[Norwegian Institute of Public Health, Division of Mental and Physical Health] [1]

Institution: Norwegian Institute of Public Health
Administrative unit: Division of Mental and Physical Health
Title of case study: Disease burden analyses
Period when the underpinning research was undertaken: 2010 - 2022
Period when staff involved in the underpinning research were employed by the submitting institution: 2012 - 2022
Period when the impact occurred: 2015 - 2022

1. Summary of the impact Our disease burden analyses provide the overview needed by policy makers to monitor progress towards the public health targets, promote an evidence-based public health policy and adjust the capacity in the health system. We have generated knowledge on the comparative disease burden impact from fatal and non-fatal causes and avoidable risk factors, forecasted the future disease burden, demonstrated socioeconomic differences in disease burden, and monetized the effect of reducing disease burden due to air pollution. This knowledge serves as evidence-base of policy plans, strategies, programs and reforms aimed to meet current and future needs in the health and welfare systems.
2. Underpinning research The Centre of Disease Burden has since its establishment in January 2017 served as the Norwegian arm of the Global Burden of Disease (GBD) study, a large-scale international collaboration that provides comprehensive overviews of causes of mortality and disability, as well as the impact of risk factors, across geographies, time, age-groups and sex. We also do our own research on disease burden beyond what is done by GBD. *Disease burden analyses* Since 2013, GBD has released country-wise estimates on disease burden, providing a complete overview of the relative and absolute impact from sources of health loss in the Norwegian population. Important insights include the contribution from non-fatal health outcomes such as mental disorders on the total disease burden, as well the burden attributable to avoidable risk factors (source 1). A collaborative effort between the Centre and the GBD resulted in the integration of disease burden results by Norwegian counties in the GBD 2019 release, highlighting large similarities overall, while noting some important differences between counties (source 2). Analyses led by the Centre also identified crucial differences in life expectancy, disease burden and risk factor attribution across the Nordic region (source 3). *Forecasting* Forecasting future disease burden is a strategic target area for both the GBD project and NIPH, and our close collaboration has given the Centre unique access to GBD forecasting results on disease burden in Norway (up till 2050). Published in 2022, the results demonstrated changes in future disease burden due to aging of the population (source 4). *Analyses based on primary data* The Centre expands the knowledge produced by GBD by employing disease burden methodology on Norwegian and Nordic primary data. We have documented large socioeconomic differences in disease burden in Norway (source 5), and quantified associated costs and productivity losses with disease burden. Further, we have estimated the disease burden due to air pollution and

transportation noise, and calculated the cost-effectiveness of interventions reducing exposure to air pollution (source 6).

Key researchers
Professor Stein Emil Vollset (2013 – 2018). Founder and first director of the Centre. Has led the work on Future Health Scenarios in GBD since 2018. Returned to NIPH in 2023 to establish the GBD Collaborating Unit on Future Health Scenarios.
Professor Simon Øverland (2018 – 2021). Director of the Centre, and member of GBD Scientific Council. Key in incorporating Norwegian counties into GBD.
Senior researcher Ann Kristin Knudsen (2014 – td). Researcher and current director of the Centre, member of GBD Scientific Council. Active in the dissemination of GBD results to Norwegian policy makers and in establishing the Nordic Burden of Disease collaborating network.
Senior researcher Jonas Minet Kinge (2013 – td). Researcher on economic costs and socioeconomic differences in disease burden, which have had great policy impact.
Researcher Benjamin Clarsen (2019-2023). Led the work on county differences in disease burden, and diet related disease burden in the Nordic and Baltic countries.
Senior researchers Gunn Marit Aasvang and Anette Kocbach Bølling (2018-td). Lead the work on environmental related disease burden.

