



Estimating disability prevalence and disability-related inequalities: Does the choice of measure matter?

Anna Amilon^{a,*}, Kasper M. Hansen^b, Agnete Aslaug Kjær^a, Tinne Steffensen^c

^a VIVE – The Danish Center for Social Science Research, Copenhagen, Denmark

^b Department of Political Science, University of Copenhagen, Copenhagen, Denmark

^c The Danish Institute for Human Rights, Copenhagen, Denmark

ARTICLE INFO

Keywords:

Disability prevalence
Disability measures
Employment
Voter turnout
Inequality
Denmark
The Washington group short set of questions on disability
The global activity limitation indicator

ABSTRACT

Rationale: Different measures for quantifying the percentage of people with a disability in surveys result in diverging estimates of prevalence and disability-related inequalities. Thus understanding the implications of using different disability measures is of vital policy importance. This study is the first to investigate the within-survey variation in disability prevalence based on two internationally recognized measures: the Washington Group Short Set (WGSS) and the Global Activity Limitation Indicator (GALI). It is also the first to examine the disability-related inequality in voter turnout, based on official validated voter records.

Methods: We use data on 11,308 25–54-year-old respondents from the 2016 wave of the Survey of Health, Impairment and Living Conditions in Denmark (SHILD) to estimate the disability prevalence based on the WGSS and the GALI. Moreover, we investigate health characteristics of individuals with a disability according to the two measures and inequalities in two central social policy success parameters: voter turnout and employment. **Results:** The WGSS estimates higher disability prevalence (10.6%) than the GALI (5.5%). Only 2.5% of the sample are in both groups, implying that largely, different individuals are defined as having a disability depending on which measure is used. The health profiles of the two groups also differ, as people with a GALI-defined disability are significantly more likely to report a severe mental illness or a major physical health problem. The GALI estimates indicate larger inequalities between people with and without a disability than the WGSS for the probability of being employed, whereas there are no significant differences for voter turnout.

Conclusion: The choice of disability measure strongly influences within-survey estimates of disability prevalence, the health profile of the defined groups, and inequalities in outcomes. The WGSS underrepresents the number of people suffering from severe mental illness. Estimated inequalities in employment are larger for the GALI than for the WGSS.

1. Introduction

People with disabilities experience significant educational, occupational, and health disparities throughout many industrialized countries (Amilon et al., 2017; Krahn et al., 2015; Rubio-Valverde et al., 2019). However, as a disability arises in the interaction between the individual with a health problem and his or her surroundings, defining and measuring who has a disability is difficult (Myers et al., 2020). A large set of measures exist for defining and quantifying the percentage of people with a disability in a population (Altman, 2014; Burkhauser et al., 2014). These measures differ in the extent to which they consider factors related to, for example, the individual's functional impairment,

societal participation, and activity level.

The variation in the degree to which these factors are included and emphasized stems from a change in the view on disabilities. While the medical model, which frames disability as solely an impairment at the individual level, was predominant in the 1970s–1980s, contemporary models tend to emphasize the interaction between the individual's impairment and the barriers and structures that prevent the individual from participating in various societal activities (McDermott and Turk, 2011). This change in the view on disabilities was influenced by the social-constructivist model (Berger and Luckmann, 1967), which postulates that societal concepts are constructed in reciprocal interactions between actors in society (Braddock and Parish, 2012). In parallel,

* Corresponding author. VIVE, Herluf Trolles gade 11, 1052, Copenhagen, Denmark.

E-mail address: ame@vive.dk (A. Amilon).

<https://doi.org/10.1016/j.socscimed.2021.113740>

Received in revised form 26 January 2021; Accepted 30 January 2021

Available online 4 February 2021

0277-9536/© 2021 Elsevier Ltd. All rights reserved.

deinstitutionalization of people with disabilities and advocacy by disability groups (inspired by the civil rights movements for people of color) have been put forward as causes behind the change in the view on disabilities (Braddock and Parish, 2012).

The World Health Organization's (WHO) International Classification of Functioning, Disability and Health (ICF) framework is widely considered the gold standard for the conceptual understanding of disability (Brandt et al., 2014). According to the ICF, disability is the outcome of the negative aspects of the interaction between a person with an impairment and the environmental and personal factors surrounding that person (World Health Organization, 2013). Thus, the experience of disability depends not only on the individual's medical impairment, but also on contextual factors such as the availability of assistive technologies, the accessibility of the built environment, societal attitudes towards people with disabilities and the individual's aspirations for his or her life (World Health Organization, 2011). As the disability arises in the dynamic interaction between individual and contextual factors, estimating the prevalence of people with disabilities is a challenging task.

While studies investigating variation in the prevalence of disability across definitions rely on data from different surveys, surveys themselves differ in factors such as sampling design, response rates, and the time and method of data collection (Lauer and Houtenville, 2018). Thus the resulting variation in disability prevalence may be due to variations in disability measure, survey methodology, or both.

Using data from the Survey of Health, Impairment and Living conditions in Denmark (SHILD), merged with administrative data on gender, age, health, income, education, unemployment and turnout, this paper systematically compares two internationally recognized disability measures—the Washington Group Short Set of questions on disability (WGSS) and the Global Activity Limitation Indicator (GALI)—for three factors: disability prevalence, sociodemographic and health profiles, and inequalities in employment rates and voter turnout.

As our study is the first to investigate the within-survey variation in disability prevalence based on different measures, it can exclude differences in survey methodology as a source of bias in differences in disability prevalence across measures. Moreover, this study is the first to investigate the disability-related inequality in employment and voter turnout, based on official records.

Various approaches to measuring disability result in substantial variation in disability rates among countries. Thus prevalence varies from approximately 1% of populations in lower-income countries, such as Bangladesh and Kenya, to about 15–20% in higher-income countries, such as Canada, New Zealand, Spain and the U.S. (Mont, 2007). This variation has mainly been attributed to lower-income countries usually collecting information on disability via censuses (which only incorporate a limited number of disability-relevant questions, often with a narrow focus on physical impairments), whereas higher-income countries usually collect disability data through more comprehensive surveys. In addition, socio-cultural differences in the understandings of what constitutes a “normal” level of functioning, as well as differences in the age-distribution of populations (lower-income countries often have younger populations than higher-income countries), may play a role (Palmer and Harley, 2012; World Health Organization, 2011).

