

Mitchell Institute Health and Education Indicators: Conceptual Foundations

VICES Discussion Paper

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Executive Summary

This paper traces the evolution of indicators of human wellbeing that are relevant to the development of the Mitchell Health and Education Indicators. It also reviews the literature to seek out the evidentiary basis for the relationship between health, education and other relevant variables.

Firstly it identifies and reviews three phases in the development of indicators of human wellbeing:

- Utilitarianism;
- capabilities approach; and
- broad determinants of wellbeing.

These different approaches grapple with a set of both practical and intellectual challenges to specifying and estimating robust measures of well-being. They go to the heart of differing views about the relationship between the individual and society. These include a preference for freedom of choice, tolerance of inequality, the importance of equality of opportunity and the obligation of society to provide minimum standards of living.

Secondly the paper examines the literature for evidence of the complex relationships between education, health and SES with a focus on the early stages of the life course, Birth/Childhood and Adolescence/Young Adult.

Finally the paper relates the capability framework and the concept of the life course to some of the challenges of developing indicators of health and education that identify not only observed deficits at key transition points but also capture the dynamics and self-perpetuating nature ('path dependency') of the transition from one stage of the life course to the next.

Brief history of the evolution of indicators of wellbeing

The utilitarian approach developed the concept of 'utility' as a measure of individual net satisfaction arising from the consumption of a basket of goods and services subject to a budget constraint. The choices open to those with larger incomes was greater, permitting higher levels of utility to be achieved. This led to income measured by GDP per capita being adopted as the indicator of human wellbeing. However this had a number of shortcomings. Utilitarianism itself failed to deal conclusively with the desirability of income distribution or with the need to prioritise basic goods necessary for life. The early utilitarians, such as Marshall, supported income distribution and giving priority to the consumption of basic goods, but Lord Robbins' opposing view, became the dominant interpretation.

Rawls challenged this approach arguing for a basic allocation of primary goods as being necessary for people to have an equal opportunity to live full lives. From this concept it was a small step to develop the capability approach, which distinguished between capabilities and actual functionings. This approach implies that there is a need for a range of basic resources, including health and education, which is broadly available to enable each individual to develop their full capabilities and to function at a higher level. Employing this approach, indices such as the Human Development Index (HDI) were developed.

The HDI incorporated measures of health and education, as well as GDP per capita, as relevant indicators for human development. However despite its broader base, the HDI did

not address either income distribution or sustainability across generations. There was also much discussion of the particular indicators chosen and the poor methodological basis for those selected over others perhaps equally deserving. Some of these shortcomings were addressed by the development of ever more complex multidimensional indicators

These failings were given more exposure by the Stiglitz Commission, which among other recommendations, suggested a greater focus on intergenerational sustainability and using changes in the value of certain stocks of wealth to measure well-being over time. This issue had been taken up by a World Bank team, which released its first report in 1997 and more recently by Arrow and his team (2012, 2013). This work developed a model of comprehensive wealth and estimated values for each of its components, including capital values reflecting education, health and the environment as well as productive capital for six very different countries.

This international literature has been reflected in Australian attempts to develop a range of indicators of total wellbeing, such as the HALE index and other specialised indicators, such as in health and education. Work by the Australian Treasury has addressed the question of sustainability across generations. Predictably these Australian indices have faced many of the same problems as those confronted in the international literature.

The lessons from this literature review, for the purposes of developing a relevant set of health and education indicators over the life course, could be summarised as follows:

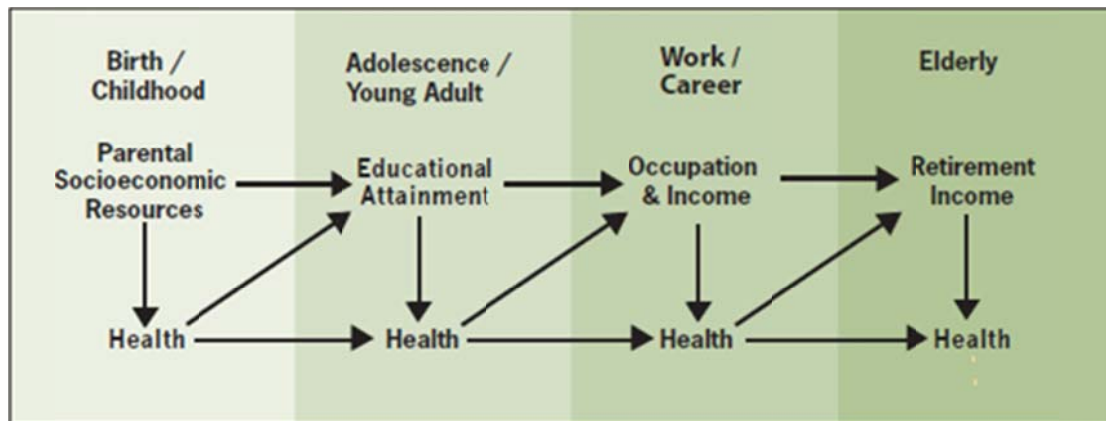
- GDP per capita is not an adequate measure of human wellbeing because it omits many aspects essential to the opportunity to realise full capabilities.
- Wellbeing is not simply determined by flows of goods and services captured by the national accounts, but also by the stocks of various types of capital.
- These stocks enable individuals to sustain their capabilities across the life course and for society in general to sustain its standard of living across generations.
- An individual's capability is both historically shaped by and, at a point in time, partly determined by broader features of the individual's community and society – what she is able to do, and to become, is influenced by a complex set of societal stocks and flows.

Relationship between health and education evidence from the literature

Health and education are closely related. Improvements in one appear to lead to improvements in the other. But are the two causally related or simply responding in a similar fashion to a changes in a third variable, e.g. income? Or if they are causally related in what direction and is the direction different across the life course?

Adler et al (2008) has suggested that the relationship between the two varies across the life course as depicted in Figure a1. In early childhood for instance, health has an impact on educational performance through such transmission channels as poor nutrition and low birth weight on cognitive development. Education for instance can be expected to act indirectly on health through occupation and income.

Figure S1 Complex interactions between health and a range of variables, including education over the life course



Source: Adler et al. 2008.

The results of the studies reviewed provide considerable support for this depiction of the relationship between the two. However in some cases the evidence suggests that the direction of causation is different to that postulated and for others firm evidence is lacking.

The evidence establishes that a range of health conditions at birth and in early childhood have a strong bearing on educational outcomes. The evidence for the adverse and lasting impact on educational outcomes and lifetime earnings of health conditions, which affect the unborn child in utero and the child post neo natal, is especially strong. Other studies of conditions, which affect young children, such as mental health, show the enduring impact of adverse health conditions on the educational performance of young children.

This research supports the proposition which suggests that health at birth or early childhood has a significant and causal impact on education outcomes in adolescence.

While there is a clear correlation between education and health, the evidence that education has a causal impact on health is less well established. This may be due in part to technical estimation problems.

There is in fact stronger evidence that poor health, especially mental health, such as ADHD in adolescence, has a significantly adverse effect on educational attainment.

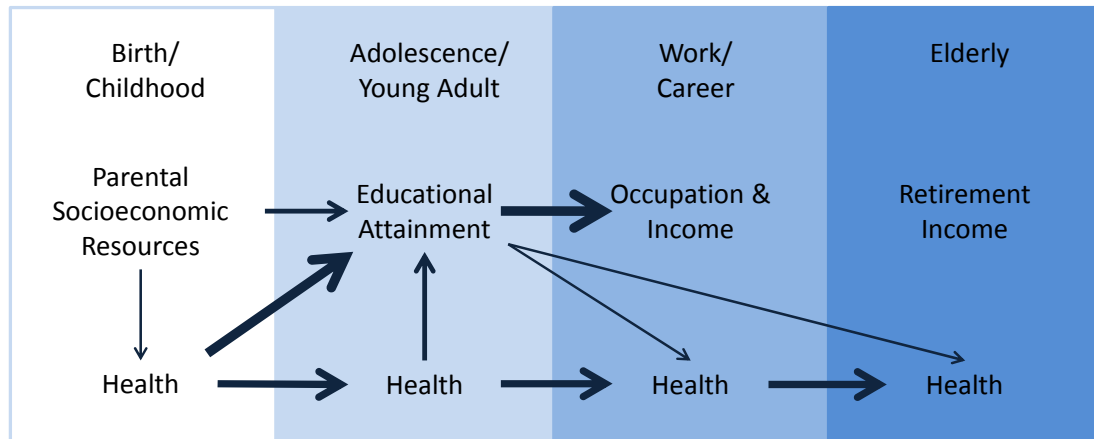
There is also strong evidence that health at birth or early childhood has a significant impact on health in later life and that health factors have an ongoing bearing on occupation and lifetime earnings. There is strong support for the Barker hypothesis that adverse *in utero* shocks have long term consequences in terms of the incidence of chronic disease and implications for educational attainment and lifetime earnings.

