressive symptoms were significantly associated with household economic strain. Thomas & Frankenberg argue strongly for the multi-directional relationship between economic strain at the micro-level, macro-level, and personal health outcomes. (Thomas & Frankenberg, 2002) First, if an individual becomes wealthier or begins to earn more at their job, they will be happier and healthier, which serves as a buffer against negative

health effects, making them less susceptible to disease. Similarly, as they are now healthier, they will be more energetic and productive, producing larger work outputs. As their production and outputs increase, in theory, the economics of their firm or business should also improve. If this micro-level relationship spreads to the greater populations, the economics of the area (i.e. community, nation) will increase. (Suhrcke, et al., 2006) However, if the economics take a large-scale negative shift at the macro-level (i.e. an economic collapse, recessions), this could shift outcomes in the reverse direction – where, in no exact order, businesses suffer, unemployment systematically increases, personal purchasing power and household incomes decrease, tax revenues decrease, the government slumps, austerity measures take hold, and banks loan less to their customers. (Giovannelli, 2013; Stuckler, Meissner, Fishback, Basu, & McKee, 2012) As these aforementioned events unfold and individuals are affected at the micro-level (e.g. job loss, reduced income), their mental and physical health decline, causing their economic productivity to decline – in turn, this exacerbates the economic changes that occurred at the macro-level.

1.5 Study motivation

With this background, the essential objective of this dissertation is to *evaluate the consequences of the economic collapse on the mental well-being and health behaviors of the Icelandic population and to identify determinants of these behaviors.*

1.5.1 Papers I-II

Aims: To examine potential changes in mental well-being since the collapse and to ascertain risk factors and determinants of mental well-being in the Icelandic population following the economic collapse in 2008, including psychological stress and depression.

1.5.2 Paper III

Aim: To examine the possible change in the prevalence of smoking since the collapse, while ascertaining the role of income change on individuals' propensity to relapse or quit smoking.

1.5.3 Paper IV

Aim: To examine the potential changes in dental health behaviors and outcomes from pre- to post-collapse, in terms of brushing/flossing habits, as well as dental visit check-up frequencies.

2 Materials and methods

2.1 Study population

All aims were ascertained using the *Health and Well-being in Iceland* cohort. This cohort (n=4100) is based upon respondents from a mail-in survey conducted by the Public Health Institute of Iceland, titled Health and Well-being in Iceland. Respondents were sent a questionnaire and then required to mail it back in order to be fully considered in the cohort. This survey was conducted in two-assessments: (1) between October and December of 2007, (2) between November and December of 2009. The initial study population was based upon a stratified random sample of the Icelandic population. This random sample consisted of 9807 individuals and was chosen from 12 strata; consisting of two geographic regions (i.e. urban vs. rural) stratified by six age groups. Of the original 9807, 5910 responded to the initial 2007 questionnaire (response rate of 60.2%), with 4100 responding again to the modified 2009 version of the survey (response rate of 69.4%), which included additional measures of the impact of the 2008 financial crisis. Consequently, these cohort studies examined changes in health indicators from 2007 to 2009, as well as the state of health in 2009 following the national economic collapse.

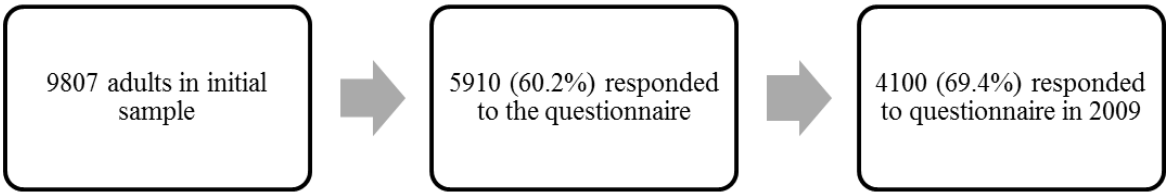

Figure 6. The cohort of the *Health and Well-Being in Iceland* cohort.

Psychological stress cohort

The final sample chosen for the psychological, perceived stress study (paper I) was further constrained to those individuals responding to the entire PSS-4 in 2007 and 2009, thus representing a cohort of 3,755 (N=3,755) individuals.

Depressive symptoms cohort

The final sample for the depressive symptoms study (paper II) was constrained to include those that responded to the WHO-5 in 2007 and 2009, which represents a final cohort of 3,783 (N=3,783) individuals.

Smoking behaviors cohort

The final sample of the smoking behaviors study was chosen to model the perceived stress study (paper III). As perceived stress was of high importance for examining smoking behaviors, the sample was constrained to those individuals that responded to the PSS-4 in both 2007 and 2009, representing a cohort of 3,755 (N=3,755) individuals

Dental behaviors cohort

As differing dental behaviors and health outcome measures were of central importance (paper IV), the entire cohort of 4,100 (N=4,100) was the final sample for the dental behaviors study.

2.2 Outcome measures

2.2.1 Mental health – Papers I-II

The *Health and Well-being in Iceland* questionnaire contains extensive measurements on mental health. The study used a four-item psychological stress scale. The Perceived Stress Scale (PSS-4) is a shortened and well-validated version of the original, larger 14-item scale. (Cohen, Kamarck, & Mermelstein, 1983; Cohen & Williamson, 1988) The PSS-4 is scored on a range of 0-16, with a higher score indicating higher levels of stress. Scores range from 0-16 – the higher the score, the higher the perceived stress. An increase in stress was classified as any increase from baseline to follow-up; conversely, a decrease was classified as any decrease from baseline to follow-up. For example, an individual with a score of 5 in 2007 and a score of 10 in 2009 would be classified as having an increase in stress. Cohen & Lichtenstein found the PSS-4 to be an evidentially valid tool in determining the relationship between smoking and stress. (1990) In a recent study in Greece, researchers used a translated version of the PSS to determine its validity and psychometric properties across its use on English-speaking population. (Andreou, et al., 2011) They found that the translated versions of the PSS were well-validated, reliable, and appropriate for determining stress levels in research and in healthcare settings.

This study also used the WHO-5 Well-Being Index (WHO-5), which is well-validated and used as a screening measure for depression in primary care. (World Health Organization, 1998; Henkel, Mergl, Kohnen, Moller, & Hegerl, 2003) Scores range from 0-25, the WHO-5 has been given a recommended cut-off for low (poor) mental well-being: 0-12 is low mental well-being, 13 or above is normal. Specifically, researchers have shown strong internal and external validity of the WHO-5. (Bonsignore, Barkow, Jensen, & Heun, 2001) Bonsignore et

al. (2001) proved the WHO-5 to be a strong scale in its detection of depression and, moreover, its detection of depression in elderly population. Henkel et al.'s (2003) work found that the WHO-5 outperformed two other questionnaires tested in its detection of depression in primary care.

2.2.2 Health behaviors

2.2.2.1 Smoking – Paper III

Smoking status was asked in the survey, specifically regarding whether respondents are current smokers, had quit smoking, or had never smoked. Respondents were then stratified according to their smoking status: non-smoker, relapsed, and quit smoking.

Non-smoker: An individual will be classified as a non-smoker if they responded that they did not currently smoke on both the 2007 and 2009 assessments.

Relapsed smoker: An individual will be identified as having relapsed if they indicated that they (a) were a former smoker in the 2007 questionnaire, but indicated they had (b) smoked in any frequency in 2009. The cohort was restricted to individuals who were former smokers at baseline in these analyses.

Quit smoking: A respondent that had quit smoking must have indicated that they were (a) currently smoking in 2007, yet had (b) quit smoking by 2009. The cohort was restricted to individuals who were current smokers at baseline in these analyses.

2.2.2.2 Dental behaviors – Paper IV

The primary outcome measure was designed to assess an individual's frequency of dental check-ups, determined by the question "How often do you go to the dentist for a check-up?" Forced item responses include "at least twice a year", "once a year", "every second year", "every third year", "every fourth year", "have not gone for the past 5-9 years", and "have not gone for the past 10 years." As a means of determining changes in frequent check-ups during the years before and after the economic collapse, only the items "at least twice a year" and "once a year" will be focused on to assess yearly check-up frequency.

The secondary outcome measures were designed to assess an individual's frequency of tooth brushing and flossing determined by the questions "How often do you brush your teeth?" and "Do you use dental floss to clean between your teeth, and, if so, how often?"

Forced responses were ordered by “more than twice a day”, “twice a day”, “once a day”, “at least once a week”, “less than once a week”, and “never.”

2.3 Explanatory variables

2.3.1 Mental health – Papers I-II

For papers I-II, age, marital, education, employment, and occupational status were classified as explanatory variables in all analyses. Age was categorized into four strata: (1) 18-34, (2) 35-49, (3) 50-64, and (4) greater than 64; marital status into (1) single or divorced, (2) committed/not cohabiting, (3) married/cohabiting, and (4) widowed. Education status was classified into (1) basic (having completed primary school or less), (2) middle (completed high school or equivalent), and (3) university (a completed university degree).

Occupational categories were stratified according to (1) executive (e.g. top-level manager), (2) skilled (e.g. office worker, specialized industrial worker), and (3) non-skilled positions (e.g. sales assistant, laborer). Executive occupations were grouped according to (1) elected and top-level officials and (2) specialists (with academic and professional degrees); skilled occupations according to (1) professionals (without degrees), (2) office workers, (3) farmers, (4) seafarers, (5) tradespersons, and (6) specialized industrial workers; non-skilled occupations according to (1) service and sales persons, (2) vehicle operators, mechanics, machine tenders, and (3) laborers.

Furthermore, economic and collapse-specific variables were examined, including income, and income-loss. Household income responses, based on 10 response alternatives, were classified according to income ranges per year (in terms of Icelandic currency: ISK) (1) low (≤3.4 million), (2) middle (3.5-9.4 million), and (3) high (≥9.5 million); corresponding approximately to (1) ≤ 28,000 USD, (2) 28,000-77,000 USD, and (3) ≥ 77,000 USD.

Questions pertaining to the national economic collapse in 2008 were incorporated in the 2009 assessment, including involuntary layoff (i.e. *yes* or *no*), and loss of savings. Loss of savings was originally coded according to monetary losses in four separate economical components: loss of (1) money market accounts, (2) retirement savings, (3) stock shares, and (4) other savings. As it should be assumed that some individuals would have overlap in loss categories due to classification ambiguities, these four separate component categories were classified into one simplified variable (i.e. *no loss of savings* or *loss of savings*) - for example, individuals could possibly qualify their stock shares as retirement savings, or money market accounts as retirement savings.

2.3.2 Health behaviors – Papers II-III

In addition to socio-economic covariates of age, sex, marital status, and education in paper I, changes in perceived psychological stress (Paper III only) and economic status (i.e. income change; Paper III only) were included. For analysis of income change, household income was further dichotomized into either high or "low" (which combined the middle & low income categories). We examined two types of income change: a) drop in income between 2007 and 2009 from high to low; and b) a rise in income between 2007 and 2009 from low to high.

2.4 Statistical analyses

2.4.1 Mental health – Papers I-II

The cohort was described by age, sex, marital status, education, and economic/employment status – achieved through standard frequencies. To compare characteristics of respondents at baseline (2007) to follow-up (2009), chi-square tests were used. Additional analysis reveals rates of depressive symptoms (WHO-5) by assessment and demographic status.

Psychological stress scores were examined by creating a binary variable from PSS-4 scores. A cutoff point was derived from the following factor scoring method, enabling us to exact a unique cutoff for high stress levels. Further information on the methodology behind the factor scoring can be found in the published article. (Hauksdottir, McClure, Jonsson, Olafsson, & Valdimarsdottir, 2013)

$$S = w_0*q_0 + w_1*q_1 + w_2*q_2 + w_3*q_3 + w_4*q_4$$

A binary variable was created from raw WHO-5 scores, with a raw score above 13 being considered as *normal* and a score below 13 as *depressive tendencies*. We examined the odds of experiencing depressive tendencies in 2009, compared to 2007, using multivariate logistic regression. Models were adjusted for the potential confounders of age, sex, educational status, and marital status, as well as baseline depressive symptoms. Household income was further adjusted for the number of adults in the household, and models for loss of savings were then adjusted for household income. The odds of depressive symptoms at follow-up (2009) by changes in economic status were analyzed; these models were adjusted for potential confounders in the same manner as the initial models.

2.4.2 Health behaviors

2.4.2.1 Smoking – Paper III

The distribution of socio-demographic characteristics according to change in smoking status between baseline (2007) and follow-up (2009) was achieved using standard frequencies.

Odds (corresponding 95% confidence intervals) of relapse in 2009 was done by using binary logistic regression, as were the odds of quitting smoking in 2009. Further analyses examine the odds of relapse and quitting by background characteristics and change in income and stress levels. Binary logistic regression models were adjusted for age and sex; additionally, models for household income and income change were adjusted for baseline income levels. Supplementary relapse and cessation models were ran with/without baseline (2007) levels of and changes in stress from 2007 to 2009, as previous research illuminates the existing role of stress on an individual's likelihood to change smoking status. (Childs & de Wit, 2010; Parrott, 1999; Tsourtos, et al., 2011)

Differences in stress levels from 2007 to 2009 overall and by sex-differences were achieved using repeated measures ANOVA (p-values, F statistic).

2.4.2.2 Dental behaviors – Paper IV

To examine potential differences between the analytical cohort in the dental behavior study to those individuals who did not follow-up in 2009 (attrition group), chi-square tests were used.

Three separate binomial variables were created to analyze the effect of the collapse on (1) the prevalence of annual dental check-ups (1: visited a dentist at least once in the past year; 2: did not), (2) the likelihood of brushing daily (1: brush at least once a day; 2: do not), and (3) the likelihood of flossing daily (1: floss at least once a day; 2: do not). The likelihood of dental behaviors in 2009 were explored with 2007 frequencies as the referent groups. Bivariate logistic regression was used for all models. The overall models was adjusted for age; the model for income was adjusted for age, sex, education, marital status, size of residency, and number of adults in the household; all other models were then adjusted for age, sex, education, marital status, and size of residency.

3 Results

3.1 Mental well-being – Papers I-II

Levels of psychological stress and depressive symptoms before and after the financial crisis

Overall, the characteristics of the responders were similar in both waves, though the respondents were older in 2009, slightly more educated, and less likely to be employed. However, the analytical cohort differed from the attrition group in regards to age, marital status, education, and employment status.

From 2007 to 2009, the average levels of perceived stress increased significantly for women ($p < 0.01$), not men after being adjusted for age. Similarly, the unadjusted prevalence of depressive symptoms increased in the study population from 17.7% to 20.1% between 2007 and 2009. Additionally, unadjusted sex-specific rates revealed an increase in female rates (15.9% to 17.4%; $p < 0.01$) from 2007 to 2009, as well as in male rates (19.3 to 22.4; $p < 0.01$).

Employment status and potential changes in economic status

Compared to before the collapse, women that were unemployed (3.38; 1.09-10.49) and those that held a non-skilled position (1.46; 1.02-2.10) were more likely to suffer from high stress levels after the collapse. The same patterns were not observed in men. However, the unemployed at follow-up experienced an almost two-fold increased risk (1.87) of depressive symptoms compared to those unemployed at baseline. Further analyses did not find a non-significant increase – but tendency – for unemployed women (1.88; 0.85-4.19) and men (1.74; 0.77-3.91). Among those men who experienced any loss following the 2008 crisis experienced an increased risk of depressive symptoms (1.56; 1.07-2.28), which did not hold true for women. Moreover, there were no observable effects of income loss or increase in home mortgage on risk of depressive symptoms.

3.2 Smoking – Paper III

Baseline characteristics

In 2009, a total of 72.2% (2711) were non-smokers, 4.0% (56) of the former smokers at baseline had relapsed in 2009, and 22.2% (149) of smokers at baseline had quit smoking in 2009. From 2007 to 2009, we observed significant reductions ($p< 0.01$) in the prevalence of both male (17.4% to 14.8%) and female (20.0% to 17.5%) smokers.

Relapse smoking

At baseline, men in the lower (i.e. low, middle) income groups who transitioned into the highest income group in 2009 experienced an increased risk of relapse (4.02; 1.15, 14.00). Similarly, the downward transition from baseline to follow-up (i.e. those whose incomes dropped) had a decreased risk of relapsing (0.37; 0.16, 0.85). Additional models adjusting for baseline stress and changes in stress levels showed a marginal effect on the coefficients. This suggests some role of stress on some subgroups, but not all. For example, former smokers whose incomes increased between 2007 and 2009 may have relapsed in part because of an increase in stress.

Smoking cessation

Compared to men in 2009, women were less likely to quit smoking (0.65; 0.45, 0.93). Further analyses revealed increased likelihoods of quitting among the following women groups: those with middle (2.78; 1.48, 5.21) or university-level (2.73; 1.38, 5.40) education, and the disabled (3.42; 1.23, 9.52). Compared to younger women aged (i.e. ages 18-29), those in the middle-aged group (0.46; 0.26, 0.83) were less likely to quit. Additional models adjusting for stress levels did not reveal diminished significant effect sizes.

Stress and smoking

Thorough examination of changes in stress levels among smoking status displayed a significant change in stress levels (SD) among women who had relapsed from baseline to follow-up – marked by a significant increase in stress scores from 3.96 (2.52) in 2007 to 5.24 (3.46) in 2009 ($p< 0.01$; $F = 7.67$).

3.3 Dental behaviors – Paper IV

Change in dental check-up frequency

Overall, there was no significant change in the proportion of individuals visiting a dentist for at least one annual check-up, with 45.7% indicating that they visited a dentist at least once per year in 2009 compared to 43.9% in 2007 ($p= 0.08$).

Annual check-ups

In 2009, compared to 2007, men were more likely (1.12; 1.02, 1.24) to visit a dentist for a check-up at least once per year. Further examination reveals that men that were married/cohabiting (1.24; 1.06, 1.45) or homemakers (2.23; 1.12, 4.44) were more likely to go to at least one annual dental check-up in 2009 than in 2007. Furthermore, employed (1.29; 1.08, 1.55) or disabled men (2.10; 1.04, 4.27) were more likely to have gone to at least one annual visit in 2009 compared to 2007.