Furthermore, the prevalence of disability varies substantially within countries, depending on what measure or definition is used (e.g., Angelov and Eliason, 2018; Brandt et al., 2014; Burkhauser et al., 2014). Clearly, the substantial variation in disability rates across definitions influences the composition of the resulting group of people that is defined as having a disability.

Moreover, estimates of inequalities in key social policy success parameters, such as employment rates (Burkhauser et al., 2014), education level (Rubio-Valverde et al., 2019), and democratic participation vary across definitions. Equal participation in these areas is protected by the United Nation's Convention on the Rights of Persons with Disabilities (CRPD). Accurate statistical data on disability and related inequalities may guide policy makers in the evaluation, planning, and development

of government programs and social interventions focused on the needs of people with disabilities in areas such as labor market participation and democratic inclusion. Thus, as the choice of definition influences the success and accuracy in monitoring the national-level implementation of the CRPD, understanding the consequences of using different definitions is of vital policy importance.

2. Background

2.1. Disability policy in Denmark

In 2009, the Danish Parliament ratified the United Nations' Convention on the Rights of Persons with Disabilities (CRPD), aimed at promoting, protecting, and ensuring the full and equal enjoyment of all human rights and fundamental freedoms by all persons with disabilities. The CRPD is based on an expanded understanding of disability, encompassing both physical and mental impairments (United Nations, 2020). In recent years, a sharp increase in the percentage of people receiving psychiatric treatment (from 20 per 1000 inhabitants in 2007 to 26 in 2017) has led to an increased focus in Denmark on people with mental health problems (Danish Regions, 2017; Mikkelsen et al., 2011).

Overall, Danish social legislation stipulates that people with severely reduced physical or mental capabilities or capacities may have the right to various forms of care and assistance services, assistive devices, adaptations to the home and workplace and financial support (The Ministry of Social Affairs, 2011). The Law on Equal Treatment in the Labor Market (LBK no. 1349, 2008) prohibits discrimination on the grounds of disability in the labor market whereas the Disability Discrimination Act (Law no. 688, 2018) prohibits such discrimination in all other areas of society. Reforms aimed at actively reducing the number of recipients of disability pensions by offering rehabilitation, training, and/or supported employment to people with limited work capacity have been implemented during the past decade (Danish Agency for Labour Market and Recruitment, 2012).

Moreover, persons with disabilities have the right to receive personal assistance when voting and absentee voting is available in hospitals and in housing for the disabled for a certain period preceding an election day (LBK no. 13, 2020).

2.2. The selected disability measures

Although standardized identification of people with disabilities in surveys has been a global priority in public health research and policy for at least the past 20 years, different measures are still used in different geographical regions and contexts (Lauer et al., 2019). The United Nations formed The Washington Group on Disability Statistics in 2001 to guide the development of a short set of general disability measures suitable for use in censuses and national surveys, with the purpose of providing internationally comparable data on disability consistent with the ICF (Lauer et al., 2019; Madans et al., 2001). As cross-national comparison was a primary objective, the *Washington Group Short Set* (WGSS) focuses on measuring functioning in core domains, rather than measuring disparities in participation. As functioning is influenced by differences in culture and economic resources across countries to a lesser extent than opportunities for participation, functioning provides a better basis for cross-country comparisons (Madans et al., 2011).

WGSS includes the following six questions with four ordinal responses (no difficulty, some difficulty, a lot of difficulty, cannot do at all):

1. Do you have difficulty seeing, even if wearing glasses?
2. Do you have difficulty hearing, even if using a hearing aid?
3. Do you have difficulty walking or climbing steps?
4. Do you have difficulty remembering or concentrating?
5. Do you have difficulty (with self-care such as) washing all over or dressing?

6. Using your usual (customary) language, do you have difficulty communicating (for example understanding or being understood by others)?

The WGSS has been used in the U.S. National Health Interview Survey since 2010 and by 2019, over 60 countries had used it in censuses or surveys (Lauer et al., 2019; Washington Group on Disability Statistics, 2018). The first part of question 6, “Using your usual (customary) language,” was omitted in the Danish translation of the WGSS.

The *Global Activity Limitation Indicator (GALI)* is a single survey item measuring participation restriction. GALI, which is primarily used within the EU and its member states, is included in several major European surveys such as the European Health Interview Survey (EHIS); Survey of Health, Ageing and Retirement in Europe (SHARE); and Survey of Income and Living Conditions (SILC) (Van Oyen et al., 2018). Van Oyen et al. (2018) have tested the concurrent and predictive validity and reliability of the GALI and shown it to be good.

The GALI question reads as follows:

For at least the past 6 months, to what extent have you been limited because of a health problem in activities people usually do? Would you say you have been severely limited, limited but not severely, or not limited at all?

2.3. Considerations and hypotheses

The differences between the WGSS and the GALI survey instruments may result in differences in the estimated prevalence of disability, in the composition of the group of people defined as having a disability, and in their average outcomes, for the following three reasons:

First, while the WGSS instrument focuses solely on difficulties in core functional domains to create a disability identifier, the GALI incorporates barriers to participation (i.e., “have you been limited in activities people usually do”). Thus, the GALI, to a larger extent than the WGSS, reflects an understanding of disability in which the health impairment, in its interaction with various barriers, may hinder full and effective participation in society. This difference between the two instruments may have important implications for the composition of the identified group with disabilities. For example, recent studies have shown that the discrimination and stigma faced by persons with disabilities in general is much more prevalent among younger persons with disabilities in particular, as it “violates cultural norms and expectations regarding able-bodied working-age adults” (Namkung and Carr, 2019). Similarly, respondents’ understanding of what “activities people usually do” may vary with socio-demographic characteristics such as gender, age, ethnicity, and educational attainment.