2. **References to the research** (indicative maximum of six references)

Research group members are highlighted in bold.
1) GBD 2013 DALYs and HALE Collaborators*. Global, regional, and national disability-adjusted life years (DALYs) for 306 diseases and injuries and healthy life expectancy (HALE) for 188 countries, 1990-2013: quantifying the epidemiological transition. Lancet. 2015 Nov 28;386(10009):2145-91. doi: 10.1016/S0140-6736(15)61340-X.
2) **Clarsen B,** Nylenna M, **Klitkou ST, Vollset SE, Baravelli CM, Bølling AK, Aasvang GM, Sulo G,** Naghavi M, Pasovic M, Asaduzzaman M, Bjørge T, Eggen AE, Eikemo TA, Ellingsen CL, Haaland ØA, Hailu A, Hassan S, Hay SI, Juliusson PB, Kisa A, Kisa S, Månsson J, Mekonnen T, Murray CJL, Norheim OF, Ottersen T, Sagoe D, Sripada K, Winkler AS, **Knudsen AKS.** Changes in life expectancy and disease burden in Norway, 1990-2019: an analysis of the Global Burden of Disease Study 2019. Lancet Public Health. 2022 Jul;7(7):e593-e605. doi: 10.1016/S2468-2667(22)00092-5.
3) **Knudsen AK**, Allebeck P, **Tollanes MC,** Skogen JC, Moesgaard Iburg K, McGrath JJ, Juel K, Agardh EE, Ärnlöv J, Bjorge T, Carrero JJ, Cederroth CR, Eggen AE, El-Khatib Z, **Ellingsen CL,** Fereshtehnejad SM, Gissler M, Hadkhale K, Havmoeller R, Johansson L, Juliusson PB, Kiadaliri AA, Kisa S, Kisa A, Lallukka T, Mekonnen T, Meretoja TJ, Meretoja A, Naghavi M, Neupane S, Nguyen TT, Petzold M, Plana-Ripoll O, Shiri R, Sigurvinsdottir R, **Skirbekk V**, Skou ST, Sigfusdottir ID, Steiner TJ, **Sulo G**, Truelsen TC, Vasankari TJ, Weiderpass E, **Vollset SE**, Vos T, **Overland S.** Life expectancy and disease burden in the Nordic countries: results from the Global Burden of Diseases, Injuries, and Risk Factors Study 2017. Lancet Public Health. 2019 Dec;4(12):e658-e669. doi: 10.1016/S2468-2667(19)30224-5.
4) **Knudsen AK, Sulo G, Klikou S, Vollset SE.** Disease burden in Norway 2050. In the Public Health Report Thematic Publication 2022: Future Public Health Challenges in Norway [Sykdomsbyrde i Norge i 2050. Folkehelserapportens temautgave 2022. Framtidens utfordringer for folkehelsen.] Report. 2022. Oslo: Norwegian Institute of Public Health. https://www.fhi.no/he/fremtidens-utfordringer-for-folkehelsen/del-1-3/sykdomsbyrde-i-norge-i-2050/?term=
5) **Kinge JM,** Modalsli JH, **Øverland S,** Gjessing HK, **Tollånes MC, Knudsen AK, Skirbekk V,** Strand BH, Håberg **SE, Vollset SE.** Association of Household Income With Life Expectancy

and Cause-Specific Mortality in Norway, 2005-2015. JAMA. 2019 May 21;321(19):1916-1925. doi: 10.1001/jama.2019.4329.

6) Norwegian Environment Agency, the Norwegian Public Roads Administration, **the Norwegian Institute of Public Health** and the Norwegian Meteorological Institute. Limit values for particulate matter: revision of Norwegian limit values for PM10 and PM2.5. [Grenseverdier for svevestøv. Forslag til reviderte grenseverdier for PM10 og PM2,5.] Report 2020. https://www.miljodirektoratet.no/globalassets/publikasjoner/m1669/m1669.pdf, and the NIPH

* The Centre for Disease Burden at NIPH is the Norwegian arm of the Global Burden of Disease (GBD) project. All GBD results are updated in each iteration of GBD, and published on the project website, as well as in capstone papers in the Lancet. Members of the Centre are co-authors on these publications.

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3. Details of the impact

Disease burden analyses are highly warranted by policy makers, and as part of NIPH, the Centre of Disease Burden is uniquely positioned to ensure direct impact on policy. We provide the overview needed by the health authorities to monitor progress towards the Norwegian public health targets, promote an evidence-based public health policy and adjust the capacity in the health system to meet current and future needs. Our research is made known for our stakeholders through both written reports, as well as direct contact and presentations in meetings and seminars with relevant ministries, directorates, and other stakeholders. Our knowledge has served as the evidence-base in a range of policy plans, strategies, programs and reforms aimed to meet current and future needs in the public health and health and welfare service arenas. In the following, we will give some examples of our policy impact.

