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The toll of stopping the virus: Is severe policy stringency associated with severe mental health? A systematic review.

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Abstract

Background and Objectives: Health policy measures played an essential preventing the spread of the COVID-19 virus, but their differing stringencies influenced mental health of the general population to a still unknown extent. Therefore, this systematic review aims to describe the association between the strictness of policy measures and mental health during the COVID-19 pandemic.

Methods: Four databases (PubMed, Scopus, PsycArticles, PsycINFO) were searched on the 27thJanuary, 2023 for articles investigating the association between policy stringency, indicated by the stringency index (OxCGRT), and mental health in the general population, with a focus on anxiety, depression, and psychological distress. Articles were synthesized according to the SWiM guidelines. Associations were visualized by effect direction heatmaps, and albatross plots, summarizing sample sizes and p-values.

Results: 15 articles, representing 17,144,693 individuals from 75 countries across the world, with a range from 873 to 16,177,184, were included. Most studies investigated the association between policy stringency and depression. Higher policy stringency was associated with higher levels of depression, anxiety, psychological distress, and overall mental health. Two articles found a negative association between policy stringency and depression, and overall mental health. Furthermore, factors influencing the association between policy stringency and mental health were found: Trust in government, and personality traits like extraversion, and introversion, moderated, to what extent higher stringency influenced mental health outcomes.

Conclusion: Policy stringency was significantly associated with mental health: Higher stringency was primarily associated with higher levels of anxiety, depression, psychological distress, and overall mental health. Future health policies need to incorporate mental health besides the actual threat. Otherwise, mental health of the general population could decrease while protecting against just one disease.

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List of abbreviations

APA – American Psychological Association

BAI – Beck Anxiety Inventory

BDI-II – Beck Depression Inventory II

CES-D – Center for Epidemiologic Studies Depression Scale

CI – confidence interval

COVID-19 – Coronavirus Disease 2019

COV-PPM – COVID-19 pandemic policy monitor

CrI – credibility interval

CS – cross-sectional study

DASS- 21 – Depression Anxiety Stress Scale

DSM-5 – Diagnostic and Statistical Manual of Mental Disorders

GAD – Generalized Anxiety Disorder Scale

GHQ – General Health Questionnaire

HADS – Hospital Anxiety and Depression Scale

ItSI – Italian Stringency Indexes

K – Kessler Psychological Distress Scale

KOF – Konjunkturforschungsstelle

LS – Longitudinal study

NOS – Newcastle Ottawa Scale

OLS – ordinary least squares

OR – odds ratio

OxCGRT – Oxford Coronavirus Government Response Tracker

PHQ – Patient Health Questionnaire

PSS-10 – Perceived Stress Scale

RCS – Repeated cross-section study

SCID-5 – Structured Clinical Interview for DSM-5 Disorders

SE – standard error

SI – stringency index

SRQ – Self-Reporting Questionnaire

UK – United Kingdom

US – United states

WHO – World Health Organization

ZSDS – Zung Self-Rating Depression Scale

1. Introduction

After the “Coronavirus Disease 2019” (COVID-19) was classified as a pandemic by the World Health Organization (WHO) in March 2020 due its alarming levels of severity and spread (WHO, 2020), health policy had an essential role in addressing the international outbreak and numerous deaths (McBryde et al., 2020). As a result, several policy measures of varying stringency have been implemented in public health to combat the virus(Hale et al., 2021): In addition to movement restrictions, hygiene guidelines, and the strengthening of case detection through testing and tracking of contacts, a focus has been on isolation measures (e.g., home confinement, quarantine measures, or school- and work closure)(Ammar et al., 2020; Asongu et al., 2020; Qian & Jiang, 2020).Policy measures aiming at social isolation led to severe consequences worldwide (O’Hara et al., 2020):Besides decreases in economic performance (Priya et al., 2020), and disrupted education due to school and university closures (Tadesse & Muluye, 2020), an increasing strain on the mental health of populations across the world has been registered (e.g., Adams-Prassl et al., 2020; Ahrens et al., 2021; Rossi et al., 2020). In the first year of the COVID-19 pandemic, the global prevalence of anxiety and depression increased by 25% (WHO, 2022a). These findings are close to research from past endemics that demonstrated an increasingly negative impact on mental health: The Ebola endemic between 2014 and 2016, the Zika virus outbreak in Brazil (2016), and the influenza pandemic in 2009, led to significant anxiety and depressive symptoms (Jalloh et al., 2015; Tucci et al., 2017). Furthermore, the SARS endemic in 2003 led to increased psychological distress and worry, primarily caused by more restrictive policy measures aiming at isolation (Maunder, 2009; Peng et al., 2003).

Two previous systematic reviews have studied the moderating role of policy stringency on the association between the COVID-19 pandemic and mental health (Lee et al., 2021; Salanti et al., 2022). Salanti et al. (2022) investigated to what extent the COVID-19 pandemic and its policy measures affected the mental health of the general population across

the world. Their review showed that a higher stringency of policy measures was associated with worse mental health outcomes, regarding anxiety and depression. Lee et al. (2021) investigated as well, to what extent the COVID-19 pandemic and the stringency of policy influenced the mental health of the general population. The review found that the prevalence of depressive symptoms was lower in countries with stringent policy measures that were implemented promptly, while the prevalence of depressive symptoms was higher in countries that implemented stringent policy measures over an extended period of time. Both studies reviewed articles about COVID-19, and mental health, and added policy stringency afterwards within a meta-regression. Considering that these reviews show a significant association between policy stringency, and mental health, further research on the mechanisms is necessary. To date, no review of studies about the association between policy stringency, and mental health exists. Therefore, this thesis aims to investigate the association between the stringency of policy measures and mental health during the COVID-19 pandemic within the scope of a systematic review. This will be accomplished by firstly examining the concept of policy stringency and its potential impact on mental health within a conceptual framework.

2. Contextualization of the review: Understanding mental health and policy stringency

Before exploring the relationship between stringency and mental health outcomes within a conceptual framework, it is important to first establish an understanding of the key concepts involved. These include the stringency index, mental health, and its determinants. In the following sections, they will be explored in more detail. By examining the connections between these concepts, we can gain a better understanding of the influence of policy stringency during the COVID-19 pandemic on mental health outcomes. To operationalize policy stringency, the Oxford COVID-19 Government Response Tracker (OxCGRT) established an index about policy responses during the COVID-19 pandemic across countries (Hale et al., 2021; Mathieu et al., 2020).

2.1 Stringency index

The stringency index (SI) is a widely used index that provides a standardized way of measuring the stringency of policy responses to the COVID-19 pandemic longitudinally (over time), across more than 180 countries of the world (Hale et al., 2021). It's a comprehensive, quantitative measure showing the intensity of governments' responses to the pandemic. The SI captures the degree of restrictions on various aspects of life and is operationalized by nine policy measures, namely school closure, workplace and public transport closures, restrictions on public gatherings and cancellation of public events, stay-at-home requirements, restrictions on internal movements, international travel controls, and public information campaigns (Mathieu et al., 2020). The SI calculates a score between 0 and 100 for any given day since January 22, 2020, based on the overall stringency of these measures, where a higher score indicates more stringent government policies (Mathieu et al., 2020). While the overall stringency index ranges from 0 to 100 points (Phillips & Tatlow, 2022), each of the nine sub-indices ranges from 0 to 3 on an ordinal scale, where 0 indicated no measure and 3 indicates a very strict policy measure. The overall SI is limited to the stringency of government responses to the COVID-19 pandemic regarding the nine containment policies. It does not provide further information on, e.g., the actual implementation of measures across countries, or consequences for disobeying the measures (Hale et al., 2021). However, the SI has been widely used in numerous studies to investigate the potential impact of policy measures on various outcomes including mental health (Kruse et al., 2022). It enables the exploration of the relationship between policy measures and socio-economic factors that have the potential to impact mental health (table 1). In addition, it facilitates the comparability of applied policies between countries (Mathieu et al., 2020). Although other stringency indices exist, e.g., the Bank of Canada Stringency index (Cheung et al., 2021), the Italian Stringency Indexes (ItSI) for Italy (Conteduca & Borin, 2022), or the Konjunkturforschungsstelle (KOF) stringency index for Switzerland (Pleninger et al., 2021), this study focuses on the SI based on

the OxCGRT as it is a widely used and well-established measure to investigate the differences of policy stringencies in different regions, countries and over time (Kruse et al., 2022). Hence, examining stringency with the SI can provide important insights into the impact of the COVID-19 pandemic on mental health outcomes, and to what extent the stringency of policies played a role. In order to understand how policy stringency might have impacted mental health, the concept of mental health is introduced in the following.

2.2 Mental health

Mental health is a complex and multifaceted concept that includes aspects of an individual's psychological and social well-being. Psychological well-being refers to the emotional and cognitive functioning of an individual, whereas social well-being relates to the quality of social relationships as well as the individual feeling of being connected to a social community (Keyes, 2002). The World Health Organization (WHO) defined that mental health is more than just the absence of mental health conditions, including an individual's ability to cope with challenges, and stresses of life, realize their potential and maintain positive relationships (WHO, 2022b; WHO, 2023a). In recent years, the global prevalence of mental health conditions increased up to one in four individuals experiencing at least one mental health condition in their lifetime (WHO, 2019). The prevalence of mental health conditions on a subclinical level is even higher with individuals experiencing symptoms that may lead to a clinical condition (Manwell et al., 2015). Subclinical conditions, or symptoms refer to individuals who do not meet the criteria according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) for a clinical mental health condition, but still experience significant mental health symptoms that can reduce the quality of the daily life (Essau, 2003). Clinical symptoms referring to individuals who meet the diagnostic criteria of the DSM-5 are clinically determined as mental health conditions, such as depression or anxiety (WHO, 2022c). As mental health is a broad term, it is crucial to focus on specific mental health conditions that are relevant to the investigation of the association between policy stringency

during COVID-19 and mental health. Therefore, this review will focus on the most common mental health conditions: psychological distress, anxiety, and depression (Arvidsdotter et al., 2016; Nigatu et al., 2016; WHO, 2022c). Firstly, they represent the most prevalent mental health conditions worldwide with high rates of occurrence even in non-pandemic times (WHO, 2022a). And secondly, there is evidence that these conditions have been exacerbated by the COVID-19 pandemic with increased levels of symptoms (e.g., Panchal et al., 2021; Pierce et al., 2020; Xiong et al., 2020). Additionally, studies screening for overall mental health as a generic concept are considered since studies assessing overall mental health can provide further insights into the broader impact of policy stringency.

Psychological distress is a natural response to perceived psychological or physical threat (Biggs et al., 2017). It is defined by subclinical depressive symptoms (e.g., sadness, hopelessness, loss of interest), subclinical anxiety symptoms (e.g., fear, tension, restlessness), and often accompanied by physical symptoms (e.g., headaches, lack of energy, insomnia) (Arvidsdotter et al., 2016; Drapeau et al., 2012; Ridner, 2003). Hence, it is used as a more generic term for emotional suffering instead of a clinical diagnosis. It can be seen as a precursor for mental health conditions, namely anxiety and depression (Arvidsdotter et al., 2016; Kendler et al., 2002; Liu et al., 2012).

Anxiety is a more intense feeling of fear, nervousness, or apprehension that can be triggered by subjectively stressful situations (Steimer, 2002). Anxiety was shown to be a more acute and reactive in response to stressors, than depression, which was shown was shown to develop more likely over time, and be more persistent, and chronic (Starr & Davila, 2012).

Depression is particularly determined by a severe and persistent feelings of sadness, hopelessness, and worthlessness. These symptoms show an individually varying intensity and tend to be long-lasting and recurrent. They can interfere with an individual's ability to function in daily life. (WHO, 2023b).

It is important to mention that the relationship between psychological distress, anxiety and depression is complex, and not everyone who experiences psychological distress will develop a clinically determined mental health condition. Individual factors as genetics and personality are also in the focus of research (WHO, 2022c). Furthermore, it is important to note that mental health conditions are often discussed as discrete illnesses, although they can be seen as part of a spectrum of symptoms that can vary in duration and severity ranging from a subclinical to a clinical condition (Kessler & Wang, 2008; WHO, 2022c). In order to differentiate this spectrum of symptoms more precisely, various methods have been developed for measuring the severity and presence of mental health conditions, including self-report questionnaires such as screening tools that can quickly assess the presence and severity of symptoms. Additionally, clinical assessment tools, e.g., clinical interviews, can provide a more comprehensive understanding of an individual's mental health status (First et al., 2016; Jones, 2010; Tannenbaum et al.; 2009).

The complexity of mental health has led to the development of various determinants of mental health including biological, psychological, and social determinants. In the context of the COVID-19 pandemic and its policy measures, the social determinants of mental health are particularly relevant to consider. Lund et al. (2018) provide a framework of the social determinants of mental health, that represents a broad and interrelated range of societal factors that are able to impact mental health outcomes, like psychological distress, depression, or anxiety (Lund et al., 2018).

2.3 Social determinants of mental health

The framework of Lund et al. (2018) subdivides social determinants of mental health into five domains: a demographic, an economic, a neighborhood, a social/cultural domain, and a domain about environmental events. All domains are separated into proximal and distal factors. Proximal factors are defined as people, objects, or events in direct interaction with an individual. Distal factors refer to a broader society influencing individuals more indirectly on

a population level. All domains can have an impact on mental health (ibid.). The framework components are displayed in *table 1*.

Table 1

Social determinants of mental health by Lund et al. (2018)

Domain	**Proximal factors**	**Distal factors**
Demographic	Age, ethnicity, gender	Community diversity, population density, longevity
Economic	Income, debt, assets, food security, employment status, subjective financial strain	Economic recessions, economic inequality, macroeconomic policy
Neighborhood	Safety and security, access to recreational facilities, availability of services, structural features (e.g., overcrowding).	Infrastructure, built environment, setting.
Social and cultural	Individual social capital (e.g., number and quality of social ties), social participation, social support, education	Community social capital (e.g., civic norms, voluntary activities within a society),
Environmental events	Trauma, Distress	Natural disasters (e.g., flooding), industrial disasters (e.g., chemical spills), war or conflict, climate change, forced migration

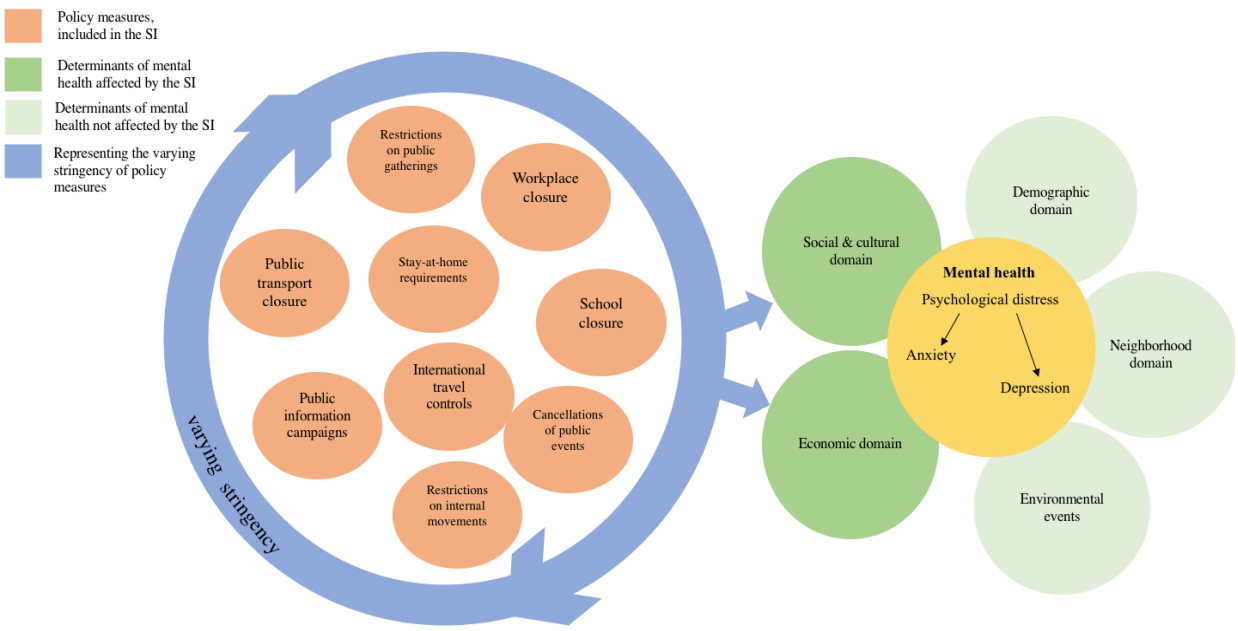
The framework by Lund et al. (2018) is useful to understand and explore the association between policy stringency and mental health since it provides various factors that influence mental health.