Second, the GALI specifies the duration of the health problem in the survey question (i.e., “at least the past 6 months”), whereas this factor is not included in the WGSS. Yet research has shown the transitory nature of disability, with some people transitioning in and out of disability over time, according to changes in their health status (Myers et al., 2020). Thus, the differences in attention to duration in the framing of the two disability instruments may have important implications for the resulting composition of groups, with and without disabilities.

Third, the two instruments differ in the way they specify impairments and their resulting limitations. The WGSS is highly specific, identifying activity limitations in six domains (e.g., seeing, hearing, walking, remembering and concentrating, washing and communicating). However, apart from “remembering and concentrating” (question 4) and, to some degree, “communicating” (question 6), the WGSS focuses solely on physical health limitations, neglecting limitations associated with mental health impairments. Largely excluding mental illness may constitute a weakness, as recent meta-analyses point toward increasing rates of mental illness prevalence (albeit driven mainly by increasing population size, population aging (Baxter et al., 2014; Richter et al., 2019), and, in the Danish context, increasing prevalence among youth (Ministry of Social Affairs and the Interior, 2020)). In contrast, the

GALI is less specific, not even defining “a health problem,” thereby leaving it up to the respondent as to which health impairments to consider relevant.

These differences between the GALI and the WGSS can potentially influence the estimated prevalence of disability and the characteristics and outcomes of the identified groups, with and without a disability. Therefore, we formulate three hypotheses:

As the GALI requires not only the existence of a health condition but also a participation limitation, we expect disability prevalence based on the GALI to be lower than that based on the WGSS. However, as people with a mental health disability may be included in the GALI and given the relatively high prevalence of such problems in Denmark (and most other high-income countries) we might expect the total disability prevalence based on the GALI to be larger than that based on the WGSS. Given these opposing expectations regarding total prevalence, and our expectation that mental health conditions are more prevalent among respondents with a GALI-defined disability, we hypothesize as follows:

Hypothesis 1: The WGSS and the GALI result in diverging estimates of disability prevalence.

Hypothesis 2: The percentage of respondents with a mental health condition is larger among respondents with a GALI-defined disability than among respondents with a WGSS-defined disability.

Moreover, the differences between the two measures may translate into differences in key social policy success outcomes, such as employment rates and voter turnout. Due to the GALI’s inclusion of participation in “activities people usually do,” we hypothesize as follows:

Hypothesis 3: The difference in employment levels and voter turnout between people with and without disabilities is larger when we use the GALI to define disability than when we use the WGSS.

This study tests these hypotheses by analyzing the within-survey differences in disability prevalence and sociodemographic and health profiles when we use the GALI and the WGSS, respectively, to identify people with disabilities. Furthermore, we analyze disability-related inequalities in employment levels and voter turnout for the two measures.

3. Methods

3.1. Data

We use data from the 2016 wave of the Survey of Health, Impairment and Living conditions in Denmark (SHILD), a representative study covering a broad range of topics, including the living conditions and disability in the Danish population aged 16–64. Statistics Denmark randomly sampled approximately 38,000 respondents for the survey from on the full population, sending them an information letter about the survey and a link to the questionnaire in their “e-boks”—a digital communication service connected to the individual’s individual identifier, used by both public authorities and private firms. In case of non-response after three contact attempts via the e-boks, Statistics Denmark contacted and interviewed respondents by telephone (with up to five contact attempts per respondent). Respondents who were exempt from using the e-boks for communication with public authorities, or who had no registered telephone number, were contacted via regular mail. The final sample includes 20,451 respondents (53.8% response-rate). In this analysis, as we are interested in outcomes related to employment and voting, we focus on individuals of prime working age (aged 25–54). For this age category, the data includes 11,308 respondents with complete information on all survey and register variables of interest.

3.2. Measures

We combine the data from SHILD with detailed individual-level information from the Danish administrative registries on socio-demographic and health characteristics, employment, and voter turnout.

3.2.1. Measures of disability

We compare two measures of disability in this study. First, we identify individuals as having a GALI-defined disability if they answered that they, due to a health problem, had been “severely limited” or “limited but not severely” from engaging in activities that people usually do during the previous six months. Second, following the cut-off recommended by The Washington group, we code individuals as having a WGSS-defined disability if they answered “a lot of difficulty” or “cannot do at all” to one or more of the six WGSS questions (Washington Group on Disability Statistics, 2019).

3.2.2. Outcome variables

To investigate inequalities between people with and without disabilities, we focus on two central policy outcomes: voter turnout and employment. A high voter turnout among people with disabilities is vital for this group to achieve political power and to influence policy. Moreover, the legitimacy of the democratic system may be called into question if the representation of voters is low among vulnerable segments of the population. At the individual level, employment can contribute to reduced social isolation, higher quality of life and better living standards. At the societal level, high labor market participation constitutes the economic basis of the welfare state.

We rely on register-based information for both outcome variables. Using register-based information for our outcome measures has two main advantages. First, we avoid common-source bias such as justification bias, which arises if individuals who, for example, report being unemployed or not voting are also more likely to report having a disability. Second, previous research consistently show that self-reported voter turnout surveys exaggerate turnout due to over-reporting (i.e., people reporting that they voted when they did not) and nonresponse bias (i.e., nonvoters are less likely to participate in surveys) (Dahlgaard et al., 2019).

We circumvent common-source and over-reporting bias by relying on unique validated turnout indicators from The Danish Turnout Project, including individual-level voter turnout information for 91% of all eligible voters in Denmark. There is no individual selection into the turnout data as the collection is done administratively based on the willingness of the municipality to provide access to the data. Seven municipalities failed to provide access mainly due to not having a digitized voting record (Hansen, 2018). Specifically, we use information from the 2017 local (municipality and region) election for three reasons: First, it took place in close connection with the 2016-SHILD wave. Second, as Danish non-nationals officially residing in Denmark are allowed to vote in local (but not national) elections, the number of respondents exempt from voting will be lower. Third, following a legal amendment in 2016 (Law no. 381, 2016), an estimated 2000 people with disabilities who were previously excluded from the right to vote due to deprivation of their legal capacity under section-6 of the Danish Guardianship Act (LBK no. 1015, 2007) were given the right to vote in the 2017 local election. This legislative change may positively have influenced societal attitudes regarding the right to democratic participation among people with disabilities. We create a binary variable for *voter turnout*: voted vs. did not vote.

