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Relationship between payment problems and health: A nation-wide register study in Norway

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Abstract

Previous studies have found a solid correlation between payment problems and health, and a large body of literature has recognised the impact of debt burden on ill health. However, few have looked at the reversed causality—the impact of health on over-indebtedness and payment problems. In this article, we investigate whether or not a person with mental and physical health challenges is more likely to experience debt enforcement, and we take a step further to explore the role of health status on receiving debt settlement for those with severe payment problems. The article uses register data from Statistics Norway, the Norwegian Patient Registry and the Mortgages Registry from 2009 to 2018. When using conditional logistic models and fixed-effects Poisson regressions with a one-year lagged effect, we find that mental disorders significantly contribute to individuals' financial strains, while physical health does not play a substantial role. When integrating the models with dynamic health effects, all health indicators turned out to have substantial impacts, indicating an extended delayed physical health effect on financial outcomes. Poor health leads to increased payment problems, yet individuals facing health challenges have a lower likelihood of receiving necessary assistance in

debt settlement. These findings emphasise the need for tailored services to address the financial challenges of debtors with diverse health conditions.

KEYWORDS
debt enforcement, debt settlement, inequality, mental health, payment problems, somatic health

INTRODUCTION

Studies undertaken in the past have found a solid correlation between payment problems and health, and the focus has been mainly on how financial strain impacts health (Ahlström et al., 2014; Hiilamo, 2018; Hintikka et al., 1998; Holmgren et al., 2019; Layton & Ramström, 2017; Lenton & Mosley, 2008). However, few have looked at the effect of poor health on payment problems. Ill health may impact a person's employment and economic situation (Artazcoz et al., 2005; Ettner, 1996) while labour market marginalisation and low income play key roles for an individual and the household's financial strains (Hiilamo, 2018; Keese, 2009; Poppe, 2008). In the absence of large amounts of savings or assets, economically disadvantaged individuals cannot obtain credit without taking on substantial risks of high rates of interest and adverse repayment terms that remove all possibilities of smoothly managing their financial situations (Lenton & Mosley, 2008). Ill health may also reduce one's capacity for financial management (Downward et al., 2020; Roos et al., 2021) that leads to payment problems (Walker, 1996).

Furthermore, ill health may reduce the possibilities for the over-indebted to receive the help they need. In 2019, on average, two out of three debt settlement applications were rejected, and the rejected applicants were characterised by, among other factors, poor health (Poppe, 2022a). Based on qualitative interviews, Kempson and Poppe (2023) found that vulnerable defaulters, particularly those with poor health, do not receive the help they need to resolve their payment problems. Health problems affect people's ability to deal with creditors or bailiffs, and many with mental health problems broke down during communications with advisors, thereby losing access to the help they needed (Kempson & Poppe, 2023).

Payment problems have become much more severe from the 1980s (Lenton & Mosley, 2008; Poppe, 2008). In Norway, the ratio of debt to disposable income has doubled between 1980 and the beginning of 2010 (Reiakvam & Solheim, 2013). In 2017, around 10% of Norwegians worried about personal finances and 6% had recurrent payment problems (SIFO, 2017). At the same time, the double disadvantage of being ill and having payment problems are too often ignored. Therefore, there is an urgent need for studies to investigate the impact of ill health on payment problems and to assess the assistance options available to the most financially vulnerable social groups for settling their debts.

The connection between health and payment problems has a broader economic impact within a welfare state, leading to significant costs associated with over-indebtedness, including expenses related to health-care and sickness benefits (Ahlström et al., 2014). Despite these substantial costs, policy instruments have often overlooked the socioeconomic determinants influencing health outcomes, such as financial strain and over-indebtedness. In addressing the welfare services provided to individuals facing financial strains, there is a need for a shift in welfare state policies from reactive and remedial approaches to more preventive and proactive

measures (Hiilamo, 2018; Poppe, 2008). This emphasises the importance of early interventions and measures to prevent financial difficulties, aligning with a more comprehensive understanding of the interplay between health and financial wellbeing.

This article explores the relationship between payment problems and ill health in Norway, based on the 2010–2018 Norwegian population registry. We ask two questions: First, are people with poor health more likely to have payment problems? Second, for those with most severe payment problems, are health problems barriers to receiving the necessary help?

This article aims to contribute to the existing literature in several ways. First, instead of looking at the effect of payment problems on health, this article adds to the literature by exploring how ill health may impact payment problems. Second, we include objective measures of disease diagnosis and capture the different impacts of somatic and mental disorders on payment problems. Moreover, taking a step forward, we look at the most vulnerable groups of the over-indebted and examine how ill health impacts their likelihood of receiving the necessary help. The findings of this article may help promote preventive initiatives for payment problems and also facilitate policy recommendations on welfare services.

BACKGROUND, THEORIES AND PREVIOUS STUDIES

Debt and health in Norway

In the second quarter of 2023, the total loans of Norwegian households surpassed 4606 billion Norwegian kroner (Statistics Norway, 2023). This amount signifies an almost eightfold increase in loan levels compared to 1981, when adjusted for inflation to 2023 values (Lunde & Poppe, 1991). Simultaneously, the burden of debt is particularly pronounced among the younger generation, who also constitute first-time homebuyers (Finanstilsynet, 2019). The predominant reason for this escalating debt burden is the upward trajectory of housing prices, coupled with the concurrent reduction in interest rates associated with secured loans (Poppe, 2022b). Moreover, households have participated in the acquisition of both leisure properties and rental properties while also resorting to borrowing for consumption through the utilisation of both credit and unsecured loans. As of October 2020, the volume of unsecured consumer credit amounted to NOK 157 billion (Poppe, 2022b). Over the course of the 2000s, the growth in overall lending consistently exceeded real wage growth (Poppe, 2022b).

Figure 1 shows the household debt level as a percentage of income in Economic Co-operation and Development (OECD) countries from 1995 to 2022, based on statistics from (OECD, 2023). The plot on the left in Figure 1 illustrates the development of household debt across years. A clear trend of increasing household debt levels in Norway is evident over the last 3 decades. Denmark, the Netherlands and Ireland were the top three countries when considering debt levels in the 2000s. From the middle of the 2000s, while all three countries exhibited declining levels of household debt in relation to income, a clear increasing trend can still be observed in Norway. In 2021, the total household debt in Norway was 2.5 times higher than net disposable income, positioning Norway as the second highest among all OECD countries (see Figure 1, right).

At the same time, while Norway boasts a comprehensive and universal health-care system (Ringard et al., 2013), notable health inequalities persist within the country (Dahl et al., 2014; Elstad, 2000). There appears to be a correlation between health inequality and financial disparity, with both sharing common socioeconomic determinants. Scholars in the field of social determinants of health have identified major contributors in the Norwegian context, such as occupation

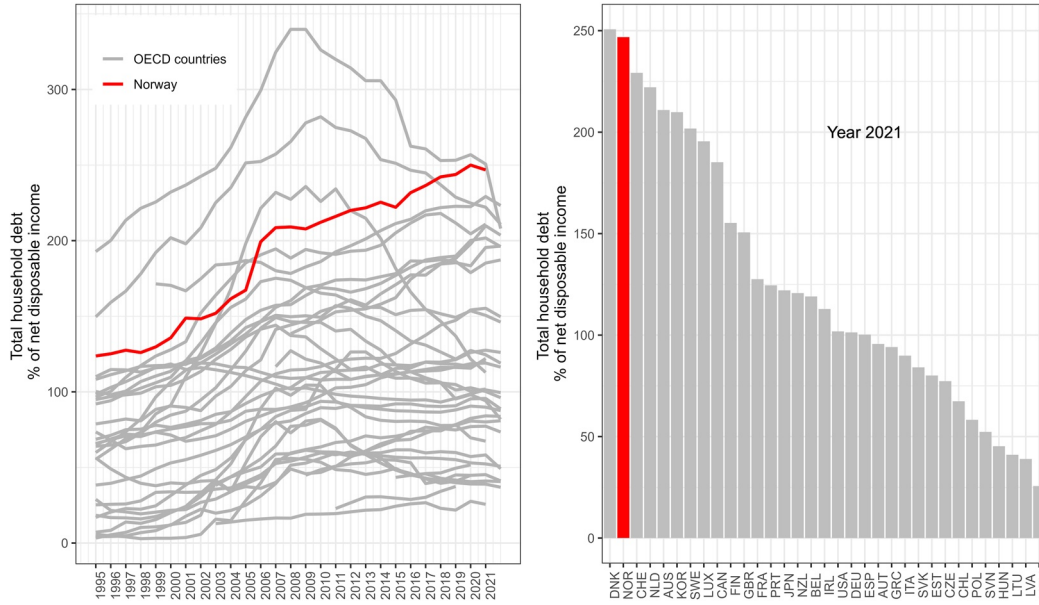


FIGURE 1 Total household debt as percentage of net disposable income in OECD countries (grey) and in Norway (red). *Source*: OECD (2023).

status, education, income and gender (see, for example, Dahl, 1994; Dahl et al., 2014; Eikemo et al., 2008; Elstad, 2000). Furthermore, research on payment problems and over-indebtedness recognises that a lower socioeconomic status (SES), including factors such as income and employment, plays a significant role in financial strains (see, for example, Kempson et al., 2004; Poppe, 2019, 2008; Solstad et al., 2022). A pathway may be established between health and payment problems, as debt is interconnected with broader socioeconomic conditions that can be influenced by prior ill health.

Two pertinent theoretical frameworks are social causation and health selection theories. According to the social causation hypothesis, SES significantly impacts health outcomes. Conversely, the health selection theory proposes that individuals' health plays a pivotal role in determining their capacity to attain or sustain favourable socioeconomic positions and resources (see, for example, Warren, 2009; West, 1991). Health selection arguments suggest that people's health can be a determining factor in their SES, affecting their education, employment, income and life chances. When studying class differences in health, Blane et al. (1993) stated that indirect health selection is 'referring to the accumulation of advantage or disadvantage during life'. For instance, illness can result in downward social mobility, indicating that individuals in poor health are more prone to experiencing a decline in their social status (Illsley & Le Grand, 1987). When studying health selections in Norway, Elstad and Krokstad (2003) found that changes in health status exhibited social patterning, especially in relation to employment status, where such mobility was influenced by self-perceived health.

The impact of diseases on financial situations, including over-indebtedness, may vary based on individuals' SES and different health conditions. The WHO Commission on Macroeconomics and Health highlights the robust connections between countries and individuals in debt and their likelihood of experiencing future health challenges. According to the 2001-report on macroeconomics and health (Sachs, 2001), the heightened burden of disease on the economically disadvantaged can be attributed to several factors: Those in a disadvantaged social position may

face higher susceptibility to diseases, given their restricted access to basic infrastructure, adequate nutrition and information about preventive health behaviours. They are also less likely to seek medical assistance, primarily due to inadequate financial resources and limited knowledge on illness responses. Furthermore, out-of-pocket expenditures for serious illnesses can ensnare individuals in a poverty trap, compelling them into debt or necessitating the sale or mortgaging of productive assets. Consequently, a severe illness may thrust a household into prolonged impoverishment, potentially influencing the life chances of the next generation (Sachs, 2001).

Payment problems and health

A large body of literature has firmly established the association between health and one's social and economic situation. Although the association between health and financial situation, such as income and wealth, is rather solid (e.g. Deaton, 2008; Easterlin et al., 2011; Pickett & Wilkinson, 2015), scholars have shown that income loses its significant association with health when looking at the indebted (Drentea & Reynolds, 2012). Debt levels are often greater in poorer families (Wagmiller, 2003), and people with health challenges face payment problems to a larger extent. For example, people with mental health problems in Britain are about three times more likely to report payment problems compared with individuals without similar conditions (Fitch et al., 2007).