3. Conceptual Framework

The conceptual framework of the present work aims to describe the impact of the nine policy measures of the SI and their differing stringencies across countries, on the social determinants outlined in the framework of Lund et al. (2018) (table 1), which potentially affect the mental health of the general population during the COVID-19 pandemic. *Figure 1* shows the connection between the nine measures of the SI and the different social determinants of mental health demonstrating how policy measures might have impacted mental health through its effect on the presented social determinants. Hence, *figure 1* serves as a visual representation of the complex interplay between pandemic-related policy measures, their stringency and mental health outcomes.

Figure 1

Conceptual framework of the present work



Considering the framework by Lund et al. (2018) about determinants of mental health, it becomes clear that especially the social, and economic domain, both important determinants of mental health, have been affected by the COVID-19 pandemic's policy measures. The social domain was affected by, e.g., stay-at-home requirements, distancing measures and restrictions on social gatherings and showed a negative impact on mental health (Brooks et al., 2020). Furthermore, COVID-19 has affected the economic domain, aggravating existing inequities within the labor market and fostering unemployment due to workplace closures, which led to financial instability in turn (Bianchi et al., 2023; Blustein et al., 2020; Carroll et al., 2020; Holmes et al., 2020). The influence of the economic domain on mental health has been shown in systematic reviews, reporting that financial instability and unemployment are significant predictors of worse mental health in adults and young people (Adegboye et al., 2021; Alegría et al., 2018; Silva et al., 2016).

The SI from the OxCGRT includes a variety of policy measures, which aim to contain the spread of the virus. They also include many measures causing social isolation, such as school and workplace closures, restrictions on public gatherings, or stay-at-home requirements. Existing literature has shown that social isolation can negatively affect mental health, contributing to anxiety and depression (Beutel et al., 2017; Ge et al., 2017; Palgi et al., 2020). Studies have also identified negative impacts of school closures during the pandemic on young people's and parents' mental health, identifying social isolation as leading cause (Kishida et al., 2021; Li et al., 2022). In summary, the conceptual framework of the present work describes how policy stringency can impact the social determinants of mental health outlined in Lund et al. (2018), which, in turn, potentially impact mental health.

The association between policy measures and mental health during the COVID-19 pandemic has been pointed out in current literature: Systematic reviews have shown that higher stringency of policy measures can negatively affect mental health leading to increased levels of depressive symptoms or psychological distress (Lee et al., 2021; Salanti et al., 2022).

Both studies examined articles, which addressed mental health during the COVID-19 pandemic but not with respect to policy stringency. They added the SI from the OxCGRT retrospectively in order to investigate the association to mental health. Hence, this study aims to synthesize articles studying the association between policy stringency and mental health outcomes on a country-level. This assumes that articles considered in this thesis already include the SI from the OxCGRT. Overall, understanding the relationship between policy stringency during COVID-19 and mental health is crucial for the development of effective public health policies and interventions to support individuals experiencing psychological distress, anxiety and depression during times of crisis. The present work is going to investigate the following research question:

- What is the association between the stringency of policy measures, as indicated by the stringency index, and mental health during the COVID-19 pandemic?

4. Methods

The structure of this systematic review was developed based on the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins et al., 2022) and the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) for systematic reviews and meta-analysis of Page et al. (2021).

4.1 Systematic search strategy

Based on the criteria, the search for the aim of this study was performed on January 27th, 2023 across *Scopus* as one multidisciplinary database, and P*ubMed*, *Psycl*NFO, and *PsycArticles* via *EBSCO* for psychology-, healthcare- and life-science-related sources. The databases and search terms were selected in consultation with an information specialist of the Faculty of Behavioural, Management, and Social Sciences of the University of Twente. Some of the keywords used were: “covid OR "coronavirus infection" OR coronavirus OR ncov OR "sars-cov-2" OR pandemic AND (policy W/2 string*) OR "stringency index" OR "policy making" OR "government response" OR "oxford government response tracker" OR oxcgrt

AND "mental health" OR "mental illness" OR "mental well-being" OR "mental well-being" OR "depressi*" OR "mood disorder" OR "affective disorder" OR anxiety OR "psychological distress". A detailed table about the search strategy can be found in *Appendix A*. In *PubMed*, the search mainly consisted of MeSH terms to secure a controlled and standardized search. Further terms have been added regarding policy stringency, as no MeSH terms are available for policy stringency and the SI. Chosen terms refer to the wording of studies dealing with the topic of this review (e.g., Aknin et al., 2022; Lee et al., 2021; O'Hara et al., 2020).

Results were limited to the period between January 1st, 2020, and January 27th, 2023, as well as to “full text”, and the English language. Furthermore, snowballing was done with the reviews of Lee et al. (2021) and Salanti et al. (2022) about the impact of the COVID-19 pandemic and its policy measures on mental health, as well as with all included articles. Snowballing means to screen the literature of similar or included articles. Based on that strategy, a final selection of studies was made.

4.2 Inclusion and exclusion criteria

Studies that report an association between policy stringency and mental health during the COVID-19 pandemic were eligible for inclusion in the present systematic review. An obligatory criterion was the English language and the availability of full texts. Furthermore, no geographical or population-related restrictions were made, which means that all genders, ages, and nationalities were included. In addition, only peer-reviewed work was included to ensure rigor of the research and maintain integrity of the synthesized results. Regarding the assessment of policy stringency, studies have to use the stringency index by Mathieu et al. (2020), as it was widely used during the pandemic in several research areas (e.g., healthcare, politics, economy, environmental science) (Hale et al., 2021). As there is no gold-standard method for measuring policy stringency across the world (Bozorgmehr et al., 2021), this study chose to only focus on the stringency index by Mathieu et al. (2020) – first, to limit heterogeneity and second, as it provides worldwide data for every day until now, since

January 2020, which no other index does. Studies assessing the link between policy stringency and mental health but not using the SI will be excluded. Furthermore, non-empirical papers (e.g., literature reviews, commentaries, articles that focus on theory and methodology, and letters to the editor) and other types of review will not be considered.

As mental health is a relatively broad term, a focus has been on the most common mental health conditions (Arvidsdotter et al., 2016; Nigatu et al., 2016): Therefore, only studies assessing anxiety, depression and/or psychological distress were included, as well as studies that screened for mental health as a generic concept, using validated and commonly used screening tools to facilitate ease of comparison and synthesis in this review. Screening tools were selected based on a systematic review, and articles of validated screening tools for common mental health conditions (Ali et al., 2016; Hyland et al., 2012; Kroenke, 2021; Spitzer et al., 2006; Topp et al., 2015), as well as on acquired knowledge of clinical psychology courses during the master. Selected tools are presented in *table 2*, with information about what they assess, the score range and the respective cut-off score. The cut-off score divides the measuring scales into two categories: Values at or above the cut-off indicates whether an individual is likely to have a condition of interest (e.g., the presence of depressive symptoms). In contrast, values below the cut-off point indicate that someone probably does not have the condition of interest. For the WHO-5 questionnaire it is reversed: Values under the cut-off indicate that an individual is likely to have poor mental health. Important to mention is, that the use of a cutoff value does not necessarily mean that all individuals above the cutoff need clinical treatment, but rather that further evaluation and discussion of treatment options may be needed.

Table 2

Pre-determined screening tools

Name of instrument	**Assessment**	**Score ranges**	**Cut-off value (source of cut-off values)**
Beck Depression Inventory (BDI/revision BDI-II) (Beck et al., 1996)	Presence and severity of depressive symptoms	0-63	>11 (Westhoff-Bleck et al., 2020)
Center for Epidemiologic Studies Depression Scale (CES-D) (Radloff, 1977)	Presence and severity of depressive symptoms	0-60	>16 (Eng et al., 2020)
Hospital Anxiety and Depression Scale (HADS-D) (Zigmond& Snaith, 1983)	Presence and severity of depressive symptoms	0-21	≥8(Snaith &Zigmond, 2000)
Patient Health Questionnaire (PHQ-2) (Kroenke et al., 2003)	Presence and severity of depressive symptoms (without suicidal item)	0-6	≥ 2 (Gómez-Gómez et al., 2022)

Table 2 (continued)

Pre-determined screening tools

Name of instrument	**Assessment**	**Score ranges**	**Cut-off value (source of cut-off values)**
PHQ-4 (Kroenke et al., 2009a)	Presence and severity of depressive, and anxiety, or psychological distress	0-6 (sub-scores), 0-12 (total)	Depression and anxiety: ≥ 3 Psychological distress: ≥ 4 (Tillinger, 2015)
PHQ-8 (Kroenke et al., 2009b)	Presence and severity of depressive symptoms (without suicidal item)	0-24	≥ 7(Gómez-Gómez et al., 2022)
PHQ-9(Kroenke & Spitzer, 2002)	Presence and severity of depressive symptoms (with suicidal item)	0-27	≥8(Liu et al., 2016)
Zung Self-Rating Depression Scale (ZSDS) (Zung et al.,1965)	Presence and severity of depressive symptoms	1-80	≥50 (Dunstan & Scott, 2019)

Table 2 (continued)

Pre-determined screening tools

Name of instrument	**Assessment**	**Score ranges**	**Cut-off value (source of cut-off values)**
Beck Anxiety Inventory (BAI) (Beck & Steer, 1988)	Presence and severity of anxiety symptoms	0-63	>13 (Adhikari, 2019)
Generalized Anxiety Disorder Scale(GAD-2) (Spitzer et al., 2006)	Presence and severity of anxiety symptoms	0-6	≥ 3(Sapra et al., 2020)
GAD-7 (Kroenke et al., 2007)	Presence and severity of anxiety symptoms	0-21	≥ 10 (Sapra et al., 2020)
HADS-A (Zigmond& Snaith, 1983)	Presence and severity of anxiety symptoms	0-21	≥8(Snaith &Zigmond, 2000)
Kessler Psychological Distress Scale(K-6) (Kessler &Mroczek, 1992)	Presence and severity of perceived stress	0-24	> 4(Sakurai et al., 2011)

Table 2 (continued)

Pre-determined screening tools

Name of instrument	**Assessment**	**Score ranges**	**Cut-off value (source of cut-off values)**
K-10 (Kessler et al., 2002)	Presence and severity of perceived stress	0-40	≥12 (Lace et al., 2019)
Perceived Stress Scale (PSS-10) (Cohen et al., 1983)	Presence and severity of psychological distress	0-40	≥ 10 (Lee, 2012)
Depression Anxiety Stress Scale (DASS-21) (Lovibond, 1995),	Depression, anxiety, and stress	0-21 (sub-scores) 0-63 (total)	Depression: ≥10, Anxiety: ≥ 6, Stress: ≥ 10 (Nilges&Essau, 2021)
WHO-Five Well-Being Index (WHO-5) (WHO, 1998)	Overall mental health	0-100	≤50(Topp et al., 2015)
General Health Questionnaire (GHQ-5) (Shamasunder et al., 1986)	overall mental health, including anxiety and depression items	0-5	≥ 1 (Shamasunder et al., 1986)

Table 2 (continued)

Pre-determined screening tools

Name of instrument	**Assessment**	**Score ranges**	**Cut-off value (source of cut-off values)**
GHQ-12(Goldberg, 1978)	overall mental health, including anxiety and depression items	0-12	> 2 (Kim et al., 2013)
GHQ-28 (Goldberg & Hillier, 1976)	overall mental health, including anxiety and depression items	0-28	> 4 (Eng& Chang, 2013)
Self-Reporting Questionnaire (SRQ-20) (Beusenberg et al., 1994)	overall mental health, including anxiety and depression items	0-20)	≥ 8 (Scholte et al., 2011)

4.3 Study screening and selection

Studies were screened based on the pre-specified inclusion/exclusion criteria in Covidence (REF) using the following procedure (Cochrane): Search results were screened within the supporting software and duplicates removed, it was screened for titles and abstracts, irrelevant reports were removed, full texts were examined, and in a further step, a decision about the final inclusion of studies was made. The search was done in a co-screening process: 10% were done in duplicate by a second researcher.

4.4 Data extraction

After identifying a final set of studies, the essential characteristics (e.g., sample size, age and gender distribution, study design, measured concepts) of each paper were extracted and presented in a table format. Missing data was considered by contacting authors when sufficient data was not published or calculated afterwards if it was possible. Data from all included articles was extracted to provide relevant information about the study design, population characteristics, contextual factors, factors related to association (possible covariates) and the study results. This comprehensive extraction process was done to ensure that all background, contextual, and related information was obtained to be able to ultimately explain the results from each study through comparison and synthesis. Data extracted regarding the study design were the following: author & year, country, type of investigation, time point of data assessment, study duration and number of waves (if longitudinal). Regarding the population characteristics, the following data were extracted: total sample size (N), mean age in years (standard deviation, SD), or gender distribution in %, employment status, household size, children in the household, information about mental health condition and chronic illnesses. Regarding the contextual factors, the total mean stringency index, respective screening tools including range and cut-offs, mean (SD) of mental health score per outcome, and pandemic intensity through daily deaths and daily cases per 100k people, were

extracted. As there are different methods of presenting deaths and cases, e.g., 7-day-incidence rate per 100k or daily cases per 1M (ourworldindata.org (n.d.); Robert Koch Institut, 2023), converting daily deaths per 100k throughout included studies seems feasible to unify data. Furthermore, information about the vaccination rate, and about trust in government were extracted, as trust in government was shown to be an important moderator in the association between policy stringency and mental health (O'Hara et al., 2020). Regarding information about the outcome, the measure of association was extracted by presenting effect estimates with respective 95% confidence intervals and p-values; as well as a summary of results in key points) and checking whether or not, subgroup analysis of separate policy measures (e.g., school closure, stay-at-home requirements) have been made, as well as checking if studies have adjusted for any factors. Most variables are going to be extracted to explain variation between articles that could occur: E.g., existing health conditions could affect the outcome of interest in this study, as well as pandemic intensity (e.g., more daily losses), information about the social aspects of life (household size, children in household) and the employment status, which is a major determinant of mental health, according to the framework of Lund et al. (2018). The detailed data extraction table can be found in *Appendix B.*

4.5 Assessment of bias

The Newcastle-Ottawa-Scale (NOS) will be used to assess the quality of included studies in this review. *The scale* will be adapted to this review, including criteria for cross-sectional and longitudinal studies (Herzog et al., 2013). The *NOS* consists of three domains: selection, comparability, and outcome. Every domain is divided into subcategories and awarded a specific number of points. The selection domain in this work can be awarded a maximum of four points and consists of the sample's representativeness, the ascertainment of the pandemic intensity, and exposure (risk factor). The domain of comparability can be awarded a maximum of two points and consists of one subcategory, assessing if a study controlled for confounding factors, in this case, e.g., for age, gender or vaccination rates and

pandemic intensity (COVID-19 cases and deaths), as they are likely to be associated with impacting mental health during COVID-19 due to increased grief and distress caused by a magnitude of deaths and fear of infection, as well as differentiated rules for individuals based on the vaccination status, e.g., different restrictions regarding social activities, locations or the workplace (Aknin et al., 2022; Simon et al., 2020; Voo et al., 2022; WHO, 2022b).The outcome domain can be awarded a maximum of three points for cross-sectional studies and five points for longitudinal studies. It consists of the assessment of outcomes, information about subgroup analysis of, e.g., school closure or stay-at-home requirements, the appropriateness of statistical tests, the appropriateness of periods between follow-ups, and the adequacy of follow-up of cohorts for longitudinal studies as additional criteria. In sum, cross-sectional studies can be rated high quality (7-9 points), middle (3-6 points), and low (0-2 points). For longitudinal studies, a high-quality rating is indicated by 8-11 points, middle by 4-7 points, and low by 0-3 points. The full NOS scale used in this review is in *Appendix C.*

4.6 Synthesis of results

Results will be stratified by outcome (Higgins et al., 2022), namely, by depression, anxiety, psychological distress, and overall mental health. In the first step, data will be extracted into tables, followed by a narrative synthesis of evidence to summarize the included studies' characteristics and findings and analyze thematic relationships between studies. If at least two papers assess the same outcome (e.g., the association between policy stringency and depression) and sufficient data is available, pooled effect estimates and their 95% confidence intervals (CIs) will be presented. In the second step, a meta-analysis will be conducted. As variability in policy stringency, heterogeneous characteristics of participants, and different effects might be possible, a random-effects meta-analysis model will be conducted. If a meta-analysis is possible, it will be conducted for each specific association between policy stringency and depression, anxiety, or psychological distress, and overall mental health. If a meta-analysis is not possible, in case that given data is too heterogeneous, and conversion of

effect sizes is not possible, a synthesis, following the SWiM guidelines (Campbell et al., 2020), will be conducted. In a second step, visualizations will be used to present results clearly: An effect direction heatmap (Ramsey et al., 2021) will be created of all included articles, which is useful in facilitating comparison of effect directions across studies with heterogeneous outcomes. The effect direction heat map summarizes the narrative synthesis in a transparent way, showing the level of significance of each study, as well as the effect direction of outcomes per study. In addition, albatross plots will be conducted with the *metap package* in *R Studio* (Dewey, 2022) for each specific association between policy stringency and depression, anxiety, psychological distress, and overall mental health. Albatross plots are a presentation of the sample sizes of included articles, plotted against the two-sided p-value, with results separated by the direction of effect (Harrison et al., 2017). They are useful for presenting heterogeneous results of included articles within systematic reviews, as they can help to identify sources for heterogeneity, as well as examine underlying effect sizes. The scatter of ß can be visually interpreted. If studies are missing p-values, which are necessary for the effect direction heatmap, as well as for the albatross plots, they will be calculated with the following steps (Altman, 2011):

1. Standard error (*SE*) = (upper 95% CI – lower 95% CI) / (2x1.96)
2. Test statistic (*z*) = Effect estimate / SE
3. P value (*p*) = exp (-0.717xz – 0.416xz^2)

Regarding the assessment tools of mental health, comparisons of papers using different assessment tools (e.g., one using the PHQ-9 for depression and one using the BDI-II for depression) are possible, as all assessment tools are validated and used for assessing the presence and severity of respective symptoms.