We retrieved information on weekly employment status from the Danish national registers (DREAM). We argue that it is labor market attachment and not the number of hours per se that is the most important indicator for employment. We therefore construct a binary variable for employment status: employed or self-employed (including part-time and full-time employment) vs. not employed (including unemployed, on sick leave, on cash benefits, and receiving a disability pension). For consistency, we measure employment status in the same week that the 2017 local election took place (from November 20–26, 2017).

3.2.3. Socio-demographic and health measures

We include basic information on gender, age and country of origin from the Danish population registers. We code information on *level of*

education from the education register to form five levels: compulsory schooling, high-school education, vocational education, short- or medium cycle higher education and long-cycle higher education.

To investigate possible asymmetries in the health profiles of the individuals with a disability according to the WGSS- and the GALI-definition, respectively, we use both objective and subjective health information. First, we use data from the Danish administrative health registers from 2005 to 2015 (the 10 years preceding the SHILD survey data collection) to construct a dichotomous indicator for medical conditions based on groups of International Classification of Disease (ICD-10) diagnoses recorded during a hospital stay or in relation to any outpatient visits to a hospital. This indicator takes the value one if an individual has been diagnosed with one or more of the following conditions at least once during the past 10 years: behavioral disorders or ADHD, autism spectrum disorders, mobility disabilities, sensory disabilities, learning disabilities, developmental disorders or mental disorders. While previous studies have identified these diagnoses as being associated with disability (Christoffersen, 2019; Dean et al., 2018), they may not be exhaustive for all diagnosed conditions that are associated with disability. We have sorted the diagnoses to form three indicators: mental, cognitive, and physical conditions (supplementary material, Table A provides a complete list of ICD-10 codes included in the three indicators).

Second, respondents to SHILD were asked whether they had a major “long-lasting physical health problem or disability,” or a major “mental disorder.” We use this information to construct two binary subjective health measures (*major physical health problem*; *major mental health disorder*). These self-reported variables have the advantage of allowing us to identify the extent to which people with self-reported mental and physical health problems, respectively, are captured by the two disability measures (GALI and WGSS).

Supplementary material Table B presents descriptive statistics for respondents, the original sample and people eligible to vote in the 2015 local Danish election. The table shows no substantial differences between the samples. Importantly, the share of individuals with disability-related diagnoses is consistent across samples, indicating limited disability-related non-response. Further, to the extent that disability-related non-response is present, a major advantage of our data is that the two measures (WGSS and GALI) are affected by it to the same extent.

3.3. Analytic strategy

We merged the data from SHILD with register data on selected medical diagnoses (ICD10-codes), voter turnout, employment and basic demographic information. We weight the data to adjust for imbalances related to gender, age, and geographical location (region). After computing the disability prevalence for the GALI and the WGSS, we compute bivariate statistics of socio-demographic and health variables to produce and compare percentages across the two disability populations.

Moreover, we estimate separate binary logistic regressions with the outcome measures (i.e. voter turnout and employment) as dependent variables and each of the two disability measures as explanatory variables. We estimate models both with and without controls for socio-demographic variables. To compare the estimated disability-related inequalities, we calculate the difference-in-difference in predicted outcomes between individuals with and without a disability for the two measures (GALI and WGSS). To calculate standard errors, we use the Delta method. To test for statistical differences in disability coefficients between models (i.e., across disability measures), we apply Z-tests. We use STATA version 15.1 for all analyses.

4. Results

Table 1 presents descriptive statistics for our sample. The data show large differences in the percentages of people defined as having a

Table 1
Descriptive statistics.

Variable	N	Percentage
GALI-defined disability	639	5.5%
WGSS-defined disability	1231	10.6%
Employed	9048	79.0%
Voted	9351	81.6%
Female	6219	49.5%
Age (years)		
25–34	3045	34.7%
35–44	3364	29.0%
45–54	4899	36.3%
Origin		
Danish born	10,315	90.7%
Immigrants	901	8.4%
Descendants	92	1.0%
Education		
Compulsory	1097	9.9%
High school	810	7.7%
Vocational	3614	31.0%
Short- and medium cycle higher education	3708	32.2%
Long-cycle higher education	2079	19.2%
Diagnoses ¹		
Physical	1101	9.3%
Mental	439	3.9%
Cognitive	32	0.3%
Self-reported health conditions		
Major physical health problem	849	7.0%
Major mental health disorder	300	2.7%

Note: ¹ Refers to selected diagnoses as specified in [supplementary material, Table A](#), registered in the period 2005–2015. Number of observations = 11,308.

disability according to the GALI and the WGSS, respectively. The prevalence of disability in the population is almost twice as large for the WGSS definition (10.6%) than for the GALI definition (5.5%). Thus, the WGSS estimates a higher disability prevalence than the GALI. This result is in line with our first expectation (Hypothesis 1), suggesting diverging estimates of disability prevalence between the two indicators.

[Fig. 1](#) presents a Venn-diagram over the populations with a WGSS-defined and GALI-defined disability, respectively. The most striking result is the low degree of overlap between the two disability measures: Of the 1231 individuals with a WGSS-defined disability, 23.6% also have a GALI-defined disability, whereas of the 639 individuals with a GALI-defined disability, 45.5% also have a WGSS-defined disability. Only 2.5 percent of the total sample have both a WGSS-defined and a GALI-defined disability.

