Conceptualisation and measurement of health

David Blane
Imperial College London

The present brief article sketches the various ways in which health has been defined and measured in quantitative linked register and survey research. Health, mortality, morbidity, functioning, quality of life and biomarkers are considered. A case is made for using the survey questionnaire measure of limiting long-standing illness in labour market economics.

Il presente articolo delinea i vari modi in cui la salute è stata definita e misurata nella ricerca su dati di tipo survey e quantitativi di fonte amministrativa. Sono presi in considerazione salute, mortalità, morbilità, capacità funzionali, qualità della vita e biomarcatori. Negli studi di economia del lavoro, si sostiene l'opportunità di utilizzare le misure – derivanti da questionario – relative alle malattie di lungo corso che comportano limitazioni per i lavoratori.

Presentation (by Chiara Ardito[1])

In February 2022 the "Laboratorio Riccardo Revelli – Centre for employment studies" organised its second biannual workshop on *Technological change, health, inequality and data for policy evaluation*. The workshop consisted of two parts, one on 'Technological change in the workplace during the fourth industrial revolution' and the second on 'Health and inequality'.

During this workshop professor David Blane delivered a talk about the challenges in measuring health. David Blane is emeritus professor at the School of Public Health at Imperial College London, and a longtime friend and collaborator with researchers at Laboratorio Revelli and at the Epidemiology Research Centre of Piemonte on various projects on the health effects of work-life extension and on the biological and political determinants of socioeconomic health inequalities[2].

In his speech, prof. Blane analysed the main measures of health that are used by labour economists and social scientists. For example, when investigating the health effects of a public policy, the health determinants of labour market participation and earnings, or the extent of health inequalities across socio-economic classes, researchers need to rely on an appropriate measure of health. These areas of research have gained an overwhelming

1 Epidemiology Unit, Piedmont Region & Department of Economics and Statistics, Torino University.

2 See for example, 'To Work or Not to Work? The Effect of Higher Pension Age on Cardiovascular Health', *Industrial Relation* 2021; 'Work and Health: old and new challenge for the welfare', *Sociologia del Lavoro* 2018; 'Trends in mortality by labour market position around retirement ages in three European countries with different welfare regimes', *International Journal of Public Health* 2013; 'Social-biological transitions: how does the social become biological?', *Longitudinal and Life Course Studies* 2013.

attention during the dramatic events spurred by the recent Covid pandemic crisis, which has so profoundly changed our concepts of health, and the way we work and organize our relationships.

Although labour economics has a long tradition in studying the health effects of pension rules, healthcare, security provisions at work, and similar public policies, the understanding and the recognition of the specific strength and weaknesses of the different health measures at hand has been generally overlooked. In his speech, Blane has highlighted often neglected nuances that lie behind popular health measures that are available to researchers thanks to the increasing availability of data. These include health data made available from large international surveys, the increasingly accessibility of administrative records with their potential of linking hospital admission, drugs prescription and historical mortality registers, and finally the upsurge of biomarkers data, which are included in large surveys such as Understanding Society or SHARE.

As pointed out by Blane, researchers should not underestimate the peculiarities of each definition of health that is adopted. The main message of his speech is that health is a multi-dimensional concept, and its measurement follows the historical evolution of medical and even administrative advances. For this reason, social scientists should think more deeply about whether a given measure of health actually allows to capture the mechanisms and the welfare dimensions that they think are the most relevant when analyzing a public policy.

Introduction

The author of the present piece has learnt much from econometricians, particularly careful instrumental variable analysis and propensity score matching, and humbly tries to repay the debt by looking at health from their point of view.

The World Health Organisation's 1948 foundation definition is a good place to start: Health is [...] *A state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity*. Nowadays some try to belittle this idea by describing it as aspirational but, to the present author at least, the concept of health being more than the absence of disease is too important to be brushed aside.

It helps to see health from a life course perspective in which the biological and the social interact: optimum growth and development as an embryo, child and adolescent; maintenance of peak functioning into mid-adulthood; slow attrition of functional capacity through early old age; and resilience against the adversities of older ages. With each of these stages influenced by social circumstances and because the social structure tends to accumulate social disadvantages across the life course, the emergence of social class differences in life expectancy, healthy life expectancy and disability-free life expectancy (Blane *et al.* 2016).