Among women-specific findings, only those unemployed (2.02; 1.03, 3.95) were more likely to go to at least one annual visit in 2009 compared to 2007.

Brushing and flossing behaviors

Similar to the overall change to visit a dentist at least once a year for a check, a significant change in the proportion of individuals brushing daily from 2007 to 2009 was not observed ($p= 0.08$) – in 2007, 96.8% of the cohort indicated that they brushed daily, while 97.4% were daily brushers in 2009. However, a significant increase in the number of individuals who flossed daily was observed ($p< 0.01$) – the percentage of individuals flossing daily increased from 40.2% in 2007 to 43.1% in 2009.

Daily brushing

Compared to 2007, in 2009 there was an overall increased likelihood (1.46; 1.11, 1.92) of individuals reporting to be daily brushers (table 10). There was a systematic increased likelihood across almost all strata, particularly among men (1.44; 1.06, 1.94) not women. Additionally, this significant increase was observed employed men (1.70; 1.09, 2.68) and those with a basic level of education (1.56; 1.09, 2.22).

Daily flossing

Similarly to daily brushing, there was an increase in overall self-reported daily flossing (1.15; 1.05, 1.26). Men experienced increased odds of daily flossing in 2009 when compared to 2007 (1.26; 1.09, 1.46), thought women did show a slight tendency (1.10; 0.98, 1.24). Further analyses found that men between the ages of 60-69 (1.36; 0.98, 1.89), as well as those men that were single (1.48; 1.00, 2.18) or married (1.22; 1.04, 1.44) were more likely to begin to floss daily in 2009.

Further non-sex specific findings indicate increased likelihood of flossing among all respondents with a basic education (1.26; 1.00, 1.61), those that were employed (1.22; 1.08, 1.37), and those in the middle income group (1.30; 1.12, 1.50). However, the effect sizes were much higher in men.

4 Discussion

4.1.1 Mental health – Papers I-II

Following the national economic collapse in 2008, our findings indicate increased risk of depressive symptomology and psychological stress for women, but not men. The largest increased risk of depressive symptoms and stress for women included those that were single, with lower levels of education, or with no children. However, we did find that unemployed individuals of both sexes, as well as men who experienced a loss of savings following the crisis had a significant increased risk of suffered psychological health. Moreover, we did not find significant risks among those with changed incomes (i.e. increased, decrease income) nor those who experienced an increase in home mortgage.

To date, studies have found mixed results regarding the impact of macroeconomic fluctuations and psychological health. (Catalano & Dooley, 1983; Khang, Lynch, & Kaplan, 2005; Prause, Dooley, & Huh, 2009) For example, studies measuring the effects of macroeconomic changes (e.g. unemployment) on suicide rates have indicated both positive and negative associations between these two variables. (Gerdtham & Johannesson, 2003; Neumayer, 2004) More recent studies examining the effects of the 2008 crisis on psychological health have found mixed and varying effects across the globe, including the less extensive – like in Australia – to the significant impact, like in Greece and Spain. (Shi, et al., 2010) In Greece, a systematic increase in depression was observed from 2008 through 2011. Moreover, the findings in Greece also indicate similar findings to ours, in that those individuals experiencing significant economic strain were at increased odds of developing depressive symptoms – though our findings indicate this for only men and only men who experienced a loss of financial savings, not direct income-loss. (Economou, et al., 2012) Similarly a substantial increase in mental health deterioration was observed in Spain following the start of the crisis. (Gili, et al., 2013) This aforementioned study found an increase in major depression, anxiety, and alcohol-related illnesses following the crisis in Spain. Particularly, this increase was observed among families exposed to unemployment and mortgage payment difficulties, with the latter finding on mortgage not aligning with our results.

Sex differences

The current findings on the effects of the collapse on the health of the Icelandic population indicate a differential effect on women. (Gudjonsdottir, et al., 2011) The psychological study

found in paper II found that the 2008 collapse impacted the stress levels of the Icelandic population, particularly among women and – moreover – unemployed women. (Hauksdottir, et al., 2013) Potential mechanisms of these sex-specific findings may be the level of labor market participation by Icelandic women, as well as high fertility rates. Using a population-based register of the Icelandic population, Gujonsdottir et al. (2011) examined changes in emergency department visits at the National University Hospital. Comparing the same 10-week periods in 2006 through 2008, highlighting the period around the start of the crisis, the authors found a considerable immediate surge in attendance rates for women, specifically within the cardiac emergency department. This gender-different surge in cardiac issues does draw support for our findings on increased stress levels for women following the start of the crisis, as higher stress levels have been linked to higher risks of cardiac issues. (House, 1974)

Similar findings were found as a result of the economic recession in Finland in the 1990s, where women and not men experienced an increase in mental disorders during the first two-years of the crisis. (Viinamaki, et al., 2000) However, other studies on the effects of the recent economic crisis have not found a similar sex difference in mental health outcomes. (Shi, et al., 2010) In 2009, the WHO indicated that women are in fact more significantly affected at the beginning of the economic crisis – similar to what our study observed. (World Health Organization, 2009) If our findings are in fact driven by the timing of follow-up (one year after the collapse) then longer-term follow-up studies are warranted. Our findings therefore highlight the need to examine the potential effects of the economic crisis in the long term, e.g. heightened rates of suicide. (Avgenakis, 2011; Katsadoros, Bekiari, & Karydi, 2011)

Employment and economic status

Of highest interest, our findings indicate employment status as a significant mechanism in changed mental health outcomes over the economic collapse period. More specifically, the lack of secure employment led to higher levels of stress for women. Most research to date has found either non-differential gender or general male-specific affect resulting from economic fluctuations. In Finland and Sweden, researchers found a rise in psychological distress following periods of economic recessions in the 1990s, with no differentiation between men or women. (Viinamaki, Hintikka, Kontula, Niskanen, & Koskela, 2000; Rahmqvist & Carstensen, 1998) Another study on the Finnish economic recession during the 1990s revealed reduction in suicide rates for men, with no observable changes in rates for women. (Ostamo & Lonnqvist, 2001) Examinations of the recent global economic crisis have shown marked increases in psychological illness. For instance, Lee et al. (2010) found a rise in major

episodic depression from 2007 to 2009 in Hong Kong, regardless of gender. Moreover, this rise was most significant among those that lost significant financial savings and investments.

Of importance, we found that the most significant risk factors for depressive symptomology were unemployment (for both men and women) and loss of savings (for men only). Similarly, this effect of financial loss has been strongly linked to a rise in suicidal ideation. (Turvey, et al., 2002) Warranted examinations on the effects of financial savings loss are need on the Icelandic population. However, it may be hypothesized that an increased risk of depression among men experiencing a loss of financial savings may be partly explained by increased reliance on personal savings. Moreover this may be rooted in men's drive to fulfill their provider role, which explains the lack of effect in women. As the provider role is not met, this may lead to economic strain, leaving men more susceptible to psychological morbidity (e.g. psychological stress).

While our findings did not show a significant increased risk of depressive symptoms for women or men who experienced job-loss following the crisis, there was a strong tendency for both sexes. This lack of evidence, however, may largely be the effect of the low sample size and follow-up rates of those unemployed. Kalil et al. (2009) found that women experiencing job insecurity and loss were at a substantially higher risk of maladaptive psychological responses (e.g. feelings of loneliness and personal stress), and not men. The increased risk of high stress levels and depressive symptoms among women after the economic crisis may be largely explained by the effects of job insecurities among employed women, rather than just the economic effects of losing a job.

4.1.2 Smoking – Paper III

Our findings indicate a decline in the prevalence of smoking following the start of severe collapse in Iceland. Furthermore, this decline was observed for both sexes. However, this decline could be attributed, at least in part, to ongoing secular trends (Statistics Iceland, 2013), which could be explained by rising costs of tobacco products and changing norms. The longitudinal nature of our study and the timing of the survey waves contribute to the strength of findings as we were able to document smoking habit changes following the start of the collapse and subsequent start of the recession. Secondly, our findings are relatively similar to the overall decline in smoking rates observed nationally over the same period (2007: 23.0% of population; 2009: 19.0%), which adds support to the generalizability and strength of our findings.

Overall, our findings largely align with previous studies on the procyclical nature of the economic downturns and health outcomes. Largely, as it has been observed during periods of economic crises and recessions, risky behaviors, e.g. smoking habits, are diminished. Former male smokers who experienced an income fall during the period of the recession had a significant decreased likelihood of smoking relapse. Conversely, among men who experienced an increase in income following the start of the crisis, there was an observable increased likelihood of smoking relapse compared to those with a stable income. There was an observable tendency for similar associations in women; however, none of the estimates were statistically significant. This may be the direct result of a low sample size and occurrence of events.

Of central novelty, the significance of our findings is that male former smokers experiencing decreased income during the economic crisis were less likely to relapse than those with stable incomes. Ruhm (2005) hypothesized that this decreased risk is largely explained by a tendency for people to adopt health behaviors during periods of economic strain. Furthermore, it can be presumed that this decreased likelihood to relapse is driven by the expense of cigarette purchasing. During periods of high inflation and simultaneous decreased incomes, individuals suffering the most (i.e. psychologically stressed and diminished household incomes) may be less willing to return to previous risky smoking habits, which leads to this asymmetric and nonsystematic change in smoking behavior by income change. For example, a former smoker is less likely to begin smoking again, in the wake of diminished income, because of the lack of affordability of cigarettes.

The national smoking prevalence is diminishing, as supported by our study, which supports the procyclical nature of smoking (i.e. recessions improve health behaviors). While this is observed at the national, macro-level, at the micro-level this is not the case, as smokers whose incomes declined were not more likely to quit. It can be argued that this the overall decline in national smoking rates could be a combination of either the procyclical nature of smoking or simply a continuation of secular trends already in place prior to the recession. Taking it all together it becomes transparent that national averages are driven by more than the small, select group of smokers whose incomes diminished in the period after the start of the crisis.

The underlying link between stress levels and smoking behaviors has long been explored, for which our findings corroborate. However, previous research is mixed: some indicating stress as a cause of smoking; some indicating smoking as a central stress causer; some pointing to smoking cessation as leading to a reduction in stress. (Childs & de Wit, 2010;

Parrott, 1999; Tsourtos, et al., 2011) Our findings show that relapsed smokers – regardless of sex – experienced the lowest stress levels in the period before the collapse when they considered themselves as having quit smoking in 2007 (table 8). However, and this is especially true for women, these relapsed smokers experienced an increase in stress in the recession period after the crisis began. This pattern illuminates on a theory of vulnerability for this group relapsing, in which these individuals use smoking as a means of stress relief. (Perkins & Grobe, 1992) Increased economic strain has been shown to be a significant contributor to increased psychological deterioration. (Aldwin & Revenson, 1986) Furthermore, heightened psychological stress may be amplified by a return to smoking. (Cohen & Lichtenstein, 1990)

4.1.3 Dental behaviors – Paper IV

At the aggregate, the 2008 crisis did not cause a significant change in the dental health behaviors of the adult population. However, further analysis does reveal significant changes for some groups from 2007 to 2009. Primary shifts were seen among men. From 2007 to 2009, men had an observable increased likelihood of visiting a dentist at least once annually. Though observable changes were observed overall for men only, both men and women with a basic level of education were more likely to attend an annual check-up after the collapse than period before. Unemployed women in 2009 compared to 2007 experienced a dramatic increased likelihood of attending at least an annual visit, which was not observable in unemployed men.

Our study reveals an effect of the economic recession on daily brushing and flossing habits among the Icelandic population. From 2007 to 2009, men were more likely to brush and floss on a daily basis. Upon further examination, the increased likelihood was most significant among employed men, as well as those with a basic level of education. Both men and women that were employed or in the middle income group were more likely to floss daily. Overall, there was no observable decrease in daily brushing and flossing habits.

Along lines of the research discussed previously, research on the role of economic recessions on health is divided between the dynamic thinking that economic hardship causes deterioration and that hardship actually produces improved/strengthened health. (Brenner & Mooney, 1983; Ruhm, 2000) What our previous research on the crisis reveal is backing for both dynamic theories. For example, the observable increase in stress and depressive symptomology supports that hardship produces health deterioration, while our findings indicating a reduction in smoking rates supports the school that hardship promotes proper

health improvement. (Hauksdottir, et al., 2013; McClure, et al., 2013; McClure, et al., 2012) The observable improvement in dental habits provides further support for the latter dynamic.

To-date very few studies have examined the role of socio-economic status/changes on dental care utilization. (Blackwell, et al., 2009; Grignon, et al., 2010; Lu, et al., 2007; Wamala, Merlo, & Bostrom, 2006) However, one such study by Blackwell et al. (2009) found strong differences between socio-economic groups in the Canadian population in regards to the overall dental care utilization, which is comparable to our indications, i.e. a significant decreased likelihood of dental care utilization in the lower socio-economic groups. Similarly, Mansnki et al. (2012) found that drops in income were highly related to a decrease in dental utilization.

Previous research has primarily focused on populations with access to private dental insurance. (Blackwell, et al., 2009) However, of greatest significance to the interpretation of our findings is the lack of existing dental insurance coverage (i.e. public, private) for Icelandic adults. Thus, as our cohort is based upon an adult population with no existing public or private dental health insurance.

4.1.4 The overall role of economic changes and health

Along lines with our previous findings, individuals have opted for healthier behaviors (e.g. smoking less, brushing/flossing more) that are of little economic costs to them. (McClure, et al., 2012; McClure & Sæmundsson, 2013) However, a reduction in certain behaviors – as in the purchasing of cigarettes or paying high out-of-pocket costs to visit a dentist – is observable for select groups (i.e. students). For instance, it can be theorized that these individuals are deciding not to go to the dentist due to the economic costs, but – in lieu – are opting for better oral self-care practices as a means of warding off the potential negative dental health consequences of not getting routine dental care. However, it seems that select groups (e.g. men, unemployed women) did experience an increased likelihood of visiting the dentist. Based on previous findings, it can be theorized that these groups are opting to visit the dentist more regularly as a means of warding off potential negative dental health implications.

As it can be theorized that the high costs of dental care is systematically causing individuals to opt-out of utilizing dental care, the government is then left with the difficult policy task of whether a public dental health insurance scheme should be implemented into the public health insurance scheme as a means of warding off the high out-of-pocket costs of seeking dental care.

A recent article by Christopher Ruhm (2013) theorizes that the current methodology of studying economic changes on health outcomes is inaccurate. He argues that valid studies in this space will only properly measure this relationship over long analysis periods (at least two decades). However, buried within his theory's arguments, contains a similar story to what our findings indicate. Ruhm shows that – over a long period of 23 years – some outcomes are highly procyclical in nature, e.g. cardiovascular disease, traffic accidents, while others are countercyclical, e.g. cancer-related fatalities, prescription overdose-related fatalities. While he essentially argues that studies of these sorts are unpredictable and may not be truly valid in drawing conclusions on the effects of economic changes on health, his study resonates almost completely with our findings and other recent findings from the same cohort (Asgeirsdottir, et al., 2012). As time is sensitive in monitoring the effects of changing economics on the health of a population, waiting to quantify these effects for a more "valid" and less "unpredictable" study over a longer period of time is disadvantageous.

As our findings point to both positive (i.e. smoking, dental habits) and negative (i.e. stress, depression) effects of economic deterioration, a significant underlying mechanism for these counter and procyclical findings may be the role of (a) policy and (b) prolonged economic strain. Research on policy, i.e. austerity cuts and Active Labor Market Programs (ALMPs), has been of high focus in recent years. Coutts et al. (2013) illuminate on the role of ALMPs on increasing the likelihood of resiliency to economic deterioration. As a form of austerity policies, ALMPs go beyond the traditional model of governmental support (i.e. subsidies) for those unemployed or newly jobless, by providing job training, search assistance, financial subsidies, etc. (Daguerre & Etherington, 2009) ALMPs typically contain elements of peer interactions and support. (Coutts, 2005) It can be viewed that ALMPs provide a surrogate for the social support found by being employed, as findings point to social support being a strong buffer against health deterioration following economic declines (e.g. mental health). (Clarke, 2013)

ALMPs have been found to diminish unemployed individuals' likelihoods of psychological deterioration (i.e. stress, depression, well-being) and lowered self-esteem. Moreover, ALMPs have been found to improve social support, supporting findings that these programs are strong surrogates for the foregone social support experienced when a job is lost. (Coutts, 2005) From Coutts' examination, evidence began to point out that it is not the material economic measures of these programs that led to changed health effects, but the psychosocial measures, i.e. social interaction.

There is an ongoing pattern following the global economic crisis – austerity cuts. Typically, governments cite the lack of available funds as a primary mechanism for reducing the scope of ALMPs or ending *job placement programs* altogether. (McKee & Stuckler, 2011) In times of economic hardship and austerity measures targeted at ALMP-like programs, policy makers should perhaps address whether cutting or limiting these programs will be potentially harmful for the health of their populations. If cutting or limiting seems like the only answer to budget issues, properly balancing economic support (i.e. unemployment benefits) with mandatory psychosocial support programs (i.e. social support-related aspects of job reintegration programs) might be a more appropriate answer to the question of *what government programs should be cut or scaled back?* Furthermore, previous research has shown that these programs (with proper social support aspects) lead to immediate positive psychological effects (Coutts, 2005; Coutts, Stuckler, & Cann, 2013), as well as long-term extended effects. (Vinokur, Schul, Vuori, & Price, 2000; Vuori & Silvonen, 2005)

Aside from the loss of the social support function of employment, an additional mechanism involved in changed health outcomes following unemployment is prolonged economic strain. During an economic crisis, when unemployment hits unprecedented systematic levels, prolonged economic strain becomes toxic. Siahpush et al. (2013) found that prolonged economic strain – marked by two-three years of extended economic strainors – was associated with obesity. Moreover, their findings illustrated that this association was strongly independent of income and actually stable across all income levels. A recent article by Herbig et al. (2013) compared short- versus long-term economic strain (i.e. unemployment) in a meta-analysis. They found that the central difference in health outcomes following the economic strainor of unemployment was the length of unemployment, with those suffering from long-term unemployment experiencing markedly higher burdens of disease than those with short-term unemployment.