The relationship between parental socioeconomic status (SES) and child health is complex, in part because each of the variables is in itself multifaceted. Factors generally used to measure SES include income, education and occupation. Parental SES is a combination of individual and household measures of these indicators. Health status is also a composite variable. Many of the studies focus on just one health condition to overcome this problem but as a consequence this limits the degree to which the results can be generalised. So while the correlation between parental SES and child health is strong, causation is more difficult to establish.

An assessment of the evidence from the literature in terms of the hypothesised life course model

Taking the evidence we have found in the literature search to date and mapping this to the causal relationships hypothesised in Figure a1 at each stage of the life course, the following chart (figure a2) summarises our findings. These focus on the two early stages of the life course model where we have concentrated our literature search efforts.

Figure S2 Evidence from the literature on relationships between health and education over the early stages of the life course



The arrows represent the direction of the effect. The thicker lines represent a causal relationship established by the literature while the thinner lines indicate lower levels of confidence in the causal effect or simply correlation supporting hypotheses without causal effect.

At the birth /childhood life stage, health has a powerful causal impact on educational attainment and the health of the adolescents/young adults. Educational attainment in adolescence has a strong causal impact on occupation and income, with a less certain causal impact on health in the later stages of the life course. Health has an ongoing causal relationship though each of the life stages Adolescent health is more likely to impact education than the reverse.

Capability and the Life Course

Some of the dynamics of the transition from one life stage to the next, based on evidence drawn from the literature, are captured in Figure a2. In particular it demonstrates the dependency of successful transition from one stage to the next on the successful functionings at earlier stages. The application of the capability approach across the life course is new ground and the task of capturing these dynamics in the form of indicators is likely to be challenging.

The capability approach relates a set of capabilities to a set of outcomes (functionings) which are based on individual choices. The capabilities set is seen as being determined, in a broader social context, by the conversion of available goods and services to a set of possibilities (capabilities). The broader social context includes access to a stock of capital assets (Robeyns 2003).

Deficits in available goods and services and access to only a poor stock of capital assets will restrict the set of capabilities available to the individual. The indicators to be developed will attempt to measure and highlight deficiencies in the resources relating to health and education. Successful transition from one life stage to the next is dependant, not only on the supply of a set of goods and services at a particular point in time, but also on access to accumulated capital stocks, financial, human and social. In the early stages, through to adulthood, these capital stocks are likely to be owned by the family. Not only is there path dependency in transition from one life stage to another, but there is also a feedback loop between the successful transition of the family through the life course and the success of their children. The evidence suggests that intervention early in this cycle has the greatest impact.

1. Introduction

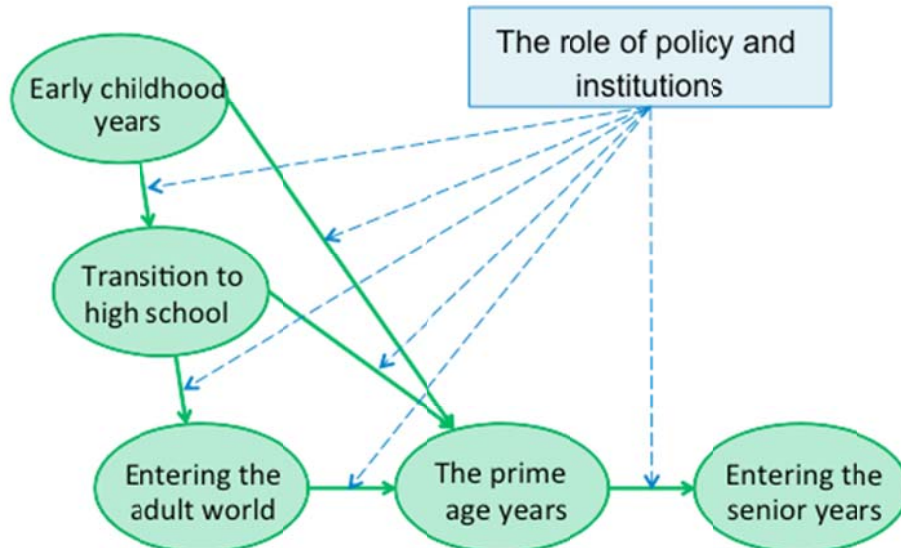
This paper develops the conceptual basis for the Mitchell Health and Education indicators. In so doing it:

- Reviews the literature on the development of indicators of wellbeing:
 - internationally, and
 - for Australia.
- Reviews the literature on the complex relationship between health, education and other factors to form an empirical basis for a set of health and education indicators at key transition stages of the life course

2. Changes in Health and Education over the Life Course

This project seeks to develop a set of indicators which are appropriate to measuring health and education capabilities and outcomes over the life course, and in particular at certain points of transition. These are shown in Figure 1 together with an indication of the impact of the role of policy and institutions at each of these transition points.

Figure 1 The evolution of capability: The role of policy and institutions



In developing indicators to measure human wellbeing, health and education are among the most commonly included variables after GDP per capita. The following section is a selected intellectual history of these indicators and in particular those that have addressed the shortcomings of GDP-based measures.

3. More than Money? Measures of Human Wellbeing

The early development of measures of human well-being resulted in the wide adoption of GDP per capita as a comprehensive and objective measure of economic well-being. Subsequent developments have reflected on the narrowness and inadequacies of this measure. For instance it fails to adequately account for inequality in incomes, and the lack of basic resources to provide access to health and education. Moreover it deals inadequately with issues of sustainability. The more recent developments have attempted to address these problems. The intellectual development of measures of human well-being can be divided into three phases.

Firstly, the modern discussion of measures of human wellbeing dates back more than 300 years to Benthamite notions of utility. This led, by a somewhat twisted path, to the wide adoption of GDP per capita as a good proxy for human wellbeing, on the basis that a higher GDP per capita (average income) provided a greater opportunity for individuals to purchase a desired bundle of goods and services to afford the greatest satisfaction.

Others argued, representing a second phase of the literature, that there was no necessary connection between growth of GDP per capita and quality of life (Dreze and Sen 2002). In many countries, growth in GDP has raised the incomes of some but left the majority behind, without much of an opportunity to participate in economic growth, because of a lack of education and poor health. Sen and others contrasted capabilities and functionings, suggesting that individuals needed a certain level of resources to allow them to function according to their capabilities. Adequate health and education formed a fundamental aspect of these resources and therefore needed to feature in any general measure of wellbeing.

A third approach (Arrow et al. 2012) which focused on a 'comprehensive' measure of wealth was to pay greater attention to changes to value of stocks of health, human and natural capital in addition to traditional or 'reproducible' capital (also World Bank 1997; Stiglitz et al. 2009, UNECE 2014). This acknowledged that increases in traditional measures of wealth were often dependent on, or occurred at the cost of, other stocks of capital such as natural capital. In their preliminary calculations of the components of 'comprehensive wealth' Arrow et al. (2012) estimated that the stocks of human and health capital for the United States far exceeded the value of reproducible and natural capital. This will be discussed in greater detail below.

3.1 From utility to GDP per capita

Neoclassical economics has provided two important concepts in the development of measures of human well-being, utility and GDP per capita. Neoclassical economics adopted the Benthamite concept of 'utility' as a measure of individual net satisfaction arising from the consumption of a basket of goods and services. Within a budget constraint, consumers chose freely between different bundles of goods trading off quantity, quality and price of each to maximise their individual utility within their income constraint. The larger the income of the individual, the less constraining the budget and the greater the range of choice.

There are difficulties both in measuring utility and summing it across individuals to arrive at a societal measure of total welfare. With the same income is one person's utility the same as the other? How could they be added if there was no way of independently measuring utility? Equally did doubling a person's income double her utility or did additions to income have a

progressively declining impact on utility? The question of summing individual utilities focussed attention on interpersonal comparison of utilities and as a consequence on income distribution.

Marshall (1890, quoted in Stanton 2007) argued that marginal utility diminished as its stock increased. In his view some goods were more important for human wellbeing than others. Adding to the rich man's table created less additional utility for society than providing basic goods and services for the poor. Pigou (1920, quoted in Cooter and Rappoport 1984) thought that while there was likely to be a strong association between income required to purchase goods necessary for physical wellbeing, it was uncertain whether income beyond this level would lead to increased welfare.