1. Mortality

Historically, all-cause mortality was the first health measure to be collected systematically. It has the attraction of high reliability (normally there is agreement about whether a person is alive or dead), so you have a potentially reliable numerator from which to calculate age-adjusted mortality rates. For this potential to be realised, two things are required. First, you need a nationally organised system of death registration; such a system in Britain was legislated in 1837 but was not considered fit for purpose until the 1850s (McKeown and Lowe 1966). Second, there needs to be agreement about who counts as having been alive. Deaths, like births and marriages, in pre-1837 Britain were recorded by the local Anglican Church, which did not recognise and hence excluded atheists and other dissenters; for similar reasons stillbirths and unbaptised neonates were also excluded. And sanctimonious prejudice against the children of unmarried mothers created a market for *baby farms* where infant deaths were common and often unrecorded (Smith 1979). Such flaws had been largely corrected in Britain by the start of the Twentieth Century although, unfortunately, the problem of low validity remains; all-cause mortality measures the chances of being alive but is silent about whether those alive are healthy.

As a measure of health, cause-specific mortality shares the problem of low validity with all-cause mortality, with the additional problem of probably lower reliability. First, a clinical diagnosis is an *in vivo* hypothesis until validated by either pathological examination of post-mortem or surgically excised tissue or, more recently, invasive technologies like angiography. Second, it is vulnerable to formal and

informal influences. Most deaths nowadays occur at older ages where co-morbidities are common, which leaves room for uncertainty and disagreement about which disease was the cause of death. Also, death certification rules now prohibit functional causes of death like *Old Age* and *Frailty,* which may nudge clinicians towards certifying a clinical cause like dementia. Informally, there is a widespread professional preference to avoid the Coroner's Court, an appearance at which is likely if a death certificate contains any suggestion of violence, malpractice, or neglect; where there is room for uncertainty, certifying a justifiable disease as the cause of death may have the advantage of avoiding the Coroner's Court.

Before leaving this high reliability-low validity measure of health, it is worth mentioning an intellectual framework and an administrative tool. Health is a moving social and biological target. Sometimes the change comes from the biological side of the phenomenon, as when a coronavirus mutated into SARS-CoV-2 to unleash the Covid-19 pandemic. Other times it comes from its sociological side, as with the de-criminalisation of homosexuality after which, hey presto, same sex love is no longer a disease. The World Health Organisation tries to bring order to this situation by creating, and periodically revising, an *International Classification of Diseases.*

2. Morbidity

Compared with mortality, morbidity is a somewhat more valid measure of health, but it is less reliable. One widely used measure of morbidity is the survey question *Have you been told by a doctor that you suffer from any of these diseases?,* followed by a list of the most prevalent and serious ones. The main problem with this measure, and indeed any others that depend on medical in-put, is the Inverse Care Law: *The availability of good medical care tends to vary inversely with the need for it in the population served*, with its consequence that those in the poorest health are least likely to know it (Tudor Hart 1971). And if this applies in rich countries like UK, it is magnified in the developing world, where most humans live, as found by Gindo Tampubolon's study of Covid-19 in Indonesia where the pandemic unearthed a mass of previously undiagnosed chronic disease (Tampubolon 2021).

Access to good quality medical care is not the only factor influencing a lay person's knowledge of their own health, which is also influenced by illness behaviour – what people do when they feel unwell. If you ask a random sample of the population whether they have felt unwell at any time in the past month their responses, which were first analysed 50 years ago (Wadsworth *et al.* 1971) and have been remarkably stable since, are roughly: 20% symptom-free; 20% symptoms ignored; 20% symptoms self-medicated with *Over-the-counter* chemist shop medicines; 20% symptoms discussed with family and friends to which, more recently, has been added Internet search; 20% symptoms consulted a doctor. So, consulting a doctor is a comparatively rare response to feeling unwell, which mostly happens when family and friends advise it, and the illness interferes with paid employment and the other demands of everyday life.

Some researchers try to take a short-cut around this complexity by asking lay people to assess their own health, which they justify by pointing to the correlation between people's answers to the question and their likelihood of having a chronic disease and raised risk of premature death. The problems with such self-assessed (or *self-rated*) health are numerous and include: first, the clinical iceberg, which is the proportion of disease in a population unknown to doctors (Last 1963), estimated in a rough and ready way at one case known to one at the same level of severity not known; second, the *Worried Well* whose numerous repeated medical consultations fail to reveal any pathology; and third, variation in lay people's interpretation of health, described first by Claudine Herzlich in France (Herzlich 1973), whereby the least advantaged equate health with being able to discharge one's social responsibilities while the more advantage expect also to have a feeling of strength and wellbeing; findings replicated subsequently by other researchers in Scotland and United States of America.