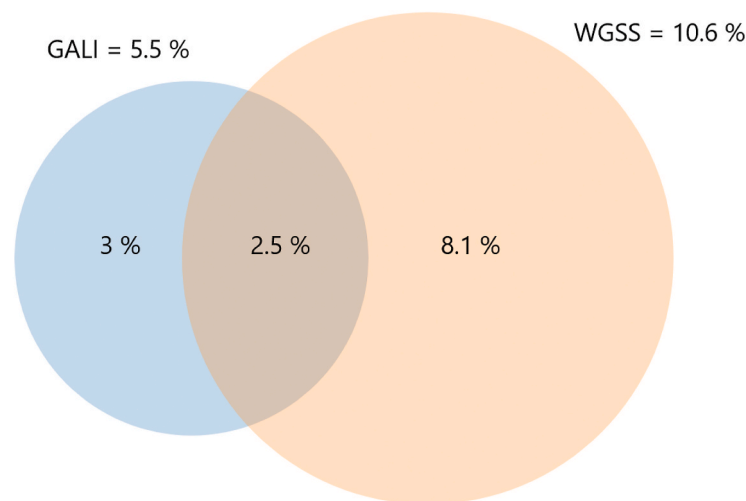
[Table 2](#) presents the percentages of demographic and health-related factors for the GALI and the WGSS samples, respectively, whereas [Fig. 2](#) displays differences in these factors between people with disabilities as defined by the GALI and the WGSS and 95% and 90% confidence intervals. We focus on the 90% level of confidence, as differences between the two samples may be understated in statistical tests due to overlapping (paired matched) samples.

Despite the large difference in prevalence and the low degree of overlap between the two definitions, there are no significant differences in gender or age. Within both samples, the greatest percentages of people with a disability were between ages 45–54 and female. The proportion of immigrants is significantly larger among people with a WGSS-defined disability (12.3%) than among people with a GALI-

Table 2
Socio-demographic and health characteristics by disability status and coding.

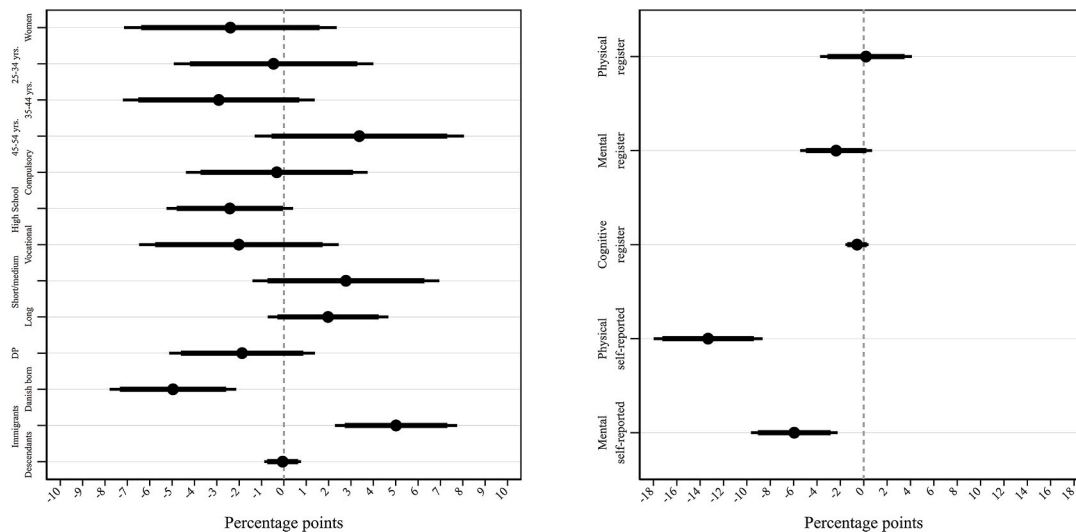
Characteristic	GALI		WGSS	
	Yes	No	Yes	No
Women	55.9%	49.1%	53.5%	49.0%
Age (years)				
25–34	32.2%	34.8%	31.8%	35.0%
35–44	28.9%	29.0%	26.0%	29.3%
45–54	38.8%	36.2%	42.2%	35.6%
Origin				
Danish born	91.9%	90.6%	86.9%	91.1%
Immigrants	7.3%	8.4%	12.3%	7.9%
Descendants	0.8%	1.0%	0.7%	1.0%
Education				
Compulsory	23.8%	9.1%	23.5%	8.2%
High-school	10.6%	7.6%	8.1%	7.7%
Vocational	32.8%	30.9%	30.8%	31.1%
Short/Medium	24.8%	32.6%	27.6%	32.8%
Long	8.1%	19.8%	10.0%	20.3%
Disability pension	14.1%	1.7%	12.2%	1.2%
Medical conditions (ICD-10 diagnoses)	30.6%	11.6%	28.4%	10.8%
Physical	21.5%	8.6%	21.7%	7.9%
Mental	12.6%	3.4%	10.2%	3.2%
Cognitive	1.3%	0.2%	0.7%	0.2%
Self-reported health problem	54.3%	5.8%	38.6%	4.9%
Major physical health problem	45.4%	4.8%	32.1%	4.1%
Major mental health disorder	20.6%	1.7%	14.6%	1.3%
Number of observations	639	10,669	1231	10,077

Note: For a full overview of diagnoses included in “medical conditions,” see [Supplementary Materials, Table A](#).



Note: Number of observations = 11,308.

Fig. 1. Venn-diagram. Percentages of adults with disabilities across disability coding.



Note: The difference in percentages is calculated as WGSS – GALI. 95% (bold lines) and 90% (thin lines) confidence intervals. Number of observations = 11.308.

Fig. 2. Differences in percentages with specific demographic and health-related characteristics between the WGSS and the GALI samples. Percentage points.

defined disability (7.3%). Some of the difference between the two definitions can be traced to WGSS question 6. To a larger extent than majority Danes, immigrants may “have difficulty communicating (for example understanding or being understood by others)” due to limited knowledge of Danish, rather than actually having a disability.

While levels of education are generally lower among people with a GALI-defined disability than among people with a WGSS-defined disability, these differences are not statistically significant. The same holds true for differences in the proportion receiving a disability pension. However, large asymmetries exist in the health profiles of the two groups. People with a GALI-defined disability are more likely to have a medical (ICD-10 classified) condition related to mental illness than people with a WGSS-defined disability. The same pattern applies to our subjective health measures, which show that the GALI estimate is 6 percentage points larger than the WGSS estimate for self-reported major mental health disorders. These results are in line with our second expectation (Hypothesis 2)—suggesting that the percentage of respondents with a mental health condition is larger when the group is defined by the GALI than when defined by the WGSS.