The combination of austerity measures and prolonged economic strain could be the most significant mechanisms involved in health changes in Iceland after the economic collapse. Findings indicate some resilience in men, which may be the result of a lack of exposure to extended, prolonged economic strain within the cohort used. However, as personal, household debt continues to climb, this will need to be monitored. Herbig et al. (2013) additionally found that the combination of prolonged economic strain (i.e. unemployment) and weakened governmental social programs (i.e. interventions) was directly associated with poor health, especially deteriorated psychological health (i.e. anxiety disorders, depression). The second

wave (post-assessment) occurred a short period after the initial start of the Icelandic collapse. A follow-up wave (one to two years after) may point to no resilience among either sexes, or improved health altogether. Thus, there is a need to continue research these potential effects.

Until now, findings on health effects following the economic crisis in Iceland indicate greater negative health effects for women than men. (Gudjonsdottir, et al., 2011; Hauksdottir, et al., 2013) Furthermore, while women appear to be more affected, it is important to highlight that the overall effects of such a severe economic crisis were minimal for men, compared to European nations. Compared to men in other nations (e.g. Greece, Spain) following the start of the recent global economic crisis, Icelandic men pliancy in the time of great economic strain, as highlighted by the work of Stuckler et al. (2009) In 2012, the Icelandic Ministry of Welfare began a third assessment (second follow-up) of the cohort used in this thesis' findings. Future analysis should explore analyze this third wave for the effects of prolonged economic strain.

4.1.5 Central methodological issues

While our study is based upon a large population-based cohort with survey assessments straddling the 2008 economic crisis, it was disposed to a few inherent limitations. We examined potential differences between the analytical cohort and the attrition group, where we indicate varying baseline differences. Though we indicated varying differences in those that dropped off, we were unable to control for the potential effects of this attrition in our analysis and must caution the reader in the interpretation of our results. For example, our findings revealed significant differences in terms of employment status, occupation, marital status, and age. Though we controlled for demographics, the economic collapse had drastic consequences on employment status and, therefore, it is quite possible that these two groups responded quite differently to the collapse, thus lending to our cautionary note. This contrast and attrition could have biased our findings.

Our outcomes on depressive symptoms are based on the WHO-5 questionnaire. Previously, the WHO-5 was well-validated and used as a screening measure for depression. (World Health Organization, 1998; Henkel, Mergl, Kohnen, Moller, & Hegerl, 2003) However, the WHO-5 – as translated into Icelandic – has not been tested for validity or reliability as of yet. Psychological stress was explored in our study on smoking behaviors and measured using the PSS-4. Similar to the WHO-5, it is well-validated and reliable. (Cohen, Kamarck, & Mermelstein, 1983; Cohen & Williamson, 1988) However, this translated version has not been tested for validity or reliability, we therefore must offer caution to these points.

Additionally, as the outcomes are based solely on self-report, we caution that our findings regarding recession, income change, and smoking habits cannot be generalized to other health outcomes. For example, observational reports found a spike in female cardiac emergency visits during the week corresponding to the economic collapse in October of 2008. (Gudjonsdottir, et al., 2011) In accordance with this, our analysis on changes in mental health revealed significant increases in stress for women. (Hauksdottir, et al., 2013) This increase in stress for women did not prove to be associated with an increased likelihood of relapsing. Caution is warranted in interpreting the findings on the role of stress on smoking habits, however, since smokers may be citing an increase in perceived stress as a rationalization for their relapse or inability to quit. What this indicates is an inability to conclusively argue that stress had a mediating role in the association between income change and smoking behavior because of measurement error.

4.1.6 Future perspective and studies

Previously mentioned, prolonged economic strain may be the most significant predictor of health changes at the macro and microeconomic levels. As the third wave of *Health and Well-being in Iceland* study was conducted in late 2012, future research needs to assess the role of prolonged economic strain, as our findings are based on short time periods post-collapse. Analysis on the third wave will enable examination of the health status of the Icelandic population about 5 years after the start of the collapse. As previous research indicates, this prolonged economic strain may be one of the biggest drivers of negative health changes following macro- and microeconomic changes. (Siahpush, et al., 2013) It will be of central focus to monitor the previously examined health outcomes of psychological health (i.e. mental well-being, stress), as well as both smoking and dental behaviors. In line with this, other mechanisms (e.g. job insecurity, social support) could also play a role – as indicated above – and needs investigation.

Future research needs to disentangle the effectiveness of varying dental health care insurance schemes on the population and – moreover – how an individual's SES status plays a role in their utilization of dental care, e.g. private vs. public-based. Our results indicate that the lack of dental health insurance during times of economic hardship only exacerbate the role of dental visits as a luxury good – the more money an individual has the more they will consume a good (i.e. dental visits). Additionally, further examination into the reasons for an increased likelihood of check-ups in unemployed women after the collapse is warranted, especially as this was not observed in unemployed men.

Along with the effects of prolonged economic strain, future research will need to closely examine the cause-and-effect relationship of austerity cuts (i.e. job placement) on the health of the Icelandic population, especially as cuts continue implementation. Moreover, in relation to job placement programs (i.e. ALMPs), studies need to examine the potential effects of these type of Iceland programs on the health of the unemployed and underemployed populations of Iceland, and whether social support is the mitigating mechanism involved.

5 Conclusions

The results of this work point to many effects of the 2008 economic collapse and subsequent recession on the health of the adult population in Iceland. Findings signify resilience in the mental health of men during this economic contraction, but an increase in mental health impairments among women. Findings especially indicate an increased likelihood of mental health impairment among those economically vulnerable groups.

Conversely, the economic recession caused an improvement in significant health behaviors of the population, as exemplified by a decrease in the prevalence of smoking and an increase in healthy dental behaviors. This adoption of healthy behaviors could largely be the result of a decrease in personal economic power (e.g. income loss, unemployment). With less disposable income, individuals are less likely to buy cigarettes and pay high OOP costs for dental visits; the latter, in turn, causing individuals to adopt healthier dental behaviors as a means of buffering off the risks associated with not regularly visiting a dental care practitioner.

Future research needs to examine the role of austerity cuts on the health of the Icelandic population and compared to other populations, as research is indicating that austerity is a failed approach. (McKee, et al., 2012) Additionally, studies like these need to continue as a means of monitoring any potential consequences of the ongoing recession years. Though the Icelandic economy is showing signs of improvement, it should not be forgotten that the nation (i.e. the Central Bank, citizens) is still in a suffered economic state, which could continue causing health changes in the population for the better and the worse. And though discussion and debate continues around the effects of economic changes on health (i.e. countercyclical vs. procyclical), there is an agreed consensus that health outcomes and behaviors will change. Because they will change, for better or for worse, it is the responsibility of researchers to continue examining and monitoring changes and of policy makers to act responsibly and for the betterment of their citizens.

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Original publications

Paper I

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Original Contribution

Increased Stress Among Women Following an Economic Collapse—A Prospective Cohort Study

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There is a scarcity of data on mental health effects of the global economic recession. In this study, we investigated potential change in self-reported levels of psychological stress in the Icelandic population as a result of the major national economic collapse that occurred in 2008. We used a national cohort of 3,755 persons who responded to a survey administered in 2007 and 2009, including demographic questions and a stress measure (the 4-item Perceived Stress Scale). We used repeated-measures analysis of variance and logistic regression models to assess change in mean stress levels and risk of high stress levels (>90th percentile) in 2009 as compared with 2007. Age-adjusted mean stress levels increased between 2007 and 2009 ($P = 0.004$), though the increase was observed only for women ($P = 0.003$), not for men ($P = 0.34$). Similarly, the odds ratios for experiencing high stress levels were increased only among women (odds ratio (OR) = 1.37), especially among women who were unemployed (OR = 3.38), students (OR = 2.01), had middle levels of education (OR = 1.65), or were in the middle income bracket (OR = 1.59). The findings indicate that psychological stress may have increased following the economic collapse in Iceland, particularly among females in economically vulnerable groups.

economic recession; psychology; socioeconomic factors; stress; unemployment; women

Abbreviations: CI, confidence interval; OECD, Organisation for Economic Co-operation and Development; PSS-4, 4-item Perceived Stress Scale; SD, standard deviation.

The global economic crisis has varied in its effects, ranging from minimal effects, such as those seen in Sweden (1), to more extreme results, like those in Portugal, Ireland, Greece, and Spain (2). However, one of the most sudden and severe economic collapses was experienced by the Icelandic population, beginning in October of 2008. Within a 1-week period, 3 of Iceland's largest banks were nationalized, resulting in a severe currency crisis, a drastic increase in national and household debt (3), rising unemployment rates, and decreased purchasing power for all citizens (4). It is unclear whether these rapid and extreme economic fluctuations will have an impact on the health of Icelanders from a long-term perspective.

Until recently, data on the relationship between national economic downturns and psychiatric morbidity have been scarce. Still, most evidence supports the conclusion that suicide rates increase following economic downturns (5–8). Studies that examined the psychiatric consequences of earlier crises obtained conflicting results; some found indicators of worsening psychiatric health during recessions (9–11), while others did not (12). Similarly, some recent studies examining the association between the economic crisis and psychiatric morbidity in Hong Kong (China), Canada, and Australia have indicated an increase in major depressive disorders (13, 14), but not all have (15). Because few studies have provided data on early signs of psychiatric morbidity (e.g., experience of psychological stress), further research is needed to advance knowledge of the mental health consequences of economic downturns.

Iceland represents a unique opportunity to examine the effect of a national economic downturn on perceived

psychological stress in the population. Psychological stress was earlier associated with an array of negative health outcomes and behaviors (16–20). Thus, using prospective data from a cohort that responded to a health-related questionnaire in 2007 and again in 2009, our aim was to investigate potential change in perceived stress in the Icelandic population, as well as to identify which subgroups were at increased risk of experiencing high levels of stress during economic hardships.

MATERIALS AND METHODS

Study design and population

Between October and December 2007, the Public Health Institute in Iceland conducted a mailed health survey, Health and Well-being in Iceland 2007. The survey was based on a stratified random sample ($n = 9,807$) of the Icelandic national population. The population was classified into 12 strata, consisting of 2 geographic regions and 6 age groups, wherein the target population was randomly selected. A total of 9,711 persons received a mailed questionnaire, of whom 5,906 responded (60.8% response rate), and 5,439 (92%) gave written informed consent to be contacted again in a follow-up study (see Figure 1). This cohort of 5,439 persons was contacted again in the fall of 2009 and responded to a modified version of the questionnaire between November and December 2009 (response rate = 77.3% of the eligible sample). Furthermore, because this was a cohort study comparing reports on psychological stress made in 2007 (with a flourishing national economy) with those made in 2009 (after the national economy collapsed), all persons who responded to all 4 items of the stress measure on both occasions were included in the final sample (89% of persons who participated in both waves; $n = 3,755$).

Measures

Exposure and outcome. Psychological stress was assessed in an identical manner in 2007 and 2009 using the 4-item Perceived Stress Scale (PSS-4), a shortened and validated version of the original 14-item scale with scores ranging from 0 to 16 (21). When a brief stress measure is needed, the PSS-4 is considered an acceptable alternative to the longer, original version (22). Representing the extensive macroeconomic changes that occurred after the economic collapse in 2008, the exposure variable was thus a proxy for time and corresponding waves of assessment, that is, 2007 and 2009.

Covariates and potential mediating variables. A battery of demographic factors was included in the analyses: age, sex, marital status, educational status, residency, and number of children. Marital status was categorized as 1) single or divorced, 2) committed but not cohabiting, 3) married or cohabiting, or 4) widowed. Educational status was classified as 1) basic (grades 1–6), 2) middle (grades 7–12), or 3) university (a completed university degree). Residency area was operationalized into categories of 1) city (>5,000 inhabitants), 2) village (200–5,000 inhabitants), and 3) farming community (<200 inhabitants). Number of children in the household was categorized as 0, 1, 2, or ≥3 children.

Employment status was categorized into 1) employed, 2) unemployed, 3) student, 4) homemaker or on maternity/paternity leave, 5) disabled (>50% disability), and 6) retired. Responses to the question on employment status were nonexclusive, meaning that respondents could belong to more than 1 category (e.g., employed and disabled). Occupational groups were categorized into 1) executive (e.g., top-level manager), 2) skilled (e.g., office worker, specialized industrial worker), and 3) nonskilled (e.g., sales assistant, laborer). Executive position responses included 1) elected representative, top-level official, or top-level manager and 2) specialist (with academic/professional degree); skilled position responses included 1) professional employee (without degree), 2) office worker, 3) farmer, 4) seafarer, 5) tradesperson, and 6) specialized industrial worker; and nonskilled position responses included 1) service, sales, or shop assistant, 2) vehicle operator, mechanic, or machine tender, and 3) laborer. Household income responses were categorized into groups coded from the income ranges (in Icelandic currency, krónur (IKr)) 1) low (≤3.4 million IKr), 2) middle (3.5–9.4 million IKr), and 3) high (≥9.5 million IKr), corresponding in US dollars to approximately 1) ≤$26,999, 2) $27,000–$74,999, and 3) ≥$75,000.

Statistical analyses

Table 1 shows the distribution of the cohort that responded in both 2007 and 2009 in comparison with persons who responded in 2007 only (the attrition group) with respect to major sociodemographic factors. Adjusting for age, we used repeated-measures analysis of variance to study overall change in mean levels of perceived stress, as well as sex-specific changes, from 2007 to 2009. When exploring differences in high stress levels between 2007 and 2009, we created a binary variable with a cutoff point at the 90th

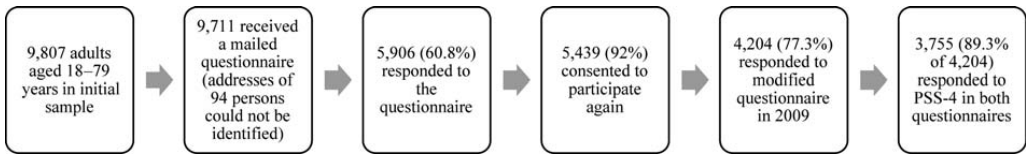

Figure 1. Selection of participants for the Health and Well-being Study, Iceland, 2007–2009. The final analytical sample ($n = 3,755$) included persons who fully completed the 4-item Perceived Stress Scale (PSS-4) in both 2007 and 2009.

percentile of the PSS-4 scores from 2007, which was derived from the following factor scoring method.

$$S = w_0 \times q_0 + w_1 \times q_1 + w_2 \times q_2 + w_3 \times q_3 + w_4 \times q_4.$$

This equation shows the computation of the summary scale, where S is the summation score for the latent variable, w_1 is a unique weight for the first item (q_1), etc. (23). We used the same item-specific weights in 2007 and 2009. We set the weights as item-specific weights rather than setting them all to 1.0, which is common when constructing a summary score from a well-developed measure of a latent variable. The unit weight was derived from factor loadings after principal component analysis. This approach is common when extracting a summary score from a set of items that measure the same underlying construct (24). Multiplying the items with item-specific weights derived from principal components analysis produces a scale with more than 600 unique values that are suitable for binary coding for a specific percentile (the 90th percentile, in our case). Without the item-specific weights, the scores from the PSS-4 would provide only 17 unique values that are difficult to dichotomize for a percentile of interest.

With scores from 2007 as the reference category, we used binary logistic regression to estimate the overall and stratified odds ratios and 95% confidence intervals for high stress levels in 2009 (Tables 2 and 3). Because the data were clustered within individuals (repeated measures), we applied the generalized estimation equations function to account for correlated error terms (25). The model for overall change in stress adjusted for age; the model for income adjusted for age, sex, education, marital status, size of residency area, and number of adults in the household; the model for residency area (determined by postal code) adjusted for age, sex, education, and marital status; and all other models then adjusted for age, sex, education, marital status, and size of residency area. Similarly, we conducted sex-stratified analyses using binary logistic regression models to calculate odds ratios and 95% confidence intervals across strata of age, marital status, education, residency, occupation, employment status, income, and number of children. In order to adjust the characteristics of the cohort and account for possible attrition effects between waves of assessment, we used weighted regression models for change in stress in the overall and sex-specific models (PROC GENMOD in SAS; SAS Institute Inc., Cary, North Carolina) (26). The sampling weights were created from the inverse of the sampling probability (1). Statistical analyses were conducted with SAS, version 9.2. Statistical significance was set at the 0.05 level, and all tests were 2-tailed. The study was approved by the Bioethics Committee of Iceland and the Data Protection Authority of Iceland.

RESULTS

Cohort demographic characteristics and attrition

The demographic characteristics of persons who responded to the PSS-4 in both 2007 and 2009 versus those who answered only in 2007 are shown in Table 1. Slightly over half of those answering on both occasions were female; in 2007, most of the participants were married/cohabiting, and the mean age was 52.3 (standard deviation (SD), 16.0) years. The cohort that responded in both 2007 and 2009 differed minimally from the attrition group. The attrition group was slightly younger, had a higher proportion of single persons, and had a lower proportion of persons with a university education. The mean score on the PSS-4 in 2007 was 4.07 (SD, 2.83) in the group responding in both 2007 and 2009 and 4.61 (SD, 2.99) in the attrition group ($P < 0.001$). For females in 2007, the mean score on the PSS-4 was 4.29 (SD, 2.85) in the cohort and 4.88 (SD, 3.06) in the attrition group ($P < 0.001$); for males in 2007, the mean score was 3.82 (SD, 2.78) in the cohort and 4.31 (SD, 2.88) in the attrition group ($P = 0.53$). Only the cohort that responded in both 2007 and 2009 was used in the following analyses ($n = 3,755$).