Financial strain has been proved to have a strong and long-lasting effect on an individual's physical and psychological wellbeing, as it causes stress, anxiety and further mental and somatic health problems (Hiilamo, 2018; Layton & Ramström, 2017). International research has linked payment problems to physical health problems, such as major physical limitations abnormal values of Body Mass Index and blood pressure obesity lower life expectancy and health-related behaviours, such as smoking and drinking (Clayton et al., 2015; Drentea & Lavrakas, 2000; Sweet et al., 2013). At the same time, financial worries, constant struggles with creditors and difficulties of maintaining a steady income are known to relate to serious mental problems, including depression, anxiety, general mental illness and suicidal behaviour (Hiilamo, 2018; Hintikka et al., 1998; Holmgren et al., 2019).

Although the effect of payment problems and indebtedness on health has been well documented (Clayton et al., 2015; Drentea & Lavrakas, 2000; Hojman et al., 2016; Keese & Schmitz, 2014; Richardson et al., 2013; Sweet et al., 2013), relatively few studies have been conducted on how ill health can impact payment problems. In many studies, financial difficulties were measured using income and wealth disadvantages or lower SES. However, fewer studies focused on consumption measures, such as over-indebtedness, to gauge financial strains. Ill health may increase the possibility of problem debt, and poor health and low financial resilience often go hand in hand and aggravate each other. Poor health may have an impact on how individuals evaluate their financial situation (Downward et al., 2020), and diseases may also lead to difficulties in financial management such as planning, organising, directing and controlling the financial activities in the daily life (see, for example, Roos et al., 2021).

Furthermore, the associations between payment problems and different types of health problems may vary. Most of the previous studies have looked at mental health and identified a strong association between mental disorders and debt problems (see, for example, Hojman et al., 2016; Holmgren et al., 2019; Richardson et al., 2013). Fewer studies looked at physical health, but some scholars found that debt can lead to physical health problems, such as drinking, drug dependence and neurotic disorders (Richardson et al., 2013). Mental and physical

health are strongly correlated (Scott et al., 2009). As physical health may directly impact work and income level, we might also expect the problem of payment to be more severe for those with somatic diseases, especially those with musculoskeletal disorders, compared with the healthy population.

This article aims to first explore the impact of health on payment problems in Norway. We hypothesise that

H1. Payment problem is associated with mental and physical health problems.

Socioeconomic status and health shocks

SES and negative life events might be important mechanisms that explain the relationship between payment problems and health. First, education can be a confounder for the payment problem–health correlation. Higher education is often associated with healthier lifestyle (Lantz et al., 2001; Mackenbach et al., 1997), easier access to better quality health care (Van der Meer, 1998; von dem Knesebeck et al., 2006), better work and economic conditions and less exposure to material deprivation (Blane et al., 1997; Wu, 2003) and less stressful psychosocial environment (Siegrist & Marmot, 2004). Therefore, morbidity and mortality rates are lower among highly educated people (Cavelaars et al., 1998; Huisman et al., 2005; Mackenbach et al., 1997; Wu, 2003). At the same time, education is also found to be positively correlated with the understanding of financial literacy and financial decision-making (Potrich et al., 2015; Worthington, 2006).

Second, work and employment situations are central. Poor health can lead to unmanageable financial situations through loss of employment and/or income. Ill health has an impact on an individual's labour market outcomes, such as lower work participation, lower wage level and higher risk of being laid-off (Hiilamo, 2018; Poppe, 2008). At the same time, adverse labour market situations such as unemployment can trigger severe household indebtedness (Keese, 2009). For example, researchers found that the risk of arrears was twice as high for families with an unemployed or a part-time employed head of the household compared with families with a full-time employed head of household (Kempson et al., 2004).

Third, income can also have important impact on the relationship between payment problems and health. Longitudinal studies show that the movement into and out of arrears was rather frequent (Kempson et al., 2004), and income of low-income families fluctuates frequently because of altering states between work and benefits (Hills et al., 2006). People's ability to manage their financial situations can be influenced by the length of time with low income and also their financial situations (Dearden et al., 2010; Kempson & Finney, 2009; Kempson et al., 1994). Most families with low income utilise several credit arrangements, and a higher probability of incurring arrears on debt is found to be related to low income (Bridges & Disney, 2004).

Fourth, negative life events can also function as a trigger for payment problems. Serious health events may lead to large declines in household net worth and assets, some of which could be due to income losses or reduced labour market performance (Smith, 1999; Wu, 2003). It has been documented that health shock such as breast cancer has a negative impact on labour market outcomes and earnings (Vaalavuo, 2021). Scholars have, for example, found that cancer diagnoses are financially destabilising even among households with health insurance, as the instability is caused by costs related to work loss, transportation and incomplete medical expenditures coverage (Gupta et al., 2017). Similarly, health shocks caused by accidents can also have an equiv-

alent effect on payment problems. Using a quasi-experimental design, Mohanan (2013) found that when facing exogenous health shocks such as a bus accident households use debt as the principal mitigating mechanism. Therefore, we hypothesise that

H2. Socioeconomic statuses and health shocks explain part of the correlation between health and payment problems.

Debt enforcement and debt settlement

Payment problems can be viewed as an imbalance between incomes and expenses that results in non-payment of bills and loan obligations and ultimately a debt settlement. There is a gradient for the severity of payment problems, and one effective way to measure payment problems is to account for whether a person has experienced debt enforcement. When the creditor sends a petition, the bailiff will inform the debtor to report their income, expenses and assets. Income will be verified from the tax offices, and in case a defaulter does not provide the details of expenses, standard amounts based on the defaulter's household size and residency region will be used. According to the Creditors Security Act §2-2 and §2-8, creditors can request the deduction of wages from outstanding debtors and/or the sale, renting or conversion into money of assets belonging to the debtor at the time of seizure (Creditors Security Act, 1986). Debt enforcement can be wage deduction, deduction of assets or freezing of assets—it is up to the creditor to decide whether they want wages or properties to be attached.

The most severe form for payment problems is debt settlement. The Debt Settlement Act in Norway was introduced in 1993, and the scheme was to help individuals with serious financial barriers, and the main requirement for receiving debt settlement is that it 'is impossible to pay the debt within the foreseeable future' for a debtor and that they face a 'permanent inability to meet liabilities' (Debt Settlement Act, 1993; Ministry of Children and Families, 2021). A debt settlement scheme is an agreement to pay as much of the debt as possible during a limited period (normally five years) and have the remaining debt cancelled. The agreement can be made between the debtor and the creditors (voluntary debt arrangement) or by a confirmation by the bailiff (forced debt arrangement).

People who applied for debt settlement tended to come from low-income households; less than half had paid work, while the rest of them depended on various types of social benefits for a living (Poppe & Bøyum, 2018). However, approximately 40% of debt settlement applicants were rejected in Oslo, and most of them had low income, high debt, with immigration background and experienced negative life events, such as unemployment, bankruptcy and health challenges (Poppe, 2022a). The most over-indebted, with their low income and higher interest rate unsecured loans, face an even greater risk of stress and are more likely to be sick. In fact, three out of four (between 60% and 75%) debtors who received debt settlement struggled with physical and mental health issues (Poppe & Bøyum, 2018).

In this article, we will further examine whether or not there is a systematic relation between suffering from ill health and not receiving debt settlement. Ill health may both reduce one's possibilities of financial management and create barriers for a person with poor mental or physical health to follow up with the bailiff's demand for information and participation in meetings with the advisors (Poppe, 2022a). In addition, stigma, embarrassment, poor health and expectation of discrimination against people diagnosed with mental illness can all be barriers towards help-seeking behaviour (Gulliver et al., 2010; Henderson et al., 2013).

Therefore, we hypothesise that

H3. Ill health is associated with lower likelihood of receiving debt settlement for the over-indebted.

DATA AND METHODS

Data and variables

We used the Norwegian population registry 2009–2018. The data links population sociodemographic information from Statistics Norway with the Norwegian Patient Registry (NPR), the State Register of Employers and Employees (Aa-registeret) and the Registration of Mortgages from the Brønnøysund Register Centre. We only have access to secondary health-care services, which includes information about patients receiving specialised medical services, typically provided in hospitals. The analysed sample was restricted to those aged 18–70 years as they were more likely to participate in the labour market.

The outcome variables for payment problems were measured by *debt enforcement* and *debt settlement*. Debt enforcement is registered (=1) if an individual experienced any of the following situations during the year: (1) assets being frozen, (2) salary deductions and (3) deductions and seizure of properties. Debt settlement (=1) includes all who received either voluntary or compulsory debt arrangement.

We measured mental and somatic health problems based on diagnoses coded in the 10th revision of the International Classification of Diseases (ICD-10). *Mental health problem* is detected (=1) if a patient was diagnosed with mental and behavioural disorders showed symptoms and signs involving cognition, perception, emotional state and behaviour and experienced trauma or had intentional self-harm. *Somatic health problem* is defined by having somatic diseases of the (1) musculoskeletal system and connective tissues and (2) circulatory system. While the musculoskeletal system diseases can be an indicator for people with heavy physical injuries, the circulatory system disorders such as hypertension and cardiovascular diseases, in contrast, can be fairly widespread among the 'normal' population. In addition, we measured *health shocks* captured by (1) diagnosed cancer or detected tumours and (2) being injured in an accident.

Important covariates included demographics, SES and health shocks (Figure A1 in Appendix A). Demographics and SES included age (18–70 years), marital status (married = 1), highest educational level (ranging from 0 to 9), natural logarithm of total annual income (in Norwegian kroner), occupational class (seven classes coded in accordance with the Oslo Register Data Class Scheme (Hansen et al., 2009)) and receipt of unemployment benefit (short-term unemployment (0–10 k kroners), medium unemployment (10–100 k kroners) and long unemployment (>100 k kroners)).

Analytical procedure

The article first briefly describes the changing relationship between payment problems and health during the period from 2009 to 2018. Next, taking advantage of the panel data structure with repeated observations over time, in the main analysis we control for all individual-specific

traits that are time-invariant. It is especially suitable for researching payment problems and health-related variables because all constant individual idiosyncratic attributes (such as biological and cognitive traits) are taken into account. To deal with possible reverse causality, the fixed-effects models looked at lagged payment problems, which captures future consequences or the prolonged effect of being sick.

The basic unobserved effect panel model can be written as $f(Y_{i,t+1}) = \boldsymbol{X}\boldsymbol{\beta} + u$, where $u = c_i + \gamma_t + \epsilon_{it}$. In this equation, $Y_{i,t+1}$ is the lagged outcome variable for individual i and time $t + 1$, and $f(Y_{i,t+1})$ is the selected functions for modelling $Y_{i,t+1}$. $\boldsymbol{X}$ is a vector that contains the independent variables: $X = [x_1, x_2, x_3, \cdots x_n]^T$, $\boldsymbol{\beta}$ is a vector of regressors, c_i is the idiosyncratic, time-constant error term (i.e. the unobserved individual fixed-effect), γ_t is the time fixed-effects, and ϵ_{it} is the time-varying idiosyncratic error term.

Lately, it has been discussed whether it is desirable to include time fixed-effects in addition to individual fixed-effects (the 'two-way fixed-effects'). Although the two-way fixed-effects regression has been much used to adjust for unobserved unit-specific and time-specific confounders for estimating causal effects, recent studies show that the double fixed-effects model critically relies upon the assumption of linear additive effects and that the combination of within-unit and time variation produces uninterpretable answers (Imai & Kim, 2021; Kropko & Kubinec, 2020). In this article, we treat $\gamma_t = 0$ in the main analysis with a one-way error model, while allowing the two-way error $\gamma_t \in \mathbb{R}$ for additional robustness check.