5. Results

5.1 Search results and study characteristics

In total, 1943 articles were identified, and 1795 were left after removing duplicates. Full texts were assessed of 34 articles, and 13 articles were eligible. Through snowballing references of eligible articles and similar systematic reviews (Lee et al., 2021; Salanti et al., 2022), two additional articles were identified, which resulted in a total inclusion of 15 articles (figure 2). As O'Hara et al. (2020) did not give enough information on the association between policy stringency and mental health, the authors were contacted and provided the necessary data. Included articles represent a total of 17,144,693 individuals (range across articles: 873 to 16,177,184), with an average of 58.32 % female. In addition, 75 countries of all continents are represented (ranging from 5 to 58 countries). The age ranges in these articles varied widely based on the information provided. Six articles reported a study population's mean age, that ranged from 25.71 (*SD*=8.55) to 44.70 (*SD*=15.7) years (table 3). Seven articles reported a percentage distribution of different age groups (table 3), ranging from 18 to 70+ years. Two articles did not report any ages. One article included only somatic inpatients (Aebi et al., 2022), three studies reported on students (Buffel et al., 2022; Ochnik et al., 2021; Van der Velde et al., 2021), and 11 studies included adults (18+ years) from the general population (Aknin et al., 2022; Cepulic et al., 2021; Hajek et al., 2022; Lee et al., 2021; Long et al., 2021; O'Hara et al., 2020; Plett et al., 2022; Riehm et al., 2022; Schifano et al., 2021; Toffolutti et al., 2022; Wijngaard et al., 2020). Nine articles reported cross-sectional associations, three articles reported repeated cross-sectional associations, and three articles longitudinal associations (see table C1). 10 out of 15 articles studied depression, six out of 15 articles studied anxiety, three articles studied psychological distress, and two articles studied overall mental health as their mental health outcome. The basic characteristics of included articles are also displayed in *table 3* for a clear overview. Furthermore, three articles reported on factors influencing the association between policy stringency and mental health (Aknin et

al., 2022; O'Hara et al., 2020; Wijngaard et al., 2020). This information was also included in the narrative evaluation, as the given information was an essential addition to understanding the associations. Tables with all extracted data, regarding contextual factors, etc. can be found in *appendix B* (table B1-B8). According to the NOS scale, 10 out of 15 articles were high quality, and five were middle quality (appendix C).

Figure 2

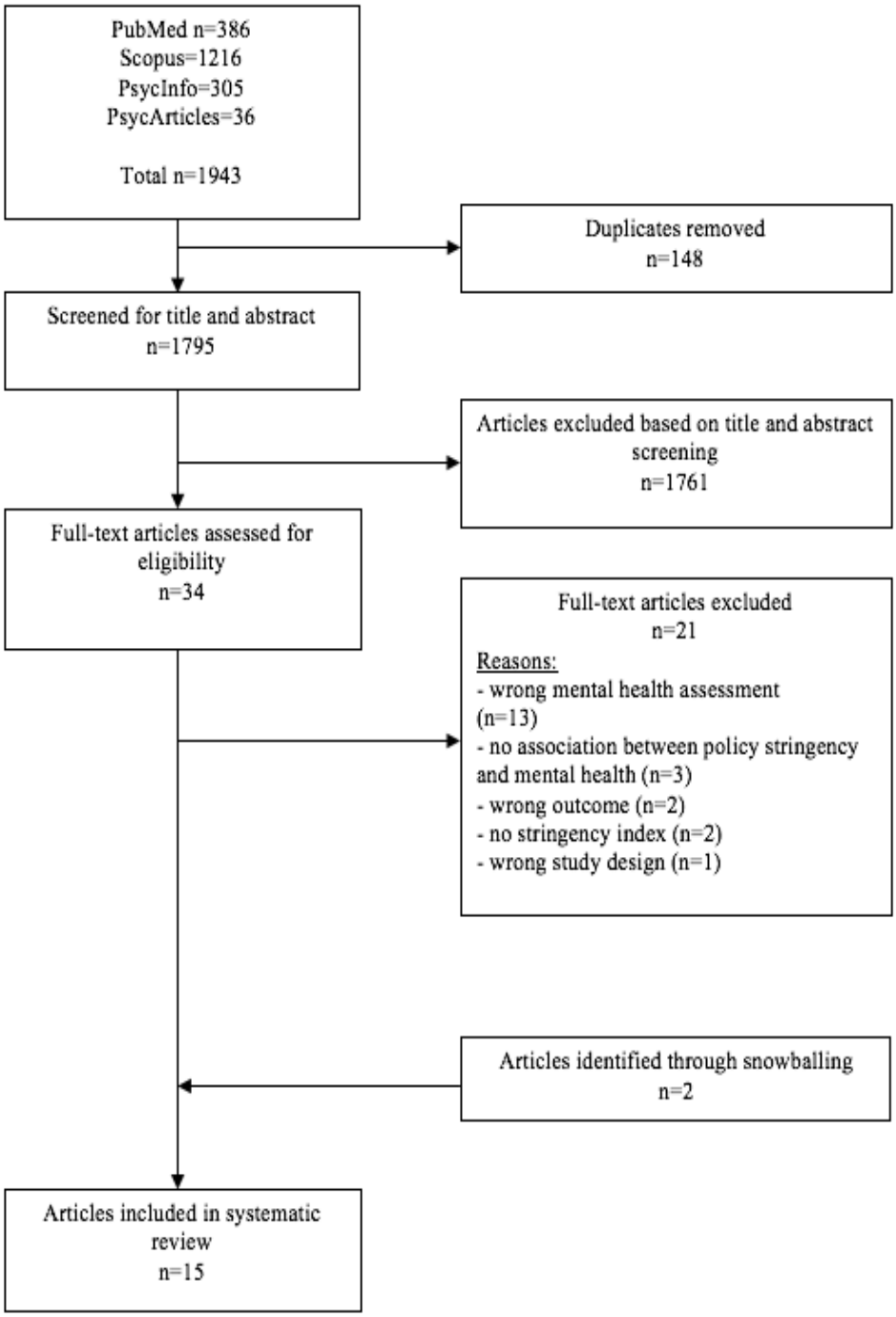


Table 3

Characteristics of included articles

Author(s)	N	Country/countries	Study design	Population type	Age in years mean (SD)	Female %	Measure of stringency	Measure of mental health
Aebi et al. (2022)	873	CH	repeated cross-sectional	somatic inpatients	N/R (≥65 years: 45.4%; <65; 54.6%)	52.5	Overall stringency index	depression, anxiety
Aknin et al. (2022)	432,642	15 countries: AU, CA, DK, FI, FR, DE, IT, JP, NL, NO, SG, KOR, ES, SE, UK	repeated cross-sectional	adults	N/R (30 years or less: 19.25%, 30-60 years: 53,78%, over 60 years: 26,97%)	51.65	Overall SI	psychological distress
Buffel et al. (2022)	78,312	26 countries: IS, NO, DK, SE, FR, FI, CY, CH, RO, CA, DE, IL, SK, GR, CZ, PT, HU, RUS, NL, IT, BE, UK, USA, ES, SA, TR	cross-sectional	students	N/R	N/R	Sub-indices of the overall SI	depression
Cepulic et al. (2021)	89,798	45 countries: AT, DK, NZ, IE, NO, SE, FI,CH, DE, UK, AU, NL, CA, US, LT, HU, AR, SA, IT, JP, PK, CZ, ES, TW, GR, KOR, PT, BE, TR, CO, FR, PL, BR, BG, VT, HR, ID, BD, MX, RS, BA, RO, PH, MY, SK	cross-sectional	adults	39.37 (13.89)	73.52	Overall SI	psychological distress

Table 3 (continued)

Author(s)	N	Country/countries	Study design	Population type	Age in years mean (SD)	Female %	Measure ofstringency	Measure of mental health
Hajek et al. (2022)	8,319	8 countries: DE, UK, DK, NL, FR, PT, IT, ES	longitudinal	adults	N/R (18-29: 15.86%, 30-49: 37.76%, 50-64: 25.86%, 65-74: 17.66%, 75+: 3.27%)	51.80	Overall SI	depression and anxiety
Lee et al. (2021)	2,683	9 countries: KOR, CN, JP, PH, ID, PE, PY, DRC, ETH	cross-sectional	adults	25.71 (8.55)	67.16	overall SI	depression
Long et al. (2021)	21,354	8 countries: GR, IT, NL, RUS, SA, SE, UK, US	cross-sectional	adults	44.7 (15.7)	52.5	overall SI	overall Mental health
Ochnik et al. (2021)	2,349	9 countries: PL, SI, CZ, UA, RUS, DE, TR, IL, CO	cross-sectional	students	N/R	69.30	overall SI	psychological distress, anxiety, depression
O'Hara et al. (2020)	106,497	58 countries: BR, US, UK, DE, SE, CH, BY, RUS, MX, TR, CA, FR, ES, PE, CO, IT, ID, UA, NL, QA, AT, IN, AU, AR, VT, RO, FI, PH, IE, LATV, AL, VE, SK, BE, JP, DO, PT, CL, SA, MY, DK, PL, SG, IL, CN, KE, MA, NZ, GR, BG, EC, NO, TH, KOR, CZ, UY, HU,	cross-sectional	adults	39.96 (12.99)	56.4	overall SI	depression

Table 3 (continued)

Author(s)	N	Country/countries	Study design	Population type	Age in years mean (SD)	Female %	Measure ofstringency	Measure of mental health
Plett et al. (2022)	7,008	CA	Repeated cross-sectional	adults	N/R (18-29: 12.2%; 30-39:26.7%; 40-49: 14.2%; 50-59: 16.4%; 60-69: 18.5%; 70+:11.9%)	49.6	Sub-indices of the overall SI	anxiety
Riehm et al. (2022)	16,177,184	43 countries: AR,AT,AU,BE, BG,BR,CA,CH,CL,CO,CR,CZ, DE,DK,EE,ES,FI,FR,GR,HU, ID,IE,IL,IN,IS,IT,JP,LATV,LT, LU,MX,NL,NO,NZ,PL,PT,RO, RUS,SA,SE,SI,TR,UK	Cross-sectional	adults	N/R (18-24: 16.9%, 25-34: 26.8%, 45-54:16.4%, 55-64:9.8%, 65+:10.8)	44.3	overall SI (sub-indices in appendix)	anxiety and depression
Schifano et al. (2021)	9,713	5 countries: FR, IT, DE, ES, SE	longitudinal	adults	43.53	48.0	overall SI	Anxiety and depression
Toffolutti et al. (2022)	15,147	28 countries: AT, BE, BG, HR, CY, CZ, DK, EE, FI, FR, DE, GR, HU, IE, IT, LATV, LT, LU, MT, NL, PL, PT, RO, SK, SI, ES, SE, UK	longitudinal	adults	N/R (18-29: 9.95%; 30-44: 29.28%; 45-64: 48.82%; 65+: 11.95)	70.13	Sub-indices of the overall SI	overall Mental health

Table 3 (continued)

Author(s)	N	Country/countries	Study design	Population type	Age in years mean (SD)	Female %	Measure ofstringency	Measure of mental health
Van der Velde et al. (2021)	99,689	26 countries: BE, CA, CZ, CY, DK, FI, FR, DE, GR, HU, IS, IL, IT, NL, NO, PT, RO, RUS, SK, SA, ES, SE, CH, TR, UK, US	cross-sectional	students	N/R (17-25: 78.3%, 26 and older: 21.7%)	73.9	overall SI	depression
Wijngaard et al. (2020)	93,125	47 countries: AR, AU, AT, BE, BR, BG, CL, CO, CZ, DK, DO, EC, FR, DE, GR, HU, IN, ID, IL, IT, JP, KE, MX, MA, NL, NZ, NO, PE, PH, PL, PT, RO, RUS, SG, SK, SA, KOR, ES, SE, CH, TH, TR, UA, UK, US, VT	cross-sectional	adults	39.1 (13.0)	56.0	overall SI	depression

Note. **Abbreviations of countries:** AL=Albania, AR=Argentina, AT=Austria, AU = Australia, BA=Bosnia & Herzegovina, BD=Bangladesh, BE=Belgium, BG=Bulgaria, BR=Brazil, BY=Belarus, CA=Canada, CH=Switzerland, CL=Chile, CN=China, CO=Colombia, CR=Costa Rica, CY=Cyprus CZ=Czech Republic, DE=Germany, DK=Denmark, DO=Dominican Republic, DRC=Congo, EC=Ecuador, EE=Estonia, ES=Spain, ETH=Ethiopia, FI=Finland, FR=France, GR=Greece, HR=Croatia, HU=Hungary, ID=Indonesia, IE=Ireland, IL=Israel, IN=India, IS= Iceland, IT=Italy, JP=Japan, KE=Kenia, KOR=South Korea, LATV=Latvia, LT=Lithuania, LU=Luxembourg, MA=Morocco, MT=Malta, MX=Mexico, MY=Malaysia, NG=Nigeria, NL=Netherlands, NO=Norway, NZ=New Zealand, PE=Peru, PH=Phillippines, PK=Pakistan, PL=Poland, PT=Portugal, PY=Paraguay, QA=Qatar, RO=Romania, RS=Serbia, RUS=Russia, SA=South Africa, SE=Sweden, SG=Singapore, SI=Slovenia, SK=Slovakia, TH=Thailand, TR=Turkey, TW=Taiwan, UA=Ukraine, UK=United Kingdom, USA=United States, UY=Uruguay, VE=Venezuela, VT=Vietnam

5.2 Measures of policy stringency and mental health

Policy stringency was assessed in all articles with the stringency index by the OxCGRT. 12 articles used the overall stringency index with a range from 0 to 100 points. Three articles only used the sub-indices of the stringency index, with an ordinal scale from 0 to 3 points (Buffel et al., 2022; Plett et al., 2022; Toffolutti et al., 2022). Detailed information can be found in *table B1*. Mental health as a generic concept was assessed in two articles with the WHO-5 scale. Psychological distress was assessed in three articles with the PHQ-4 (n=1), and the PSS-10 (n=2). Depression was assessed in ten studies with the PHQ-8 (n=3), the CES-D (n=2), the PHQ-4 (n=1), the PHQ-9 (n=3), and with depression items of the K-10 (n=1). Anxiety was assessed in six studies with the GAD-7 (n=4), the PHQ-4 (n=1), and with anxiety items of the K-10 (n=1). Detailed information about assessment tools used per study, can be found *in table B1*. All mental health scales are measured on scales with points as units. The point ranges, as well as cut-off values can be found in *table 2.*