Stress

In 2009, the average level of perceived stress according to PSS-4 score was 4.07 (SD, 2.83), which, after adjustment for age, differed significantly from 2007 levels ($F = 11.74$; $P = 0.001$). Average levels of perceived stress had increased significantly for women ($F = 7.85$; $P = 0.005$) but not for men ($F = 0.48$; $P = 0.49$).

Table 2 presents the proportion of persons with high stress levels (above the cutoff score of the 90th percentile) in 2007 and the corresponding proportion of persons in 2009. With 2007 as the referent, the adjusted odds ratio for reporting high levels of stress was 1.29 overall (95% confidence interval (CI): 1.14, 1.45), 1.37 (95% CI: 1.16, 1.61) for women, and 1.13 (95% CI: 0.92, 1.39) for men (Table 2). In the stratified multivariate analyses, high 2009 stress levels with confidence intervals excluding 1.0 were obtained for persons aged 40–49 years and 60–69 years, married and/or cohabiting persons, persons with a middle level of education, and persons with no children in the household. Additionally, persons living in areas with 5,000 or more inhabitants and 200–5,000 inhabitants had increased odds. These models adjusted for age, sex, education, marital status, and size of residency area.

For variables related to employment and economic status, stratified analyses revealed an increased likelihood (95% confidence intervals excluding 1.0) of becoming highly stressed in 2009 for employed persons or students, persons with a skilled or nonskilled occupation, and persons in the middle income bracket.

Sex differences

Table 3 presents a sex-stratified analysis of high stress levels in 2007 and 2009, respectively. Increased odds ratios (95% confidence intervals excluding 1.0) were mainly observed for women, specifically women aged 18–29, 40–49, and 60–69 years, women with a middle education, single/divorced or married/cohabiting women, and women with no children. Additionally, female students, employed women, unemployed women, female homemakers/women on parental

Table 1. Characteristics of Persons Who Responded to a Mailed Health Survey in 2007 and 2009 (the Analytical Cohort) Compared With Those Who Responded in 2007 Only, Health and Well-being Study, Iceland, 2007–2009

	Analytical Cohort ($n = 3,755$)			Responders in 2007 Only ($n = 2,151$)		
	Mean (SD)	No.	%	Mean (SD)	No.	%
Age, years	52.3 (16.0)			48.6 (18.5)		
Stress score (PSS-4)[a]	4.07 (2.83)			4.61 (2.99)		
Sex						
Male		1,767	47.1		976	46.2
Female		1,987	52.9		1,138	53.8
Not stated		1			37	
Age group, years						
18–29		382	10.2		424	20.0
30–39		547	14.6		332	15.7
40–49		636	16.9		356	16.8
50–59		746	19.9		301	14.2
60–69		792	21.1		288	13.6
≥70		651	17.3		417	19.7
Not stated		1			33	
Marital status						
Single/divorced		556	14.9		402	19.1
Committed but not cohabiting		131	3.5		148	7.0
Married or cohabiting		2,871	76.7		1,449	68.7
Widowed		184	4.9		110	5.2
Not stated		13			42	
Education						
Basic (grades 1–6)		1,688	47.1		948	51.7
Middle (grades 7–12)		971	27.1		502	27.4
University (completed university degree)		928	25.9		382	20.9
Not stated		168			319	
Size of residency area						
≥5,000 inhabitants (city)		2,384	63.6		1,346	64.3
200–5,000 inhabitants (village)		997	26.6		575	27.5
<200 inhabitants (farming community)		368	9.8		173	8.3
Not stated		6			57	

Table continues

leave, and women who held a nonskilled occupation or had no paid employment classification were all at increased risk of high stress levels. Higher stress levels were also seen in women living in a residency area with 5,000 or more inhabitants or 200–5,000 inhabitants, in addition to women in middle-income households.

Male-specific analysis showed significant increases in 2 subgroups: married men and men in the middle income bracket.

To address concerns regarding the possibility of selective attrition and sample stratification from 2007 to the 2009, we repeated the analyses with incorporated weights. We found that the overall increase in high stress levels went from an odds ratio of 1.29 (95% CI: 1.14, 1.45) to a weighted odds ratio of 1.24 (95% CI: 1.06, 1.44) overall, from 1.13 (95% CI: 0.92, 1.39) to 1.15 (95% CI: 0.81, 1.37) for males, and from 1.37 (95% CI: 1.16, 1.61) to 1.46 (95% CI: 1.16, 1.70) for females.

DISCUSSION

Our findings indicate that stress levels increased in this Icelandic cohort following the economic collapse of 2008, particularly among women. Increases in high stress levels were mostly evident among unemployed women and those not active in the labor market, such as students and homemakers. While employment seems to be a buffer in comparison with other employment categories, persons who

Table 1. Continued

	Analytical Cohort ($n = 3,755$)			Responders in 2007 Only ($n = 2,151$)		
	Mean (SD)	No.	%	Mean (SD)	No.	%
Employment status[b]						
Employed		2,484	75.6		1,283	73.2
Unemployed		116	4.0		83	5.3
Student		420	14.1		345	21.5
Homemaker/on parental leave		546	18.2		296	18.1
Disabled (≥50% disability)		241	8.1		162	10.0
Retired		682	21.5		357	20.4
Occupation						
Executive		759	22.9		312	17.8
Skilled		1,292	39.1		666	37.9
Nonskilled		670	20.3		444	25.3
Not engaged in paid work		587	17.7		334	19.0
Not stated		447			395	
Income[c]						
Low		621	20.6		370	23.8
Middle		1,855	61.4		913	58.6
High		543	18.0		274	17.6
Not stated		736			594	
No. of children in household						
0		1,267	47.1		469	35.2
1		578	21.5		331	24.8
2		560	20.8		354	26.6
≥3		287	10.7		179	13.4
Not stated		1,063			818	

Abbreviations: PSS-4, 4-item Perceived Stress Scale; SD, standard deviation.

[a] Possible scores on the PSS-4 ranged from 0 to 16.

[b] Responses to the question on employment status were nonexclusive, meaning that respondents could belong to more than 1 category (e.g., employed and disabled).

[c] Household income responses were categorized into groups coded from the income ranges (in Icelandic currency, krónur (IKr)) of 1) low (≤3.4 million IKr), 2) middle (3.5–9.4 million IKr), and 3) high (≥9.5 million IKr), corresponding in US dollars to approximately 1) ≤$26,999, 2) $27,000–$74,999, and (3) ≥$75,000.

were employed still experienced an increased risk of psychological stress. Higher stress levels were also noted among persons in densely populated areas, those of prepension ages, and those with no children, as well as in persons with a middle education, those involved in skilled/nonskilled work, and those in the middle income range.

Until now, there has been a scarcity of data examining trends in mental disorders and mental well-being during recent global economic recessions. Similarities may be drawn between the economic crises that occurred in Finland and Sweden in the 1990s, where unemployment rates rapidly rose (11, 27), and the crisis that occurred in Iceland in recent years, where unemployment rose from 2% in 2007 to a maximum of 9% in 2009 (4). Findings in Finland and Sweden revealed an increased prevalence of psychological distress during the aforementioned recessions, as assessed by self-report measures, regardless of sex (10, 11). In contrast, findings on suicide in Finland during this time revealed overall stable rates of suicide attempts, with an actual marked decrease in male rates (28).

Recent evidence on the effects of the 2008 economic crisis indicates that the risk of mental disorders has risen. In Canada and Hong Kong, major depressive disorders have been reported to have increased during crisis years (13, 14). Results from Hong Kong resonate with our results showing that persons in the prepension age group (60–69 years), as well as the unemployed, experienced an increase in stress. Older persons in the labor market might experience their pending pension and job insecurity as particularly stressful—especially when faced with a potential loss of life savings or pension funds following an economic crisis. With a qualifying pension age of 67 years in Iceland (as of 2011), the possibility of losing one's savings (e.g., retirement savings) could be an added stressor for a person

Table 2. Odds Ratios for Experiencing High Stress Levels in 2009 as Compared With 2007, According to Respondent Characteristics, Health and Well-being Study, Iceland, 2007–2009

	2007		2009		Odds Ratio	95% Confidence Interval
	No.	%	No.	%		
High stress level[a]	396	10.5	471	12.5	1.29	1.14, 1.45
Sex[a]						
Male	156	8.8	176	10.0	1.13	0.92, 1.39
Female	240	12.1	295	14.8	1.37	1.16, 1.61
Age group, years[a]						
18–29	60	15.7	61	20.5	1.33	0.91, 1.94
30–39	88	16.1	91	17.9	0.99	0.71, 1.38
40–49	71	11.2	96	15.3	1.41	1.04, 1.91
50–59	85	11.4	94	12.9	1.12	0.86, 1.46
60–69	55	6.9	78	9.6	1.65	1.18, 2.29
≥70	37	5.5	51	6.5	1.09	0.74, 1.61
Marital status[a]						
Single/divorced	104	18.7	117	21.8	1.27	0.98, 1.64
Committed but not cohabiting	18	13.7	25	17.2	1.42	0.76, 2.64
Married or cohabiting	253	8.8	303	10.6	1.33	1.14, 1.55
Widowed	18	9.8	24	11.3	1.26	0.72, 2.20
Education[a]						
Basic (grades 1–6)	185	11.0	230	12.0	1.18	0.98, 1.42
Middle (grades 7–12)	107	11.0	116	16.5	1.54	1.18, 2.01
University (completed university degree)	85	9.2	106	11.0	1.27	0.97, 1.66
Size of residency area[a]						
≥5,000 inhabitants (city)	237	9.9	284	11.9	1.27	1.08, 1.49
200–5,000 inhabitants (village)	110	11.0	145	14.5	1.39	1.11, 1.76
<200 inhabitants (farming community)	48	13.0	41	11.3	0.83	0.56, 1.24
Occupation[a]						
Executive	60	7.9	75	10.0	1.30	0.93, 1.81
Skilled	121	9.4	137	10.8	1.31	1.02, 1.68
Nonskilled	91	13.6	102	16.5	1.36	1.02, 1.81
No paid employment	65	11.1	87	15.8	1.35	0.96, 1.90
Employment[a]						
Employed	250	10.1	283	12.7	1.31	1.11, 1.55
Unemployed	22	19.0	49	29.0	1.66	0.87, 3.15
Student	51	12.1	60	17.4	1.64	1.07, 2.52
Homemaker/parental leave	56	10.3	51	13.1	1.39	0.93, 2.08
Disabled	57	23.7	66	28.0	1.29	0.88, 1.88
Retired	41	6.0	65	7.1	1.09	0.77, 1.55
Income[b]						
Low	84	13.5	81	14.8	1.10	0.74, 1.65
Middle	176	9.5	235	12.8	1.55	1.23, 1.95
High	45	8.3	51	8.5	1.16	0.74, 1.84
No. of children in household[a]						
0	116	9.2	157	11.9	1.36	1.08, 1.70
1	73	12.6	87	15.1	1.24	0.89, 1.72
2	63	11.3	71	13.5	1.30	0.89, 1.90
≥3	39	13.6	48	17.8	1.33	0.83, 2.14

[a] Adjusted for age, sex, education, marital status, and size of residency area.
[b] Adjusted for age, sex, education, marital status, size of residency area, and number of adults in the home. See Table 1 for definition of categories.

Table 3. Odds Ratios for Experiencing High Stress Levels in 2009 as Compared With 2007, According to Respondent Characteristics and Sex, Health and Well-being Study, Iceland, 2007–2009

	Women		Men	
	OR	95% CI	OR	95% CI
Age group, years[a]				
18–29	1.64	1.05, 2.58	0.75	0.35, 1.63
30–39	1.20	0.80, 1.80	0.65	0.34, 1.22
40–49	1.52	1.03, 2.25	1.30	0.79, 2.15
50–59	1.05	0.71, 1.54	1.20	0.83, 1.73
60–69	1.75	1.15, 2.66	1.55	0.90, 2.67
≥70	1.28	0.78, 2.12	0.86	0.46, 1.60
Marital status[a]				
Single/divorced	1.75	1.22, 2.50	0.85	0.59, 1.24
Committed but not cohabiting	1.52	0.71, 3.24	1.29	0.39, 4.32
Married or cohabiting	1.31	1.07, 1.60	1.37	1.07, 1.75
Widowed	1.26	0.71, 2.23	1.13	0.09, 13.65
Education[a]				
Basic (grades 1–6)	1.29	1.02, 1.63	1.10	0.83, 1.47
Middle (grades 7–12)	1.65	1.17, 2.34	1.33	0.87, 2.04
University (completed university degree)	1.30	0.94, 1.81	1.20	0.74, 1.96
Size of residency area[a]				
≥5,000 inhabitants (city)	1.39	1.12, 1.72	1.12	0.86, 1.45
200–5,000 inhabitants (village)	1.55	1.15, 2.07	1.26	0.85, 1.86
<200 inhabitants (farming community)	0.72	0.42, 1.22	0.99	0.53, 1.83
Occupation[a]				
Executive	1.34	0.90, 1.99	1.16	0.60, 2.23
Skilled	1.30	0.91, 1.85	1.40	0.96, 2.02
Nonskilled	1.46	1.02, 2.10	1.26	0.78, 2.02
No paid employment	1.82	1.20, 2.76	0.69	0.36, 1.32
Employment[a]				
Employed	1.38	1.11, 1.72	1.24	0.97, 1.60
Unemployed	3.38	1.09, 10.49	1.01	0.42, 2.41
Student	2.01	1.23, 3.28	0.93	0.37, 2.37
Homemaker/parental leave	1.57	1.02, 2.42	0.69	0.20, 2.34
Disabled	1.40	0.87, 2.25	1.22	0.64, 2.31
Retired	1.36	0.87, 2.13	0.77	0.43, 1.37
Income[b]				
Low	1.09	0.66, 1.80	1.20	0.61, 2.37
Middle	1.59	1.18, 2.15	1.49	1.03, 2.15
High	1.20	0.66, 2.17	1.14	0.55, 2.35
No. of children in household[a]				
0	1.47	1.07, 2.02	1.27	0.91, 1.77
1	1.40	0.91, 2.14	1.03	0.64, 1.65
2	1.16	0.73, 1.84	1.76	0.89, 3.49
≥3	1.36	0.76, 2.43	1.28	0.52, 3.18

Abbreviations: CI, confidence interval; OR, odds ratio.

[a] Adjusted for age, sex, education, marital status, and size of residency area.

[b] Adjusted for age, sex, education, marital status, size of residency area, and number of adults in the home. See Table 1 for definition of categories.

nearing retirement (29). Additionally, with the Icelandic government spending 1.9% of its gross domestic product on public pension funds in 2011, as compared with 7.0% spending by the average Organisation for Economic Co-operation and Development (OECD) country (29), it is possible that Icelanders have an increased reliance on personal savings (i.e., retirement savings), causing them to suffer increased psychological stress when threatened with a loss of savings.

To our knowledge, this is one of the first investigations to have found such distinct female-specific effects of a national economic recession. In a previous investigation, we observed an increase in female visits to the cardiac emergency department in the capital area specifically during the week of the swift economic collapse in October 2008 (30). Based on these findings, it may be speculated that following the economic downturn, Icelandic women experienced more insecurity and worries for the future than Icelandic men. A similar pattern was found during the aforementioned economic recession in Finland, where psychological morbidity increased for women only (10). Studies following the 2008 crises in China and Australia did not observe similar sex differences (13, 15); in fact, a decrease in psychological distress for females was observed in 1 Australian study (15). The difference in findings on the mental health of women following an economic downturn is not entirely clear, yet differences in gender equality and women's activity in the labor market, as well as differences in the nature of recessions across countries, may play a role.

The elevation in high stress levels was marked among unemployed women, as well as among women who either were not occupationally active (e.g., students, home workers) or had a vulnerable status in the labor market (e.g., persons of prepension ages or in nonskilled work). These findings may be partly due to feelings of having an occupation in which one is easily disposable, coupled with the perception of lacking credentials for future employment following a potential job loss. Research on macroeconomic fluctuations and population health resonates with our findings. Procyclical associations between mental health and economic change have been reported (31–33), and suicide rates have been shown to correlate with unemployment rates (5, 6, 34, 35). In discordance with our findings, sex-specific results have mainly been found between unemployment and male suicide rates (36, 37). In fact, prior research on unemployment and psychological outcomes has focused heavily on males (38–41). In addition, some of the earlier studies focused on samples or populations in which there were traditional, primary-provider roles for males (42). Our female-specific results may also have been driven by the involvement of Icelandic women in the labor market, as Iceland has one of the highest rates of labor market participation for women within the OECD (43, 44)—possibly indicating a change from historically traditional gender roles.

While unemployment and job market insecurities seem to play a considerable role in increasing stress levels among women, our findings also indicate that middle-income families—regardless of sex—suffer increased stress levels following economic collapse. The economic crisis in Iceland was multilevel, with decreasing purchasing power and an increasing percentage of homeowners defaulting on their mortgages (3, 4). Suffering these economic consequences, after having invested in high-priced real estate during the economic boom, may have hit middle-income families the hardest, resulting in distress and economic insecurity that eventually led to increased stress levels.

The strengths of this study include the use of a large, demographically diverse cohort, allowing for prospective assessment of stress levels within subpopulations, as well as comprehensive covariate ascertainment and the use of a reliable, well-validated measure of perceived stress (21). Plausible limitations of this study should also be noted, including the possibility of selection bias due to attrition. While our findings indicate that the stress levels of the attrition group were higher in 2007 than those of the cohort responding again in 2009, it is difficult to assess how this may have affected our results; yet there is no reason to believe that exposure (the experience of economic collapse) affected persons who already had high stress levels to a lesser degree. Selective attrition may well have affected our findings on subgroups—for example, if unemployed men emigrated to find work without their families after the collapse, we may have failed to observe a real increase in high stress levels among unemployed men. However, we find it unlikely that responders in 2007 were differentially affected by the economic crisis in Iceland than nonresponders. Although our findings indicate (see Table 1) that responders in 2007 and 2009 were very similar to those who responded only in 2007—with regard to educational levels, occupational status, and income—we repeated our analyses incorporating weights that accounted for selective attrition by age, sex, and residence, which did not change our main conclusions.