Moreover, remarkably large percentages of respondents with a disability (regardless of whether we use the WGSS or the GALI to define the group) do not have any type of medical diagnosis or subjective health problem. Among respondents with a WGSS-defined disability in particular, less than half have either a diagnosis or a self-reported health problem.

In Table 3, we present differences in predicted probabilities of being employed or having voted in the 2017 regional election for people with and without a GALI-defined and a WGSS-defined disability, respectively. We estimate models with and without controls for demographic variables (age, gender, origin) and level of education. While level of education is an important predictor of employment and voter turnout, this variable may be influenced by disability and hence, results in which we control for level of education should be interpreted with caution.

We find significant disability-related inequalities in employment and voter turnout, regardless of disability definition. The inequalities in outcomes are much larger for employment than for voter turnout for both disability definitions.

People with a GALI-defined disability are approximately 36 percentage points less likely to be employed than people not experiencing a GALI-defined disability, whereas the corresponding inequality between people with and without a WGSS-defined disability is approximately 30

Table 3

Difference in predicted outcomes for respondents with and without disabilities across disability measures (percentage points).

Disability measure	Difference in employment			Difference in voter turnout		
GALI	-36.1 (2.1) ***	-36.1 (2.1) ***	-29.4 (2.1) ***	-4.2 (1.8)*	-5.4 (1.8)	-1.2 (1.6)
WGSS	-30.1 (1.5) ***	-31.3 (1.5) ***	-25.7 (1.5) ***	-7.5 (1.4) ***	-7.4 (1.3) ***	-3.6 (1.2) **
Difference-in-difference (WGSS – GALI).	6.0*	5.2 ⁺	3.7	-3.3	-2.0	-2.4
No controls	x			x		
Demographic controls		x			x	
Demographic & education controls			x			x

Note: ⁺p < 0.10, *p < 0.05, **p < 0.01, ***p < 0.001. Demographic controls include age, country of origin and gender. Number of observations = 11.308.

percentage points. Thus, we find larger disability-related inequality in employment when measuring disability with the GALI than with the WGSS. A Z-test (i.e., which tests the equality of the two disability coefficients between the two models) reveals that this difference-in-difference of 6 percentage points is statistically significant at the 95% level (or at the 90% level, when we control for demographic characteristics). These results indicate that, when examining a specific policy success parameter such as employment, we find support for Hypothesis 3 i.e., our results show larger inequalities when we use the GALI to define people with disabilities than when we use the WGSS. The relatively larger inequality associated with a GALI-defined disability may be due to the GALI’s capturing more people with mental health disorders than the WGSS.

For the second outcome, voter turnout, we find similar disability-related inequality, although the difference between individuals with and without a disability is less substantial for participation in elections than for employment. People with a GALI-defined disability are approximately 5 percentage points less likely to vote than people

without a GALI-defined disability, whereas the corresponding inequality between people with and without a WGSS-defined disability is marginally larger, at approximately 7 percentage points. However, a Z-test reveals that the difference-in-difference between the two definitions is not statistically significant at the 90% level.

5. Discussion

Our findings suggest that choice of disability measure strongly influences the prevalence, composition, and outcomes of people defined as having a disability. The WGSS produced prevalence estimates nearly twice as large as the GALI. Several factors may explain this difference. The GALI's inclusion of limitations to participation in the question may lead to lower percentages of people having a GALI-defined disability, as people may indeed experience physical difficulties without being "limited ... in activities people usually do." Moreover, as the WGSS, in contrast to the GALI, does not consider the duration of the health problem, some people may be defined as having a WGSS-defined disability on the basis of having an acute injury rather than a lasting disability. Our findings are in line with those reported by Myers et al. (2020), who elaborate on the transitory nature of disability.

Moreover, and surprisingly, we find limited overlap between the two measures: Less than a fifth of individuals with either type of disability had both types. Furthermore, among people with a WGSS-defined disability, only about a quarter also had a GALI-defined disability, whereas among people with a GALI-defined disability, only slightly less than half also had a WGSS-defined disability. This limited overlap suggests that the two definitions may identify groups of people with different demographic and health profiles.

Nevertheless, differences in demographic characteristics between the two groups were either insignificant (gender, age) or small (origin). The higher percentage of people of immigrant descent with a WGSS-defined disability is in line with the overall aim of the Washington Group, that is, to produce internationally comparable data based on questions concerning performance of "basic universal activities" (Washington Group, 2009). Moreover, cultural differences in perceptions of what types of "activities people usually do" may have attenuated the percentages of immigrants whom we coded as having a GALI-defined disability. Consequently, the GALI may underestimate disabilities among immigrants.

Although the sociodemographic differences were small, we find substantial differences in the health profile of individuals defined by either the WGSS or the GALI as having a disability. Despite resulting in much larger estimates of disability prevalence, our findings strongly suggest that the WGSS underrepresents individuals suffering from mental illnesses. Given the increasing prevalence of mental illness in many (high-income) countries (Baxter et al., 2014; Richter et al., 2019), the specific focus of the WGSS on activity limitations in six domains—not including limitations related to mental impairments—is a potential limitation.

However, regardless of the choice of measure, we find large inequalities in the probability of employment between people with and without disabilities. Thus, even in an egalitarian country such as Denmark, with reforms encouraging labor market participation of, and laws explicitly prohibiting discrimination against, people with disabilities, this group has a much smaller probability of employment than people without disabilities.

As we hypothesized (hypothesis 3) the inequality in employment is largest for the GALI—a result most likely due to the incorporation of barriers to participation in the question (employment is most likely considered an "activity people usually do" by most people). Similarly, regardless of the choice of measure, we find inequality—albeit relatively small—in voter turnout between people with and without disabilities. However, for voter turnout, we find no significant differences between the two disability measures. This result contradicts our hypothesis 3, that is, our expectation that inequalities would be largest for the GALI

for both outcomes. Yet, contrary to employment, voting may not be considered an activity people usually do and this distinction may explain the different results for the two outcomes.