3. Functioning

With functional measures of health, we get closer to the WHO's initial idea, elaborated subsequently by Economics Nobel Laureate Amartya Sen's formulation: […] *the capability to live a life you have cause to value* (Sen 1992). There are survey questionnaire measures of functioning, like Activities of Daily Living, but these lack objective

quantification. Frailty shares the same problem but compensates by getting to the heart of the matter: the loss of energy and strength and easy exhaustion which often accompanies older ages as a prelude to death (Watts *et al.* 2019). For various professional reasons, the clinical manifestations of functional loss, like falls, incontinence and joint pain, are greatly under-recorded despite their often-devastating effect on self-image and independence (Netuveli *et al.* 2005). Objective measures of functioning like the *flamingo test* (standing on one leg, as a measure of balance), *get up & go test* (getting out of an armchair and crossing the room, as a measure of flexibility) and walking speed, as a measure of balance and muscular strength have been developed for use in studies of ageing, but they require an interviewer to ensure protocol adherence and to stopwatch-time the performance. In addition, simple instruments are available to measure lung function (peak flow meter) and muscular strength (hand grip dynamometer), which can be self-administered (Cheval *et al.* 2019; Cheval *et al.* 2018).

Some measures of quality of life were designed with functioning rather than disease in mind (Higgs *et al.* 2003). One such (CASP-19) accesses the level of Control, Autonomy, Self-realisation, and Pleasure among people in early old age. CASP-19 scores appear to be independent of most biomarkers (Wu *et al.* 2015), but predict all-cause mortality risk, at least in the short term (Netuveli *et al.* 2012).

4. Objective measures

Anthropometric measurement of height and weight, if conducted to protocol, are valid and reliable measures of growth and development during childhood and adolescence and, when related to each other in a simple ratio, give the Body Mass Index measure of dangerous over-weight and under-weight. Most other survey biomarkers have been taken from clinical practice, so are more likely to reflect disease rather than health. Here blood analytes predominate, particularly those associated with cardiovascular diseases, although a few studies also include other special investigations like X-rays, magnetic resonance imaging (MRI scans) and electrocardiograms (ECGs). These data need to be used cautiously by those with little training in biology; and it is important to remember that there are no biomarkers of mental health and wellbeing nor of most cancers, which together account for a large proportion of total morbidity.

5. Health in labour market econometric analyses: recommendation

The preceding sections hopefully demonstrate that there is no perfect measure of health. Rather the choice of which measure of health to use needs to be determined by the research question at hand. And the results obtained by using that measure need to be interpreted in the light of that measure's strengths and weaknesses. For example, the author of the present piece is interested in the possible health consequences of raising the State Pension Age (Ardito *et al.* 2020) and questions whether life expectancy is a reasonable measure to use as its official driver.

Labour market economics, in partial contrast, presumably needs to consider health as a pre-condition for labour market entry or as a cause of early labour market exit. The ages involved will be the normal years of working life, say late adolescence to early old age, when the best hours of most days during the best years of most lives are spent in paid employment. In terms of the biology of health, this period of the life course will involve the maintenance of peak functioning into mid-adulthood; then slow attrition of functional capacity through to early old age. Or its converse, premature loss of peak functioning followed by accelerated attrition of functional capacity.

In addition to the study's research question, the choice of health measure may be limited by what is available in the data set being used. If you are lucky or have chosen wisely, your data set will contain the limiting long-standing (or long-term) illness measure, which can be considered a standard survey question, having been included in the British General Household Survey since its inception in 1971 and its Decennial Census since 1991. And, unlike the self-assessed (or *self-rated*) health question, limiting long-standing illness has a clinical correlate in chronic disease; as well as being a powerful predictor of quality of life and mortality risk. If the limiting long-standing illness measure is not in your data set, use whatever else is available, but remember to think about the direction of bias involved and, perhaps, re-run

the analysis using a second measure, as a form of sensitivity analysis.

6. An afterthought

Two examples may be helpful. First, Bartley and Owen's paper from a quarter-century ago (1996), which used a sequence of annual cross-sectional General Household Surveys to compare rates of employment, unemployment and economic inactivity among men with and without limiting longstanding illness (LLSI) in different social classes during an historical period that included the 1980's economic recession and de-industrialisation. The likelihood of paid employment was found to be less affected by limiting longstanding illness among those in the most advantaged (85% of men with LLSI employed in 1979; 75% in 1993) than in the most disadvantaged occupations (70% in 1979; 40% in 1993), with this difference becoming wider and less reversible during the economic recession.

Second, Goldblatt's somewhat more recent Figure 1 (Marmot *et al.* 2010, 17) that uses limiting longstanding illness to chart disability-free life expectancy against neighbourhood income; and relates these data to currently legislated changes in eligibility for the UK State Old Age Pension, which at present is 66 years for both women and men. The Figure shows that disability-free life expectancy is lowest, at 52 years, in neighbourhoods with the lowest incomes; and that it improves with rising neighbourhood affluence to 66 years for the least deprived 25-30 per cent of all neighbourhoods. On these data, only the most affluent 5-10 per cent of all neighbourhoods will have a disability-free life expectancy of more than 68 years when the currently legislated increase in the State Pension Age to 68 years is enacted.