Finally, economic recessions strike differently across cultures and time periods; thus, the generalizability of our findings may be reasonably limited to the uniqueness of Icelandic culture and society, as well as the nature of the 2008 economic collapse in Iceland.

In summary, our findings indicate that stress levels may have increased in the Icelandic population following the economic crisis of 2008—particularly among women in a vulnerable situation in the labor market. Furthermore, our findings point to stress vulnerabilities in middle-income families. Future studies on long-term mental health impacts of economic recessions need to address potential sex disparities, while public health authorities need to be alert for potential health effects on women.

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Paper II

Male resiliency and an increase in female depressive symptoms following the 2008 economic collapse in Iceland: results from a prospective cohort study

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Abstract

Background: Iceland experienced a severe and acute economic collapse in late 2008. We investigated whether depressive symptoms have increased in the Icelandic population following the economic collapse.

Methods and Findings: In a nationally representative, prospective cohort, 3783 individuals answered a questionnaire in 2007 (pre-collapse) and again in 2009 (post-collapse) including measurements of depressive symptoms (WHO-5 Well-Being Index). Stratified by sex, multivariate logistic regression was used to assess the risk of depression pre- and post-crisis, adjusting for age, education and marital status. Overall adjusted odds ratios for having depressive symptoms increased from 2007 to 2009 (odds ratio 1·14; 95% confidence interval 1·00-1·29) but only among women (1·22; 1·04, 1·44) and not men (1·02; 0·84 to 1·25). The greatest risk increase was observed among the unemployed (1·87; 1·06, 3·31), regardless of sex. No statistically significant increase was observed for subgroups of males except among men who experienced a loss of savings following the collapse (1·56; 1·07-2·28).

Conclusions: Following the economic collapse in Iceland, the risks of depressive symptoms increased moderately in women. Higher risks were also observed for the unemployed and males who experienced a loss of savings. Of novelty, and in contrast to patterns observed elsewhere in Europe, no increase in depressive symptoms was observed in Icelandic men – further research should explore these differential impacts of the crises across Europe.

Introduction

Iceland experienced one of the most acute financial crises in Europe in autumn of 2008. National unemployment increased from 2·3% in August 2008 to 11·9 in May 2009[1] and household debts increased dramatically and purchasing power decreased.[2] While our previous findings have shown strong effects of the crises on health behaviors (i.e. smoking),[3] it is unclear whether these rapid and extreme economic fluctuations will have an impact on the long-term mental well-being of Icelanders.

Prior studies have generally found the risk of suicide to increase following an economic turndown[4,5] and markedly so for working age men[6,7]. Our previous report on the global economic crisis shows that in Greece and Spain, suicides have risen by 13% and 17% respectively.[8] In addition, studies from Hong Kong, Canada and Australia on psychological morbidity following the recession have indicated an increase in major depressive disorders in affected populations in some studies,[9,10] but not all[11].

In many ways Iceland's population may have been protected from the health effects of economic crisis because of its high degree of social capital and cohesion, public decisions to delay austerity and vote democratically, small population size, and relatively high labor market protections. Nevertheless, in a recent study we found a clear increase in high stress levels in females but not males.[12] Thus, before seeking to learn lessons from Iceland, it is first necessary to further assess whether mental health problems were affected by the recession.

In this study, we utilized a nationally representative, prospective cohort of 3783 Iceland adults, assessed in 2007 and 2009, to investigate whether the financial crisis had significant effects on depression levels and if the effects are mediated by exposure related factors (job-loss, loss of savings, etc.).

Materials and Methods

A nationally representative survey, *Health and Well-being in Iceland*, was given to a stratified random sample of Iceland's population by the Public Health Institute of Iceland. Surveys were mailed, between October and December of 2007 and again between November and December of 2009. 9807 individuals were chosen from two geographic regions (i.e. urban and rural) stratified by six age groups. Of the original 9807, 5913 responded to the initial 2007 questionnaire (response rate of 60·3%), with 3783 responding again to the modified 2009 version of the survey (response rate of 64·0%). To assess the effects of the crisis on depressive symptoms, our prospective cohort included those who responded to both surveys following the national economic collapse (N=3783).

To measure individuals' indication of depression, we utilized the WHO-Five Well-being Index (WHO-5),[13] a five-item, six-point Likert-scale designed to assess a respondent's level of mental well-being over a 14-day period. The WHO-5 has been shown to be a preliminary screening tool for depression (see panel 1 for more details).[14] Following the WHO's guideline, we assessed depressive symptom tendencies as a score below 13 from a summation of the five questions.

[Panel 1 about here]

Socio-demographic variables

Table 1 describes the socio-demographic characteristics of the survey. Age was categorized into four strata: (1) 18-34, (2) 35-49, (3) 50-64, and (4) greater than 64; marital status into (1) single or divorced, (2) committed/not cohabiting, (3) married/cohabiting, and (4) widowed. Education status was classified into (1) basic (having completed primary school or less), (2) middle (completed high school or equivalent), and (3) university (a completed university degree).

Occupational categories were stratified according to (1) executive (e.g. top-level manager), (2) skilled (e.g. office worker, specialized industrial worker), and (3) non-skilled positions (e.g. sales assistant, laborer). Executive occupations were grouped according to (1) elected and top-level officials and (2) specialists (with academic and professional degrees); skilled occupations according to (1) professionals (without degrees), (2) office workers, (3) farmers, (4) seafarers, (5) tradespersons, and (6) specialized industrial workers; non-skilled occupations according to (1) service and sales persons, (2) vehicle operators, mechanics, machine tenders, and (3) laborers.

Economic and collapse-specific variables

Household income responses, based on 10 response alternatives, were classified according to income ranges per year (in terms of Icelandic currency: ISK) (1) low (≤3·4 million), (2) middle (3·5-9·4 million), and (3) high (≥9·5 million); corresponding approximately to (1) ≤ 28,000 USD, (2) 28,000-77,000 USD, and (3) ≥ 77,000 USD.

Questions pertaining to the national economic collapse in 2008 were incorporated in the 2009 assessment, including involuntary layoff (i.e. *yes* or *no*), and loss of savings. Loss of savings was originally coded according to monetary losses in four separate economical components: loss of (1) money market accounts, (2) retirement savings, (3) stock shares, and (4) other savings. As it should be assumed that some individuals would have overlap in loss categories due to classification ambiguities, these four separate component categories were classified into one simplified variable (i.e. *no loss of savings* or *loss of savings*)—for example, individuals could possibly qualify their stock shares as retirement savings, or money market accounts as retirement savings.

Statistical analyses

Standard frequencies (table 1) describe the cohort at each survey wave with respect to age, sex, marital status, and education, as well as economic (i.e. income, loss of savings), employment-specific (i.e. occupation, job-loss). Chi-square tests were used to compare the characteristics of the cohort at baseline (2007) to follow-up (2009) (table 1); also as a means of comparing the full analytical cohort to those lost-to-follow-up (attrition group) - located in appendix table 1. Changes in depression rates, according to the WHO-5 were examined (figure 1). Additional

comparison of depression prevalence rates from 2007 to 2009 according to demographic status were done (appendix table 2).

For primary analysis, a binary variable was created from raw WHO-5 scores: normal (raw score above 13) and depressive tendencies (below 13). Multivariate logistic regression was used to examine the odds of depressive tendencies in 2009 according to a change in employment from 2007 to 2009 among those employed at baseline (table 2). Models were adjusted or stratified for age, sex, educational status, and marital status as well as baseline depressive symptoms. Household income was further adjusted for the number of adults in the household; loss of savings was then adjusted for household income. Logistic regression was additionally used to estimate odds of depressive symptoms in 2009 (table 3), according to an individual's change in economic status (e.g. employment/income change), as well as accrued debt following the collapse; these models were additionally adjusted for baseline depressive symptoms. Statistical analyses were conducted with Stata 12 (Stata Corp., College Station, Texas).

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Results

Characteristics of the responders were similar in both waves, however, in 2009 they were older, more likely to have finished basic levels of education, having retired and less likely to be employed (Table 1). Baseline (i.e. 2007) characteristics of the analytical cohort differed to those lost to attrition (Appendix, Table 1). The analytical cohort differed from the attrition group in terms of age, marital status, education, and employment status.

Depressive Symptoms before and after the financial crisis

The crude prevalence of depressive symptoms increased in the study population from 17·7% to 20·1% between 2007 and 2009 (Appendix, Table 2). In addition, crude sex-specific prevalence rates revealed a significant increase in female rates (15·9% to 17·4%; $p < 0·01$) from 2007 to 2009, as well as for male rates (19·3 to 22·4; $p<0·01$).

Between 2007 and 2009, increase in adjusted odds ratios of depressive symptoms were statistically significant among women (odds ratio 1·22; 95% confidence interval 1·04-1·44), but not men (1·02; 0·84-1·25) (Table 2). Among women, the risks appeared to be greater among those who were single (1·45; 0·99-2·13), without children (1·62; 1·10-2·38), and with a basic level of education (1·33; 1·06-1·68). No increase in odds ratios were observed for subgroups of males.

Employment status and potential changes in economic status

Compared to the employed, persons who were unemployed in 2009 had almost a two-fold increased (1·87; 1·06-3·31) risk of depressive symptoms at follow-up (Table 3). Sex-specific analyses revealed a non-significant increase – but tendency – for unemployed women (1·88; 0·85-4·19) and men (1·74; 0·77-3·91). Compared to men not having experienced any loss of savings, men who had experienced any loss following the 2008 crisis had increased depressive symptoms (1·56; 1·07-2·28) – this did not show for women. Additionally, there was no significant effect of income loss nor increase in home mortgage on risk of depressive symptoms.

Discussion

The findings from this prospective cohort study of 3783 Icelanders suggest that only women – not men – had an observable increased risk of depressive symptoms one year following the national economic collapse. The risk increase was mostly apparent for women who were single, with a basic level of education, and with no children. Also important, our analysis on economic status reveals that the unemployed and men who had lost savings of any kind following the crisis (compared to men who had not lost savings) had a significant increased risk of depressive symptoms. No effects on depressive symptoms were observed among those individuals who had experienced income loss or increase in home mortgage.

Studies examining the impact of macroeconomic fluctuations and mental health outcomes have found mixed results. Studies using suicide rates as measurement of mental health status and the key indicator of macroeconomic changes represented by unemployment rates, have found both a positive[15] and negative[16] associations between unemployment and suicide rates. Recent studies examining the effects of the 2008 crisis on mental well-being in other countries have also found various effects, ranging from less effects (i.e. Australia)[11] to strong negative effects – for example, in Greece an increase in depression was observed among all subgroups between 2008-2011,[17] while a considerable increase in mental health illnesses was observed in Spain.[18]

Sex difference

This study adds to the existing knowledge base through our findings that the economic crisis in Iceland seems to have affected women to a larger extent than males.[3 12 19] These findings are further supported by our previous work on the effects of the 2008 collapse on stress levels of the Icelandic population where we found an increased risk of high levels of stress in women (particularly the unemployed), but not for men.[12] These sex-specific findings may partly be explained by the facts that Icelandic women have high participation in the labor market and high fertility rates. Even though balance between females and males in domestic work has increased in Iceland after the 2008 crisis, employed females still spend more hours doing domestic work than employed males, which could lead to more strain during economic hardships[20] An earlier study on the economic recession in Finland in the 1990s showed that females, not males, experienced a 3.5% increase in mental disorders during the first two-years of the crisis.[21] Other recent studies on mental health following the 2008 crisis have not observed a similar sex difference in negative mental affect.[22 23] A recent WHO report summarizes that it is indeed

women – not men – that are more affected at the onslaught and early on in an economic crisis.[24] If our findings are in fact driven by the timing of follow-up (one year after the collapse) then longer-term follow-up studies are warranted. Our findings on worse mental health among women in Iceland following the collapse calls attention to the needed examination of suicide and parasuicidal behaviors following the collapse in Iceland, as data from the current Greek crises of similar velocity – yet worse in magnitude – show rising suicide rates, with indications of financial difficulties being the root (e.g. high levels of personal debt).[25 26]

Employment and economic status

We found that being unemployed was a risk factor for depressive symptoms – regardless of sex – and having lost any savings increased odds of experiencing those symptoms in men only. Financial loss has earlier been found to be strongly indicative of suicidal ideation, rather than just low income or chronic poverty.[27,28] Our results showing an increased risk of depression among males who experienced a loss of financial savings may be partly explained by an increased reliance on personal savings and private provisions, which were not alleviated appropriately by state-funded social protection measures. Why this was not seen in women, may be rooted in men's drive to fulfill their provider role. Thus, when financial security is not met or suffers large-scale setbacks (e.g. savings loss), men are susceptible to mental health deterioration.

While our findings did not show a significant increased risk for women or men who became unemployed, there was a strong tendency for both groups – especially women. The lack of significance is most likely attributable to the low sample size and follow-up rates of those unemployed. Furthermore, this tendency supports our previous findings of increased stress levels for unemployed females in the same cohort.[12] A previous study found that women, compared to men, who experienced job insecurity showed higher depressive symptoms, including feelings of loneliness and personal stress.[29] Therefore this increased risk of depressive symptoms among females post-crisis may not just be explained by the economic effects of losing a job, but also job insecurities among employed women Taken together, high involvement in job market, maintaining their roles as having primary responsibility at home and experiencing job insecurity more negatively than males (partly because of potential loss of a social network), might explain our sex-specific effects. Understanding the mechanisms behind the higher investment in social networks and the higher propensity to be affected by other people's lives and stressful life events, we begin to understand the increased risk of psychological morbidity (e.g. stress levels, depressive symptoms) in women during economic crises, especially among those that lost their jobs.

Male resilience in Iceland?

It is noteworthy that although we found some negative mental health effects among women, the overall effects may be considered smaller than what could be expected given findings from other countries as well as the velocity of the economic crisis in Iceland. This could best be understood through the notion of 'resilience', referring to the dynamic capacity of Icelandic individuals, families, communities and societies to adapt positively to shocks.[30] Although subject to the ruling of long-term follow-up studies, our findings reported here one year after the economic

collapse may indeed be interpreted to indicate a high degree of resilience (especially for males) in Iceland compared with other countries whose economies have been adversely affected by the economic crisis (such as Spain, Greece).[8] The most plausible candidate for this greater protection is the social welfare provision along with high social capital in Icelandic society. If limited health effects are confirmed in more long-term follow-up studies, these findings may also suggest potential for policy guidance to effected countries which are confronting a similarly high-level of debt/GDP as Iceland but have thus far pursued extensive austerity with differing mental health outcomes. Why resilience seems to be stronger in men than women during economic hardship remains open for further investigation, but potential explanatory factors have been suggested above.

Strengths and limitations

The aforementioned results are fortified by the strength of a large, national, representative prospective cohort. Indeed the attrition analyses revealed select demographic differences between the analytical cohort and those individuals lost-to-follow-up. Though we cannot ascertain the degree to which this attrition potentially biased our findings, we were able to control for a host of potential confounders. Additionally, due to the framing of the household income responses as categorical variables – with large income ranges – not continuous, we were unable to effectively adjust for inflation between waves. Yet taken all together, this study is unique in terms of the "natural experiment" afforded by the timing of study waves – with a severe economic collapse (2008) straddled by the two survey waves (2007/2009).

Conclusions

Our findings reveal an increased risk of depressive symptoms in the female Icelandic population following the economic crisis in 2008 and the subsequent recession. More specifically, our results indicate a resiliency among males to respond to the negative effects of the collapse on their mental health – however, certain subgroups of males experienced an increased risk of depressive symptoms. The highest risk for depressive symptoms was found among single and low education women, as well as the unemployed and men who had suffered a loss in financial savings. While longer-term follow-up is needed, future research needs to delve further into the mechanisms involved in these initial sex-specific mental health responses to economic recessions. If longer-term follow-ups confirm the observed resilience in male mental health during the economic crisis there are inevitably important lessons to be learned that may be extended to other countries facing an economic crisis. However, more research is needed to understand why certain populations across Europe are faring better during this economic crisis.

Author contributions: CM, UA, and AH designed the study. CM analysed the data. All authors interpreted the data and gave equal contribution to the writing of the article.

Conflicts of interest: No conflicts to declare.

Figure Legends

Panel. WHO-5 Well-Being Index items. Items scored from 0 (low well-being) to 25 (best possible well-being); a score below 13 indicates poor well-being and recommendation for a clinical depression test.