For the two outcome variables, debt enforcement and debt settlement, we made the following modifications. First, we estimated the lagged effect of the binary dependent variable, debt enforcement ($y_{i,t+1}$). To control for the order of occurrence, mental and somatic health disorders were to happen before the occurrence of debt enforcement. A conditional logistic model (the fixed-effects logit model) was specified by the logistic probability of $y_{i,t+1} : f(y_{i,t+1} \mid \boldsymbol{X}_{it}, \boldsymbol{\beta}, c_i) = p_{i,t+1}^{y_{i,t+1}} (1 - y_{i,t+1})^{1-y_{i,t+1}}$, with $p_{i,t+1} = \Pr(y_{i,t+1} = 1 \mid \boldsymbol{X}_{it}, \boldsymbol{\beta}, c_i) = 1/\left(1 + e^{-c_i - \boldsymbol{X}_{it}\boldsymbol{\beta}}\right)$. This makes $y_{i,t+1} = 1$ $[c_i + \boldsymbol{X}_{it}\boldsymbol{\beta} + \epsilon_{it} > 0]$. In this equation, $\boldsymbol{\beta}$ is the $(M \times 1)$ parameter vector of the M regressors, $\boldsymbol{X}_{it}$, and ϵ_{it} is the logistically distributed error term ($i = 1, \cdots, N$; $t = 1, \cdots, T$). The parameter c_i is a fixed-effect given that $E(\epsilon_{it} \mid x_{it}, c_i) = 0$, $x_i = x_{i1}, \cdots x_{iT}$ and arbitrary correlations between the fixed-effects and the regressors. Based on the conditional likelihood, the conditional logistic model effectively deals with the incidental parameter problem for non-linear models (see, for example, Chamberlain, 1980; Stammann et al., 2016). The coefficients of our model were expressed by odds ratios. As the number of observations is large, the odds and risk are similar and the odds ratios approximate relative risks.

Second, a fixed-effect Poisson model to estimate the lagged debt settlement, $y_{i,t+1}$, was specified. Dealing with debt settlement as the outcome variable, we assume that each $y_{i,t+1}$ is drawn from a Poisson distribution with expected value and variance $E(y_{it}) = var(y_{it}) = \lambda_{i,t+1}$, which in turn depends on a vector of exogenous variables $\boldsymbol{X}_{it}$. We model the log probabilities with the Poisson parameter as following: $f(y_{i,t+1} \mid \boldsymbol{X}_{it}, \boldsymbol{\beta}, c_i) = \ln\lambda_{i,t+1} = c_i + \boldsymbol{X}_{it}\boldsymbol{\beta} + \epsilon_{it}$, where $i = 1, \cdots, N$ and $t = 1, \cdots, T$. Here, c_i is the individual specific intercept term, $\boldsymbol{X}_{it}$ is a $1 \times M$ vector of observations on the time varying covariates, and $\boldsymbol{\beta}$ is a $M \times 1$ parameter vector. We used the Poisson regression to estimate relative risks because the proportion of people having debt settlement is very low, and logistic regressions estimations can be biased when analysing rare events (King & Zeng, 2001). Furthermore, the Poisson model tends to be more stable than the log binomial model and gives consistent estimates; it has no incidental parameter problem with fixed-effects, and the use of cluster-robust estimates helps in relaxing the assumption and correcting standard errors (see Allison, 2009; Wooldridge, 2010; Zou, 2004).

The conditional logistic model and fixed-effect Poisson model capture the one-year lagged effect of health on debt enforcement and debt settlement, respectively. To address a more extended lagged effect, in the final analysis, we included the dynamic health effect in the fixed-effect models.

The dynamic effects, denoted as $D = \sum_{p=-Q}^{P} \zeta_p Z_{i,t-p}$, are added to the linear fixed-effect model: $y_{it} = \boldsymbol{X\beta} + u + D = \boldsymbol{X_{it}\beta} + c_i + \gamma_t + \epsilon_{it} + \sum_{p=-Q}^{P} \zeta_p Z_{i,t-p}$. The outcome of debt enforcement or debt settlement at time t can be directly influenced by health status in the P periods before t and in the Q periods after t. This model estimates the magnitude of dynamic effects $\{\zeta_p\}_{p=-Q}^{P}$, and illustrates the linear panel event-time plots by using the cumulative effects $\sum_{p=-Q}^{k} \zeta_p$ at different event time k (time leads or lags relative to the event at t), calculated as parameters $\{\delta_k\}_{k=-Q-L_Q-1}^{k=P+L_p}$ (Freyaldenhoven et al., 2021; Schmidheiny & Siegloch, 2019). The event study framework improves result reliability by concentrating on the post-treatment period, providing flexibility for inquiries about the timing and persistence of effects (MacKinlay, 1997).

RESULTS

Descriptive statistics

Table 1 shows descriptive statistics. The distributions of debt enforcement and debt settlement are rather similar—around 6% of the population experienced debt enforcement, while 0.4% had debt settlement. Figure B1 in Appendix B illustrates correlations between the covariates. The correlations are relatively low among all covariates.

Payment problem and health, 2009–2018

To have a glimpse of the changes in health-payment–problem relationship, we have performed separate regression analyses for each year (see Figure 2).

For all ratios in the figure, we have controlled for demographic background (age, age squared and marital status); SES (education, log income, occupational class and employment status) and health shocks (having cancer or being in an accident during the last year).

Plot (a) shows the changes in odds ratio of debt enforcement when comparing those with mental or somatic health diagnoses and those without the respective conditions. As the denominators are large (which is also the whole Norwegian population) and the events of petition are rare, odds ratio estimates approximate the relative risk (risk ratio). All three types of health problems indicated higher odds for payment problems. Mental disorders clearly had the highest correlation with payment problems, followed by circulatory system disorder. The odds ratios for experiencing debt enforcement were the lowest for people with musculoskeletal disorder among all three health indicators.

Plot (b) in Figure 2 shows the changes in predicted incident rate ratios (IRR) of debt settlement across years. It shows the same trend: mental health challenges stood out to have the strongest associations with increased risk ratios for debt settlement compared with physical health problems.

TABLE 1 Descriptive statistics.

	Mean (SD)	Min/max	No. obs.
Dependent variable			
Debt enforcement	0.057 (0.231)	0/1	4,342,506
Lagged debt enforcement	0.057 (0.233)	0/1	4,154,394
Debt settlement	0.004 (0.064)	0/1	4,342,506
Lagged debt settlement	0.004 (0.065)	0/1	4,154,394
Health problems			
Mental disorder	0.055 (0.229)	0/1	4,342,506
Circulatory system disorder	0.043 (0.203)	0/1	4,342,506
Musculoskeletal disorder	0.075 (0.264)	0/1	4,342,506
Health shocks			
Cancer	0.044 (0.205)	0/1	4,342,506
Accident	0.020 (0.142)	0/1	4,342,506
Demographic variables			
Age	42.80 (14.72)	18/70	4,342,506
Married	0.416 (0.493)	0/1	4,342,506
Socioeconomic status			
Highest educational level	4.25 (1.737)	0/9	4,116,569
ln(income)	12.50 (1.785)	0/20.73	4,289,441
Occupation		1/7	4,174,282
Upper-class	0.050 (0.218)	0/1	4,174,282
Upper-middle class	0.184 (0.387)	0/1	4,174,282
Lower-middle class	0.157 (0.363)	0/1	4,174,282
Skilled workers	0.144 (0.351)	0/1	4,174,282
Unskilled/semi-skilled workers	0.179 (0.383)	0/1	4,174,282
Farmers, fishermen, foresters	0.004 (0.060)	0/1	4,174,282
Welfare and transference	0.283 (0.451)	0/1	4,174,282
Unemployment status		0/2	4,342,506
Unemployed: <10 k	0.963 (0.188)	0/1	4,342,506
Unemployed: 10–100 k	0.025 (0.155)	0/1	4,342,506
Unemployed: >100 k	0.012 (0.109)	0/1	4,342,506
Year		2009/2018	4,342,506

The models in Figure 2 were run in each year separately. Although we may gain an overview of the changes in the health-payment–problem relationship across time, it does not take into account individual-specific heterogeneities. Individual traits may impact on behaviours and aspects related to both payment problems and health status and may introduce an endogeneity that will result in biased estimates. Therefore, we wish to remove the effect of individual time-invariant characteristics to assess the net effect of health on debt.

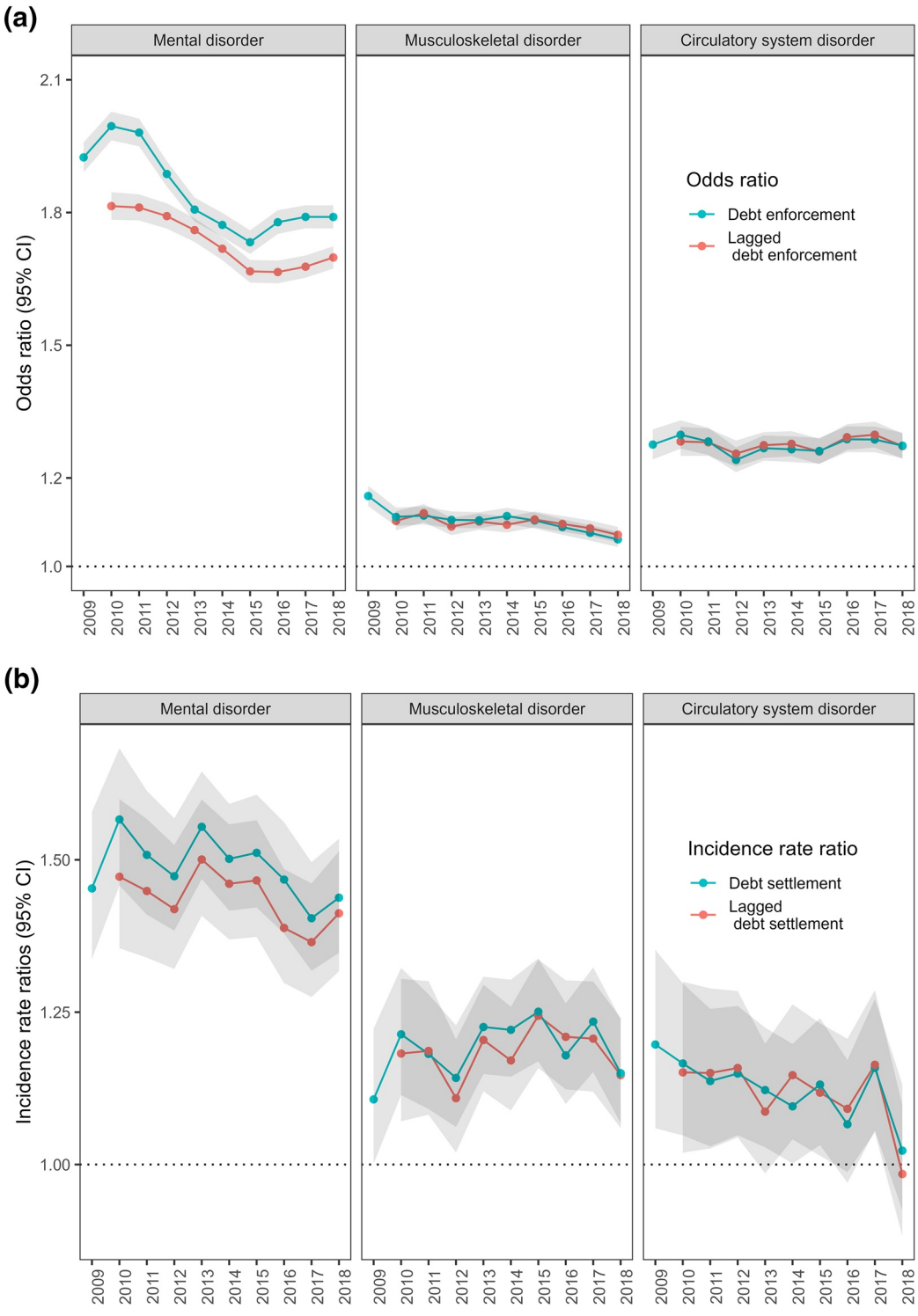


FIGURE 2 Predicting payment problems in each year, controlled for demographics, socioeconomic status and health shocks. 95% confidence interval (CI). (a) Odds ratios for debt enforcement and lagged debt enforcement in each year. (b) Incidence rate ratios for debt settlement and lagged debt settlement in each year.