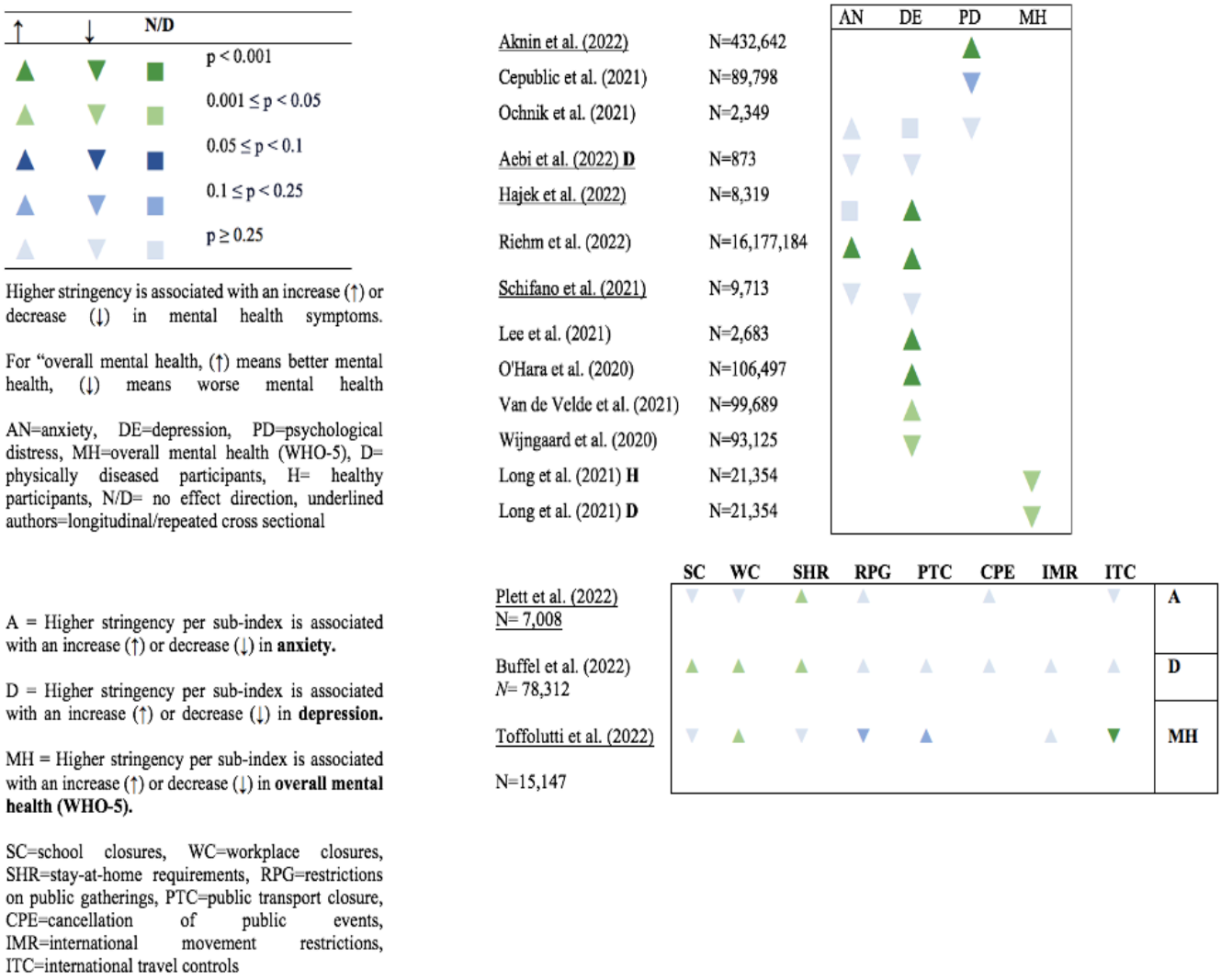
5.3 Associations of policy stringency and mental health

Results of the cross-sectional studies were synthesized for each condition, namely anxiety, depression, and psychological distress. The results of longitudinal and repeated cross-sectional studies were summarized in a separate section. As overall mental health was assessed in only two studies with the WHO-5 (one cross-sectional and one longitudinal), the narrative synthesis of these results was done in an additional, separate section. One additional section is about the different population types within this review, and one section evaluates additional findings of articles that investigated influencing factors of the association between policy stringency and mental health. Additionally, to the following sections, all narrative evaluations of articles can be found in *appendix D* for a structured overview of results per study (table D1). Due to the few included articles, only a few studies were grouped in each mental health condition of interest. Therefore, no meta-analysis was conducted. In addition, conversion of effect sizes into standardized ß's was not possible in many cases, as necessary

information was missing. As an alternative, this review followed the SWiM guidelines (Campbell et al., 2020) for synthesizing results, as well as visualizations to present results clearly, and comprehensively: An effect direction heatmap was created of all included articles, as well as albatross plots for each specific association between policy stringency and depression, anxiety, psychological distress, and overall mental health. Visualizations of the association between policy stringency and all mental health conditions can be found in *figure 1*. The figures present each article's outcome and condition within an effect direction heatmap. Albatross plots can be found in *figure E1-E4* (appendix E).

Figure 1

Effect direction heatmap of the association between policy stringency, and the mental health conditions



5.3.1 Associations between policy stringency and anxiety

Two cross-sectional articles investigated the association between policy stringency and anxiety (Ochnik et al., 2021; Riehm et al., 2022). In the cross-sectional study of Ochnik et al. (2021) across nine countries (South America, Asia, Europe) with a sample of 2,349 students, no significant association between the stringency of policy measures and anxiety (*B*=0.04 [-0.37-0.46], p=.860) was found across countries. It was not reported if the study controlled for confounding factors. The cross-sectional study of Riehm et al. (2022) studied a sample of 16,177,184 adults across 43 countries (all continents). Countries with more stringent policy measures were associated with higher levels of anxiety and depressive symptoms, relative to countries with lower stringency, when adjusted for age, gender, economic support index, working outside the home, urbanicity, COVID-19 cases, and the number of COVID-19 deaths. A one-point increase in policy stringency on the overall stringency index (0 to 100 points) was associated with a 1.4% increase in anxiety (OR=1.014 [1.008 to 1.019]) and a 2.7% increase in depression OR=1.027 (1.022 to 1.032) on the K-10 scale, ranging from 0 to 20 for anxiety, and from 0 to 30 for depression.

5.3.2 Associations between policy stringency and depression

Seven articles investigated the association between policy stringency and depression with a cross-sectional study design. In the article of Buffel et al. (2022) across 26 countries (North America, Europe, Asia, and Africa) with a sample of 78,312 students, a higher stringency of policy measures was associated with higher levels of depressive symptoms, indicating that in countries with stricter policy measures, higher levels of depressive symptoms were found, relative to countries with less strict measures. Depressive symptoms were measured by the CES-D, ranging from 0 to 60 points. Three sub-indices of the stringency index (each ranging from 0 to 3 points), namely school closures (*β*=0.871 [0.306 to 1.437], *SE*=0.288, *p*=.003), workplace closures (β=1.040 [0.441 to 1.639], *SE*=0.306, *p*=.001) and stay-at-home requirements (*β*=0.880 [0.127 to 1.634], *SE*=0.384, *p*=.022), were

significantly associated with depressive symptoms, when controlled for demographic, educational and financial variables, as well as for pandemic intensity (e.g., excessive mortality) and economic factors (GDP per capita and youth unemployment rate). This means, e.g., that a country with a higher stringency of one standard deviation in stay-at-home requirements, relative to a country with a lower stringency, was associated with a higher depression score on the CES-D by 0.880 standard deviations, on average. Cancellation of public events, restrictions on public gatherings, public transport closure, internal movement restrictions, and international travel controls was not significantly associated with depressive symptoms.

In the study of Lee et al. (2021) across nine countries from South America, Africa, and Asia, varying policy stringency between countries was significantly associated with variations in depressive symptoms within a sample of 2,683 adults. Levels of depression were higher in countries where policy stringency was higher (β=0.139 [0.074 to 0.203], p<.001) in comparison to countries with less strict policy measures. In particular, in countries with a higher stringency (0 to 100 points) of one standard deviation, relative to countries with lower stringency, the score in depression on the PHQ-9 (0 to 27 points) was 0.139 standard deviations higher, on average. It was not reported if the study controlled for confounding factors.

In addition, O'Hara et al. (2020) found a significant association between depression and policy stringency (ß=0.02 [0.02-0.03], p<.001) in a cross-sectional study across 58 countries (all continents), with a sample of 106.497 adults. Countries with stricter measures were associated with higher levels of depression in the population relative to countries with less strict measures. In countries with a higher overall stringency (0-100 points) of one standard deviation, depression scores on the PHQ-9 scale (range from 0 to 27 points) were 0.02 standard deviations higher, relative to countries with lower stringency, when adjusted for age, education, and income.

Similar to the previously mentioned articles, Van der Velde et al. (2021) found a significant association between the stringency of policy measures and depressive symptoms among a sample of 99,689 students (b = 0.045, SE=0.021, p<.05), when adjusted for age, gender, migrant background, relationship status, socioeconomic status, academic-related factors, and country-level factors, across 26 European, Asian and North American countries. Countries with stricter policy measures were associated with higher levels of depression in students relative to countries with less strict measures. Across countries, an increase by one point on the overall stringency index was associated with an increase of 0.045 points in depressive symptoms on the CES-D scale, ranging from 0 to 60 points on average.

In contrast, the study by Wijngaard et al. (2020) with a sample of 93,125 adults from 47 countries (all continents) showed that countries with stricter policy measures were associated with lower levels of depression relative to countries with less strict policy measures (β=-0.877 [-1.65 to -0.10], SE=0.394, p<.05), when adjusted for individual-level variables (e.g., age, gender, monthly household income), and country-level variables (e.g., number of and day-to-day change in COVID-19 cases and the number of deaths per capita). On average, in countries where policy stringency (0 to 100 points) was one point higher, relative to countries with lower stringency, depressive symptoms were 0.877 points lower on the PHQ-8 scale (0 to 24 points).

As for anxiety, Ochnik et al. (2021) found no significant association between the stringency of policy measures and depression (B=0 [-0.4-0.41], p=1) across nine countries (South America, Asia, Europe) within a sample of 2,349 students. However, it was not reported if the study controlled for confounding factors.

Regarding the article of Riehm et al. (2022) across 43 countries (all continents) within a sample of 16,177,184 adults, countries with more stringent policy measures were associated with higher levels of depressive symptoms relative to countries with lower stringency, when adjusted for age, gender, economic support index, working outside home, urbanicity, COVID-

19 cases, and the number of COVID-19 deaths. A one-point increase in policy stringency on the overall stringency index (0 to 100) was associated with a 2.7% increase in depression OR=1.027 (1.022 to 1.032) on the K-10 scale, ranging from 0 to 30 points.

5.3.3 Associations between policy stringency and psychological distress

The association between policy stringency and psychological distress was assessed in two cross-sectional studies. Cepulic et al. (2021) and Ochnik et al. (2021) did not find significant associations. Cepulic et al. (2021) investigated the association in a sample of 89,798 adults across 45 countries from North America, South America, Europe, Asia, Africa, and Oceania. No significant association of policy stringency and psychological distress, measured with the PSS-10 (range from 0 to 40 points), was found between different countries with differing stringencies (*B*=-0.035 [-0.092 to 0.022], *p*=.230). In addition, Ochnik et al. (2021) studied a sample of 2,349 students. Countries with stricter measures were not significantly associated with higher levels of psychological distress (*B*=0.02 [-0.45-0.53], *p*=.942). It was not reported if the study controlled for confounding factors.

5.3.4 Associations between policy stringency and overall mental health (WHO-5)

Two articles investigated the association between policy stringency and overall mental health, measured by the WHO-5, ranging from 0 to 100 points, where 0 represents the lowest possible mental health, and 100 represents the best possible mental health (Topp et al., 2015). Long et al. (2021) investigated the association within a cross-sectional study across eight countries from North America, Europe, Africa, and Asia. A significant association between mental health and policy stringency within a sample of 21,354 adults was found. The study separated the association results for healthy (*B*=-30.6, *p*<.05) and chronically diseased adults (e.g., asthma, rheumatism, or cancer) (*B*=-17.9, *p*<.05). When stringency increased by one on the overall stringency index (0 to 100), mental health decreased by 30.6 on the WHO-5, that ranges from 0 to 100, where 0 represents the worst and 100 the best possible mental health in healthy adults, and by 17.9 in chronically diseased adults, on average. As the study reported

the concrete mean stringency indices of each country, an increase in stringency from 64.8 in Sweden to 93.5 in Italy was associated with a decrease of 8.35 points in mental health in healthy adults and with a decrease of 4.89 points in mental health in chronically diseased adults on the WHO-5. It was not reported if the study controlled for confounding factors. In contrast, Toffolutti et al. (2022) investigated the longitudinal relationship between the sub-indices of the stringency index and mental health in a sample of 15,147 adults from 28 European countries, namely: stay-at-home requirements, internal movement restrictions, international travel controls, restrictions on public gatherings, cancellation of public events, school-, workplace-, and transport closures. All sub-indices were coded on an ordinal scale from 0 to 3. Stricter measures of international travel controls (*B*=-0.63 [-0.79 to -0.47]) and restrictions on public gatherings (*B*=-0.24 [-0.38 to -0.10]) were negatively associated with mental health, compared to an assessment point at which policy stringency was lower. In contrast, workplace closures (*B*=0.29 [0.11 to 0.48]) were positively related to mental health relative to an assessment point at which policy stringency was less strict. This indicates, e.g., that an increase by one point in the stringency of international travel controls is associated with a 0.29-point increase in mental health on the WHO-5 scale that ranges from 0 to 100.

5.3.5 Longitudinal and repeated cross-sectional associations

Longitudinal and repeated cross-sectional associations of policy stringency and anxiety, depression, and psychological distress, were assessed in six articles.

All articles investigating the association between policy stringency and anxiety over time did not find a significant association between the overall stringency index (0-100 points) and anxiety, indicating that varying stringency over time was not significantly related to variations in anxiety: In a repeated cross-sectional study from Switzerland (Aebi et al., 2022) with 873 hospital inpatients, that were not admitted for COVID-19, no significant change in anxiety, measured with the GAD-7 (*B*=1.68 [−5.10 to 8.45], *p*=0.312) was found from modest (June-October 2020) to strong (October 2020-April 2021) COVID-19 policy stringency (scale from

0 to 100), when adjusted for sex, age group, nationality, education level, marital status, the weekly incidence of COVID-19 infections in Basel-Stadt, and hospital. Detailed values of the stringency index that define “modest” and “strong” stringency were not given. In a longitudinal study by Hajek et al. (2022) across eight European countries (June 2021-January 2022, 3 waves) with a sample of 8,319 adults, no significant association between policy stringency and anxiety was found over time (β=0.00, *SE*=0.00, p=1). In the longitudinal study of Schifano et al. (2021) across five European countries, with a sample of 9,713 adults, varying stringency over time was not significantly associated with variations in anxiety (assessed with GAD-7) over time.

In contrast to the overall stringency index, the association between one sub-index of the overall stringency index, namely stay-at-home requirements, was significantly associated with anxiety over time: In a repeated cross-sectional study with a Canadian sample of 7008 adults by Plett et al. (2022), the association between six sub-indices of the stringency index and anxiety was investigated. The sub-indices of interest were international travel controls, stay-at-home requirements, restrictions on public gatherings, cancellation of public events, workplace- and school closures. All sub-indices were measured on an ordinal scale from 0 (no measure) to 3 (strictly required measure). Only the association between stay-at-home orders and anxiety was significant (β=0.07 [0.011 to 0.129], *SE*=0.03, p<.05), indicating that an increase of one standard deviation in stay-at-home orders, relative to the lowest observed stringency on a scale from 0 to 3 over the assessment period, was associated with an increase by 0.07 standard deviations in anxiety on the GAD-7 (0 to 21 points), on average. The association between all other sub-indices and anxiety was not significant, namely international travel controls (β=-0.06, [-0.138 to 0.018], *SE*=0.04), restrictions on public gatherings (β=0.06 [-0.136 to 0.256], *SE*=0.10), cancellation of public events (β=0.05 [-0.048 to 0.148], *SE*=0.05), workplace closure (β=-0.04 [-0.216 to 0.136], *SE*=0.09), and school closures (β=-0.06 [-0.178 to 0.058], *SE*=0.06).