Figure 1. Prevalence rates of depression symptoms in Iceland's *Health and Well-being* cohort population, 2007 to 2009 – according to WHO-5 Index

Table 1. Characteristics of participants in the Iceland's *Health and Well-being* cohort at each survey wave (n=3783)

	Participants in 2007	Participants in 2009	
Age	% (n)		$\chi 2$ (p-value) ±
18-34	16·4 (640)	13·5 (509)	21·4 (<0·01)
35-49	25·4 (954)	24·8 (932)	
50-64	31·7 (1191)	31·2 (1172)	
> 64	26·5 (998)	30·5 (1148)	
Sex			
Males	47·1 (1783)	47·1 (1783)	0·0 (1·00)
Females	52·9 (1999)	52·9 (1999)	
Marital status			
Single/Divorced	14·8 (557)	14·4 (543)	3·5 (0·32)
Committed, not cohabiting	3·5 (132)	3·8 (145)	
Married, cohabiting	76·8 (2898)	76·0 (2867)	
Widowed	4·9 (184)	5·7 (216)	
Education			
Basic	44·3 (1440)	54·5 (1825)	112·4 (<0·01)
Middle	28·5 (926)	18·0 (604)	
University	27·2 (885)	27·5 (920)	
Number of children			
0	37·9 (834)	42·5 (914)	10·3 (0·02)
1	24·5 (539)	23·0 (495)	
2	24·8 (547)	23·2 (499)	
≤ 3	12·8 (283)	11·3 (242)	
Employment status			
Employed	71·8 (2485)	64·0 (2230)	50·7 (<0·01)
Unemployed	3·4 (116)	4·9 (171)	
Inactive*	24·8 (859)	31·1 (1086)	
Occupational status of the employed			
Executive	29·4 (682)	31·2 (669)	18.9 (<0·01)
Skilled	44·5 (1031)	44·1 (945)	
Non-Skilled	26·1 (604)	24·6 (527)	
Household income			
High	18·1 (551)	20·1 (605)	7·9 (0·02)
Middle	61·3 (1866)	61·7 (1858)	
Low	20·6 (628)	18·2 (547)	

± Chi-square used to compare variations in the demographic composition of the cohort from 2007 to 2009 caused by attrition

* Inactive group categorized from employment status of: homemaker/parental leave, disabled (≥50%), student, retired

Table 2. Odds ratios (corresponding 95% confidence intervals) of depression symptoms in 2009 compared to 2007 according to an individual's socio-demographic status – assessed by WHO-5 Index

	OR (95% CI) ±		
	Total	**Males**	**Females**
	1·14 (1·00, 1·29)	1·02 (0·84, 1·25)	1·22 (1·04, 1·44)
Age			
18-34	1·03 (0·76, 1·41)	0·71 (0·40, 1·25)	1·25 (0·71, 1·82)
35-49	1·03 (0·81, 1·32)	0·93 (0·61, 1·42)	1·10 (0·81, 1·49)
50-64	1·21 (0·96, 1·52)	1·16 (0·83, 1·61)	1·31 (0·95, 1·82)
> 64	1·26 (0·97, 1·63)	1·17 (0·79, 1·74)	1·35 (0·95, 1·92)
Marital status			
Single/Divorced	1·22 (0·92, 1·62)	0·99 (0·65, 1·51)	1·45 (0.99, 2·11)
Committed, not cohabiting	1·14 (0·61, 2·13)	0·83 (0·27, 2·57)	1·29 (0·60, 2·76)
Married/Cohabiting	1·17 (1·01, 1·37)	1·16 (0·92, 1·47)	1·20 (0.99, 1·47)
Widowed	1·53 (0·89, 2·63)	2·03 (0·46, 8.88)	1·50 (0·84, 2·68)
Education			
Basic	1·21 (1·02, 1·45)	1·05 (0·79, 1·39)	1·33 (1·06, 1·68)
Middle	1·10 (0·85, 1·44)	1·04 (0·69, 1·56)	1·18 (0·83, 1·67)
University	1·06 (0·82, 1·37)	1·13 (0·73, 1·75)	1·03 (0·74, 1·42)
Number of children			
0	1·45 (1·10, 1·91)	1·39 (0·94, 2·05)	1·62 (1·10, 2·38)
1	0·83 (0·59, 1·16)	0·55 (0·29, 1·03)	0·98 (0·66, 1·47)
2	1·09 (0·79, 1·50)	1·30 (0·73, 2·31)	0.99 (0·67, 1·47)
≥ 3	1·02 (0·60, 1·72)	0·61 (0·23, 1·63)	1·27 (0·68, 2·39)

± Reference group is 2007. Logistic regression models are adjusted for age, education, marital status; the total column is additionally adjusted for sex.

Table 3. Odds ratios (corresponding 95% confidence intervals) of depression symptoms in 2009 according to an individual's employment status in 2009 and potential change in economic status since 2007 – assessed by WHO-5 Index

		OR (95% CI) ±		
Employment status in 2009 among those employed at baseline	n (%)*	Total	Male	Female
Employed	366 (18·0)	Ref	Ref	Ref
Unemployed	31 (33·3)	1·87 (1·06, 3·31)	1·74 (0·77, 3·91)	1·88 (0·85, 4·19)
Inactive**	44 (17·5)	0·76 (0·49, 1·17)	0·58 (0·28, 1·23)	0·80 (0·46, 1·39)
Income change in 2009 among high income at baseline* **				
High income in 2009 (*stable income*)	51 (13·8)	Ref	Ref	Ref
Low income in 2009 (*decreased income*)	32 (19·9)	1·10 (0·63, 1·97)	0·82 (0·35, 1·93)	1·35 (0·59, 3·07)
Increased principal on home mortgage following the 2008 crisis* **				
No	25 (16·3)	Ref	Ref	Ref
1-60% increase	370 (20·0)	1·11 (0·64, 1·91)	0·97 (0·44, 2·15)	1·21 (0·57, 2·57)
>60% increase	22 (17·2)	0·88 (0·40, 1·90)	0·53 (0·16, 1·75)	1·29 (0·46, 3·64)
Loss of savings following the 2008 crisis**				
No	317 (20·9)	Ref	Ref	Ref
Yes	415 (19·5)	1·15 (0·91, 1·46)	1·56 (1·07, 2·28)	0·97 (0·71, 1·32)

* Represents the number (n) of respondents with *depression symptoms* in 2009 within each category, as well as the percentage (%) of the total cohort.

** Inactive group categorized from employment status of: homemaker/parental leave, disabled (≥50%), student, retired

*** Additionally adjusted for baseline household income

*** Additionally adjusted for household income in 2009

**** Includes loss of stock shares, pension funds, money market savings, and a classification of other sources; additionally adjusted for household income in 2009

± Adjusted for age, sex, marital, educational status, WHO-5 at baseline

Appendix

Table 1. Characteristics of the full cohort (analytical cohort; n=3783) and those lost at follow-up (attrition; n=2130)

	Analytical cohort (n=3783)	Attrition group (n=2130)	
Age	% (n)		$\chi 2$ (p-value) ±
18-34	16·4 (618)	28·3 (588)	141·06 (<0·01)
35-49	25·4 (954)	24·5 (509)	
50-64	31·7 (1191)	21·5 (446)	
> 64	26·5 (998)	25·8 (536)	
Sex			
Males	47·1 (1783)	46·0 (960)	0·68 (0·41)
Females	52·9 (1999)	54·0 (1126)	
Marital status			
Single/Divorced	14·8 (557)	19·3 (401)	65·93 (<0·01)
Committed, not cohabiting	3·5 (132)	7·1 (147)	
Married, cohabiting	76·8 (2898)	68·4 (1422)	
Widowed	4·9 (184)	5·3 (110)	
Education			
Basic	44·3 (1440)	51·1 (902)	27·36 (<0·01)
Middle	28·5 (926)	27·5 (486)	
University	27·2 (885)	21·4 (377)	
Employment status			
Employed	71·8 (2485)	66·5 (1236)	17·31 (<0·01)
Unemployed	3·4 (116)	4·5 (83)	
Inactive*	24·8 (859)	29·1 (541)	
Occupational status of the employed			
Executive	22·7 (759)	18·2 (312)	24·44 (<0·01)
Skilled	39·2 (1312)	37·7 (646)	
Non-Skilled	20·3 (681)	25·3 (433)	
Household income			
High	18·1 (551)	17·4 (266)	5·72 (0·06)
Middle	61·3 (1866)	58·9 (902)	
Low	20·6 (628)	23·7 (363)	

± Chi-square tests used to compare variations in the baseline demographic makeup of the analytical cohort with those lost at follow-up (attrition group)

* Inactive group categorized from employment status of: homemaker/parental leave, disabled (≥50%), student, retired

Table 2. Prevalence rates of depression symptoms in Iceland's *Health and Well-being* cohort population, 2007 to 2009 ±

	WHO-5 Indicators	
	2007 (%)	**2009 (%)**
Total (n = 3783)	17·7	20·0
Age		
18-34	22·7	25·7
35-49	19·4	21·0
50-64	16·8	19·7
> 64	13·9	16·6
Sex		
Male	15·9	17·4
Female	19·3	22·4
Marital Status		
Single/Divorced	27·6	32·0
Committed, not cohabiting	18·9	20·7
Married, cohabiting	15·6	17·4
Widowed	19·6	23·1
Education		
Basic	18·5	21·0
Middle	18·6	22·0
University	15·4	17·3
Loss savings of any kind following the crisis		
No	19·9	20·9
Yes	16·3	19·5
Employment status in 2009 *		
Employed	15·9	18·0
Unemployed	21·5	33·3
Inactive**	19·0	17·5
Household Income change from 2007 to 2009		
Decreased income ***	10·6	13·8
Increased income ****	17·8	20·3

* Analyses only include those employed at baseline

** Inactive group categorized from employment status of: homemaker/parental leave, disabled (≥50%), student, retired

*** Analyses only include those in the high income group at baseline

**** Analyses only include those in the low income group at baseline

± Significantly different between-year rates at 0·05 level

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Paper III

BMJ open accessible medical research

Economic crisis and smoking behaviour: prospective cohort study in Iceland

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ABSTRACT

Objective: To examine the associations between the 2008 economic collapse in Iceland and smoking behaviour at the national and individual levels.

Design: A population-based, prospective cohort study based on a mail survey (*Health and Wellbeing in Iceland*) assessed in 2007 and 2009.

Setting: National mail survey.

Participants: Representative cohort (n=3755) of Icelandic adults.

Main outcome measure: Smoking status.

Results: A significant reduction in the prevalence of smoking was observed from 2007 (pre-economic collapse) to 2009 (postcollapse) in both males (17.4–14.8%; p 0.01) and females (20.0–17.5%; p 0.01) in the cohort (n=3755). At the individual level of analysis, male former smokers experiencing a reduction in income during the same period were less likely to relapse (OR 0.37; 95% CI 0.16 to 0.85). Female smokers were less likely to quit over time compared to males (OR 0.65; 95% CI 0.45 to 0.93). Among male former smokers who experienced an increase in income between 2007 and 2009, we observed an elevated risk of smoking relapse (OR 4.02; 95% CI 1.15 to 14.00).

Conclusions: The national prevalence of smoking in Iceland declined following the 2008 economic crisis. This could be due to the procyclical relationship between macro-economic conditions and smoking behaviour (ie, hard times lead to less smoking because of lower affordability), or it may simply reflect a continuation of trends already in place prior to the crisis. In individual-level analysis, we find that former smokers who experienced a decline in income were less likely to relapse; and conversely, an increase in income raises the risk. However, caution is warranted since these findings are based on small numbers.

ARTICLE SUMMARY

Article focus

- An examination on the association between economic crises and smoking behaviours, that is, is change in income (at both the national and individual levels) related to a change in smoking status?

Key messages

- National smoking prevalence declined in Iceland following the 2008 economic crisis.
- In individual-level analysis, male former smokers whose incomes declined experienced a reduced risk of smoking relapse.
- Conversely, an increase in income from 2007 to 2009 was associated with increased risk of relapse.
- Our findings are consistent with the hypothesis that economic downturns may result in decreased tobacco use (procyclical effect).

Strengths and limitations of this study

- A representative prospective cohort study assessed at two time points, which straddle the start of a severe economic crisis.
- Owing to the low number of individuals that change their smoking behaviours in a short period, we were unable to assess the effects of a change in employment on smoking habits.
- Findings are based on a low number of subjects and must be taken with caution.

INTRODUCTION

The Icelandic economy was severely affected by the global economic collapse of 2008. After a decade-long period of financial prosperity the nation was plunged into a recession of great severity, resulting in a severe currency crisis, as well as a drastic increase in national and household debts, runaway unemployment rates and decreased per capita purchasing power.[1 2]

Previous research on the health consequences of the Icelandic economic collapse has suggested adverse impacts on cardiovascular and mental health among women.[3 4] In the broader literature on economic crises and population health, however, it has been debated whether health moves in a procyclical or counter-cyclical direction to macroeconomic conditions. The work of Brenner[5] beginning in the 1970s suggested that mortality is counter-cyclical, that is, when the economy is down, death rates—in particular, suicides—rise. However, in more recent

years, a series of econometric studies have suggested that mortality is procyclical, that is, during economic contractions death rates decline.[6–9] There are plausible reasons for this unexpected finding—for instance, during the 1998 Korean financial crisis, economic activity was so depressed that there was a detectable decline in traffic-related mortality.[10] Others have speculated—without direct evidence—that people are more likely to be over-worked and 'stressed' during economic booms than during busts, having less time flexibility to engage in health promoting behaviours.[11 12]

Few studies, however, have used individual-level data to test the association between recession and health, especially smoking. Most of the evidence to date has been at the ecological level, though not all.[13] For instance, Shaw *et al*[14] found a direct association between economic hardship and a propensity to smoke. Using US data, Ruhm[12] previously reported that economic recession was associated with a decline in the prevalence of cigarette smoking. A recent report from Gallus *et al*[15] found that the recent economic contraction in Italy has given rise to an increase in the percentage of current smokers—primarily for women. In the present study, we took advantage of the natural experiment afforded by the Icelandic crisis to examine the relationship between changes in economic conditions and smoking behaviour. Utilising a prospective cohort of Icelandic adults assessed before (in 2007) and after the start of the collapse (in 2009), we sought to examine the risk of relapse among precollapse former smokers, as well as quitting behaviour among current smokers in terms of economic changes. Furthermore, because of the important role of perceived stress on smoking status, we sought to examine the potential influence of stress on the studied associations.[16 17]

METHODS

Design and samples

Cohort

Our cohort is based on the *Health and Wellbeing in Iceland* health survey. Data were collected by a questionnaire in two waves: (1) from October to December of 2007 (10–12 months precollapse), then again (2) between November and December of 2009 (13–14 months postcollapse). The cohort was based on a stratified random sample of the Icelandic population (n=9807), which was selected from 12 strata: consisting of two geographic regions further stratified by six age groups. Of the initial 9807, a total of 5918 responded to the initial 2007 assessment (response rate of 60.3%), with 4092 responding again to the modified version of the survey in 2007 (response rate of 82.8% of those who responded to the precollapse baseline survey). Because of the importance of stress as a potential predictor of smoking behaviour, we excluded individuals who did not have complete responses to the *Perceived Stress Scale* (PSS-4) in both 2007 and 2009. This left a final analytical sample of n=3755. Figure 1 shows the cohort attrition over questionnaire waves.

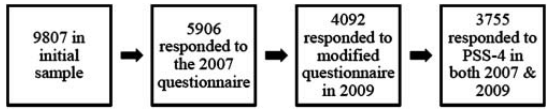

Figure 1 The cohort of the 'Health and well-being' study.

Measures

Smoking status and behaviour

In the questionnaire, we inquired about smoking status, that is, whether respondents were current smokers, had quit smoking or had never smoked. In order to examine the likelihood of relapsing or quitting following an economic collapse, respondents were stratified according to their smoking status: non-smoker, relapsed and quit smoking.

Non-smoker: an individual was classified as a non-smoker if they responded that they did not currently smoke on both the 2007 and 2009 assessments.

Relapsed smoker: an individual was identified as relapsed if they indicated that they (a) were a former smoker on the 2007 questionnaire, but indicated they had (b) smoked in any frequency in 2009. In our analyses estimating the ORs of relapse, the base population was restricted to individuals who were former smokers at baseline.

Quit smoking: a respondent who had quit smoking must have indicated that they were (a) currently smoking in 2007, yet had (b) quit smoking by 2009. In our analyses estimating the ORs of quitting, our base population was restricted to individuals who were current smokers at baseline.

Change in economic status

Additional socio-economic questions pertained to employment and income status. Household income was classified into income ranges of (in terms of Icelandic currency; *ISK*) (1) low (≤3.4 million ISK), (2) middle (3.5–9.4 million ISK) and (3) high (≥9.5 million ISK); corresponding approximately to (1) ≤28 000 US$, (2) 28 000–77 000 US$ and (3) ≥77 000 US$. For analysis of income change, household income was further dichotomised into either high or 'low' (which combined the middle-income and low-income categories). We examined two types of income change: (a) drop in income between 2007 and 2009 from high to low and (b) a rise in income between 2007 and 2009 from low to high.

Change in perceived stress

Psychological stress was measured in both 2007 and 2009 using the four-item PSS-4.[18] The PSS-4 is a shortened, validated and acceptable substitute for the original scale,[19] with scores ranging from 0 to 16; the higher the score, the higher the perceived stress. An increase in

stress was classified as any increase from baseline to follow-up; conversely, a decrease was classified as any decrease from baseline to follow-up. For example, an individual with a score of 5 in 2007 and a score of 10 in 2009 would be classified as having an increase in stress.

Explanatory variables and demographics

Our regression models controlled for the following socio-demographic covariates: age, sex, marital status and education. Education was categorised as (1) basic (completed primary school or less), (2) middle (completed high school or equivalent) and (3) university (a completed university degree). Employment status was categorised as (1) employed, (2) unemployed, (3) student (4) homemaker/paternal leave, (5) retired and (6) disabled.

Statistical analyses

Table 1 presents the distribution of socio-demographic characteristics according to change in smoking status between 2007 and 2009.

Binary logistic regression was used to estimate OR (corresponding 95% CIs) of relapse in 2009 (table 2), and the odds of quitting smoking in 2009 (table 3) by background characteristics, change in income and stress levels. Analyses were also stratified by gender. Models were adjusted for age and sex; models for household income and income change were additionally adjusted for baseline income levels. As previous research supports the role of stress as a mediator of an individual's propensity to change smoking status,[15 16 20] we also ran models of relapse and cessation with and without the inclusion of (1) changes in stress levels between 2007 and 2009 and (2) baseline stress levels.

Repeated measures analysis of variance (p values, F statistic) was used to examine overall and gender-specific mean differences in stress levels from 2007 to 2009 (table 4). Statistical analyses were conducted with IBM SPSS Statistics V.19.0 (SPSS Inc, Chicago, Illinois, USA). Statistical significance was set at the 0.05 level, and all tests were two-tailed.

RESULTS

Baseline characteristics

Table 1 describes the baseline characteristics of the cohort in 2007 (n=3755), which was 53.0% female, 76.7% married/cohabiting and with a mean (SD) age of 52.3 (16.0). Table 1 also describes the characteristics of those that had relapsed and quit: 72.2% (n=2711) of the cohort were non-smokers, 4.0% (n=56) of the former smokers at baseline had relapsed in 2009 and 22.2% (n=149) of smokers at baseline had quit smoking in 2009. A significant reduction (p<0.01) in the prevalence of smokers was observed from 2007 to 2009 in both males (17.4–14.8%) and females (20.0–17.5%).