Fixed-effects models

Next, we run the models with within-transformations. Results from regression analysis with individual-level fixed-effects are illustrated in Figure 3–5.

Payment problems and health: Debt enforcement

The two plots in Figure 3a examine the relationship between health and payment problems, defined by debt enforcement. We compare among the four models. In Model 1, only mental and somatic health variables were included. In Model 2, we added demographic controls. Socioeconomic backgrounds and work relationships were added in Model 3, and we additionally controlled for health shocks in Model 4. Clustered robust standard errors were applied to all the models.

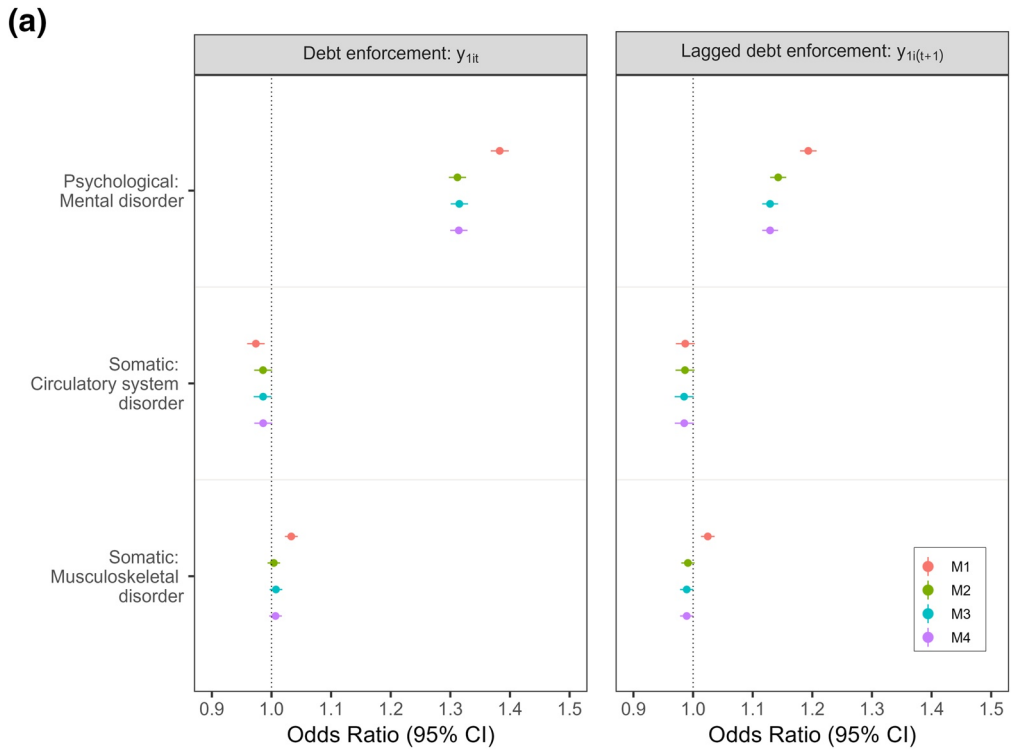
The plot on the left in Figure 3a shows the association between health on payment problems in the same year, logit($y_{i,t}$). When only looking at the bivariate relationship (Model 1), both mental and somatic health problems were significantly related to enforcement. However, the strength and direction varied much among the different health indicators. While mental illnesses had a relatively large and negative impact on debt enforcement, somatic illnesses played a rather limited role in predicting the outcome variable. People with mental disorders had 1.4 times higher odds of experiencing enforcement compared with those who did not have the same problem, whereas the corresponding odds ratios for musculoskeletal disorder were only around 1.03. Moreover, people with circulatory system disorders had lower odds (0.97) of having payment problems compared with those without the same illness.

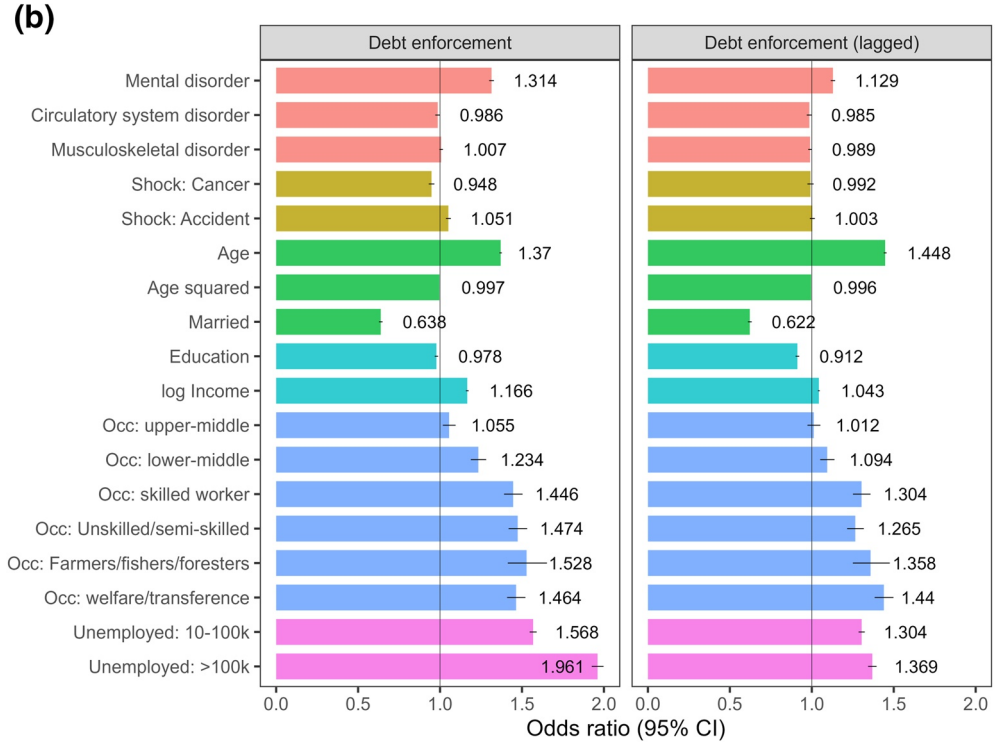
The coefficients for mental and musculoskeletal disorders on debt enforcement reduced in size when adding demographic controls but remained statistically significant (Model 2). However, the sizes of the health coefficients remained stable when controlling for SES (Model 3) and health shocks (Model 4). Nonetheless, somatic illnesses have lost their significance in predicting payment problems after adding socioeconomic controls.

The plot on the right in Figure 3a shows the lagged effect of health on overall payment problems, logit($y_{i,t+1}$). The trends are very similar to the non-lagged models. Mental health problems were correlated with lagged payment problems, and the odds ratios of having delayed debt enforcement one year after being diagnosed with mental illness were lower than the odds ratio of having debt enforcement in the same year. This partly supports our first hypothesis (*H1*). However, when estimating the one-year lagged effect of health, none of the indicators for somatic disorders had a significant impact on lagged enforcement after controlling for background variables.

Moreover, when controlling for demographic backgrounds, all health-related coefficients changed in size. However, adding further controls of SES and health shocks only changed the health coefficients to a minimal extent. This may suggest that socioeconomic background and health shock did not have as much mediating or confounding effect as we expected in the second hypothesis (*H2*).

We chose to present the coefficients in Model 4 which had the best model fits (see Figure 3b). The plots on the left predict debt enforcement in the same year, and the plots on the right predict the lagged effect on debt settlement one year later. Odds ratio for each of the variables are reported in the figures. Compared with people without mental health problems, people with mental disorder had higher odds of experiencing petitions. Somatic diseases, such as circulatory system disorder and musculoskeletal disorder, did not have significant impact on debt enforcement. Being diagnosed with cancer or tumour was correlated with lower odds ratio for debt





enforcement in the same year but not for the following year. Being in an accident was not associated with payment problems. Payment problems decreased with age but increased after a turning point, being married and having higher education reduced the risk of payment problems and less privileged occupational classes meant higher risks for payment problems. Unemployment status was associated with significantly higher odds ratios of debt enforcement.

Debt settlement and health

The following analysis examines the relationship between poor health and debt settlement with a limited sample of people with payment problem, that is, those who experienced debt enforcement. The number of observations inside each group was around 20,000. The smaller sample size was also because individuals with constant value in the outcome variables were automatically removed—only panels that have variations in the target variable are informative in fixed-effects models.

Figure 4a shows the incidence rate ratios of debt settlement, comparing people with and without mental or somatic health problems in the four models. The plot on the left predicts debt enforcement in the same year, and the plot on the right predicts the lagged effect on debt settlement one year later. When looking at the bivariate relationship between health and debt settlement in the same year, somatic health problems had a positive correlation with debt settlement, while mental disorders indicated lower rate ratios for receiving debt settlement (Figure 4a, left). However, physical health conditions were no longer associated with debt settlement after controlling for demographics, SES and health shocks.

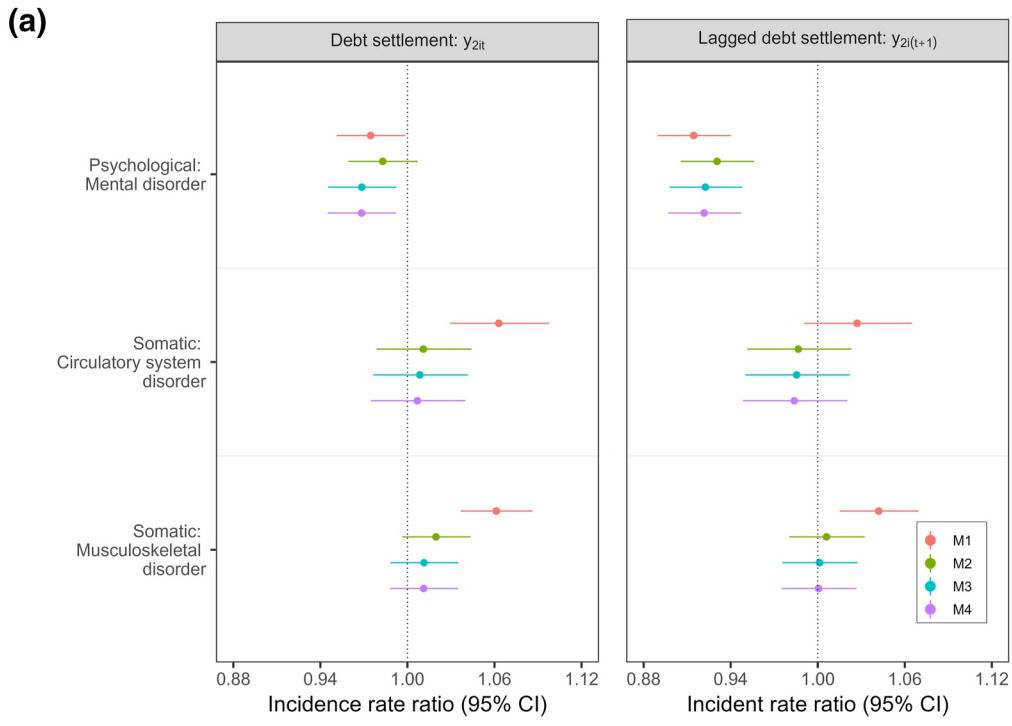
The patterns were similar when predicting the one-year lagged effect of health on debt settlement. Circulatory system disorders did not impact debt settlement, and musculoskeletal disorders lost their significance when controlling for other covariates (Figure 4a, right). Those with mental disorders had lower chances of receiving debt settlement both in the same year and in the following year, even after controlling for all background variables and health shocks. This supports our third hypothesis (*H3*). Moreover, the likelihood of receiving debt settlement for people with mental diseases was even lower in the second year compared to the first year after they were diagnosed with mental disorders.