Three articles assessed the association between policy stringency and depression over time: Hajek et al. (2022) found a significant association between policy stringency and depression within the scope of a longitudinal study across eight European countries (June 2021-January 2022, 3 waves) in a sample of 8,319 adults. An increase of one point in policy stringency, relative to, e.g., the lowest observed stringency over the assessment period on a scale from 0 to 100, was associated with a 0.003-point increase in depressive symptoms on the PHQ-4 scale, expressed by a standardized scoring system from 0 to 12, on average (B=0.003 [0.00298 to 0.00302], SE=0.00, p<.001). In contrast, Aebi et al. (2022), and Schifano et al. (2021), did not find significant associations between policy stringency and depression over time. In the repeated cross-sectional study from Switzerland by Aebi et al. (2022) with 873 hospital inpatients that were not admitted for COVID-19, no significant change in depression, measured with the PHQ-8 (B=-1.43[−9.23 to 6.37], p=0.875) was found from modest (June-October 2020) to strong (October 2020-April 2021) COVID-19 policy stringency (scale from 0 to 100), when adjusted for sex, age group, nationality, education level, marital status, the weekly incidence of COVID-19 infections in Basel-Stadt, and hospital. Schifano et al. (2021) also did not find a significant association. Varying stringency over time was not associated with variations in depression (assessed with the PHQ-9), within the scope of a longitudinal study across five European countries, with a sample of 9,713 adults.

Regarding psychological distress, only one study assessed the association between policy stringency and psychological distress over time: In a sample size of 432,642 adults from 15 countries (North America, Europe, Asia), policy stringency and psychological distress were positively and significantly associated in a longitudinal analysis from April 2020 to June 2020 within five waves (Aknin et al., 2022). Stricter policy measures were associated with higher psychological distress compared to an assessment point with lower stringency. When controlling for demographic and contextual variables, as well as country-fixed effects, a change of 0.01 on the policy stringency scale, expressed as an index from 0 to 1 point, was

associated with a 0.142-point increase in psychological distress, on average (*B*=0.142 [0·091 to 0·193], *p*=.0001). The overall stringency index was rescaled in this study from 100 to 1. Psychological distress was expressed by the standardized scoring system of the PHQ-4 scale (ranging from 0 to 12 points). Furthermore, the study reported that a change in policy stringency from 0.17 (lowest assessed stringency over time) to 0.93 (highest assessed stringency over time) was associated with a 0.11-point increase in psychological distress on the PHQ-4 scale (Aknin et al., 2022). When pandemic intensity was added as a control, the association between psychological distress and policy stringency remained significant and positive: controlling for daily deaths/100,000 (*B*=0·088 [0·024 to 0·151], *p*=0.0107), controlling for daily cases/100,000 (*B*=0·110 [0·064 to 0·155], *p*=.0002).

5.3.6 Associations in different populations

Most of the 15 included articles assessed the association between policy stringency and mental health in adults of the general population (N=11). As studies have been evaluated in the previous sections, this section will not give exact values and interpretations again. They can be found in *appendix B* (*table B1-B8*). This section merely serves as an additional broad comparison of specific groups within the studied populations, namely students and diseased adults (chronically ill adults and hospitalized inpatients). One of the articles assessed the association between policy stringency and mental health (WHO-5) across countries in chronically diseased adults (Long et al., 2021). The article of Aebi et al. (2022) studied diseased adults within a longitudinal design (PHQ-8 and GAD-7). It investigated the association between policy stringency and anxiety and depression in a sample of hospital inpatients that were not admitted for COVID-19. While Aebi et al. (2022) did not find significant associations between policy stringency and depression and anxiety in diseased and hospitalized adults, Long et al. (2021) found a significant association between policy stringency and mental health in chronically diseased adults (not hospitalized). The remaining three articles assessed the association of policy stringency and anxiety, depression, and

psychological distress in a sample of students across countries (Buffel et al., 2022; Ochnik et al., 2021; Van der Velde et al., 2021). Two of the three articles found a significant association between policy stringency and depression (CES-D) (Buffel et al., 2022; Van der Velde et al., 2021).

5.4 Influencing factors on the association between policy stringency and mental health

Three articles investigated factors that seem to moderate the association between policy stringency and mental health: O'Hara et al. (2020) found that trust in the government moderates the association between policy stringency and depressive symptoms (table B7). Both men and women that strongly trusted, or distrusted the government, showed higher depression scores on the PHQ-9 in countries with higher stringency. Similarly, Aknin et al. (2022) found that people who evaluated the government low had higher depression scores over time when stringency was higher (table B7). Furthermore, it was reported that countries following an elimination strategy instead of a mitigation strategy could restrict mental health effects. Due to different policy timings, countries pursuing an elimination strategy had less stringent policies than countries pursuing mitigation strategies. In addition, Wijngaard et al. (2020) found that personality traits like introversion and extraversion seem to moderate the association between policy stringency and depression. Extraverts seem to suffer more from strict COVID-19 policy measures than introverts.

5.5 Albatross plots

The albatross plots show heterogeneous results. *Figure E1* shows that psychological distress seems to worsen over time, while anxiety is more likely to differ across countries (figure E2). In both cases, effect sizes are relatively small (β=+- 0.05). *Figure E3* shows the magnitude of the association between policy stringency and depression. Effect sizes are relatively small (β=+- 0.05, β=+- 0.10). Overall, cross-sectional studies seem to show more significant associations between policy stringency and depression, compared to longitudinal studies, as well as larger effect sizes.

6. Discussion

The present work investigated the association between the stringency of policy measures and mental health during the COVID-19 pandemic across 75 countries from all continents within the general population. 11 out of 15 studies investigated the association between policy stringency and mental health with the overall stringency index. One study investigated the association with the overall stringency index and the sub-indices, and three studies only with the sub-indices. One out of 15 articles found significant associations between policy stringency and psychological distress, two out of 15 articles between policy stringency and anxiety, seven out of 15 studies between policy stringency and depression, and two out of 15 between policy stringency and overall mental health (WHO-5): Most significant associations were found between policy stringency and depression, followed by overall mental health and anxiety. Only one article found significant associations between psychological distress and policy stringency. These findings contradict the fact that psychological distress can be seen as a precursor for anxiety as a more short-term consequence, and depression as a more long-term consequence (Starr & Davila, 2012). This can be due to the number of included studies, and the few number of studies investigating psychological distress and anxiety. A comparison, which mental health condition, has been affected most by policy stringency (across countries, but also over time) can't be made. Further investigations of the association between the separate mental health conditions have to be made. Especially psychological distress has to be investigated, as it is known as a precursor for anxiety and depression, and an early detection of highly distressed populations could prevent worse mental health conditions through precise improvements of policy responses, as well as prevention and support-programs during times of crisis. Furthermore, four studies didn't find any significant results (Aebi et al., 2022; Cepulic et al., 2021; Ochnik et al., 2021; Schifano et al., 2021). Firstly, this can be due to a significantly smaller sample size in comparison to the other included articles (Aebi et al., 2022: N=873, Ochnik et al. 2021:

N=2349, Schifano et al., 2021: *N*=9713). And secondly, the PSS-10 questionnaire seems to play a role in not finding significant results, as only Ochnik et al. (2021), and Cepulic et al. (2021) used the PSS-10 for assessing psychological distress and didn't find significant results. In contrast, Aknin used the PHQ-4 for assessing psychological distress and found significant associations. However, actual statements about reasons can't be made, as the number of studies to compare is very small.

Regarding the direction of effects, 10 articles with significant associations reported that stricter policies worsen mental health. Only two studies reported that stricter policies were associated with better mental health (Toffolutti et al., 2022; Wijngaard et al., 2020). For Wijngaard et al. (2020), the time point of assessment seems to be an explanation, as it is the study with the earliest time point of data collection. The data collection was conducted from March 2020 to the beginning of April, when all policy measures were relatively new and seemed to give an initial feeling of security, which shifted after a few weeks/months of implementation to the contrary. For Toffolutti et al. (2022), the benefits of working from home might be an explanation. As most of the sample was female (70%), and women are still the primary caretaker of children in most cases, working from home might have facilitated, e.g., tasks like homeschooling, etc.

Regarding the study design, cross-sectional findings indicated that stricter policy measures were associated with higher levels of anxiety, depression, and lower levels of overall mental health (measured with the WHO-5) within the general population in comparison to countries with less strict policy measures. These findings align with longitudinal and repeated cross-sectional findings: Four out of six articles showed positive and significant associations between policy stringency and depression, anxiety, and psychological distress, as well as a significant and positive association between policy stringency and overall mental health (WHO-5). Therefore, severe stringency seems to be

associated with severe mental health between countries with different stringencies, but also over time.

Articles that investigated the association between the stringency of sub-indices of the stringency index and mental health found significant associations between stay-at-home requirements, school closures, workplace closures, and international travel controls, and depression, anxiety, and overall mental health (WHO-5) within the general population. Significantly, stricter stay-at-home requirementswere mainly associated with worse depression, and anxiety, relative to countries with less strict measures (respectively relative to assessment points with less strict measures over time in repeated cross-sectional and longitudinal studies). Although studies about the association between mental health and the sub-indices of policy stringency exist, the number of studies compared to those that investigate the overall stringency index is small. Therefore, more studies are needed to investigate the association of single policy measures and mental health to see which measures particularly worsen the population's mental health.

Regarding the different studied populations, two of three articles that studied students exclusively, found positive and significant associations between policy stringency and depressive symptoms. Especially school closures, workplace closures, and stay-at-home requirements were positively associated with depressive symptoms in students. Especially changes in social contacts, and day structure, as well as financial worries through losses of student jobs, moving back to parents, and different methods of education might be an explanation for this association (Buffel et al., 2022; Van der Velde et al., 2021). Two further articles studied a sample with a physical illness. Long et al. (2021) showed that countries with stricter policy measures were associated with worse mental health in diseased adults, compared to countries with less strict policy measures. This is consistent with findings of Feter et al. (2020), that showed a higher likelihood of worse mental health in people with a chronical disease during the COVID-19 pandemic, compared to before the pandemic. Aebi et

al., (2022) did not find significant associations between policy stringency, and depression, and anxiety. The inconsistency in findings can be due to a relatively small sample size (*N*=873), in comparison to the article of Long et al. (2021) (*N*=21,354). In addition, Aebi et al. (2022) mentioned, that measures didn't affect inpatients directly, as they were primarily focused on physical recovery.

Regarding the quality assessment, 10 out of 15 studies were high quality, while 5 studies were middle quality. The main reason for studies being rated as middle quality was that they didn't adjust for any factors. Especially when studying the influence of a pandemic, it seems important to adjust for related factors e.g., about the pandemic intensity (deaths, and new cases), besides adjusting for demographic factors (e.g., age, and gender).

The present work's findings align with other systematic reviews about the association between policy stringency and mental health (Lee et al., 2021; Salanti et al., 2022). Although Lee et al. (2021) stated that more stringent policy measures are associated with better mental health outcomes, these findings only hold true when countries implemented stricter policy measures very soon. When countries implemented stricter measures over an extended period, stricter policy measures were also associated with higher levels of depression. Salanti et al. (2022) also showed that a higher stringency of policy measures was associated with higher levels of depression and anxiety. As already mentioned in the introduction, also past endemics (e.g., Ebola, Zika virus, or the SARS endemic) demonstrated a negative impact on mental health due to isolating policy measures (Jalloh et al., 2015; Maunder, 2009; Peng et al., 2003; Tucci et al., 2017).

Although specific and strict policy measures were mandatory to confine the spreading of COVID-19, these measures were carried out on the general population's mental health. It can be assumed that especially vulnerable groups have been affected by strict policy measures, e.g., migrant workers, people in low-paid jobs, students, unemployed people, or the elderly (to name a few): People, who are at higher risk for job loss, loss of insurance,

loneliness, or financial worries. All are factors, that can negatively influence mental health (Alegría et al., 2018). In addition, all policy measures of the stringency index aim at social isolation, but especially stay-at-home requirements have been shown to be associated with worse mental health. This is in line with research about determinants of mental health. Past studies emphasized that employment, income, and social support are the main social determinants of mental health (Alegría et al., 2018; Brydsten et al., 2018; Reibling et al., 2017). These findings highlight the need to further investigate the impact of policy measures on the population's mental health, particularly with regard to the social determinants of mental health. This could be done with qualitative research in forms of representative testimonials of the pandemic and its policy measures, perceptions of the government, and wishes for future pandemics/endemics. These insights could help to get a deeper understanding of societal, and also individual resilience, and therefore assist in reducing mental health struggles in future crises, as well as setting up highly effective prevention programs.In addition, influencing factors have to be investigated in more detail, as O'Hara et al. (2020), Aknin et al. (2022), and Wjingaard et al. (2022) did in their paper, e.g., investigating the moderating effect of the household situation, frequency and intensity of contact with other people, and/or relationship status within the association between policy stringency and mental health, as policy measures primarily focuses on isolation. Therefore, these variables might be attenuating factors.

7. Strengths and limitations

The present work is the first systematic review synthesizing associations between policy stringency and mental health. Although Lee et al. (2021) and Salanti et al. (2022) investigated the association between mental health and policy stringency within a systematic review and meta-analysis, both used policy stringency as a moderator in a meta-regression. To date, no review of studies about the impact of policy stringency on mental health exists. Therefore, this thesis is the first one studying the direct association. Furthermore, this study

includes 75 countries from all continents with a large sample size of over 17 million participants, more closely approximating the population. In addition, the present work pre-defined mental health assessments that included studies that had to use.

On the one hand, this pre-definition is a strength, as it ensures a standardized and valid assessment of participants' mental health status. On the other hand, 13 papers had to be excluded that used self-generated questions to assess the mental health of participants, which would have been an informative asset to the findings of this study. Moreover, results were limited only to the English language, which causes language bias and may cause missing important articles. Another limiting aspect is the search strategy. Although another researcher did 10% of the search process, the leading search and snowballing were done by one researcher. Therefore, the missing of relevant literature must be considered.

Regarding the missing of relevant literature, publication bias has to be considered, as findings are usually published when providing significance (Dwan et al., 2008). Therefore, the findings of this review might be overrated. Nonetheless, the present work narratively synthesized the results of 15 included studies, of which 11 demonstrated significant results.

8. Policy implications

For future pandemics and/or endemics, a consensus between supporting and protecting vulnerable groups (e.g., the elderly) and the common good, especially regarding health, in the general population has to be found. While stringent policy measures may be mandatory again, support services have to be strengthened: Financially through supportive payments and from a mental health perspective, through a broader offer of socializing possibilities, e.g., virtual groups for social interaction, or outdoor activities, like walking tours. In addition, a preventive program within the scope of a civil protection program would be an option, that could be freely available for everyone, aiming at strengthening the resilience of people, which is also defined as "the ability to cope" with burdening events (Mowbray, 2011). Conceivable would

be an integration of the positive psychology approach, as it is proven to prevent and reduce mental health burdens, and to foster “the positive” in life, even in times of adverse events (Devi, 2021). Exercises like practicing gratitude, savoring (whereby an individual can enhance positive emotions through appreciating certain life experiences or the actual moment in a mindful way), or fostering one’s own strength, could be integrated into a preventive or supportive intervention (ibid.). A similar approach was already tested during the COVID-19 pandemic in different samples, that showed significant improvements in well-being, resilience, and positive emotions, as well as reductions in loneliness, and fear of COVID-19 (Brouzos et al., 2021; García-Alvarez et al., 2021). Therefore, a preventive or supportive program based on the positive psychology approach might be effective in mitigating negative effects of future endemics/pandemics.

Additionally, increased capacities of supportive hotlines, or support programs via a chat system in times of isolation would be possible. People could have short check-ins with psychologists, social workers and/or psychology-, and social work students, or even chat-bots.

Furthermore, as O'Hara et al. (2020) and Aknin et al. (2022) showed that trust in government seemed to be an essential determinant in the association of policy stringency and mental health, governments must work on their communication with the general population. As distrust in governments and low evaluations of governments were associated with an increase in depressive symptoms and psychological distress in countries with stricter policy measures relative to countries with less strict measures (Aknin et al., 2022; O'Hara et al., 2020), trust has to be strengthened through more transparency and certainty within future pandemics/endemics: This is also a consequence of Margraf et al. (2020), who investigated perceptions of policy measures across eight countries. More transparency could be achieved by an informative website (containing short texts and videos with a clear structure), that gives comprehensive information, e.g., about vaccines, policy measures, and what sense stands behind every single measure that is being implemented, both in specialized language but also

in an easy language to reach everyone in the population. Moreover, Aknin et al. (2022) reported that countries pursuing an elimination strategy observed fewer COVID-19 deaths and better mental health relative to countries pursuing a mitigation strategy. Therefore, countries should prospectively implement elimination strategies during future pandemics/endemics, e.g., transparent planning of more stringent but only temporary measures on the part of governments (Oliu-Barton et al., 2022).