Relapse smoking

Among individuals who were former smokers at baseline (table 2), decreased odds of relapsing in 2009 (after the collapse) were observed in the older age groups

Table 1 Baseline characteristics (in 2007) of the cohort and among differential smoking status

	Cohort	Relapsed in 2009	Quit smoking in 2009
n	3755	56	160
Age mean±SD	52.3±16.0	45.7±14.2	47.4±15.5
Sex	n (% of category)		
Male	1763 (47.0)	31 (55.4)	82 (51.3)
Female	1992 (53.0)	25 (44.6)	78 (48.8)
Marital status			
Single/divorced	556 (14.9)	7 (13.0)	31 (19.9)
Committed, not cohabiting	131 (3.5)	2 (3.7)	9 (5.8)
Married, cohabiting	2871 (76.7)	45 (83.3)	116 (74.4)
Education			
Basic	1688 (47.1)	22 (40.7)	65 (42.5)
Middle	971 (27.1)	15 (27.8)	51 (33.3)
University	928 (25.9)	17 (31.5)	37 (24.2)
Employment status			
Employed	2019 (58.4)	37 (71.2)	98 (64.5)
Unemployed	169 (4.9)	3 (5.8)	10 (6.6)
Student	122 (3.5)	1 (1.9)	5 (3.3)
Homemaker/paternal leave	159 (4.6)	2 (3.8)	9 (5.9)
Retired	872 (25.2)	4 (7.7)	24 (15.8)
Disabled	119 (3.4)	5 (9.6)	6 (3.9)
Household income			
Low	621 (20.6)	8 (17.0)	22 (16.5)
Middle	1855 (61.4)	25 (53.2)	80 (60.2)
High	543 (18.0)	14 (29.8)	31 (23.3)

Table 2 The OR of relapsing in 2009 among those who had quit smoking at the baseline (2007)

		OR (95% CI)*		
			Male	Female
2009 status	**Overall**		**Ref**	**0.67 (0.38 to 1.18)**
Household income in 2009†	n‡			
Low	8	0.66 (0.26 to 1.70)	1.13 (0.24 to 5.36)	0.56 (0.15 to 2.08)
Middle	25	1.57 (0.48 to 5.17)	2.28 (0.38 to 13.55)	1.31 (0.21 to 8.32)
High	17	Ref	Ref	Ref
Household income in 2009 (among high income at baseline)†				
High income in 2009	5	Ref	Ref	Ref
Lower income in 2009	9	0.53 (0.28 to 1.01)	0.37 (0.16 to 0.85)	0.92 (0.29 to 2.88)
Household income in 2009 (among low incomes at baseline)†				
High income in 2009	23	3.14 (1.27 to 7.72)	4.02 (1.15 to 14.00)	2.43 (0.64 to 9.19)
Lower income in 2009	7	Ref	Ref	Ref
Change in stress from 2007 to 2009§				
Same	7	Ref	Ref	Ref
Decreased	15	0.91 (0.35to 2.36)	0.83 (0.23 to 2.99)	1.03 (0.25 to 4.28)
Increased	34	1.71 (0.86 to 3.37)	1.75 (0.68 to 4.53)	1.64 (0.61 to 4.39)

*OR adjusted for statuses in 2009: age and sex.
†OR adjusted for statuses in 2009: age, sex and baseline income in 2007.
‡Totals do not include missing values from 2009.
§OR additionally adjusted for baseline stress (2007).

(compared to those aged 18–39), regardless of gender (age of 40–59: OR 0.38; 95% CI 0.21, 0.69 | age ≥60: 0.10; 0.04, 0.23).

While an individual's employment status was not involved in their risk of relapsing, retired women showed a significant increased risk of relapsing (4.12; 1.11, 15.29), compared to the employed.

Among men in the lower-income groups at baseline (ie, low and middle), those who moved into the high-income group in 2009 experienced an increased risk of relapse (4.02; 1.15, 14.00)—while among those in the high-income group at baseline, those whose incomes dropped had a decreased risk of relapsing (0.37; 0.16, 0.85). Further adjustments for a change in stress levels from

Table 3 The OR of smoking cessation in 2009 among those who were smokers at the baseline (2007)

		OR (95% CI)*		
			Male	Female
2009 status	**Overall**		**Ref**	**0.65 (0.45 to 0.93)**
Household income in 2009†	n‡			
Low	22	0.89 (0.49 to 1.60)	0.75 (0.33 to 1.74)	1.01 (0.43 to 2.36)
Middle	80	0.98 (0.45 to 2.13)	0.80 (0.27 to 2.38)	1.12 (0.36 to 3.46)
High	31	Ref	Ref	Ref
Household income in 2009 (among high income at baseline)†				
High income in 2009	19	Ref	Ref	Ref
Lower income in 2009	6	0.75 (0.46 to 1.22)	0.82 (0.41to 1.62)	0.68 (0.34 to 1.37)
Household income in 2009 (among low incomes at baseline)†				
High income in 2009	85	0.68 (0.30 to 1.55)	0.61 (0.19 to 1.97)	0.77 (0.24 to 2.41)
Lower income in 2009	8	Ref	Ref	Ref
Change in stress from 2007 to 2009§				
Same	22	Ref	Ref	Ref
Decreased	62	0.84 (0.47 to1.48)	0.73 (0.34 to 1.56)	0.98 (0.41 to 2.31)
Increased	76	0.98 (0.64 to 1.51)	0.66 (0.36 to 1.22)	1.38 (0.74 to 2.58)

*OR adjusted for statuses in 2009: age and sex.
† OR adjusted for statuses in 2009: age, sex and baseline income in 2007.
‡Totals do not include missing values from 2009.
§OR additionally adjusted for baseline stress (2007).

Table 4 Average stress levels according to smoking status—among waves (2007 and 2009)

	2007 Stress mean (SD)	2009 Stress mean (SD)	p Value (F)*
Never smoker			
Male	3.70 (2.75)	3.83 (2.69)	0.31 (1.02)
Female	4.18 (2.70)	4.40 (2.90)	0.44 (0.60)
Relapsed			
Male	3.52 (2.28)	4.94 (2.80)	0.28 (1.20)
Female	3.96 (2.52)	5.24 (3.46)	0.01 (7.67)
Quit smoking			
Male	4.21 (2.71)	4.16 (2.78)	0.91 (0.01)
Female	4.38 (3.49)	5.03 (3.35)	0.13 (2.31)

*Repeated measures analysis of variance (p values, F statistic) used to examine overall and gender-specific mean differences in stress levels from 2007 to 2009; adjusted for age in 2009.

2007 to 2009, showed limited attenuation in the coefficients, suggesting some mediation by perceived stress—that is, former smokers whose incomes increased between 2007 and 2009 may have relapsed in part because of an increase in stress.

Smoking cessation

Women were less likely to quit smoking in 2009 (0.65; 0.45, 0.93), compared to men. An increased likelihood of quitting in 2009 was observed among the following female groups: those with middle (2.78; 1.48, 5.21) or university-level (2.73; 1.38, 5.40) education compared to a basic, and the disabled (3.42; 1.23, 9.52) compared to the employed. Compared to women aged 18–29, those in the middle-aged group (0.46; 0.26, 0.83) were less likely to quit. Additional adjustments for a change in stress levels from baseline to follow-up in the cessation models revealed no diminished significance in effect sizes.

Stress and smoking

Though stress change (increase versus Stable and decrease versus stable) did not predict a relapse in women in aforementioned analyses, further examination of changes in stress levels among smoking status displayed a significant change in mean stress levels (SD) among women that had relapsed, with a significant increase in stress scores from 3.96 (2.52) in 2007 to 5.24 (3.46) (p 0.01; F=7.67).

DISCUSSION

In response to the severe economic collapse in Iceland, we found that the prevalence of smoking continued to decrease for both genders in the short period after. This drop in smoking may be attributed to background secular trends,[21] while other factors, such as changes in the price of cigarettes, and changing norms about the acceptability of smoking, may also have played a role. The strength of our study is that we were able to document changes in individual economic status straddling the economic downturn and link these exposures to individual changes in smoking habits. Additionally, in comparison to national smoking rates (2007: 23.0% of population; 2009: 19.0%) the prevalence rates from 2007 to 2009 of this sample are relatively analogous—offering support for the generalisability of the sample.

Our findings partially corroborate previous research on the procyclical nature of the association between economic downturns and smoking habit, that is, during recessions, smoking habits may be dampened. Among male former smokers, those who experienced a decline in income during the economic recession had a significantly lower risk of relapse two years later. Conversely, among men whose incomes increased during the period of recession, their risk of relapse was considerably higher compared to those whose incomes stayed the same. Although the direction of associations was similar among women, none of the estimates were statistically significant.

Taken together, the main significant finding of our analyses is that male former smokers whose incomes fell during the period of the economic collapse experienced a reduced risk of relapse. Ruhm[22] hypothesised that this risk reduction is possibly driven by a tendency to adopt healthier behaviours during periods of reduced income—driven by an increase in positive health behaviours (ie, exercise) that accompanies newly acquired increased leisure time during economic contractions. It could also be argued their behaviour change in a recession can be either intentional or inadvertent. When facing enforced economic inactivity—individuals may choose to fill their time by actively investing in positive personal health changes, which include stopping smoking or joining a fitness club. However, our results did not indicate an increased risk of quitting among those whose incomes fell—which is inconsistent with previous research by Siahpush and Carlin.[23]

It is possible that smoking cessation and smoking relapse are 'asymmetric' behaviours with different triggers. Thus, a former smoker who experiences a drop in income may be less tempted to start smoking again because of the reduced affordability of cigarettes. However, someone who is already smoking may be less sensitive to an income drop (higher income inelasticity)—that is, he is unable to quit his ongoing behavior because of the offsetting increase in stress (although our data on self-reported stress did not support this).

There is an apparent discrepancy between the national decline in smoking in Iceland and the fact that smokers whose incomes declined were not more likely to quit. This underscores the point that macrolevel data and individual-level patterns are often driven by a different set of causes. Thus, the overall decline in national smoking rates could be either due to the procyclical nature of smoking (ie, recessions are good for health), or it may simply reflect a continuation of trends already

in place prior to the recession (ie, national antismoking campaigns, declining social acceptability of smoking, etc). In other words, national averages are driven by more than the group of smokers whose incomes decreased after the crisis.

Furthermore, we caution that our findings regarding recession, income change and smoking habits cannot be generalised to other health outcomes. For example, observational reports found a spike in female cardiac emergency visits during the week corresponding to the economic collapse in October 2008.[3] In accordance with this, our previous analysis on changes in mental health revealed significant increases in stress for mainly women.[4] This increase in stress for women, however, threatening to related health outcomes, did not prove to be associated with an increased likelihood of relapsing.

Our findings are also congruent with multiple models explaining the link between stress levels and smoking behaviour. Though much research shows stress as a cause of smoking,[15 16] additional research actually points to cigarette smoking as a cause of stress and, furthermore, smoking cessation as leading to a reduction in stress.[20] This is in line with our findings, as both male and female relapsed smokers had the lowest levels of stress before the collapse when they considered themselves as having quit smoking in 2007 (table 4), yet experienced an increase in stress postcollapse—significantly for women. This may also point to a vulnerability of this group to use smoking as a means of alleviating stress—explaining their relapse in smoking after the collapse.[24] This vulnerability has been discussed and supported by previous research showing economic stress as a cause of adverse mental health.[25] This increased stress may have also been amplified by a return to smoking, as Cohen and Lichtenstein[26] have found. Caution is warranted in interpreting the findings on stress, however, since smokers may be citing an increase in perceived stress to justify their relapse or failure to quit. We cannot conclusively argue that stress did not play a mediating role in the association between income change and smoking behaviour because of measurement error.

Study limitations

Some limitations of our study should be noted. Relapsed smokers and quitters represent a small proportion of the population, and hence our ORs were estimated with imprecision and must be interpreted with caution. Similarly, we lacked statistical power to directly examine the effects of a change in employment status on change in smoking habits. In other words, though we were able to examine the effects of income change, we were not able to directly estimate the effects of unemployment as there were too few individuals in the sample who lost their jobs between 2007 and 2009. While our findings are based on the potential effects of an economic crisis on a change in smoking status, it is not clear whether these similar findings would hold true in normal scenarios and, thus, caution is warranted when generalising our findings to other normative scenarios. Finally, smoking status was based on self-report only, and not validated by biomarkers such as cotinine. This may have produced misclassification of the outcome, though it is not clear whether this misclassification was differential by exposure status (eg, income changes).

Conclusions

Our large population-based cohort with assessment points straddling the 2008 economic crisis in Iceland revealed a reduction in smoking rates from the short periods before and after the start of the crisis—though our study could not disentangle the direct effects of the crisis with other mechanisms, for example, secular trends and changing cigarette prices. Chiefly, this examination revealed a role of income change on the risk of relapse after the collapse among former male smokers.

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Economic crisis and smoking behaviour: prospective cohort study in Iceland

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Notes

Paper IV

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Effects of a national economic crisis on dental habits and checkup behaviors – a prospective cohort study

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Abstract – *Objectives:* The effects of economic recessions on dental health behaviors and care utilization are vastly unexamined. Thus, we aimed to ascertain changes in dental health behaviors and checkup frequency from before to after the start of the 2008 Icelandic economic collapse using a nationally representative, prospective cohort – the *Health and Wellbeing in Iceland* cohort. *Methods:* Participants in the cohort (n = 4100) were contacted first from October to December of 2007 and again from November to December of 2009. The questionnaires assessed respondent's demographics, dental behaviors (brushing, flossing), and dental checkup frequency. We present odds ratios derived from multivariate logistic regression of visiting a dentist annually after the collapse compared with before, as well as odds ratios of daily brushing and flossing habits. *Results:* Overall, there was no strong evidence for drastic changes in dental health behaviors as from 2007 to 2009. However, employed men (odds ratio 1.29; 95% confidence interval 1.07–1.54) – as well as unemployed women (1.98; 1.00–3.92) – experienced increased odds of visiting a dentist at least annually. Additionally, men were more likely to brush (1.42; 1.05–1.93) and floss daily (1.20; 1.03–1.42) after the collapse compared with before. *Conclusions:* Overall, it seems as if the collapse did not have drastic negative effects on dental health behaviors of the population in Iceland. Our findings suggest that men may have opted for healthier dental health behaviors following the national economic collapse in 2008.

Key words: dental health; dental services research; economics; health services research; public health

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Iceland, along with fellow Nordic nations, offers a universally comprehensive healthcare system funded almost entirely by general taxation. Yet what this universal system of health care lacks is basic dental health insurance for its adult population (1). Although partial reimbursements are in place for those under the age of 18 and other qualifying pension recipients (i.e., retired, disabled), dental care is, in essence, a luxury good for the majority of the population. In addition to this fee-for-service dental care system, private dental insurance plans are nonexistent, aside from limited accidental dental care.

In late 2008, Iceland's economy began to collapse after a distinct decade of economic prosperity. The formerly secure nation with the fifth highest average income in the world and marginally low unemployment spiraled to a state of runaway inflation, high unemployment, large-scale national and household debts, and a nationalization of the three largest domestic banks (2, 3). What led this small Nordic nation to one of the biggest economic failures in modern history was a system of inherently flawed business behaviors – the same behaviors that led it to a false feeling of economic growth and security the decade prior (2, 4). As the country

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begins to see signs of economic growth out of this severe recession, it is left wondering whether this economic contraction led to a change in health outcomes (5, 6).

While existing research on the impact of the recent global economic crises on health outcomes is limited, epidemiological studies on dental care outcomes and behaviors are more limited (7). In Iceland, where dental care is a luxury expense, it becomes extensively important to determine the possible effects of this drastic period of economic contraction on the population's dental behaviors. Utilizing a representative, prospective cohort study assessed a short period before and after the start of the 2008 economic collapse, this study sought to determine whether there was a change in dental checkup frequencies and dental habits (i.e., daily brushing and flossing) following the economic collapse and subsequent recession.

Materials and methods

Study population

This study is based upon the cohort from the *Health and Wellbeing in Iceland* health survey that was conducted in two waves: (i) from October to December of 2007 and then again (ii) between November and December of 2009. The cohort was based on a stratified random sample of the Icelandic population (n = 9807), which was chosen from 12 strata: consisting of two geographic regions further stratified by six age groups. Of this initial 9807 individuals, a total of 5906 responded to the 2007 assessment (response rate of 60.3%), with 4100 responding again to the modified version of the survey in 2009 (response rate of 69.4%). Thus, this is an analytical cohort of 4100 individuals.

Measures

Outcome measures. Dental checkup frequency—The primary outcome measure was designed to assess an individual's frequency of dental checkups, determined by the question 'How often do you go to the dentist for a checkup?' Forced item responses include 'at least twice a year', 'once a year', 'every second year', 'every third year', 'every fourth year', 'have not gone for the past 5–9 years', and 'have not gone for the past 10 years'.

Brushing and flossing behaviors—The secondary outcome measures were designed to assess an individual's frequency of tooth brushing and flossing determined by the questions 'How often do you brush your teeth?' and 'Do you use dental floss to clean between your teeth, and, if so, how often?' Forced responses were ordered by 'more than twice a day', 'twice a day', 'once a day', 'at least once a week', 'less than once a week', and 'never'.

Explanatory variables

Socioeconomic status was determined by a respondent's employment status and household income level. Employment status responses were categorized into (1) employed, (2) unemployed, (3) student, (4) homemaker or parental leave, (5) disabled (>50% disability), and (6) retired. Household income responses were classified according to income ranges per year (in terms of Icelandic currency: ISK): (1) low (≤3.4 million), (2) middle (3.5–9.4 million), and (3) high (≥9.5 million), corresponding approximately to (1) ≤28 000 USD, (2) 28 000–77 000 USD, and (3) ≥77 000 USD.