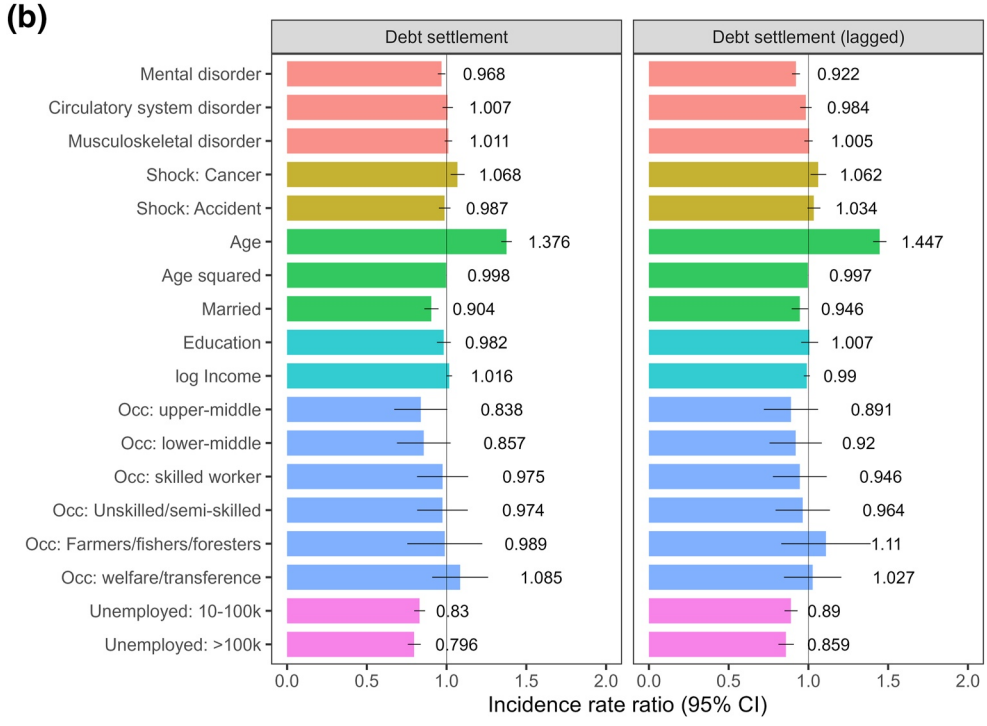
The results from the model that included all control variables (Model 4) are shown in Figure 4b. The plots on the left predict debt settlement in the same year, and the plots on the right predict lagged settlement. Being diagnosed with cancer or tumour was associated with higher chance of receiving debt settlement, and age had a convex (U-shaped) relationship with debt settlement. Suffering from mental health problems and being unemployed meant lower chance of receiving debt settlement. Physical health, accident, education, income and occupation did not influence receiving debt settlement.

Dynamic health effect on debt

When estimating lagged outcome variables using conditional logistic models and fixed-effect Poisson models, somatic health conditions exhibit no significant impact when socioeconomic

FIGURE 3 Odds ratios for debt enforcement. Left: $N_{group} = 413{,}630$, $N_{obs} = 3{,}745{,}540$; Right: $N_{group} = 381{,}082$, $N_{obs} = 3{,}151{,}539$. (a) Debt enforcement and health. Model 1: only health variables. Model 2: controlling for demographic background. Model 3: adding socioeconomic status. Model 4: adding health shocks. (b) Debt enforcement and health, controlled for all covariates (Model 4).





features and health shocks are taken into account. However, these models lack the capability to capture dynamic changes over time. As diseases develop, their implications for payment problems and debt settlement may evolve. Therefore, the impact of health may take some time to appear.

In the final analysis, dynamic health effects were incorporated into the linear panel models to evaluate the prolonged impact of health on debt enforcement and debt settlement. In the linear panel event study, the outcome variables are debt enforcement and debt settlement. We accounted for individual and year fixed-effects and considered all confounding variables, including demographic factors, SES and health shocks. We specified a three-year window around the occurrence of the disease, with endpoints four years before and after the event. The results of the linear panel model event study are shown in Figure 5.

The top three figures in Figure 5 illustrate the probability of encountering payment problems before and after the onset of diseases. The three figures below depict the probability of undergoing debt settlement prior to and subsequent to the onset of illness. Specifically, the left, middle and right plots represent occurrences of mental disorders, musculoskeletal disorders and circulatory system disorders, respectively. The grey reference line highlights the year of disease occurrence, while the blue reference line marks the first year after disease onset (which corresponds to the one-year lagged health effect). The estimates, $\{\hat{\delta}_k\}_{k=-Q-L_Q-1}^{k=P+L_p}$, and their 95% confidence intervals, were plotted in the graphs. The results can be interpreted as the cumulative health effect in probabilities of experiencing debt enforcement or the likelihood of receiving debt settlement in relation to the year the event (disease) occurred.

In the linear panel event study models, δ_k represents the cumulative impact of health for various durations of exposure to the disease. Following the conventions of event study frameworks, δ_{-1} is normalised to 0. The estimation of δ_0 denotes the instantaneous treatment effect, representing the average effect in the first year the disease occurred. Positive values for k signify treatment lags, offering insights into the dynamics of treatment effects. The estimate of δ_k is the coefficient on the kth lag, indicating the average effect of health k years after the initial (immediate) adoption year. The primary focus of this analysis is to observe the evolution over time by plotting the δ coefficients.

The upper plots in Figure 5 illustrate an upward trend in the probability of experiencing payment problems, as measured by debt enforcement, following the onset of both mental and musculoskeletal disorders. In contrast, the occurrence of circulatory system disorders did not significantly impact debt enforcement. Concurrently, the lower three plots depict a decline in the likelihood of receiving debt settlement in the years following the onset of all three disease types. All pre-event effects are estimated to be zero, indicating the absence of significant pre-effects or a systematic relationship between the treatment and outcome variables before the event (being sick) occurs. This supports the use of event study design in which the onset of disease is the only intervention that affect debt outcomes.

Notably, changes in debt settlement took a more extended period to manifest following the occurrence of health problems. The likelihood of receiving debt settlement increased in the year following the onset of mental disorder but decreased from the second year onwards.

FIGURE 4 Incidence rate ratios for debt settlement. Left: $N_{\text{group}} = 20{,}684$, $N_{\text{obs}} = 124{,}854$; Right: $N_{\text{group}} = 16{,}281$, $N_{\text{obs}} = 94{,}425$. (a) Debt settlement and health. Model 1: only health variables. Model 2: controlling for demographic background. Model 3: adding socioeconomic status. Model 4: adding health shocks. (b) Debt settlement and health, controlled for all covariates (Model 4).

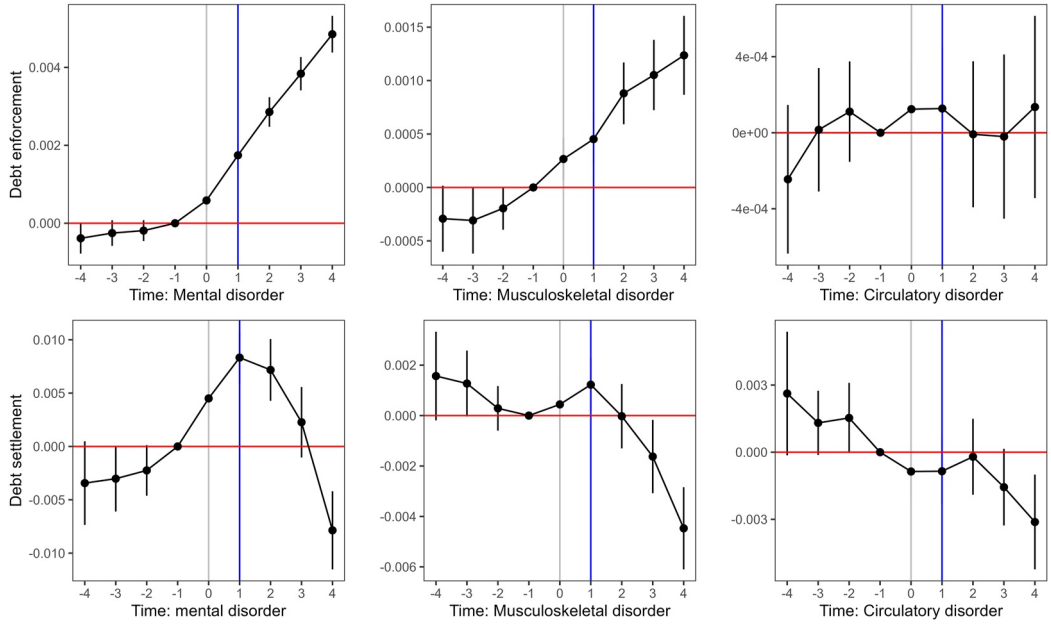


FIGURE 5 Predicting debt enforcement and debt settlement with linear panel event models with individual fixed-effects and clustered robust standard errors, controlled for all covariates. 95% confidence interval. Upper-left: N_{group} = 3,033,890, N_{obs} = 8,400,994; Upper-middle: N_{group} = 3,022,875, N_{obs} = 8,400,979; Upper-right: N_{group} = 3,022,886, N_{obs} = 8,400,990; Lower-left: N_{group} = 55,880, N_{obs} = 125,067; Lower-middle: N_{group} = 55,854, N_{obs} = 125,041; Lower-right: N_{group} = 55,957, N_{obs} = 125,144.

Similarly, the probability of receiving debt settlement did not decrease significantly until the third year after the onset of musculoskeletal disorder and the fourth year after the onset of circulatory system disorder. This may explain the non-significant findings related to somatic health in the outcome variables of the conditional logistic models and Poisson models, as these models did not incorporate more extended dynamic health effects over a prolonged period.

Robustness tests

We have also performed several robustness tests. First, we included two way fixed-effects (individual and year fixed-effects), see Figure C1 in Appendix C. After year fixed-effects were included, the coefficient sizes were slightly reduced but the associations between debt enforcement/debt settlement, health and other covariates stayed rather stable.

Second, we controlled for the number of distinct diagnoses a person has during a year as an indicator of morbidity (Figure D1 in Appendix D and Figure E1 in Appendix E). The inclusion of this indicator did not influence the results from the fixed-effects models.

Third, we introduced interaction terms between different health indicators (Appendix F). None of the interactions were significant when predicting debt settlement. However, when considering debt enforcement, we observed significant interaction between mental and musculoskeletal disorders, as well as between the two physical health indicators. Mental disorders increase the likelihood of encountering debt problems by an odd of 1.135. For individuals with

muscle and skeletal diseases, the presence of a mental disorder increases their risk of facing debt problems by an odd of 1.101(=1.135 × 0.970). In other words, the adverse impact of a mental disorder is less pronounced for those with musculoskeletal disorders but more substantial for those without musculoskeletal disorders. The interaction term between musculoskeletal and circulatory system diseases shows that the coexistence of musculoskeletal and circulatory disorders elevates the probability of facing payment problems compared to individuals with only one type of somatic disorder. Musculoskeletal diseases amplify the odds of payment problems by 1.032 for those also with circulatory disorders (=0.991 × 1.041), while circulatory diseases increase the odds of payment problems by 1.032 for those also with muscle and skeletal diseases (=0.981 ×1.021).

DISCUSSION

The debt trap

This article analyses the 2009–2018 Norwegian population registry combined with NPR, State Register of Employers and Employees and the Registration of Mortgages. This nation-wide register data across a 10-year period provides unique possibilities for studying trends and development and controlling for individual-specific idiosyncratic traits over time.