9. Conclusion

Results from the present work show a significant association between policy stringency and mental health. Stricter policy measures were associated with worse mental health. Especially stay-at-home requirements, school closures, and restrictions on public gatherings have shown a negative association with mental health. These results emphasize the need for more and intensified research in this area. Future research should investigate the association between single policy measures and mental health in more detail. Studying psychological distress, anxiety, and depression separately, while also considering moderating factors, could yield more distinctive results. Furthermore, qualitative research could provide more comprehensive insights into societal resilience and help develop effective prevention programs. Overall, a comprehensive approach that includes financial support plans, improvements of mental health services, and the development of preventive programs should be implemented to mitigate negative effects of future humanitarian crisis.

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Appendix

Appendix A

Table A1

database	date	terms	records	notes
PubMed	27.01.23	((“COVID-19”[Mesh]) OR (“Coronavirus Infections”[Mesh]) OR (“SARS-CoV-2”[Mesh]) OR (“Coronavirus”[Mesh])) AND ((“Mental Health”[Mesh]) OR (“Psychological Phenomena”[Mesh]) OR (“Mental Disorders”[Mesh]) OR (“Behavioral Symptoms”[Mesh]) OR (“Emotions”[Mesh])) AND ((“Public Policy”[Mesh]) OR ("Social Control Policies"[Mesh]) OR (policy W/2 stringent*) OR "stringency index" OR "government response tracker" OR "government response" OR "policy measure" OR "policy making" OR OROxCGRT)	386	Filters: Full text, English, from 2020 - 2023
Scopus #1	27.01.23	(TITLE-ABS-KEY ((covid OR "coronavirus infection" OR coronavirus OR ncov OR "sars-cov-2" OR pandemic))) AND (TITLE-ABS-KEY ((policy W/2 string*) OR "stringency index" OR (policy AND mak*) OR "government response" OR "oxford government response tracker" OR oxcgrt)) AND (TITLE-ABS-KEY (("mental health" OR "mental illness" OR "mental well-being" OR "depressi*" OR "mood disorder" OR "affective disorder" OR anxiety OR "psychological distress" OR stress))) AND (LIMIT-TO (PUBYEAR , 2023) OR LIMIT-TO (PUBYEAR , 2022) OR LIMIT-TO (PUBYEAR , 2021) OR LIMIT-TO (PUBYEAR , 2020)) AND (LIMIT-TO (LANGUAGE , "English"))	1214	/

Table A1 (continued)

database	date	terms	records	notes
Scopus #2	27.01.23	(TITLE-ABS-KEY ((*covid* OR *"coronavirus infection"* OR *coronavirus* OR *ncov* OR *"sars-cov-2"* OR *pandemic*))) AND (TITLE-ABS-KEY ((*policy* W/2 *string**) OR *"stringency index"* OR (*policy* AND *mak**) OR *" government response"* OR *"oxford government response tracker"* OR *oxcgrt*)) AND (TITLE-ABS-KEY ((*"mental health"* OR *"mental illness"* OR *"mental well-being"* OR *"mental wellbeing"* OR *"depressi*"* OR *"mood disorder"* OR *"affective disorder"* OR *anxiety* OR *"psychological distress"* OR *stress*))) AND (LIMIT-TO (PUBYEAR , *2023*) OR LIMIT-TO (PUBYEAR , *2022*) OR LIMIT-TO (PUBYEAR , *2021*) OR LIMIT-TO (PUBYEAR , *2020*)) AND (LIMIT-TO (LANGUAGE , *"English"*))	1216	#2 will be used.
PsycInfo	27.01.23	(covid OR "coronavirus infection" OR coronavirus OR ncov OR "sars-cov-2" OR pandemic) AND ((policy W/2 string*) OR "stringency index" OR "policy making" OR "government response" OR "oxford government response tracker" OR oxcgrt) AND ("mental health" OR "mental illness" OR "mental well-being" OR "mental wellbeing" OR "depressi*" OR "mood disorder" OR "affective disorder" OR anxiety OR "psychological distress" OR stress).	305	Limiters - Linked Full Text; Publication Year: 2020-2023; Narrow by Language: - English; Search modes - Boolean/Phrase

Table A1 (continued)

database	date	terms	records	notes
PsycArticles	27.01.23	(covid OR "coronavirus infection" OR coronavirus OR ncov OR "sars-cov-2" OR pandemic) AND ((policy W/2 string*) OR "stringency index" OR "policy making" OR "government response" OR "oxford government response tracker" OR oxcgrt) AND ("mental health" OR "mental illness" OR "mental well-being" OR "mental wellbeing" OR "depressi*" OR "mood disorder" OR "affective disorder" OR anxiety OR "psychological distress" OR stress)	36	Limiters - Linked Full Text; Publication Year: 2020-2023; Narrow by Language: - English; Search modes - Boolean/Phrase

Appendix B

Table B1

Measurement and characteristics of policy stringency and mental health

Author(s)	Stringency units (lowest to highest)	Overall stringency total mean (SD)/ total mean of sub-indices (SD)	Assessment tool mental health	Units ofassessmenttool	Anxiety mean (SD)	Depression mean (SD)	Psychological distress mean (SD)	Overall mental health mean (SD)
Aebi et al. (2022)**RCS**	0-100 points	N/R	GAD-7, PHQ-8	Changes in percentage (0-100%)	5.3 (N/R)	6.6 (N/R)	/	/
Aknin et al. (2022)**RCS**	0-100 points (for analysis 0-1 point. SI was divided by 100)	57.79 (5.99)	PHQ-4	Points (see *table 2*)	/	/	1.91 (0.02)	/
Buffel et al. (2022)	0-3 points (sub-indices)	N/R	CES-D	Points (see *table 2*)	/	9.84 (1.33)	N/R	/
Cepulic et al. (2021)	0-100 points	79.53 (13.34)	PSS-10	Points (see *table 2*)	/	/	N/R	/
Hajek et al. (2022)	0-100 points	N/R	PHQ-4	Points (see *table 2*)	N/R	N/R	/	/
Lee et al. (2021)	0-100 points	77.79 (12.30)	PHQ-9	Points (see *table 2*)	/	7.07 (6.12)	/	/
Long et al. (2021)	0-100 points	79.51 (8.51)	WHO-5	Points (see *table 2*)	/	/	/	N/R

Table B1 (continued)

Measurement and characteristics of policy stringency and mental health

Author(s)	Stringency units (lowest to highest)	Overall stringency total mean (SD)/ total mean of sub-indices (SD)	Assessment tool mental health	Units ofassessmenttool	Anxiety mean (SD)	Depression mean (SD)	Psychological distress mean (SD)	Overall mental health mean (SD)
Ochnik et al. (2021)	0-100 points	N/R	GAD-7, PHQ-8, PSS-10	Points (see *table 2*)	7.16 (5.52)	8.85 (6.05)	21.16 (6.44)	/
O'Hara et al. (2020)	0-100 points	N/R	PHQ-9	Points (see *table 2*)	/	N/R	/	/
Plett et al. (2022)**RCS**	0-3 points (sub-indices)	N/R	GAD-7	Points (see *table 2*)	N/R	/	/	/
Riehm et al. (2022)	0-100 points + 0-3 points for sub-indices	N/R	K-10	Points (see *table 2*)	N/R	N/R	N/R	/
Schifano et al. (2021)	0-100 points	69.0 (14.0)	GAD-7, PHQ-9	Points (see *table 2*)	N/R	N/R	/	/
Toffolutti et al. (2022)	0-3 points (sub-indices)	N/R	WHO-5	Points (see *table 2*)	/	/	/	13.08 (5.27)
Van der Velde et al. (2021)	0-100 points	N/R	CES-D	Points (see *table 2*)	/	N/R	/	/
Wijngaard et al. (2020)	0-100 points	69.0 (16.0)	PHQ-8	Points (see *table 2*)	/	1.72 (0.64)	/	/

*Note.*Longitudinal studies are underlined, repeated cross-sectional studies are marked by **RCS**

Table B2

Methods of analysis and measures of association of studies using the overall SI

Author(s)	Method of analysis	Effect estimate with 95% CI, CrI				SE	p-value	Adjustment
		anxiety	depression	Psychol.distress	Overall mental health			
Aebi et al. (2022)**RCS**	linear regression models	ß = -0.31 (-1.14 to 0.51)	ß = -0.07 (-0.95 to 0.81)	/	/	N/R	A: .459 D: .877	sex, age group, nationality, education level, marital status, weekly incidence COVID-19 infections in Basel-Stadt, and hospital.
Aknin et al. (2022) **RCS**	linear regression models effects	/	/	ß = 0.142 (0.091-0.193)	/	N/R	.0001	1) demographic and contextual covariates and country-fixed effects 2) daily deaths added 3) daily cases added
Cepulic et al. (2021)	Linear mixed model analyses	/	/	b = -0.035 (-0.092 - 0.022)	/	N/R	.230	number of daily deaths per million citizens, GDP, sex, age, employment status, and belonging to a risk group for COVID-19.
Hajek et al. (2022)	linear regression	b = 0.00	b = 0.003	/	/	D: 0.00 A: 0.00	D: <.001 A: N/R (n.s.)	N/R

Table B2 (continued)

Methods of analysis and measures of association of studies using the overall SI

Author(s)	Method of analysis	Effect estimate with 95% CI, CrI				SE	p-value	Adjustment
		anxiety	depression	Psychol. distress	Overall mental health			
Lee et al. (2021)	multilevel regression analysis	/	ß = 0.139 (0.074-0.203)	/	/	N/R	<.001	N/R
Long et al. (2021)	multiple linear regression	/	/	/	healthy: ß = -30.6 diseased: ß =-17.9	N/R	<.05 (both)	N/R
Ochnik et al. (2021)	Bayesian multilevel models	b = 0.04 95% **CrI** (-0.37-0.46)	b = 0 95% **CrI** (-0.4-0.41)	b = 0.02 95% **CrI** (-0.45-0.53)	/	N/R	N/R (n.s. for all)	N/R
O'Hara et al. (2020)	linear regression	/	ß=0.02 (0.02-0.03)	/	/	N/R	<.001	age, education, income
Riehm et al. (2022)	logistic regression models	OR=1.014 (1.008-1.019)	OR=1.027 (1.022-1.032)	/	/	N/R	N/R (both significant)	COVID-19 cases, number of COVID-19 deaths, economic support index, age, gender, working outside home, urbanicity
Schifano et al. (2021)	OLS regression	ß = -0.08 (-0.28-0.17)	ß = -0.03 (-0.23-0.17)	/	/	0.10 (both)	N/R (n.s.)	age, sex and education

Table B2 (continued)

Methods of analysis and measures of association of studies using the overall SI

Author(s)	Method of analysis	Effect estimate with 95% CI, CrI				SE	p-value	Adjustment
		anxiety	depression	Psychol. distress	Overall mental health			
Van der Velde et al. (2021)	multilevel regression analysis	/	b = 0.045	/	/	0.021	<.05	age, gender, migrant background, relationship status, socioeconomic status, academic-related factors, country-level factors
Wijngaard et al. (2020)	difference-in-difference analysis	/	b = -0.877 (-1.65 - -0.10)	/	/	0.394	<.05	age, gender, monthly household income, marital status and years of education, Big Five, trust in government, health problems, household composition, and participation in social gatherings over the past 5 days, number of and day-to-day change in COVID-19 cases and the number of deaths per capita.

*Note.*CI= confidence interval, CrI= credibility interval, N/R=not reported, n.s.= not significant, OLS= ordinary least squares, OR=odds ratios, psychol.=psychological, SE= standard error, / = was not investigated, longitudinal studies are underlined, repeated cross-sectional studies are marked by **RCS**

Table B3

Methods of analysis and measures of association of studies using the sub-indices with effect estimate, 95% CI, SE, p-value - DEPRESSION

Author(s)	Method of analysis	SC	WC	SHR	RPG	PTC	CPE	IMR	ITC
Buffel et al. (2022)	multilevel regression	*ß*=0.871 (0.306-1.437), *SE*=0.288, *p*=.003)	*ß*=1.040 (0.441-1.639), *SE*=0.306, *p*=.001)	*ß*=0.880 (0.127-1.634), *SE*=0.384, *p*=.022)	*ß*=0.020 (-0.365-0.405), *SE*=0.196, *p*=.920)	*ß*=0.187 (-0.661-1.035), *SE*=0.433, *p*=.666)	*ß*=0.208 (-0.773-1.189), *SE*=0.501, *p*=.677)	*ß*=0.222 (-0.466-0.890), *SE*=0.341, *p*=..515)	*ß*=0.176 (-0.717-0.366), *SE*=0.276, *p*=.525)

SC=school closures, WC=workplace closures, SHR=stay-at-home requirements, RPG=restrictions on public gatherings, CPE=cancellation of public events, IMR=Internal movement restrictions, ITC=international travel controls, N/R=not reported, OR=odds ratios, ß=standardized regression coefficient, b=unstandardized regression coefficient.

Table B4

Methods of analysis and measures of association of studies using the sub-indices with effect estimate, 95% CI, SE, p-value - ANXIETY

Author(s)	Method of analysis	SC	WC	SHR	RPG	PTC	CPE	IMR	ITC
Plett et al. (2022)**RCS**	linear regression	*ß*=-0.06 (-0.178-0.058), *SE*=0.06, *p*=N/R, n.s.)	*ß*=-0.04 (-0.216-0.136), *SE*=0.09, *p*=N/R, n.s.)	*ß*=0.07 (0.011-0.129), *SE*=0.03, *p*=.05)	*ß*=0.06 (-0.136-0.256), *SE*=0.10, *p*=N/R, n.s.)	N/R	*ß*=0.05 (-0.048-0.148), *SE*=0.05, *p*=N/R, n.s.)	N/R	*ß*=-0.06 (-0.138-0.018), *SE*=0.04, *p*=N/R, n.s.)

Note. SC=school closures, WC=workplace closures, SHR=stay-at-home requirements, RPG=restrictions on public gatherings, CPE=cancellation of public events, IMR=Internal movement restrictions, ITC=international travel controls, N/R=not reported, n.s.=not significant, longitudinal studies are underlined, repeated cross-sectional studies are marked by **RCS,** ß=standardized regression coefficient, b=unstandardized regression coefficient.

Table B5

Methods of analysis and measures of association of the sub-indices with effect estimate, 95% CI, SE, p-value – MENTAL HEALTH (WHO-5)

Author(s)	Method of analysis	SC	WC	SHR	RPG	PTC	CPE	IMR	ITC
Toffolutti et al. (2022)	OLS regression	*b*=-0.15 (-0.30-0.001), *SE*=N/R, *p*=N/R)	*b*=0.29 (0.11-0.48), *SE*=N/R, *p*=N/R)	*b*=-0.15 (-0.32-0.03), *SE*=N/R, *p*=N/R)	*b*=-0.24 (-0.38- -0.10), *SE*=N/R, *p*=N/R)	*b*=0.14 (-0.04 - 0.31), *SE*=N/R, *p*=N/R)	*b*=0.12 (-0.09-0.32), *SE*=N/R, *p*=N/R)	*b*=0.07 (-0.08-0.21), *SE*=N/R, *p*=N/R)	*b*=-0.63 (-0.79- -0.47), *SE*=N/R, *p*=N/R)

Note. SC=school closures, WC=workplace closures, SHR=stay-at-home requirements, RPG=restrictions on public gatherings, CPE=cancellation of public events, IMR=Internal movement restrictions, ITC=international travel controls, N/R=not reported, n.s.=not significant. repeated cross-sectional or longitudinal studies are marked with (RCS) or (LS), OLS=ordinary least squares, ß=standardized regression coefficient, b=unstandardized regression coefficient.

Table B6

Information about the studied population

Author(s)	Employm. status %				Income %			Household size %			Children yes %	MHC yes%	Chronic illness yes %
	UE	E	S	R	low	medium	high	single	two	>two			
Aebi et al. (2022)	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
Aknin et al. (2022)	7.84	54.92	6.00	21.13	N/R	N/R	N/R	20.13	33.96	44.14	35.97	8.12	34.14
Buffel et al. (2022)	22.71	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
Cepulic et al. (2021)	0.09	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
Hajek et al. (2022)	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	30.53	N/R	N/R
Lee et al. (2021)	N/R	N/R	N/R	N/R	N/R	N/R	N/R	9.24	12.45	78.31	N/R	N/R	N/R
Long et al. (2021)	15.9	55.6	6.4	16.7	21.1	50.0	18.9	19.7	N/R	N/R	39.3	N/R	N/R
Ochnik et al. (2021)	N/R	N/R	100	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R

Table B6 (continued)

Author(s)	Employm. status %				Income %			Household size %			Children yes %	MHC yes%	Chronic illness yes %
	UE	E	S	R	low	medium	high	single	two	>two			
O'Hara et al. (2020)	N/R	N/R	N/R	N/R	34.9	33.5	31.7	N/R	N/R	N/R	N/R	N/R	N/R
Plett et al. (2022)	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
Riehm et al. (2022)	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
Schifano et al. (2021)	7.0	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
Toffolutti et al. (2022)	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	71.39	N/R	N/R
Van der Velde et al. (2021)	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
Wijngaard et al. (2020)	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R

Note. Employm. status=Employment status, UE=unemployed, E=employed, S=student, R=retired, MHC=mental health condition, N/R=not reported.