Disease burden analyses, including socioeconomic differences in disease burden
In March 2015, the first **Public Health Plan** (source 1) from the Ministry of Health was released. Evidence from the GBD project, processed, detailed, and presented by the Centre, provided essential insights for this plan, and affected several of the stated targets. For instance, the results revealed a high disease burden due to mental health in Norway, but also identified a lack of necessary data to monitor mental disorders in the population. This served as a key argument by the Government for integrating mental health as an important and focused part of the public health work, as well as initiate data collection on mental disorders, piloted in the HUNT study (November 2018 to September 2020). The following Public Health Plans (**Public Health Plan of 2018-2019,** released in April 20219, source 2 and **Public Health Plan of 2022-2023**, released in April 2023, source 3), have underscored the significance of disease burden analyses as a vital source of information regarding the health status in Norway. In the latest Public Health Plan (source 3), great attention was also given to our evidence on social inequalities in disease burden, strengthening the knowledge-base for the current government's strategy to eliminate social inequalities in health. In addition, we provided knowledge on excess mortality during the COVID-19 pandemic and future health challenges, as identified by our forecasting analyses. Disease burden analyses were also part of the evidence-base for the **National Health and Hospital Plan (2020 – 2023)** of November 2019, demonstrating the increasing burden from neurological diseases, diabetes and mental disorders, and the related impact this have on current and future health service needs (source 4).

Based on data from GBD, we have generated rankings of the most important causes and risk factors for disease burden in Norway. This served as the basis for the Health Directorates **recommendations for interventions to reduce disease burden and improve public health** in September 2018 (source 5). These recommendations were also incorporated in the Governments

Public Health Plans. In addition, we contributed with assistance, analyses and input in the Health Directorate's recommendations on the introduction of fruit and free meals at schools, the societal and economic benefits of following the Directorates diet recommendations, and in calculation of societal costs of diseases and injuries. Work conducted at the Centre has also contributed to the evidence base of the revised **Nordic Nutrition Recommendations** (source 6).

Disease burden is frequently discussed as a relevant criterion for prioritization of health resources, and our research has been used to inform these discussions in **prioritization reports** from both the Norwegian Government in 2015-2016 (source 7) and the Finnish Government in 2022 (source 8).

Disease burden from air pollution and noise
In a **joint report** (source 9) from the Norwegian Environment Agency, the Norwegian Public Roads Administration, the Norwegian Meteorological Institute, and the NIPH, the Centre was responsible for developing methodology for assessment of the burden of disease due to particulate matter (PM) in Norway, including quality control, comparison with GBD estimates and sensitivity analyses. The change in BoD due to implementation of policies were monetized and included in a cost-benefit analysis. The Norwegian limit values for PM2.5 and PM10 were lowered as of January 1st 2022 as a result of this work.

Forecasting and future health scenarios
Forecasts of future health scenarios are highly warranted for planning and scaling of the health services, the welfare state and public health work. Our forecasting of future disease burden has been used in a range of policy documents, reports and reforms. One example of this is **the Perspective Plan (2020-2021)** (source 10), in which the Ministry of Finance presented key strategies to address future demographic, social, economic and climate challenges.

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5. Sources to corroborate the impact (indicative maximum of ten references)

1) Meld. St. 19 (2014-2015). Folkehelsemeldingen. Mestring og muligheter
2) Meld. St. 19 (2018-2019). Folkehelsemeldinga. Gode liv i eit trygt samfunn
3) Meld. St.15 (2022-2023). Folkehelsemeldinga. Nasjonal strategi for utjamning av sosiale helseforskjellar.
4) Meld. St. 7 (2019-2020). Nasjonal helse- og sykehusplan 2020-2023.
5) Helsedirektoratet (2018). Ti tiltak for å redusere sykdomsbyrden og bedre folkehelsen.
6) Nordic Nutrition Recommendations 2023. Integrating Environmental Aspects.
7) Meld. St. 34 (2015-2016). Verdier i pasientens helsetjeneste. Melding om prioritering.
8) Terveydenhuollon palveluvalikoiman priorisointi. Valtioneuvoston selvitys- ja tutkimustoiminnan julkaisusarja 2022:53
9) Grenseverdier for svevestøv. Forslag til reviderte grenseverdier for PM10 og PM2,5.
10) Meld. St. 14 (2020-2021). Perspektivmeldingen 2021.