Acknowledgements

References

Ardito C., Leombruni R., Blane D., d'Errico A. (2020), To work or not to work? The effect of higher pension age on cardiovascular health, *Industrial Relations: A Journal of Economy and Society*, 59, n.3, pp.399-434

Bartley M., Owen C. (1996), Relation between socioeconomic status, employment and health during economic change 1973-93, *British Medical Journal*, 313, n.7055, pp.445-449

Blane D., Akinwale B., Landy R., Matthews K., Wahrendorf M., Wahl H.-W., Hayward M.D., Liefbroer A.C., Mishra G.D., Ferreira I., Koupil I. (2016), What can the life course approach contribute to an understanding of longevity risk?, *Longitudinal and Life Course Studies: International Journal*, 7, n.2, pp.165-196

Cheval B., Chabert C., Orsholits D., Sieber S., Guessous I., Blane D., Kliegel M., Janssens J.P., Burton-Jeangros C., Pison C., Courvoisier D.S., Boisgontier M.P., Cullati S., (2019), Disadvantaged early-life socioeconomic circumstances are associated with low respiratory function in older age, *The Journals of Gerontology: Biological Sciences. Series A*, 74, n.7, pp.1134-1140

Cheval B., Boisgontier M.P., Orsholits D., Sieber S., Guessous I., Gabriel R., Stringhini S., Blane D., van der Linden B.W.A., Kliegel M., Burton-Jeangros C., Courvoisier D.S., Cullati S. (2018), Association of early- and adult-life socioeconomic circumstances with muscle strength in older age, *Age and Ageing*, 47, n.3, pp.398-407

Herzlich C. (1973), *Health and Illness. A social psychological analysis*, London, Academic Press

Higgs P., Hyde M., Wiggins R., Blane D. (2003), Researching quality of life in early old age. The importance of the sociological dimension, *Social Policy & Administration*, 37, n.3, pp.239-252

Last J.M. (1963), The iceberg 'completing the clinical picture' in general practice, *The Lancet*, 282, n.7297, pp.28-31

Marmot M., Allen J., Goldblatt P., Boyce T., McNeish D., Grady M., Geddes I. (2010), *Fair Society, Healthy Lives. The Marmot Review*, London, Institute of Health Equity

McKeown T., Lowe C.R. (1966), *An Introduction to Social Medicine*, Oxford, Blackwell Scientific Publications

Netuveli G., Hildon Z., Montgomery S., Wiggins R., Blane D. (2005), Functional limitation in long standing illness and quality of life. Evidence from a national survey, *British Medical Journal*, 331, n.7529, pp.1382-1383

Netuveli G., Pikhart H., Bobak M., Blane D. (2012), Generic quality of life predicts all-cause mortality in the short term. Evidence from British Household Panel Survey, *Journal of Epidemiology and Community Health*, 66, n.10, pp.962-966

Sen A. (1992), *Inequality Reexamined*, Cambridge, Harvard University Press

Smith F.B. (1979), *The People's Health 1830-1910*, London, Croom Helm

Tudor Hart J. (1971), The inverse care law, *The Lancet*, 297, n.7696, pp.405-412

Tampubolon G. (2021), Study of pre-existing chronic disease and Covid-19 in Malang Region, in *Interdisciplinary Health Research group*, SLLS-Society for Longitudinal and Life Course Studies, webinar, 22 June

Wadsworth M.E.J., Butterfield W.J.H., Blaney R. (1971), *Health and Sickness: the Choice of Treatment. Perception of illness and use of services in an urban community*, London, Tavistock Publications

Watts P.N., Blane D., Netuveli G. (2019), Minimum income for healthy living and frailty in adults over 65 years old in the English Longitudinal Study of Ageing. A population-based cohort study, *BMJ Open*, 9, n.2, article e025334

Wu T.-Y., Chie W.-C., Liu C.-K., Netuveli G., Blane D. (2015), Association of quality of life with laboratory measurements and lifestyle factors in community dwelling older people in Taiwan, *Aging & Mental Health*, 19, n.6, pp.548-559

David Blane
d.blane@imperial.ac.uk

Professor Emeritus of Imperial College London, Honorary Professor of University College London and Fellow by Distinction of UK Faculty of Public Health. His last publications include: Ardito C., Leombruni R., Blane D., d'Errico A., To work or not to work? The effect of higher pension age on cardiovascular health, *Industrial Relations Journal*, 2020; Watts P., Blane D., Netuveli G., Minimum income for healthy living and frailty in adults over 65 years old in the English Longitudinal Study of Ageing: a population-based cohort study, *BMJ Open,* 2019; Glickman M., Bartley M., Blane D., *Occupational pensions: a bridge between social class before and after labour market exit?*, International Centre for Life Course Studies in Society and Health Working Paper 2, 2018.