Statistical analyses

Standard frequencies (Table 1) describe the analytical cohort at the time of their enrollment in the 2007, in terms of age, marital status, education, employment status, household income level, and dental behaviors. The analytical cohort was compared with those individuals that did not follow up in 2009 (attrition group) using chi-square tests, to ascertain potential differences.

To ascertain the likelihood of visiting a dentist, the binomial outcome variable was created from the dental checkup frequency question. Thus, the biannual dental checkup variable was dichotomized into those that (1) visited a dentist at least once a year and (2) did not. Additionally, two binomial variables were created from the brushing and flossing items: one for daily brushing and one for daily flossing. Daily brushing was dichotomized into those that (1) had brushed at least once a day and (2) did not; daily flossing was dichotomized into those that (1) had flossed at least once a day and (2) did not.

Bivariate logistic regression (Tables 2 and 3) was used to estimate gender-specific odds ratios (ORs) and corresponding 95% confidence intervals (CI) of visiting a dentist at least per year (Table 2) and of daily teeth brushing and flossing (Table 3), with 2007 frequencies as the referent group. Logistic regression was used to estimate ORs (95% CIs) of canceling/postponing needed dental care in 2009. Additionally, all individuals belonging to a specific stratum were compared with all individuals

Table 1. Characteristics of the full cohort (analytical cohort; n = 4100) and those lost at follow-up (attrition; n = 1810)

	Analytical cohort (n = 4100) % (n)	Attrition group (n = 1810) % (n)	χ^2 (P-value)[a]
Age			
18–29	9.7 (396)	23.2 (409)	475.61 (<0.01)
30–39	13.8 (560)	17.7 (313)	
40–49	16.3 (662)	18.5 (327)	
50–59	19.4 (790)	14.3 (253)	
60–69	21.1 (858)	12.0 (212)	
>70	19.7 (800)	14.2 (250)	
Sex			
Men	46.6 (1910)	47.1 (833)	0.14 (0.71)
Women	53.4 (2190)	52.9 (935)	
Marital status			
Single/Divorced	14.7 (599)	20.3 (359)	89.16 (<0.01)
Committed, not cohabiting	3.5 (141)	7.8 (141)	
Married, cohabiting	76.6 (3130)	67.4 (1190)	
Widowed	5.3 (215)	4.5 (79)	
Education			
Basic	46.3 (1618)	47.6 (724)	6.22 (0.05)
Middle	27.6 (964)	29.5 (448)	
University	26.1 (914)	22.9 (348)	
Employment status			
Employed	62.1 (2311)	63.3 (1014)	621.92 (<0.01)
Unemployed	3.4 (125)	4.6 (74)	
Homemaker/Parental leave	6.3 (234)	6.6 (106)	
Disabled (≥50%)	4.9 (182)	6.7 (107)	
Student	3.3 (124)	12.9 (206)	
Retired	20.0 (743)	5.9 (94)	
Occupational status of the employed			
Executive	21.9 (782)	19.3 (289)	19.22 (<0.01)
Skilled	38.8 (1385)	38.3 (573)	
Nonskilled	39.2 (1399)	42.5 (636)	
Household income			
High	21.8 (701)	21.3 (290)	0.32 (0.85)
Middle	60.5 (1944)	60.5 (824)	
Low	17.7 (568)	18.3 (249)	
Frequency of dental checkups			
At least twice a year	934 (22.8)	401 (22.2)	5.05 (0.54)
Once a year	1799 (43.9)	827 (45.7)	
Every second year	492 (12.0)	199 (11.0)	
Every third year	184 (4.5)	87 (4.8)	
Every fourth year	156 (3.8)	65 (3.6)	
Have not gone for the past 5–9 years	270 (6.6)	114 (6.3)	
Have not gone for the past 10 years	258 (6.3)	116 (6.4)	
Brush Daily			
Yes	3969 (96.8)	1763 (97.4)	2.55 (0.11)
No	131 (3.2)	47 (2.6)	
Floss Daily			
Yes	1648 (40.2)	780 (43.1)	7.87 (<0.01)
No	2452 (59.8)	1030 (56.9)	

[a]Chi-square tests to compare variations in the demographic composition of the cohort from 2007 to 2009 caused by attrition.

belonging to that same specific stratum at follow-up. For example, the unemployed category within the 'employment status' stratum is a comparison of all unemployed individuals in 2007 with all unemployed individuals in 2009.

Because the data are clustered within individual (repeated measures), we applied the generalized estimation equation function to account for correlated error terms (8). The overall models were adjusted for age; the model for income was adjusted for age, sex, education, marital status, size of residency, and number of adults in the household; all other models were then adjusted for age, sex, education, marital status, and size of residency. Similarly, we conducted gender-stratified analyses using binary logistic regression models to

Table 2. Odds ratios of attending at least one annual dental checkup before at the time of follow-up (2009) – compared to baseline (2007)

	At least one dental checkup in 2009[a]		
	Total	Men	Women
	1.11 (1.01–1.23)	1.20 (1.04–1.39)	1.02 (0.91–1.17)
Education			
Basic	1.20 (1.05–1.37)	1.31 (1.08–1.59)	1.12 (0.90–1.32)
Middle	1.00 (0.80–1.25)	1.10 (0.79–1.52)	0.91 (0.66–1.24)
University	1.05 (0.85–1.30)	1.17 (0.86–1.58)	0.95 (0.71–1.29)
Employment			
Employed	1.13 (1.00–1.29)	1.28 (1.07–1.54)	0.99 (0.83–1.19)
Unemployed	1.18 (0.72–1.94)	0.64 (0.29–1.39)	1.98 (1.00–3.92)
Student	0.57 (0.41–0.78)	0.50 (0.29–0.84)	0.57 (0.38–0.86)
Retired	1.17 (0.93–1.48)	1.21 (0.86–1.68)	1.12 (0.81–1.54)
Household income[b]			
Low	0.87 (0.62–1.21)	0.99 (0.60–1.59)	0.81 (0.52–1.25)
Middle	1.01 (0.85–1.20)	1.11 (0.88–1.39)	0.94 (0.73–1.20)
High	0.92 (0.67–1.25)	0.90 (0.61–1.33)	0.90 (0.53–1.52)

[a]OR adjusted for age, education, marital status.
[b]OR adjusted for age, education, marital status, adults in household.

calculate ORs and 95% CI across the stratum of socioeconomic status. To adjust the characteristics of the cohort and account for the possible effects of attrition between waves of assessment, we used weighted regression models on the overall and gender-specific models (*Proc Genmod*) (9). The sampling weights were created from the inverse of the sampling probability poststratification to adjust for varying attrition rates by sex, age, and residence. Statistical analyses were conducted with SAS version 9.2 (SAS Institute, Cary, NC, USA). Statistical significance was set at the 0.05 level, and all tests were two-tailed. The study was approved by the Ethics Review Board (09-094) and the Data Protection Authority (S4455).

Results

Table 1 describes the demographic breakdown of the *Health and Wellbeing in Iceland* cohort (n = 4100) at baseline compared with those lost to follow-up (n = 1810). In 2007, the cohort was defined as 53.4% women, 76.6% married and/or cohabiting, and 26.1% with a university-level education, and having a mean (SD) age of 50.9 years (17.0). Furthermore, 60.5% of the cohort was in the response, with 62.5% classifying themselves as employed. In 2009, 20.2% of respondents marked that they had canceled or postponed needed dental care within the past 12 months, compared with 15.9% canceling/postponing needed general health clinic care, 4.6% psychological/psychiatric care, and 13.3% not filling a prescription submitted by their healthcare provider.

Change in dental checkup frequency

A change in the proportion of individuals visiting a dentist for a checkup, annually or biannually, was not significant. In 2009, 45.7% indicated that they visited a dentist once a year compared with 43.9% in 2007 (P = 0.08) and 22.8% indicated they visited a dentist at least twice a year compared with 22.2% in 2007 (P = 0.49).

Although the effect sizes are not large, further analyses found that men (1.20; 1.04–1.39) were more likely to visit a dentist for a checkup at least once a year after the collapse than before (Table 2). Furthermore, employed men (1.28; 1.07–1.54) were more likely to have gone to at least one annual visit in 2009 compared with 2007. Men students (0.55; 0.34–0.89) were less likely to attend at least a single annual visit after the collapse than they were before.

Overall, women did not experience an observable change in visitation frequency. Only women (1.98; 1.00–3.92) that were unemployed were more likely to go to at least one annual visit in 2009 than in 2007.

Brushing and flossing behaviors

A significant change in the proportion of individuals brushing daily from 2007 to 2009 was not observed (P = 0.08) – although a significant increase in daily flossing was observed (P < 0.01). In 2007, 96.8% of the cohort indicated that they

Table 3. Odds ratios of daily brushing and flossing at follow-up (2009) compared to baseline (2007)

	Odds of brushing daily in 2009 OR (95% CI)[a]			Odds of flossing daily in 2009 OR (95% CI)[a]		
	Total	Men	Women	Total	Men	Women
	1.40 (1.06–1.87)	1.42 (1.05–1.93)	1.30 (0.68–2.78)	1.12 (1.01–1.21)	1.20 (1.03–1.42)	1.02 (0.93–1.19)
Education						
Basic	1.45 (1.03–2.02)	1.48 (1.01–2.14)	1.31 (0.61–2.74)	1.22 (1.06–1.42)	1.35 (1.08–1.67)	1.17 (0.98–1.39)
Middle	1.01 (0.43–2.20)	0.92 (0.40–2.00)	[b]	1.11 (0.90–1.37)	1.19 (0.85–1.65)	1.06 (0.81–1.39)
University	1.40 (0.62–3.20)	1.54 (0.67–3.50)	0.72 (0.07–11.34)	1.03 (0.86–1.23)	1.06 (0.80–1.42)	1.01 (0.79–1.28)
Employment						
Employed	1.80 (1.15–2.81)	1.64 (1.03–2.62)	3.53 (0.74–16.18)	1.30 (1.16–1.45)	1.31 (1.08–1.61)	1.16 (1.02–1.39)
Unemployed	1.97 (0.68–5.56)	1.59 (0.46–5.29)	2.41 (0.20–24.67)	1.29 (0.74–2.12)	0.95 (0.38–2.33)	1.33 (0.71–2.54)
Student	0.68 (0.12–2.40)	0.76 (0.16–2.92)	0.60 (0.01–7.28)	1.09 (0.82–1.44)	1.11 (0.66–1.87)	1.07 (0.78–1.54)
Retired	1.15 (0.67–1.96)	1.10 (0.60–2.00)	1.32 (0.35–4.42)	1.07 (0.85–1.34)	1.21 (0.83–1.77)	0.98 (0.68–1.39)
Household income[c]						
Low	1.31 (0.52–3.15)	1.10 (0.43–2.79)	3.04 (0.25–29.08)	1.12 (0.90–1.68)	1.23 (0.75–2.18)	1.02 (0.74–1.78)
Middle	1.32 (0.82–2.11)	1.33 (0.80–2.18)	0.99 (0.24–3.64)	1.28 (1.08–1.56)	1.43 (1.12–1.95)	1.26 (1.04–1.52)
High	1.54 (0.36–5.87)	1.53 (0.32–5.76)	[b]	0.91 (0.72–1.16)	0.84 (0.58–1.20)	0.98 (0.69–1.40)

ORs represent effect sizes of attending at least one dental visit in the previous year before follow-up (2009). Sample constrained to only those individuals that attended at least one visit in the previous 12 months before baseline (2007); $n = 2580$.
[a]OR adjusted for age, sex, education, marital status.
[b]Estimates not possible, as sample was too small.
[c]OR adjusted for age, sex, education, marital status, adults in household.

brushed daily, while 97.4% were daily brushers in 2009. The percentage of individuals flossing daily increased from 40.2% in 2007 to 43.1% in 2009.

Daily brushing. Overall, there was an increase in the likelihood (1.40; 1.06–1.87) of daily brushing in 2009 as compared to 2007 (Table 3). This trend was seen only in men (1.42; 1.05–1.93) and not in women (Table 3). Additionally, employed men (1.64; 1.03–2.62) or those men with a basic level of education (1.48; 1.01–2.14) experienced increased odds of brushing daily.

Daily flossing. Similar in pattern to daily brushing habits, the overall cohort did not experience a change in dental habits. However, men experienced increased odds of daily flossing in 2009 when compared with 2007 (1.20; 1.03–1.42).

Nondifferential gender results were found in those respondents with a basic education (1.22; 1.06–1.42), those that were employed (1.30; 1.16–1.45), and those that belonged to the middle income bracket (1.28; 1.08–1.56) – although men had an observably higher effect size.

Discussion

The economic collapse that began in 2008 in Iceland did not cause a major significant shift in dental health behaviors in the general adult population. Although the proportion of individuals visiting a dentist for a checkup appointment did not significantly change from 2007 to 2009, further analysis revealed pressing changes for select groups. From 2007 to 2009, men experienced an increase in the likelihood of visiting a dentist at least once annually, although an individual's socioeconomic status proved to be an important factor in an observable change in annual dental checkups. Irrespective of gender, those with a basic level of education were more likely to attend an annual checkup after the collapse than the period before. Furthermore, it seems that unemployment had a differential effect on genders. While unemployed men did not experience a changed likelihood of attending at least one checkup in 2009 compared with 2007, unemployed women did.

The economic contraction further showed to be beneficial for daily brushing and flossing habits. Compared with 2007, men in 2009 were more likely to brush and floss daily. Specifically, an increase in the likelihood of brushing was observed in employed men or those with a basic education. Regardless of gender, those that were employed or in the middle income were more likely to floss daily. More importantly, neither gender had an observable decrease in daily brushing or flossing odds.

Research on the role of economic downturns on health outcomes has fueled the existence of two

dynamic schools of thought. The first claim, and most classical theory, argues that economic hardship causes a deterioration in health outcomes (10, 11), while the second, most notably new thought, argues that this hardship actually produces a healthier society (5, 6). Our previous research on the 2008 Icelandic crisis revealed support for both theories, with an increase in psychological stress and depression (12, 13) – especially among women and economically vulnerable groups – and, conversely, a reduction in smoking rates (14). This increase in positive dental health behaviors resonate with the previously observed increase in positive health behaviors (e.g., smoking cessation).

Although findings on the differential utilization of healthcare services among socioeconomic groups have been consistently found (15, 16), only a few studies have actually focused on dental care utilization (17, 18). One such study on the inequity of utilization in the Canadian population follows a similar pattern espoused by our findings (17). Along comparable lines, our results show a significant decrease in the likelihood of dental care utilization among the lower socioeconomic groups. A similar study found that a large reduction in household income was related to a decreased likelihood of seeking dental care (19).

While previous studies have examined a sample of individuals with access to a system of private dental insurance, this cohort is based upon an adult population with no existing public or private dental health insurance. Taken together, these findings indicate that national health systems with only private insurance plans for dental health care produce comparable dental care socioeconomic inequities. Future research needs to disentangle the effectiveness of varying dental healthcare insurance schemes on the population and – moreover – how an individual's SES status plays a role in their utilization of dental care, for example, private versus public based. Our results indicate that the lack of dental health insurance during times of economic hardship only exacerbates the role of dental visits as a luxury good – the more money an individual has, the more they will consume a good (i.e., dental visits). Additionally, further investigation into the reasons for an increase in the likelihood of checkups in unemployed women after the collapse is warranted, especially as this was not observed in unemployed men.

Along comparable lines with our previous findings (10–12), individuals have opted for healthier behaviors (e.g., smoking less and brushing/flossing more) that are of little economic costs to them. However, a reduction in certain behaviors – as in the purchasing of cigarettes or paying high out-of-pocket costs to visit a dentist – is observable for select groups (i.e., students). It can be theorized that these individuals are deciding not to go to the dentist due to the economic costs, but – in lieu – are opting for better oral self-care practices as a means of warding off the potential negative dental health consequences of not getting routine dental care. However, it seems that select groups (e.g., men and unemployed women) did experience an increase in the likelihood of visiting the dentist. Based on the previous findings, it can be theorized that these groups are opting to visit the dentist more regularly as a means of warding off potential negative dental health implications.

As it can be theorized that the high costs of dental care are systematically causing individuals to opt out of utilizing dental care, the government is then left with the difficult policy task of whether a public dental health insurance scheme should be implemented in the public health insurance scheme as a means of warding off the high out-of-pocket costs of seeking dental care.

While our study is based upon a large population-based cohort with survey assessments straddling the 2008 economic crisis, it was disposed to a few inherent limitations. Although large, the study faced considerable attrition, which we ascertained through differential analysis between the baseline characteristics of the analytical cohort and the attrition group. However, we were unable to control for the potential effects of this attrition in our analysis and must caution the reader in the interpretation of our results. Although we were unable to control for the differences in dental behaviors between the attrition and analytical groups, our analysis found that the two groups did vary significantly in terms of employment status and occupation. As the economic collapse had drastic consequences on employment status, it is quite possible that these two groups responded quite differently to the collapse. Additionally, the analytical group consisted of more individuals that were in executive occupations and married, while the attrition group consisted more of those that were in nonskilled occupations and single. This contrast and attrition could have resulted in biased results. Although the analysis only included those that responded at both time points, caution is warranted in interpreting these findings. It could be very well likely that those individuals with

propensity for unhealthier behaviors dropped off from 2007 to 2009. Thus, this could be a cohort of generally healthier individuals. Additionally, as the outcomes are based solely on self-report and not absolute registry data, caution on the generalizability of these findings is warranted.

Conclusions

To our knowledge, this is the first study examining the consequences of a national economic crisis on a population's dental health. Our findings do not indicate an overall change in dental health behaviors (e.g., annual dental visitations and proper brushing/flossing habits). Although we did not observe a general increase in overall healthier dental behaviors, our findings indicate that certain groups (e.g., students, economically vulnerable) are less likely to seek dental care during an economic contraction, while select groups (e.g., men and unemployed women) opted for healthier behaviors (i.e., brushing, flossing, and dental visits) following the economic collapse.

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