6. Limitations

Despite its high-quality data and comprehensive statistical analysis, this study has four potential limitations that need mentioning. First, although the opportunity to compare the within-survey variation between two internationally recognized disability measures is a clear advantage of this study, the specific survey context may have influenced prevalence estimates. The SHILD, as a survey on health, impairments and living conditions, includes a number of items on health status that may have "primed" respondents towards giving affirmative answers to the two disability measures we examine, potentially leading us to overestimate the prevalence of disability for both measures (Lee and Schwarz, 2014).

Second, this study relies on cross-sectional data. Although this type of data works well for our objectives (i.e., comparing the prevalence, composition, and disability-related inequalities between the two disability measures in focus), future studies could benefit from the inclusion of panel data, particularly as disability status may change over time (Myers et al., 2020).

Third, we focus on disability-related inequalities in relation to two vital policy outcomes, employment and voter turnout, finding particularly large disability-related inequalities in employment. Nevertheless, with the specific employment indicator used in this study, we cannot distinguish between voluntary and involuntary labor market non-participation. As we conducted the study in a Nordic welfare state, where both disability pensions and similar social transfers are in place, aimed at ensuring a certain income and living standard for individuals who cannot participate in ordinary employment due to a health condition, the interpretation of differences in employment is not straightforward.

Fourth, this study analyzes differences between the WGSS and the GALI when using the conventional (binary) coding of disability, thereby ignoring the gradient or severity in disability. Studying this gradient and how it influences disability prevalence and inequalities therefor remains an important topic for future research.

7. Conclusions

The choice of disability measure strongly influences estimates of disability prevalence, the composition and characteristics of the group defined as having a disability, and the inequalities that people with disabilities experience. Policy-makers and researchers need to be aware of these differences when designing surveys and censuses, choosing between disability measures, and interpreting results. The GALI has the advantage of being short and simple and of capturing a more disadvantaged group than the WGSS. However, given its focus on limitations in participation, the GALI may be sensitive to different perceptions of what types of "activities people usually do," particularly when used across different cultures or contexts.

In contrast, the WGSS has the clear advantage of being less sensitive than the GALI to such variation in interpretation. Nonetheless, the omission of questions on mental illness is a weakness, particularly in high-income countries where mental health problems are a growing concern. The current development of a module for psychosocial functioning by The Washington Group is therefore a step in the right direction.

Author contributions

Anna Amilon: Conceptualization, Writing – original draft, Writing – reviewing & editing, Project administration. Kasper M. Hansen: Conceptualization, Formal analysis, Visualization, Writing – reviewing

& editing. Agnete Aslaug Kjær: Conceptualization, Formal analysis, Writing – reviewing & editing. Tinne Steffensen: Conceptualization, Data curation, Visualization, Writing – reviewing & editing.

Declaration of competing interest

None.

Acknowledgements

The SHILD data-collection was financed through government funds (Satspuljen 2016–2019). The collection and analysis of turnout data was financed by the Ministry of Social Affairs and the Interior, DUF - Danish Youth Council, The Danish Institute for Human Rights and the Department of Political Science, University of Copenhagen.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.socscimed.2021.113740>.