Table B7

Information on pandemic related factors per study

Author(s)	Pandemic intensity		Vaccination rate % (at least one)	Trust in government	
	Daily deaths/ 100k (mean with SD)	daily cases/ 100k (mean with SD)		Yes %	Different assessment
Aebi et al. (2022)	N/R	N/R	N/R	N/R	N/R
Aknin et al. (2022)	0.186 (0.22)	10,848.6 (11.34)	38.16	N/R	1 (very badly) to 4 (very well) government evaluation; *M*=2.53, *SD*=0.08
Buffel et al. (2022)	N/R	N/R	N/R	N/R	N/R
Cepulic et al. (2021)	0.26	N/R	N/R	N/R	0 (not at all) to 10 (complete trust); M=4.83, SD=1.54
Hajek et al. (2022)	N/R	N/R	80.48	N/R	N/R
Lee et al. (2021)	1.63 (N/R)	52.61(N/R)	N/R	N/R	N/R
Long et al. (2021)	N/R	N/R	N/R	N/R	N/R
Ochnik et al. (2021)	N/R	N/R	N/R	N/R	N/R
O'Hara et al. (2020)	N/R	N/R	N/R	43.8	N/R

Table B7 (continued)

Information on pandemic related factors per study

Author(s)	Pandemic intensity		Vaccination rate % (at least one)	Trust in government	
	Daily deaths/ 100k (mean with SD)	daily cases/ 100k (mean with SD)		Yes %	Different assessment
Plett et al. (2022)	N/R	N/R	N/R	N/R	N/R
Riehm et al. (2022)	N/R	N/R	N/R	N/R	N/R
Schifano et al. (2021)	N/R	N/R	N/R	N/R	N/R
Toffolutti et al. (2022)	N/R	N/R	N/R	N/R	N/R
Van der Velde et al. (2021)	N/R	N/R	N/R	N/R	N/R
Wijngaard et al. (2020)	0.01 (0.02)	0.22 (0.31)	N/R	N/R	1 (strongly distrust)-5 (strongly trust); M=2.83, SD=1.49

Note. SD=standard deviation

Table B8

Information on assessment conditions of included articles

Author(s)	(LS/RCS) first TPof DC	(LS/RCS) last TP of DC	(LS/RCS) number of TP	spacing information (regular/irregular)	(CS) TP of DC
Aebi et al. (2022)	06 to 10/2020	10/2020-04/2021	2	Regular (every	/
Aknin et al. (2022)	04/06/2020	04/06/2021	5	regular	/
Buffel et al. (2022)	/	/	/	/	27/04-07/06/2020
Cepulic et al. (2021)	/	/	/	/	30/03-03/05/2020
Hajek et al. (2022)	06 & 07/ 2021	12/2021 & 01/2022	3	regular	/
Lee et al. (2021)	/	/	/	/	25/05 – 24/06/2020
Long et al. (2021)	/	/	/	/	22/04 - 01/06/2020
Ochnik et al. (2021)	/	/	/	/	05 - 07/ 2020
O'Hara et al. (2020)	/	/	/	/	20/03-07/04.2020
Plett et al. (2022)	05/2020	03/2021	7	N/R	/
Riehm et al. (2022)	/	/	/	/	04 to 12/ 2020
Schifano et al. (2021)	01/05/2020	20/11/2020	4	regular	/
Toffolutti et al. (2022)	09/04/2020	31/03/2021	3	regular	/
Van der Velde et al. (2021)	/	/	/	/	27/04 - 07.07.2020
Wijngaard et al. (2020)	/	/	/	/	20/03 – 05/04/2020

Note. CS=cross-sectional study LS=longitudinal study, RCS=repeated cross-sectional study, DC=data collection, TP=time point, N/R=not reported, / = not relevant (e.g., spacing for CS)

Appendix C

Selection (Maximum 4 points):

1. Representativeness of the sample:
    a. Truly representative of the general population, random sampling. Age, gender, country, and population (e.g., sample size) and additional information (e.g., mental (health) condition, income etc.) are reported **
    b. Somewhat representative (e.g., only sample size, age, and gender distribution – no additional information about the population).*
    c. No description.

2. Ascertainment of the pandemic situation:
    a. Surveillance of Pandemic (daily deaths/1M; daily cases/1M), vaccination rate.*
    b. No information given.

3. Ascertainment of the exposure/risk factor: policy measures during the pandemic and its differing stringency.
    a. Use of data of policy stringency (Oxford stringency index).*
    b. Reporting about containment measures without using the index values.

Comparability (Maximum 2 points):

1. Comparability of subjects in different outcome groups based on design or analysis. Confounding factors controlled.
    a. Data/ results adjusted for relevant predictors/risk factors/confounders, e.g., age, sex and/or mental health condition- at least one of them. **

b. Controlling for other important variables, e.g., economic status, trust in government, employment, daily COVID-19 infections, daily COVID-19 deaths, vaccination rates. *
c. Information not provided.

Outcome (Maximum 3 points for cross-sectional, for longitudinal studies 5 points):

1. Assessment of outcome:
    a. Validated and pre-determined screening tools for assessing mental health. *
    b. Self-report.
    c. No description.

2. Subgroup analysis of policy measures:
    a. Assessing effects not only for an overall stringency index but also for sub-measures, like school or work closure, stay-at-home requirements, etc.*
    b. No information.

3. Statistical test:
    a. The statistical test used to analyze the data is clearly described, appropriate, and measures of the association presented include confidence intervals and probability level (p-value). *
    b. Statistical tests not appropriate, not described or incomplete.

Additional criteria for longitudinal studies (Maximum 2 points):

Was the interval of the follow-up chosen appropriately for examining changes in policy stringency? (time points that reflect different stringencies)

a. Yes. *
b. No.
c. Not reported.

Adequacy of follow-up of cohorts

a. Complete follow-up - all subjects accounted for. *
b. Subjects lost, but ≤ 20 %. *
c. Follow-up rate less than 80%
d. No statement.

Cross-sectional Studies (max. 9):

High: 7-9 points

Middle: 3-6 points

Low: 0-2 points

Longitudinal Studies (max. 11):

High: 8-11 points

Middle: 4-7 points

Low: 0-3 points

Table C1

Quality assessment

Study	Selection			Comparability	Outcome					Score	Quality
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8 LS/ RCS	Q9 LS/ RCS		
#1 Aebi et al. (2022)	*	/	*	**	*	/	*	*	/	7	Middle
#2 Aknin et al. (2022)	**	*	*	**	*	*	*	*	*	11	High
#3 Buffel et al. (2022)	*	/	*	**	*	*	*	/	/	7	High
#4 Cepulic et al. (2021)	**	*	*	*	*	/	*	/	/	7	High
#5 Hajék et al. (2022)	**	*	*	/	*	/	*	*	*	8	High
#6 Lee et al. (2021)	**	*	*	/	*	/	*	/	/	6	Middle
#7 Long et al. (2021)	**	/	*	/	*	/	*	/	/	5	Middle
#8 Ochnik et al. (2021)	*	/	*	/	*	/	*	/	/	4	Middle
#9 O'Hara et al. (2020)	**	/	*	/	*	/	*	/	/	5	Middle
#10 Plett et al. (2022)	**	*	*	**	*	*	*	*	*	11	High
#11 Riehm et al. (2022)	**	*	*	**	/	*	*	/	/	8	High
#12 Schifano et al. (2021)	**	/	*	**	*	/	*	*	*	9	High
#13 Toffolutti et al. (2022)	**	*	*	*	*	*	/	*	*	9	High
#14 Van der Velde et al. (2012)	*	*	*	**	*	/	*	/	/	7	High
#15 Wijngaard et al. (2020)	**	*	*	**	*	/	*	/	/	8	High

Note. Underlined articles are longitudinal or repeated cross-sectional.

Appendix D

Table D1

Longitudinal and repeated cross-sectional articles

Aebi et al. (2022) (RCS)	In a repeated cross-sectional study from Switzerland with 873 hospital inpatients, that were not admitted for COVID-19, no significant change in anxiety, measured with the GAD-7 (*B*=1.68 [−5.10 to 8.45], *p*=0.312), and depression, measured with the PHQ-8 (*B*=-1.43[−9.23 to 6.37], *p*=0.875) was found from modest (June-October 2020) to strong (October 2020-April 2021) COVID-19 policy stringency (scale from 0 to 100), when adjusted for adjusted for sex, age group, nationality, education level, marital status, weekly incidence of COVID-19 infections in Basel-Stadt, and hospital.
Aknin et al. (2022) (RCS)	In a sample size of 432,642 adults from 15 countries (North America, Europe, Asia), policy stringency and psychological distress were positively and significantly associated in a repeated cross-sectional analysis from April 2020 to June 2020 (five waves). Assessment points with stricter policy measures were associated with an increase in psychological distress, relative to an assessment point with lower stringency. When controlling for demographic and contextual variables, as well as country-fixed effects, a change of 0.01 on the policy stringency scale, expressed as an index from 0 to 1 point, was associated with a 0.142-point increase in psychological distress, on average (*B*=0.142 [0·091 to 0·193], *p*=.0001). The overall stringency index was rescaled in this study from 100 to 1. Psychological distress was expressed by the standardized scoring system of the PHQ-4 scale (rangefrom 0 to 12 points). Furthermore, the study reported that a change in policy stringency from 0.17 (lowest assessed stringency over time) to 0.93 (highest assessed stringency over time) was associated with a 0.11-point increase in psychological distress on the PHQ-4 scale (Aknin et al., 2022). When pandemic intensity was added as a control, the association between psychological distress and policy stringency remained significant and positive: controlling for daily deaths/100,000 (*B*=0·088 [0·024 to 0·151], *p*=0.0107), controlling for daily cases/100,000 (*B*=0·110 [0·064 to 0·155], *p*=.0002). Both B's indicate that, when adding pandemic intensity as a control, an increase in psychological distress is slightly smaller than when controlling only for contextual and demographic variables, as well as country-fixed effects.
Hajek et al. (2022) (LS)	In a longitudinal study across 8 European countries (June 2021-January 2022, 3 waves), with a sample of 8,319 adults, a significant association between policy stringency and depression was found, but not for anxiety. An increase of one point in policy stringency, relative to e.g., the lowest observed stringency over the assessment period on a scale from 0 to 100, was associated with a 0.003-point increase in depressive symptoms on the PHQ-4 scale, expressed by a standardized scoring system from 0 to 12, on average (*B*=0.003 [0.00298 to 0.00302], *SE*=0.00, *p*<.001). The association between policy stringency and anxiety, measured on the PHQ-4 scale, was not significant (*B*=0.00, *SE*=0.00, *p*=1).

Table D1 (continued)

Plett et al. (2022) (RCS)	In a repeated cross-sectional study with a Canadian sample of 7008 adults, the association between six sub-indices of the stringency index and anxiety was investigated. The sub-indices of interest were: international travel controls, stay-at-home requirements, restrictions on public gatherings, cancellation of public events, workplace and school closures. All sub-indices are measured on an ordinal scale from 0 (no measure) to 3 (strictly required measure) points. Only the association between stay-at-home orders and anxiety was significant (β=0.07 [0.011 to 0.129], *SE*=0.03, p<.05), indicating that an increase of one standard deviation in stay-at-home orders, relative to the lowest observed stringency on a scale from 0 to 3 over the assessment period, was associated with an increase by 0.07 standard deviations in anxiety on the GAD-7, expressed by a standardized scoring system from 0 to 21, on average. The association between all other sub-indices and anxiety were not significant, namely international travel controls (β=-0.06, [-0.138 to 0.018], *SE*=0.04), restrictions on public gatherings (β=0.06 [-0.136 to 0.256], *SE*=0.10), cancellation of public events (β=0.05 [-0.048 to 0.148], *SE*=0.05), workplace closure (β=-0.04 [-0.216 to 0.136], *SE*=0.09), and school closures (β=-0.06 [-0.178 to 0.058], *SE*=0.06).
Schifano et al. (2021) (LS)	In a longitudinal study across 5 European countries from May to November 2020 (four waves) with a sample of 9,713 adults, varying policy stringency over time, wasn't significantly associated with variations in depression (β=-0.03 [-0.23 to 0.17], p=.764), and anxiety (β=-0.08 [-0.28 to 0.17], p=.424), assessed with the PHQ-9 and GAD-7.
Toffolutti et al. (2022) (LS)	In a sample of 15,147 adults from 28 European countries, policy stringency and mental health, assessed with the WHO-5, were significantly associated in a longitudinal analysis. The article investigated the association between eight sub-indices of the stringency index and mental health, namely: stay-at-home requirements, internal movement restrictions, international travel controls, restrictions on public gatherings, cancellation of public events, school-, workplace-, and transport closures. All sub-indices were coded on an ordinal scale from 0 to 3 points. Stricter measures of international travel controls (*B*=-0.63 [-0.79 to -0.47]), and restrictions on public gatherings (*B*=-0.24 [-0.38 to -0.10])were negatively associated with mental health, relative to an assessment point at which policy stringency was lower. In contrast, workplace closures (*B*=0.29 [0.11 to 0.48]) were positively related to mental health, relative to an assessment point at which policy stringency was less strict. This indicates e.g., that an increase by one point in the stringency of international travel controls is associated with a 0.29-point increase in mental health on the WHO-5 scale that ranges from 0 to 100.

Table D2

Cross-sectional articles

Buffel et al. (2022)	In a cross-sectional study across 26 countries (North America, Europe, Asia and Africa) with a sample of 78,312 students, a higher stringency of policy measures was significantly associated with higher levels of depressive symptoms, indicating that in countries with stricter measures, higher levels of depressive symptoms were found, relative to countries with less strict measures. Depressive symptoms were measured by the CES-D, ranging from 0 to 60 points. Three sub-indices of the stringency index (each ranging from 0 to 3 points), namely school closures (β=0.871 [0.306 to 1.437], *SE*=0.288, *p*=.003), workplace closures (β=1.040 [0.441 to 1.639], *SE*=0.306, *p*=.001) and stay-at-home requirements (β=0.880 [0.127 to 1.634], *SE*=0.384, *p*=.022), were significantly associated with depressive symptoms, when controlled for demographic, educational and financial variables, as well as for pandemic intensity (e.g., excessive mortality) and economic factors (GDP per capita and youth unemployment rate). This means e.g., that a country with a higher stringency of one standard deviation in stay-at-home requirements, relative to a country with a lower stringency, was associated with a higher depression score on the CES-D by 0.880 standard deviations, on average. Cancellation of public events, restrictions on public gatherings, public transport closure, internal movement restrictions and international travel controls weren't significantly associated with depressive symptoms.
Cepulic et al. (2021)	In a cross-sectional study with a sample of 89,798 adults across 45 countries from North America, South America, Europe, Asia, Africa and Oceania, no significant association of policy stringency and psychological distress, measured with the PSS-10 (range from 0 to 40 points), was found between different countries with differing stringencies (*B*=-0.035 [-0.092 to 0.022], *p*=.230).
Lee et al. (2021)	In a web-based cross-sectional survey across 9 countries from South America, Africa and Asia, varying policy stringency between countries was significantly associated with variations in depressive symptoms, within a sample of 2,683 adults. Levels of depression were higher in countries, where policy stringency was higher (β=0.139 [0.074 to 0.203], *p*<.001), in comparison to countries with less strict policy measures. In particular, in countries with a higher stringency (0 to 100 points) of one standard deviation, relative to countries with lower stringency, the score in depression on the PHQ-9 (0 to 27 points) was 0.139 standard deviations higher, on average. It was not reported, if the study controlled for confounding factors.