Using individual fixed-effects, our analysis revealed that individuals facing health issues were more prone to encountering debt enforcement. Both mental disorders and musculoskeletal disorders demonstrated a significant impact on debt-related issues, whereas circulatory system disorders did not show a significant correlation. When focusing on those with payment problems, having mental or physical health diseases led to a lower chance of receiving necessary help from the authorities. While mental disorders had an almost immediate impact on increasing payment problem and reducing the likelihood of receiving assistance, physical health problems exhibited a longer lagged effect on debt enforcement and debt settlement. The robustness of the findings persisted even after incorporating individual and year fixed-effects, and controlling for demographic, socioeconomic confounders and health shocks.

Poor health is associated with increased payment problems but a diminished likelihood of receiving necessary assistance. These findings align with previous research suggesting that individuals in vulnerable social positions are more susceptible to enduring debt burdens, potentially leading to a 'debt trap.' A 'debt trap' refers to a situation in which individuals, often encountering challenges such as poor health, vulnerable life situations and low socioeconomic conditions, consistently struggle to manage and resolve their debts. This cycle can create persistent difficulties, making it challenging for them to break free from the burden of debt and perpetuating a cycle of financial struggles (Sorcha & Larissa, 2018). Ill health, combined with the adverse socioeconomic outcomes it brings, can heighten the challenge for people to escape their debt burden.

According to the Wealth and Assets Survey, on average, two out of three individuals in poor health grapple with persistent debt, facing obstacles in resolving payment issues (Tinson & Bunbury, 2022). Furthermore, those in more vulnerable situations face exacerbated difficulties when carrying debt into low-income circumstances—once they enter the cycle of indebtedness, individuals and families find financial management and budgeting extremely difficult, and such circumstances often prevent them from meeting their current commitments or avoiding further high-cost borrowing (Dearden et al., 2010). Health challenges pose additional hurdles for debtors, impacting negatively on their ability to manage financial situations, make timely

payments, participate in repayment plans and engage with advisors for negotiation (Kempson & Poppe, 2023; Poppe, 2022a).

Debt, health and socioeconomic status

SES plays a central role in predicting the likelihood of encountering payment problems and the probability of receiving necessary assistance. In this article, we found that a higher educational level was associated with reduced odds of facing debt enforcement, while lower occupational status and unemployment substantially increased the likelihood of encountering payment problems. When examining the likelihood of receiving debt settlement, neither education, income nor occupation exhibited a significant impact on debt settlement. Nevertheless, among individuals facing severe debt problems due to over-indebtedness, those who were unemployed had a diminished chance of obtaining debt settlement.

The inclusion of demographic controls has significantly altered the coefficient of health on debt. When controlling for demographic variables like age and marital status, we capture some crucial aspects related to an individual's relationship with debt across various life stages. To a certain extent, these controls consider life events such as changes in marital status and transitions through different life phases. These life events are correlated with one's health status and have a substantial impact on a person's financial circumstances. This might explain the changed health coefficients observed when controlling for demographics.

Moreover, the inclusion of socioeconomic controls and health shocks resulted in only minor changes to the health coefficients when predicting debt outcomes. When considering health shocks, the free and universal health-care services in Norway may provide a basic safety net for those facing sudden health challenges, thus potentially suppressing the effect of health shocks on payment problems. When considering the impact of socioeconomic factors, one explanation could be rooted in the understanding of the divergence between the two types of somatic illnesses as they may affect different social groups. Musculoskeletal system diseases may encompass individuals with significant physical injuries, and are more prevalent among those with relatively lower SES, such as the working class and manual workers engaged in strenuous physical tasks (Bernard & Vern, 1997; Hoogendoorn et al., 1999; Hoozemans et al., 2002; Pope et al., 1990; Svane & Johansen, 1995). Previous research has identified links between physically demanding occupational tasks and musculoskeletal disorders, with physical work factors playing a crucial role in the development of musculoskeletal disorders affecting the upper extremities and the lower back (Aittomäki et al., 2007). Physical working conditions and job control have also been identified as significant contributors to disparities in self-rated health, morbidity and musculoskeletal disorders (Kaikkonen et al., 2009; Punnett & Wegman, 2004). The working conditions associated with physical work, including heavy physical workloads, repetitive trunk movements and heavy lifting, account for a substantial portion of health inequalities (Aittomäki et al., 2007). Consequently, regressing the variable of musculoskeletal disorders in our study may inherently control for much of the socioeconomic background, particularly in terms of educational, occupational and economic differences.

On the contrary, although certain factors, such as lifestyle and health behaviour, can both relate to SES and the risk of cardiovascular diseases (Kreatsoulas & Anand, 2010; Powell-Wiley et al., 2022), circulatory system disorders are more prevalent in the general population and are often regarded as part of the epidemiological transition (Blacher et al., 2016; Yusuf et al., 2001). This could also explain the non-significant relationship between circulatory disorders and

payment problems. In industrialised countries like Norway, there has been a noticeable rise in chronic diseases, particularly circulatory system disorders such as cardiovascular diseases (e.g. heart disease and stroke). This shift is ascribed to alterations in lifestyle, dietary habits and advancements in health care, resulting in increased life expectancy alongside a heightened burden of chronic diseases associated with ageing population. Circulatory system disorders play a significant role in this transition, underscoring the evolving disease profile from infectious diseases to chronic conditions commonly linked to modern lifestyles and aging (see, for example, Blacher et al., 2016; Luepker, 2016; Rabanal et al., 2015).

In addition, there might also be other crucial factors that play a more substantial role in establishing the link between health and debt issues, which were not encompassed in our analysis. These factors comprise, but are not limited to, the level of financial literacy (Potrich et al., 2015; Worthington, 2006), cultural perspectives on debt (Braucher, 2006), individual psychological aspects and coping mechanisms (García, 2013; Richardson et al., 2013). Furthermore, the strength of social and family support systems (Pearlin & Schooler, 1978; Tran et al., 2018), other unanticipated life events (Oksanen et al., 2016, 2017), accessibility to housing and housing prices (Oksanen et al., 2015; Poppe, 2022b; Solstad et al., 2022) and government policies related to debt management, credit accessibility and social welfare programs can significantly contribute to the intricate interplay between health and debt (Kempson & Poppe, 2023; Poppe, 2022a, 2022b). Comprehensive examination of these elements in future studies is vital for a nuanced understanding of the complex dynamics between health and debt, allowing for a more holistic interpretation and targeted interventions.

Casualties of the system: Debt settlement

Although the authorities in Norway have introduced a series of interventions to help the over-indebted, debtors with health problems and those who were unemployed were more disadvantaged in the process of obtaining help for a debt settlement. This is because health challenges made it more difficult for the debtors to manage their financial situations, pay their arrears to creditors, engage with repayment plan and meet their advisors to set up negotiations (which is also a requirement they must meet for debt settlement) (Kempson & Poppe, 2023; Poppe, 2022a). A recent report studying the case processing of applications for debt settlement in Norway shows that applicants were refused due to various reasons, such as recent borrowing, undisclosed financial circumstances, lack of cooperation, additional offensive conditions etc. (Poppe, 2022a). When cognition and behaviours were more limited due to ill health, debtors have a larger probability of failing in the process of applying for debt settlements. This can be caused by the challenges of obtaining information about the debt arrangement and also difficulties in following up on the bailiff's demands for information and participation in the application process.

Vulnerable individuals grappling with payment difficulties often find themselves without the necessary assistance to overcome their financial challenges. Despite the comprehensive welfare state in Norway, which provides various forms of support, including social assistance and financial advice, the system tends to be more standardised than individually tailored. The Norwegian welfare services employ a one-size-fits-all debt enforcement system, lacking specific protections for individuals facing extraordinary vulnerabilities. For example, creditors are not obligated to engage in negotiations or formulate suitable solutions for individuals in need of additional support (Kempson & Poppe, 2023; Poppe, 2022a). A government-appointed expert committee highlighted challenges in Norwegian welfare services, including strict procedures constraining

caseworkers' capacity to assist clients, a lack of client involvement and consideration of individual needs and overly strict top-down steering (Vågeng Commitee, 2015).

This standardised approach, particularly detrimental to individuals with health issues, has intensified the challenges for those struggles with both illness and debt. A more adaptable and personalised approach in addressing the needs of individual clients, especially those with special challenges, can draw inspiration from the practices of employment specialists in Norway. In this case, a central dynamic involves the interaction between frontline workers and the distinct needs of individual clients. Clients are given the opportunity to experience customised and flexible processes, receiving support tailored to address their specific challenges (Bakkeli, 2022, 2023).

Furthermore, there is a lack of coordination among welfare agencies, including caseworkers, money advisers and health workers (Kempson & Poppe, 2023). This fragmentation disrupts the connections between various challenges, such as payment difficulties, ill health, prolonged low income and insecure employment. As a result, individuals facing multiple difficulties lack sufficient support and have limited options to advocate for their vulnerable circumstances (Kempson & Poppe, 2023; Poppe, 2022a).

It is worth mentioning that those with health challenges might also be less likely to apply for debt settlement. Previous studies found that stigma associated with mental illnesses and expectation for discrimination against people with mental health diagnosis were important factors that increased the likelihood of help-seeking avoidance or delay (Henderson et al., 2013). In addition, a majority of the Norwegian population (60%) associate consumer loans with shame and would rather suppress their payment problems (Poppe et al., 2019). Unfortunately, we only have data on receiving debt settlement but not on applications or rejections of the settlement. Future studies may look closer at the help-seeking behaviour and the characteristics of rejected applicants to distinguish between the two mechanisms of self-exclusion and institutional marginalisation.

Limitations and future directions

This article has several limitations. First, we only had access to the secondary health-care services, which refers to specialised medical services that are more complex and often provided by specialists and medical professionals. These services go beyond primary care and are often delivered in hospitals or specialised medical facilities. Secondary health care includes specialised treatments, surgeries and interventions that require a higher level of expertise and resources. The use of only secondary health data may lead to underestimation of the health–debt relationship, as secondary health-care data typically capture more severe or clinically diagnosed health conditions that result in hospital visits or specialised medical care. As a result, it may not fully capture less severe health issues or conditions managed in primary care settings. In addition, minorities and individuals with lower income and education levels are less likely to utilise health-care services (Debesay et al., 2019; Vikum et al., 2013). This selective focus on diagnoses may underestimate the broader impact of health on debt, as it overlooks a variety of health conditions that individuals may experience without seeking specialised medical attention, and it fails to account for certain social groups that are less likely to access health-care services.

Second, incorporating comorbidity into the analysis can provide valuable insights into the relationship between debt and health. This is underscored by the noteworthy interaction between different disease types: Individuals with a combination of multiple health problems may experience distinct effects on debt issues compared to those with a single health condition. However, the method of introducing the number of diagnoses a person has as a measure of comorbidity

presents several challenges. An individual may exhibit multiple distinct diseases, each categorised independently, despite sharing a common etiological origin. The dynamic progression of diseases can also lead to changes in the disease phenotype over time, resulting in the emergence of different clinical entities. Understanding the intricate connections between seemingly unrelated clinical conditions, which may actually share a common pathophysiological foundation, becomes challenging without a medical background. Additionally, our dataset only provides access to the first two ICD codes, leading to broad disease categories that lack the granularity needed for in-depth analysis.

Third, we measured payment problems by using debt enforcement. It is essential to note that debt enforcement does not encompass all individuals facing payment challenges. Instead, it primarily captures those undergoing specific difficulties in debt repayment at a particular moment. There are cases where individuals confront payment problems without undergoing a formal debt enforcement process. Therefore, focusing on individuals experiencing the most severe payment problems may result in underestimating the health impact on payment issues. Furthermore, debt enforcement is subject to creditors' collection practices, which can differ across cases and evolve over time.