References

- Washington Group on Disability Statistics, 2018. The Washington Group on Disability Statistics Background Document.
- Altman, B.M., 2014. Another perspective: capturing the working-age population with disabilities in survey measures. *J. Disabil. Pol. Stud.* 25, 146–153. <https://doi.org/10.1177/1044207312474309>.
- Amilon, A., Larsen, L.B., Østergaard, S.V., Rasmussen, A.H., 2017. *Personer Med Handicap - Hverdagsliv Og Levevilkår* (Copenhagen).
- Angelov, N., Eliason, M., 2018. Factors associated with occupational disability Classification. *Scand. J. Disabil. Res.* 20, 37–49. <https://doi.org/10.16993/sjdr.42>.
- Baxter, A.J., Scott, K.M., Ferrari, A.J., Norman, R.E., Vos, T., Whiteford, H.A., 2014. Challenging the myth of an “epidemic” of common mental disorders: trends in the global prevalence of anxiety and depression between 1990 and 2010. *Depress. Anxiety* 31, 506–516. <https://doi.org/10.1002/da.22230>.
- Berger, P.L., Luckmann, T., 1967. *The Social Construction of Reality: A Treatise in the Sociology of Knowledge*. Penguin Books, London.
- Braddock, D.L., Parish, S.L., 2012. An institutional history of disability. *Handbook of Disability Studies*. <https://doi.org/10.4135/9781412976251.n2>.
- Brandt, D.E., Ho, P.S., Chan, L., Rasch, E.K., 2014. Conceptualizing disability in US national surveys: application of the World health organization’s (WHO) international Classification of functioning, disability, and health (ICF) framework. *Qual. Life Res.* 23, 2663–2671. <https://doi.org/10.1007/s11136-014-0740-6>.
- Burkhauser, R.V., Houtenville, A.J., Tennant, J.R., 2014. Capturing the elusive working-age population with disabilities. *J. Disabil. Pol. Stud.* 24, 195–205. <https://doi.org/10.1177/1044207312446226>.
- Christoffersen, M.N., 2019. Violent crime against children with disabilities: a nationwide prospective birth cohort-study. *Child Abus. Negl.* 98 <https://doi.org/10.1016/j.chiabu.2019.104150>.
- Dahlgaard, J.O., Hansen, J.H., Hansen, K.M., Bhatti, Y., 2019. Bias in self-reported voting and how it distorts turnout models: disentangling nonresponse bias and overreporting among Danish voters. *Polit. Anal.* 27, 590–598. <https://doi.org/10.1017/pan.2019.9>.
- Danish Agency for Labour Market and Recruitment, 2012. *Aftale om en reform af førtidspension og fleksjob* [WWW Document]. URL accessed 2.10.20. https://star.dk/media/8043/aftale_fop-pdf.pdf.
- Danish Regions, 2017. *Benchmarking Af Psykiatrien 2017*.
- Dean, K., Laurson, T.M., Pedersen, C.B., Webb, R.T., Mortensen, P.B., Agerbo, E., 2018. Risk of being subjected to crime, including violent crime, after onset of mental illness: a Danish national registry study using police data. *JAMA Psychiatry* 75, 689–696. <https://doi.org/10.1001/jamapsychiatry.2018.0534>.
- Hansen, K.M., 2018. *Valgdeltagelsen Ved Kommunal-Og Regionsvalget 2017* (Copenhagen).
- Krahn, G.L., Klein Walker, D., Correa-De-Araujo, R., 2015. Persons with disabilities as an unrecognized health disparity population. *American Journal of Public Health* (Supplement).
- Lauer, E.A., Houtenville, A.J., 2018. Estimates of prevalence, demographic characteristics and social factors among people with disabilities in the USA: a cross-survey comparison. *BMJ Open* 8, 17828. <https://doi.org/10.1136/bmjopen-2017-017828>.
- Lauer, E.A., Henly, M., Coleman, R., 2019. Comparing estimates of disability prevalence using federal and international disability measures in national surveillance. *Disabil. Health J.* 12, 195–202. <https://doi.org/10.1016/j.dhjo.2018.08.008>.
- Law no. 381, 2016. *Lov Om Ændring Af Lov Om Valg Af Danske Medlemmer Til Europa-Parlamentet Og Lov Om Kommunale Og Regionale Valg*.
- Law no. 688, 2018. *Lov Om Forbud Mod Forskelsbehandling På Grund Af Handicap*.
- LBK no. 1015, 2007. *Bekendtgørelse Af Værgemålsloven*.
- LBK no. 13, 2020. *Bekendtgørelse Af Lov Om Kommunale Og Regionale Valg*. Ministry of Social Affairs and the Interior, Copenhagen.
- LBK no. 1349, 2008. *Bekendtgørelse Af Lov Om Forbud Mod Forskelsbehandling På Arbejdsmarkedet Mv* [WWW Document]. URL accessed 9.17.20. <https://rm.coe.int/16806c83e5>.
- Lee, S., Schwarz, N., 2014. Question context and priming meaning of health: effect on differences in self-rated health between Hispanics and non-Hispanic Whites. *Am. J. Public Health* 104, 179–185. <https://doi.org/10.2105/AJPH.2012.301055>.
- Madans, J.H., Altman, B.M., Rasch for Nchs, E.K., Mbogoni, M., Synneborn, M., Banda, J., 2001. *Washington Group Position Paper on the Proposed Purpose of an Internationally Comparable General Disability Measure*.
- Madans, J.H., Loeb, M.E., Altman, B.M., 2011. Measuring disability and monitoring the UN convention on the rights of persons with disabilities: the work of the Washington group on disability statistics. *BMC Publ. Health*. <https://doi.org/10.1186/1471-2458-11-S4-S4>.
- McDermott, S., Turk, M.A., 2011. The myth and reality of disability prevalence: measuring disability for research and service. *Disabil. Health J.* <https://doi.org/10.1016/j.dhjo.2010.06.002>.
- Mikkelsen, C.H., Rask, M.B., Jensen, A.R., 2011. *Benchmarking Af Psykiatrien 2010*. Ministry of Social Affairs and the Interior, 2020. *Udviklingstendenser I Forhold Til Born Og Unge Med Psykiatriske Diagnoser* (Copenhagen).
- Mont, D., 2007. *Measuring Disability Prevalence*.
- Myers, A., Ward, B., Wong, J., Ravesloot, C., 2020. Health status changes with transitory disability over time. *Soc. Sci. Med.* 244 <https://doi.org/10.1016/j.socscimed.2019.112647>.
- Namkung, E.H., Carr, D., 2019. Perceived interpersonal and institutional discrimination among persons with disability in the U.S.: do patterns differ by age? *Soc. Sci. Med.* <https://doi.org/10.1016/j.socscimed.2019.112521>.
- Palmer, M., Harley, D., 2012. Models and Measurement in Disability: an International Review. *Health Policy Plan.* <https://doi.org/10.1093/heapol/czr047>.
- Richter, D., Wall, A., Bruen, A., Whittington, R., 2019. Is the global prevalence rate of adult mental illness increasing? Systematic review and meta-analysis. *Acta Psychiatr. Scand.* 140, 393–407. <https://doi.org/10.1111/acps.13083>.
- Rubio-Valverde, J.R., Nusselder, W.J., Mackenbach, J.P., 2019. Educational inequalities in global activity limitation indicator disability in 28 European countries: does the choice of survey matter? *Int. J. Public Health* 64, 461–474. <https://doi.org/10.1007/s00038-018-1174-7>.
- The Ministry of Social Affairs, 2011. *Social Policy in Denmark* (Copenhagen).
- United Nations, 2020. *Convention on the Rights of Persons with Disabilities (CRPD) | United Nations Enable* [WWW Document]. URL accessed 1.30.20. <https://www.un.org/development/desa/disabilities/convention-on-the-rights-of-persons-with-disabilities.html>.
- Van Oyen, H., Bogaert, P., Yokota, R.T.C., Berger, N., 2018. Measuring disability: a systematic review of the validity and reliability of the Global Activity Limitations Indicator (GALI). *Arch. Publ. Health* 76, 1–11. <https://doi.org/10.1186/s13690-018-0270-8>.
- Washington Group, 2009. *Statement of rationale for the Washington Group general measure on disability* [WWW Document]. URL Cent. Dis. Control Prev. accessed 2.27.20. https://www.cdc.gov/nchs/data/washington_group/rationale.pdf.
- Washington Group on Disability Statistics, 2019. *Analytic Guidelines: Creating Disability Identifiers Using the Washington Group Short Set (WG-SS) SAS Syntax*.
- World Health Organization, 2011. *World Report on Disability*. Geneva. <https://doi.org/10.1111/j.1741-1130.2011.00320.x>.
- World Health Organization, 2013. *How to Use the ICF: A Practical Manual for Using the International Classification of Functioning, Disability and Health. Exposure Draft for Comment*. October 2013. WHO, Geneva.