Table D2 (continued)

Long et al. (2021)	In a cross-sectional study across 8 countries from North America, Europe, Africa and Asia, a significant association between mental health, and policy stringency within a sample of 21,354 adults was found. The study separated the association results for healthy (*B*=-30.6, *p*<.05) and chronically diseased adults (e.g., asthma, rheumatism or cancer) (*B*=-17.9, *p*<.05). When stringency increased by one on the overall stringency index (0 to 100), mental health decreased by 30.6 on the WHO-5, that ranges from 0 to 100, while 0 represents the worst and 100 the best possible mental health in healthy adults, and by 17.9 in chronically diseased adults, on average. As the study reported the concrete mean stringency indices of each country, an increase in stringency from 64.8 in Sweden to 93.5 in Italy, was associated with a decrease of 8.35 points in mental health in healthy adults and with a decrease of 4.89 points in mental health in chronically diseased adults on the WHO-5. It was not reported, if the study controlled for confounding factors.
Ochnik et al. (2021)	In a cross-sectional study across 9 countries (South America, Asia, Europe) with a sample of 2,349 students, no significant association between the stringency of policy measures, and psychological distress (*B*=0.02 [-0.45-0.53], *p*=.942), anxiety (*B*=0.04 [-0.37-0.46], p=.860), and depression (*B*=0 [-0.4-0.41], *p*=1) was found across countries. It was not reported, if the study controlled for confounding factors.
O'Hara et al. (2020)	In a cross-sectional study across 58 countries (all continents), with a sample of 106.497 adults, a significant association between depression and policy stringency (ß=0.02 [0.02-0.03], *p*<.001) was found. In countries with a higher overall stringency (0-100 points) of one standard deviation, depression scores on the PHQ-9 scale (range from 0 to 27 points) were 0.02 standard deviations higher, relative to countries with lower stringency.
Van der Velde et al. (2021)	In a cross-sectional study across 26 European, Asian and North American countries, a significant association between the stringency of policy measures and depressive symptoms among a sample of 99,689students was found (*B*=0.045, *SE*=0.021, *p*<.05), when adjusted for age, gender, migrant background, relationship status, socioeconomic status, academic-related factors, country-level factors.On average, in countries with a one-point higher overall stringency (0 to 100 points), depression scores on the CES-D scale (0 to 60 points) were 0.045 points higher, relative to countries with lower stringency.

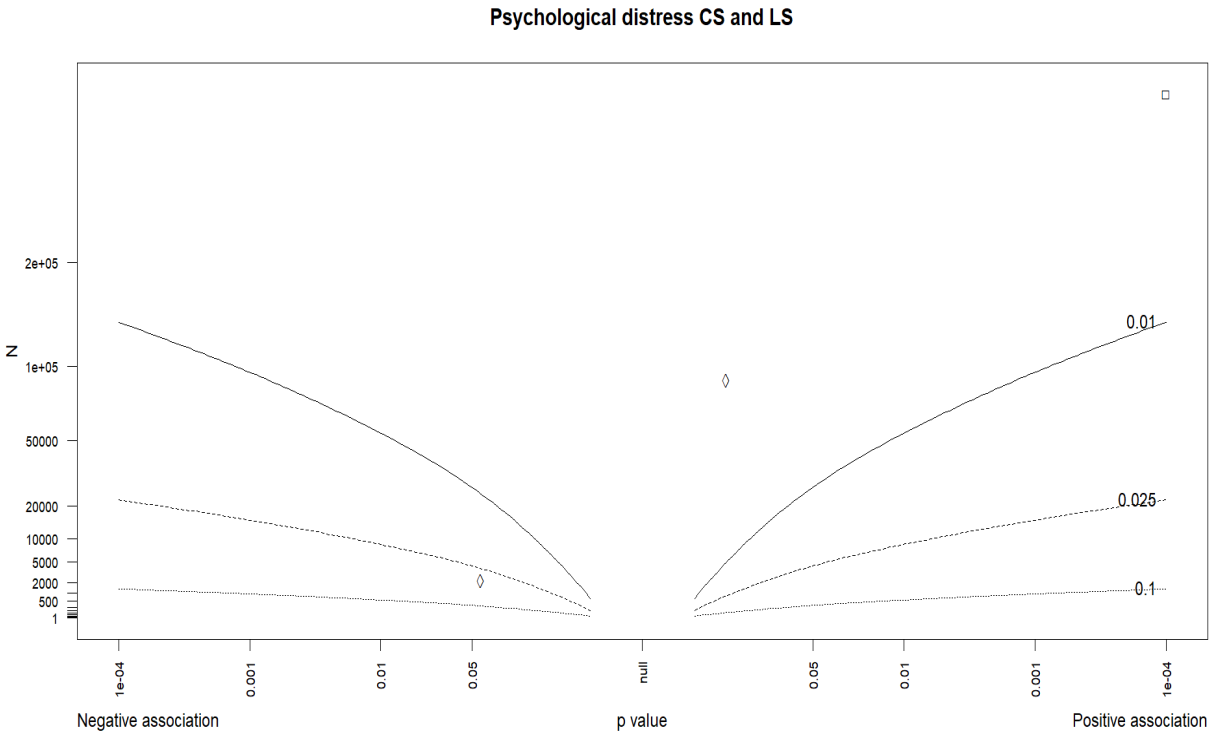
Table D2 (continued)

Riehm et al. (2022)	In a cross-sectional study across 43 countries (all continents), with a sample of 16,177,184 adults, more stringent policy measures were associated with higher levels of anxiety and depressive symptoms, when adjusted for age, gender, economic support index, working outside home, urbanicity, COVID-19 cases, and number of COVID-19 deaths. A one-point increase in policy stringency on the overall stringency index (0 to 100 points), was significantly associated with a 1.4% increase in anxiety (OR=1.014 [1.008 to 1.019]), and a 2.7% increase in depression OR=1.027 (1.022 to 1.032) on the K-10 scale, ranging from 0 to 20 for anxiety, and from 0 to 30 for depression.
Wijngaard et al. (2020)	In a cross-sectional study with a sample of 93,125 adults from 47 countries (all continents), a significant and negative association between depression and policy stringency was found (*B*=-0.877 [-1.65 to -0.10], *SE*=0.394, $p<.05$), when adjusted for individual-level variables (e.g., age, gender, monthly household income), and country-level variables (e.g., number of and day-to-day change in COVID-19 cases and the number of deaths per capita). On average, in countries where policy stringency (0 to 100 points) was one point higher, relative to countries with lower stringency, depressive symptoms, measured with the PHQ-8 (0 to 24 points), were 0.877 points lower.

Appendix E

Figure E1

Albatross plot of the association between policy stringency, and psychological distress

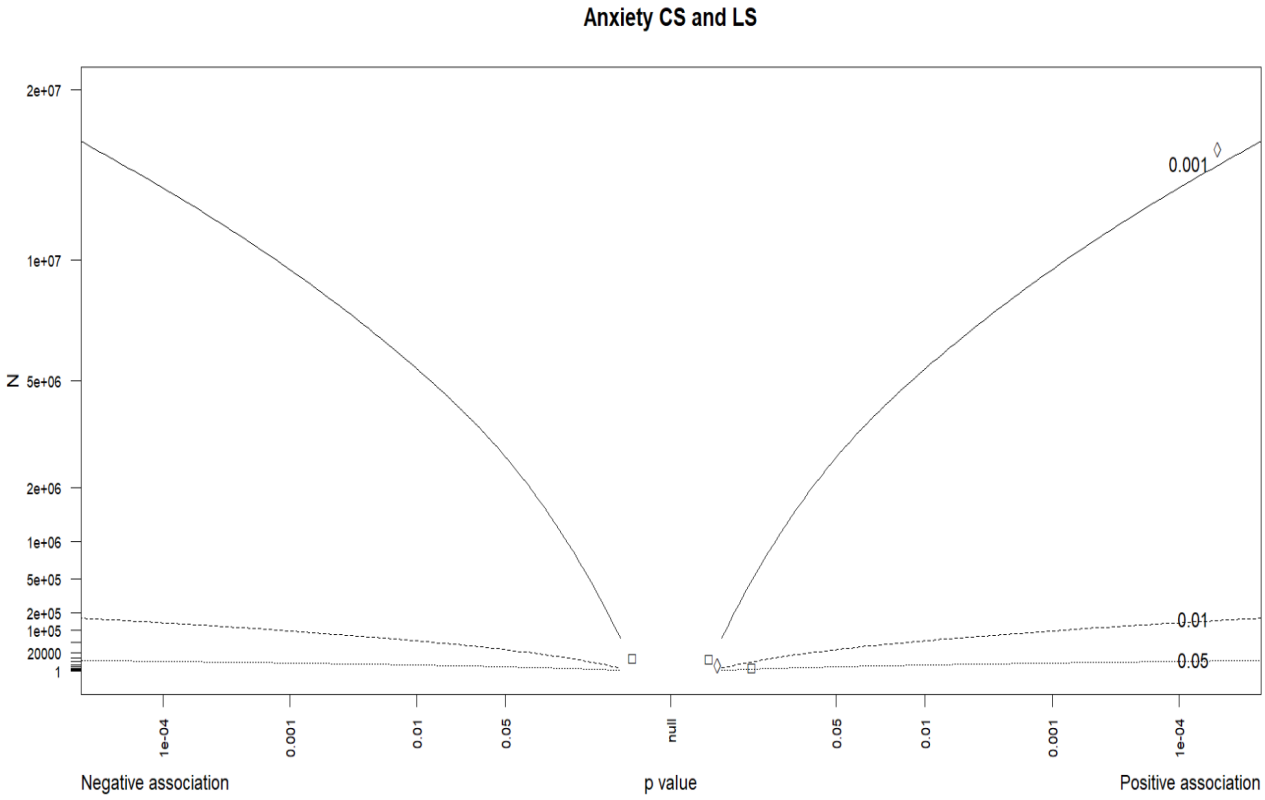


Note. Albatross plots illustrating the magnitude of the association between policy stringency and psychological distress. ◊ = cross-sectional studies, □ = longitudinal study.

Negative association = lower levels of psychological distress, positive association = higher levels of psychological distress

Figure E2

Albatross plot of the association between policy stringency, and anxiety

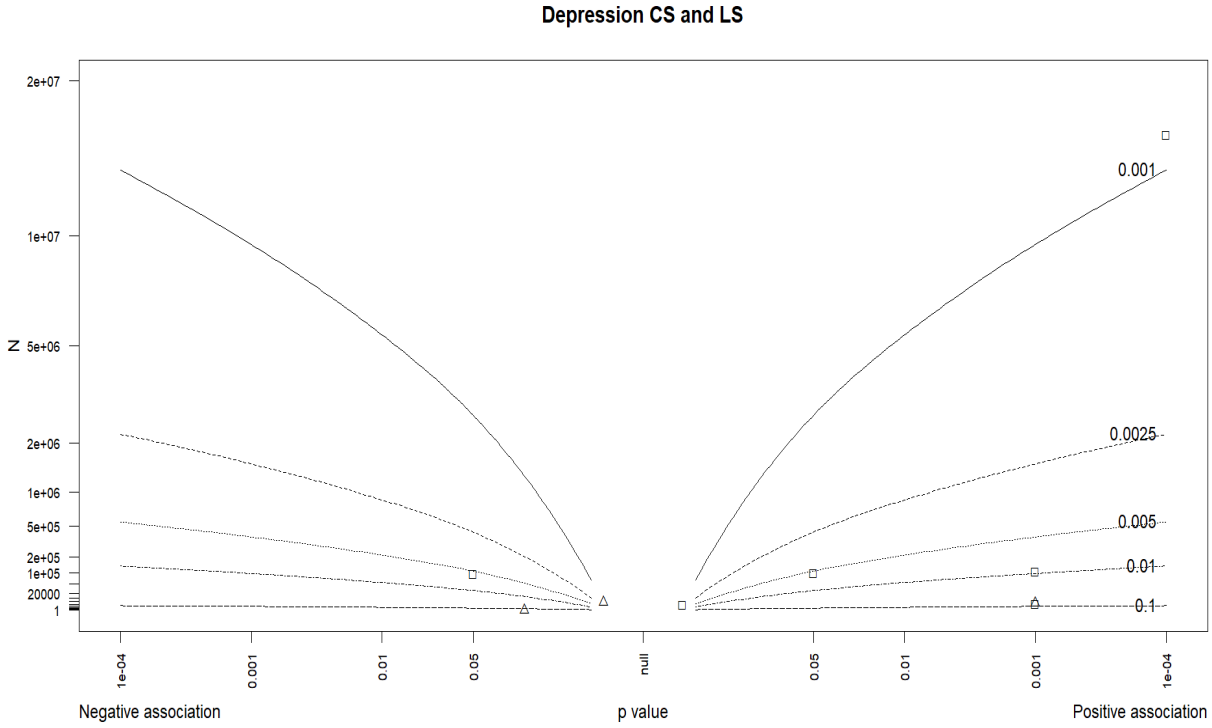


Note. Albatross plots illustrating the magnitude of the association between policy stringency and anxiety. ◊ = cross-sectional studies, □ = longitudinal studies.

Negative association = lower levels of anxiety, positive association = higher levels of anxiety

Figure E3

Albatross plot of the association between policy stringency, and depression

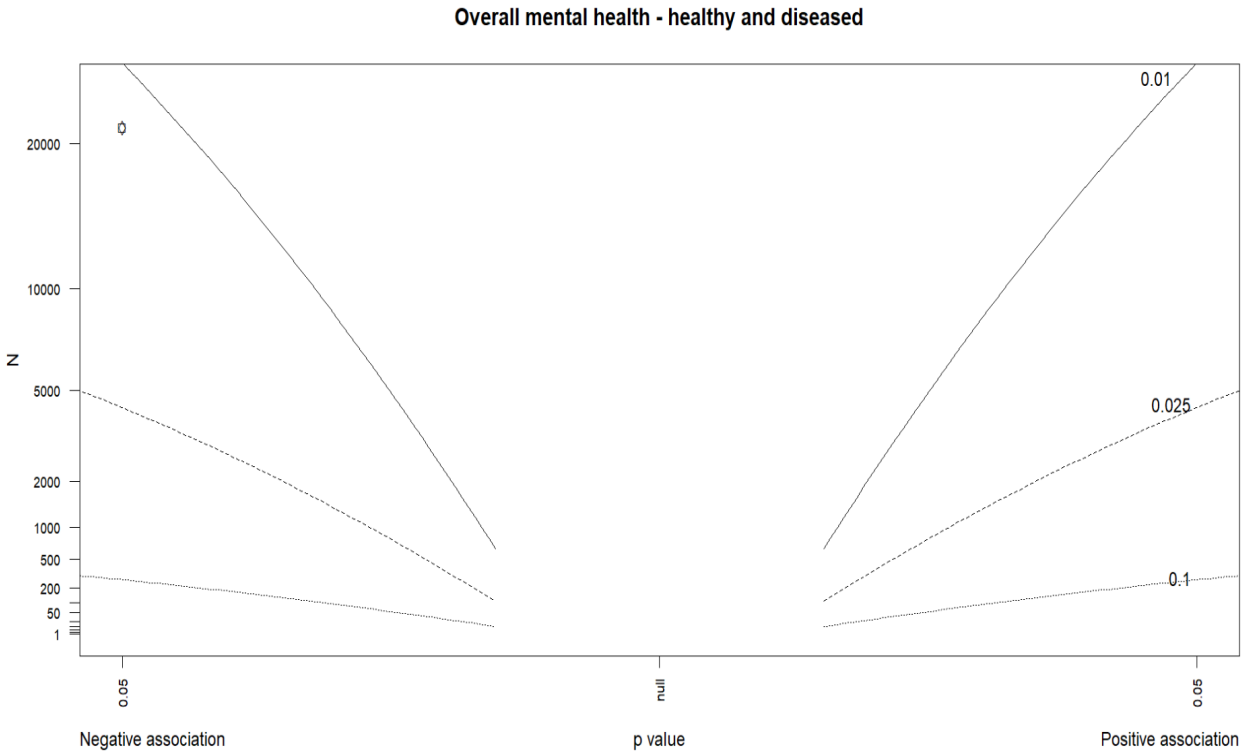


Note. Albatross plots illustrating the magnitude of the association between policy stringency and depression. ◊ = cross-sectional studies, □ = longitudinal studies.

Negative association = lower levels of depression, positive association = higher levels of depression

Figure E4

Albatross plot of the association between policy stringency, and overall mental health



Note. Albatross plots illustrating the magnitude of the association between policy stringency and overall mental health (cross-sectional study), stratified by healthy and diseased adults.

◊ = healthy adults, □ = diseased adults.

Negative association = worse mental health, positive association = better mental health

Statement of Authorship

I hereby declare that I am the sole author of thismaster thesis, and that I have not used any sources other than those listed in the bibliography and identified as references. I further declare that I have not submitted this thesis at any other institution in order to obtain a degree.

Haltern am See (DE), 18/04/2023