Finally, it is essential to acknowledge a limitation of fixed-effects models: they do not account for the effects of time-varying factors, limiting the examination of life course effects. This exclusion results in challenges when estimating health selection effects from earlier life phases, particularly for individuals with long-term physical or mental health conditions or chronic diseases. Similarly, fixed-effects models have omitted crucial time-constant factors, including gender and minority background. Given that gender and ethnicity are often crucial determinants of health inequality and significant contributors to financial strain, these factors could substantially impact the relationship between health and debt. Future studies should thoroughly investigate these aspects.

CONCLUSION

Financial management capacity may constitute a key influence on health behaviour through debt repayment structure and worries (Lenton & Mosley, 2008), and financial strain causes stress, anxiety and further mental and physical health problems (Ahlström et al., 2014; Hiilamo, 2018; Hintikka et al., 1998). At the same time, poor health leads to both more payment problems and a lower chance of receiving debt settlement. This leads to a vicious circle. Individuals with poor health in retrenched economic situation may take up loans in the hope of extricating themselves from their predicament, but some may end up with over-indebtedness and payment problems. These individuals and their families may thus face higher health risks and higher vulnerability in the labour market. Financial stress, anxiety and illness may contribute to lower productivity, and people with wage deductions are most likely to lose their jobs in a shrinking economy (Poppe, 2008). Therefore, illness and financial strain may have a reinforcing effect on each other. The multiplicative disadvantages may further cause marginalisation in work-life, social exclusion, lower degree of wellbeing and lower quality of life.

The link between health and payment problems has a macroeconomic impact on a welfare state and the society as a whole. The cost of over-indebtedness for the Swedish society is estimated to be about €20 billion each year, when estimating the costs of loss of production, health care, sickness benefits, early retirement, social welfare benefits and unemployment benefits (Ahlström et al., 2014).

The Nordic welfare states offer a protective function to their citizens against uncertainties caused by the market by providing sufficient economic support and social services (Esping-Andersen, 1990). Although there have been efforts to reduce risks for health-damaging factors, socioeconomic predictors for health outcomes such as financial strain and payment problems have been ignored for a long time in policy instruments. When considering care and services provided to people with financial strains, the welfare state policy practices have always been more reparative and remedial than preventive or proactive (see, for example, Hiilamo, 2018; Poppe, 2008). The focus has often been on health-care services for people who are already sick or on labour market measures for those who already fell outside the labour market in forms of benefits, indemnification or compensation.

Liberalisation of banking markets from the 1980s was accompanied by loosened credit policies, reduced constraints on borrowing and less capital requirement on deposit for loans (Eitrheim et al., 2017; Knutsen & Lie, 2002). This development has more or less suppressed the development of a preventive welfare state function in the financial market. It is therefore argued that proactive policy instruments can be desirable, which may preclude individuals from payment problems (Alleweldt et al., 2013; Poppe, 2008). According to a report across 27 European countries, 'the aim of policy development should be to prevent and resolve over-indebtedness, and not just to alleviate or manage it' (Alleweldt et al., 2013, p. 239).

Ill health and payment problems are often dealt with separately in the welfare services. The primary goal of a universal and free health-care system is often quick recovery that helps people get back to work (cf. arbeidslinje, 'the work line'), while debt settlement aims to help people with payment problems and release their financial burdens. It is crucial to gain more knowledge about links between health and payment problems, not only to improve services and provide the necessary help for those in need but also to facilitate better cooperation between different welfare services, invest in prevention initiatives and advocate financial wellbeing.

AUTHOR CONTRIBUTIONS

Nan Zou Bakkeli: Conceptualization (equal); data curation (equal); formal analysis (equal); funding acquisition (equal); investigation (equal); methodology (equal); software (equal); validation (equal); visualization (equal); writing—original draft (equal). **Ida Drange**: Conceptualization (equal); formal analysis (equal); methodology (equal); validation (equal).

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CONFLICT OF INTEREST STATEMENT

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

DATA AVAILABILITY STATEMENT

The used datasets are available for research purposes after ethical approval from Norwegian Agency for Shared Services in Education and research (previous known as Norwegian Centre for Research Data, NSD). The administrative registries are administered by Statistics Norway, the

NPR by Norwegian Directorate of Health and the Mortgage Registry by the Brønnøysund Register Centre. The database was conceived, compiled and made available by the Faculty of Social Sciences at Oslo Metropolitan University, within the project Welfare State Life Course (PI: Kjetil A. van der Wel). Code for data handling and statistical analysis can be made available by request. Restrictions apply to the availability of these data, which were used under license for this article. Due to its person-sensitive concerns, supporting data cannot be made openly available. Further information about the data and conditions for access are available at Statistics Norway (https://www.ssb.no/en/data-til-forskning), the Norwegian Directorate of Health (https://www.helsedirektoratet.no/tema/statistikk-registre-og-rapporter/helsedata-og-helseregistre/norsk-pasientregister-npr/sok-om-data-fra-npr) and the Brønnøysund Register Centre (https://www.brreg.no/en/products-and-services-2/statistics/?nocache=1670772684310).

ETHICS STATEMENT

Ethical approval for record-linkage of the register data was obtained from Norwegian Agency for Shared Services in Education and research (NSD-686272) and Regional Committees for Medical and Health Research Ethics (REK-project 11880, saksnummer 2019/643).

PATIENT CONSENT STATEMENT

Not applicable.

PERMISSION TO REPRODUCE MATERIAL FROM OTHER SOURCES

Not applicable.

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APPENDICES

APPENDIX A: Pathways between health and payment problems

The article briefly visualises the flow of values between variables using the directed acyclic graph (DAG). The DAG illustrates causal and counterfactual relationships among variables, which detects independencies through the *d*-separation criterion, identifies a set of variables to control for confounding and estimates causal effects through the *f* -formula (see, for example, Morgan & Winship, 2007; Pearl, 2009; VanderWeele & Robins, 2010).

Important covariates are checked by using the DAG. By including demographics (DEM), socioeconomic status (SES) and health shocks (shocks) into modelling the relationship between health and payment problems (problems), we can identify six pathways. Three direct causal pathways are health problems, health SES problems and health shock problems. The indirect pathways are health SES DEM problems, health DEM problems and health DEM SES problems.

To estimate the total effect of health on payment problems, the minimal sufficient adjustment that needed to be made was in demographics. In addition, we adjusted for SES and health shocks to estimate the direct effect between health and payment problems. The graph also detected two testable implications for conditional independence: DEM ⫫ shock | health and SES ⫫ shocks | health. We checked these conditional independences by using regression-based tests.

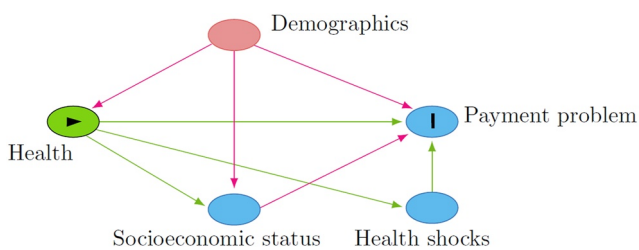

FIGURE A1 Pathways between health and payment problems.

The logic behind the test is to assume that X and Y are the functions of Z with a noise term: $X = f(Z) + \varepsilon_x$ and $Y = g(Z) + \varepsilon_y$, where ε_x and ε_y are zero-mean random variables independent of Z and $X \perp\!\!\!\perp Y \mid Z \iff \varepsilon_x \perp\!\!\!\perp \varepsilon_y$. The regression-based test was performed by (1) regressing X on Z and Y on Z and (2) tested for the unconditional independence between the fitted residuals $\hat{\varepsilon}_x = X - \hat{\mathbb{E}}[X|Z]$ and $\hat{\varepsilon}_y = Y - \hat{\mathbb{E}}[Y|Z]$ (see, for example, Li & Fan, 2020).

APPENDIX B: Correlation between covariates

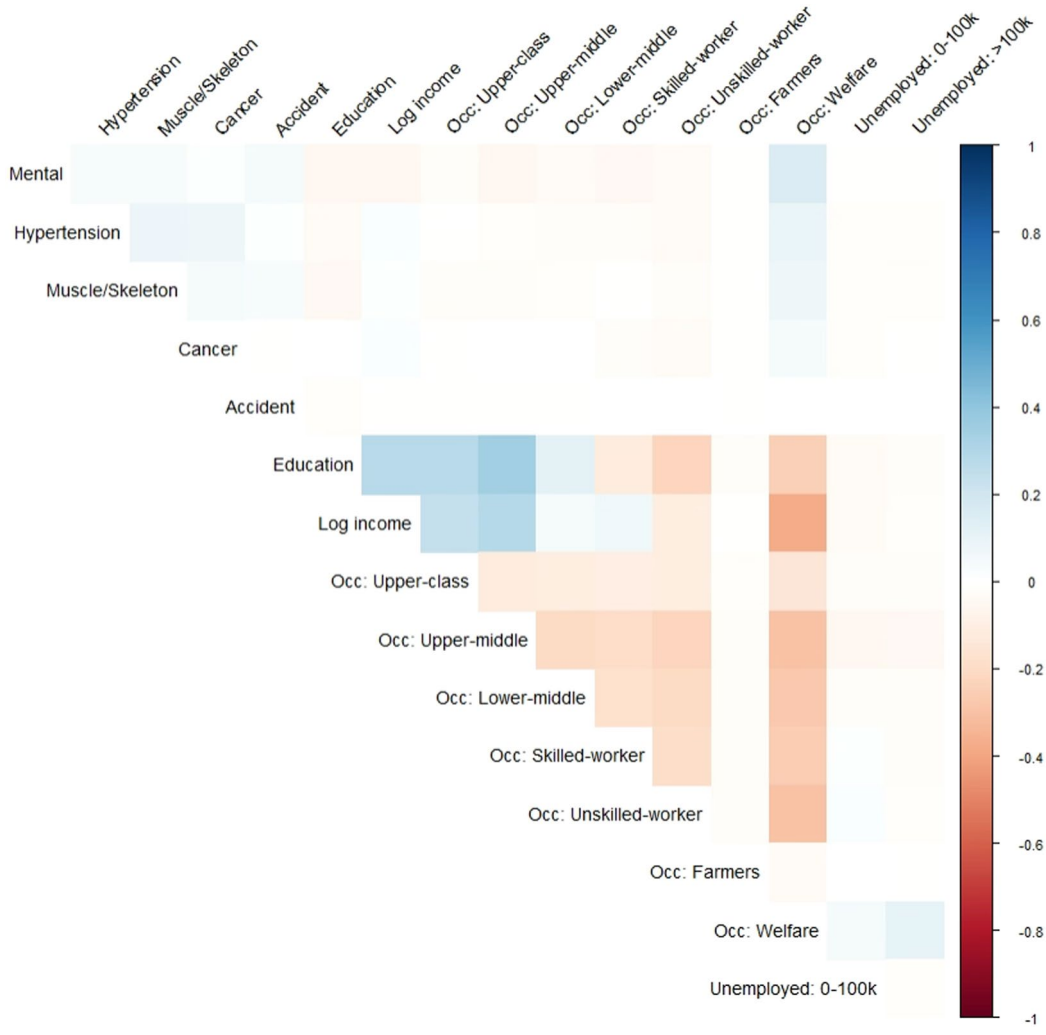

FIGURE B1 Correlation between covariates.

APPENDIX C: Predicting payment problems using two-way fixed-effects

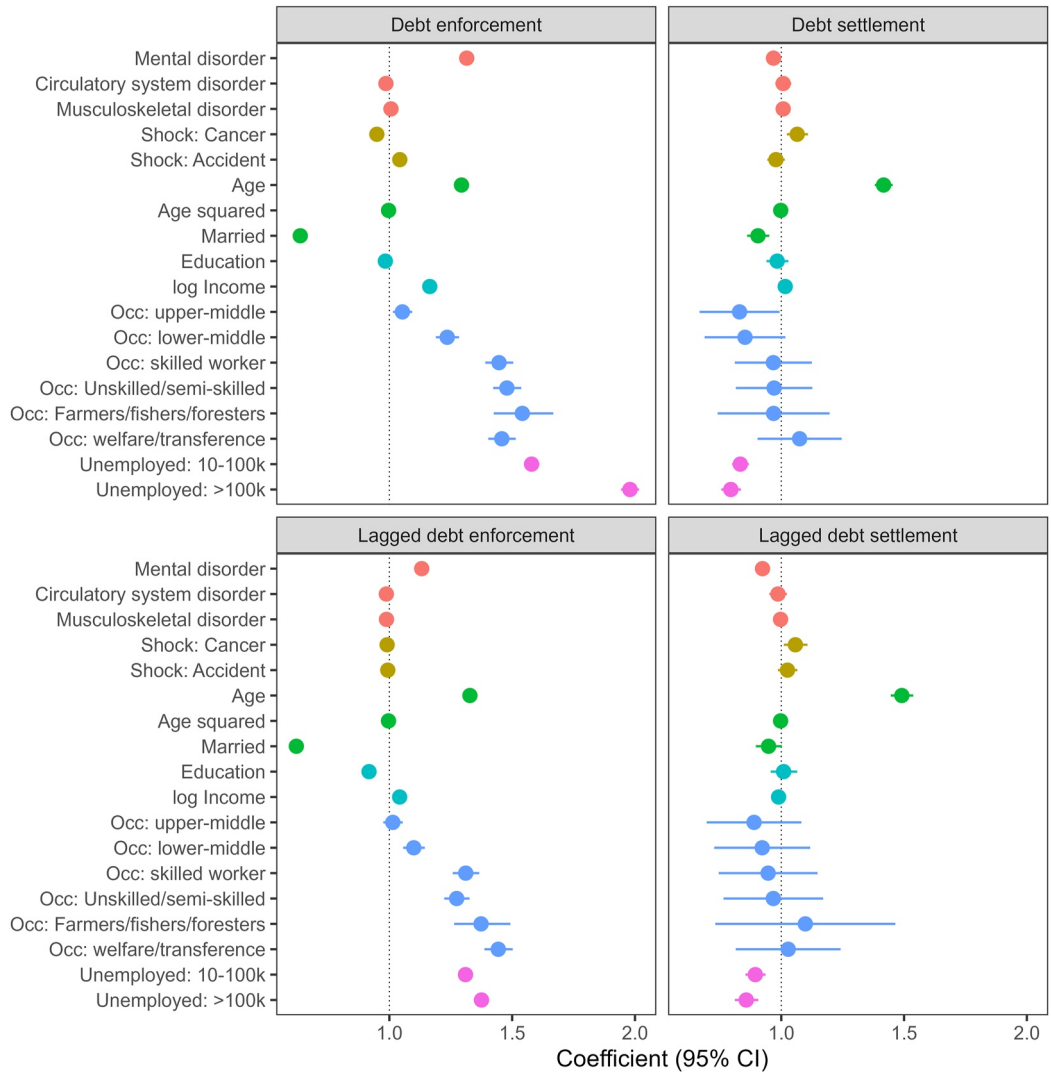

FIGURE C1 Predicting payment problems using two-way fixed-effects. Two-way fixed-effects models with robust standard errors. Number of groups (observations): Upper left: $N_{group} = 413{,}630$, $N_{obs} = 3{,}745{,}540$; Lower left: $N_{group} = 381{,}082$, $N_{obs} = 3{,}151{,}539$; Upper right: $N_{group} = 33{,}152$, $N_{obs} = 311{,}129$; Lower right: $N_{group} = 30{,}910$, $N_{obs} = 262{,}564$.

APPENDIX D: Predicting payment problems in the same year and the coming year

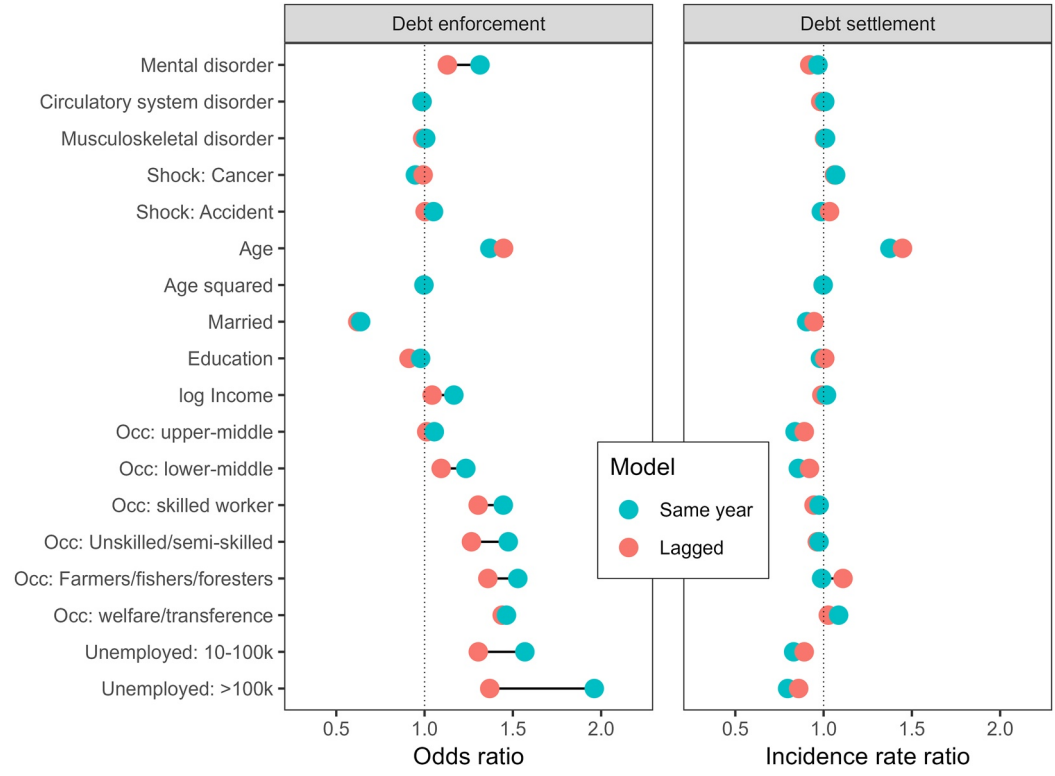

FIGURE D1 Predicting payment problems in the same year and the coming year. Predicting debt enforcement and debt settlement with individual fixed-effects and clustered robust standard errors, controlled for all covariates. Comparison between models with and without lagged effects.

APPENDIX E: Controlling for comorbidity

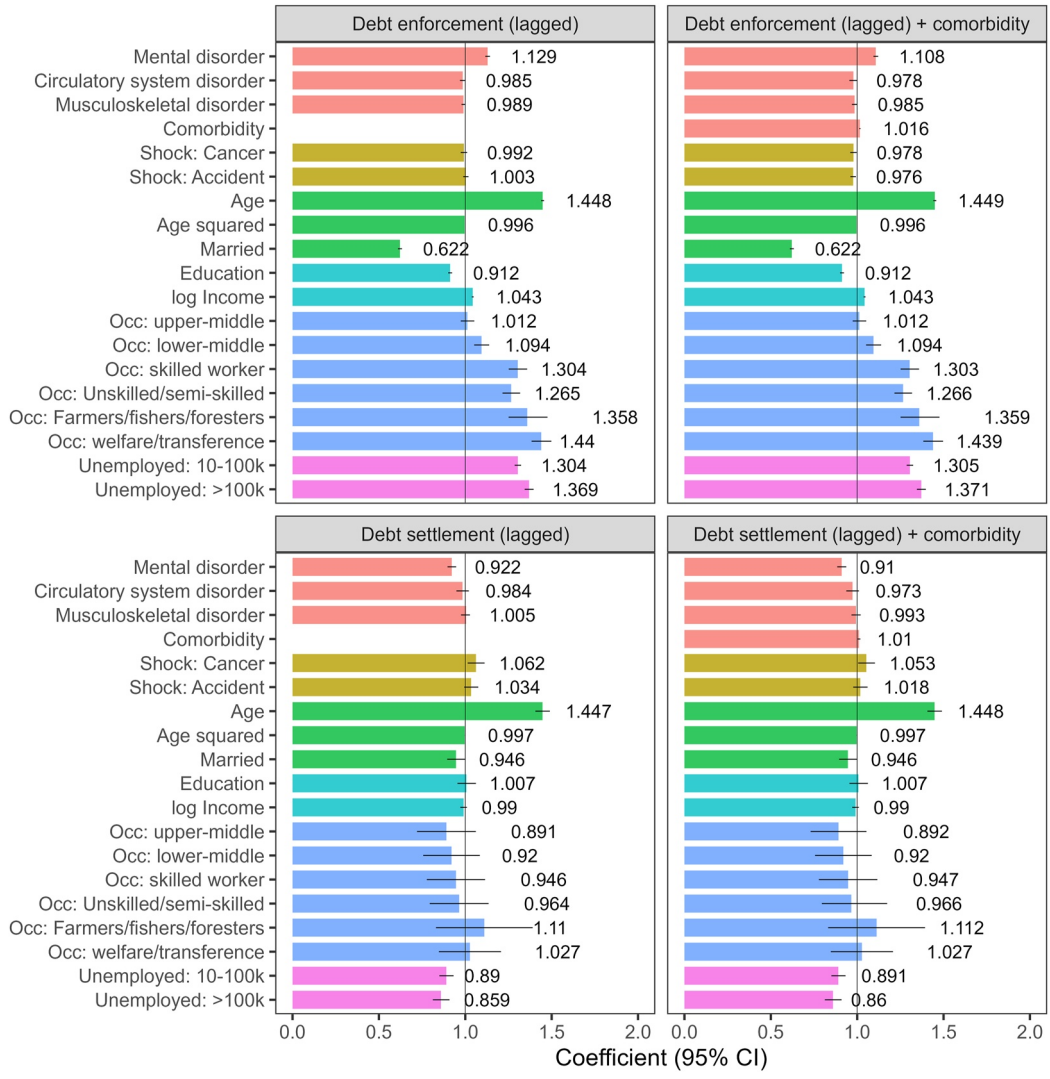

FIGURE E1 Controlling for comorbidity. Predicting one-year lagged debt enforcement and lagged debt settlement with individual fixed-effects and clustered robust standard errors, controlled for all covariates and comorbidity. Comparison between models with and without the indicator of comorbidity. Comorbidity is measured by the number of diagnoses each person had within a single year. Upper left: N_{group} = 381,082, N_{obs} = 3,151,539; Lower left: N_{group} = 16,281, N_{obs} = 94,425; Upper right: N_{group} = 380,990, N_{obs} = 3,148,940; Lower right: N_{group} = 30,906, N_{obs} = 262,303.

APPENDIX F: Interactions between health indicators

	Debt settlement OR [95% CI]	Debt settlement IRR [95% CI]
Health indicators		
Mental disorder	1.135 [1.120, 1.149]***	0.941 [0.924, 0.958]*
Circulatory system disorder	0.981 [0.961, 1.000]	0.999 [0.975, 1.024]
Musculoskeletal disorder	0.991 [0.979, 1.003]	0.994 [0.977, 1.012]
Interaction terms		
Mental × Circulatory	0.986 [0.952, 1.022]	0.970 [0.931, 1.009]
Mental × Musculoskeletal	0.970 [0.944, 0.997]*	1.001 [0.969, 1.034]
Circulatory × Musculoskeletal	1.041 [1.006, 1.078]*	0.993 [0.954, 1.034]
All control variables	✓	✓
Fixed-effects	✓	✓
N (groups)	3,151,539	30,910
N (observations)	381,082	262,564

Note: Predicting one-year lagged debt enforcement and lagged debt settlement with individual fixed-effects and clustered robust standard errors, controlled for all covariates. Results show interaction terms between different health indicators.

Abbreviation: IRR, incident rate ratios.

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.