These ideas were criticised by Lord Robbins (1932) who in particular rejected the validity of interpersonal comparisons. He was influenced by the scientifically based logical positivism, which was imported into England through economists such as Von Hayek from Vienna (Cooter and Rappoport 1984). The conception of diminishing relative utility was, in his view, lacking in scientific foundation. It did 'not justify the inference that transferences from the rich to the poor will increase total satisfaction' (Robbins 1932). Nor did it follow from the positive assumptions of pure theory.

If interpersonal comparisons of satisfaction derived from individually chosen bundles of goods could not be made, then there was no way of summing individual utilities to reach a measure of social welfare. Within this framework the scope for public policy was small. Social welfare was maximised when each individual pursued utility maximising behaviour. The associated concept of Pareto optimality suggested that public policy could only intervene to make someone better off if others were not made worse off.

The Kaldor Hicks compensation test (Kaldor 1941) allowed more scope for public policy by providing for a trade-off in costs and benefits between those who gained and those who lost. If winners from a change of public policy could compensate the losers so that they still gained, but the losers were no worse off, then the conditions of Pareto optimality could still be satisfied.

It was suggested that at a societal level it didn't matter if the compensation payment was actually paid. If it is assumed that marginal utility of money is constant, that is an increase in income at any level produces the same increase in satisfaction across all levels of income for the individual, then it is sufficient for the change to be implemented providing there are net benefits to society. These calculations of net benefits, as for instance in cost benefit analysis, can be made based on average income (GDP per capita) as the numeraire. Given the view that distributional issues have no relevance and there is no hierarchy of goods that value some goods, such as health, more highly than others, then average income or GDP per capita is an adequate measure of human wellbeing.

Within this framework, an increase in average incomes suggests that those benefitting from the increase will be able to achieve higher levels of individual utility and these winners will be in a position to compensate any losers should the need arise.

The validity of average income (per capita GDP) as a valid measure of human well-being, at least in an economic sense, depends on the marginal utility of money being constant. In essence this means that transfers of income between individuals makes no change to society's total welfare. There are two policy implications of this. Firstly income distribution

from high to low income results in no increase in society welfare and secondly a policy which leads to higher net incomes is worthwhile, despite its possible costs to some groups in society.

3.2 Capabilities and the Human Development Index

These shortcomings of GDP per capita as a measure of welfare has drawn wide criticism for its failure to account for differences in income distribution and its dismissal of any sense of priority to be given to basic needs necessary for a minimum standard of living. In response Sen developed his capabilities approach. However the intellectual foundations of this approach were laid by John Rawls.

Rawls' *Theory of Justice* (1971, revised 1999) provided a bridge between utilitarianism and the capabilities approach developed by Amartya Sen. He questioned whether utilitarianism, based on each individual maximising his own utility, would be most advantageous for the social contract on which individuals decided to cooperate in society.

Rawls' theory of justice was based on two principles:

...the first requires equality in the assignment of basic rights and duties, while the second holds that social and economic inequalities, for example inequalities of wealth and authority, are just only if they result in compensating benefits for everyone, and in particular for the least advantaged members of society. (Rawls 1999, p. 13)

His influential work shifted the debate from income redistribution to equality of opportunity. For instance he distinguished between the 'welfare state' in which there could be large inequalities but 'none should fall below a decent standard of life, and that all should receive certain protections against accident and misfortune—for example, unemployment compensation and medical care' (Rawls 1999, p. xv.) and a 'property owning democracy' where:

The emphasis falls on the steady dispersal over time of the ownership of capital and resources by the laws of inheritance and bequest, *on fair equality of opportunity secured by provisions for education and training, and the like*, as well as on institutions that support the fair value of the political liberties. (Rawls 1999, p. xv; author emphasis)

Whereas Robbins made no distinction between goods which were necessary for life and those that provided say so called higher or intellectual pleasures, e.g. bread versus opera, Rawls defined *primary goods* to be those that provided a foundation for citizens to participate in society as free and equal.

Primary goods are 'what persons need in their status as free and equal citizens, and as normal and fully cooperating members of society over a complete life' (Rawls 1999, p. xiii). He defined these as 'rights, liberties, and opportunities, and income and wealth' (Rawls 1999, p. 79).

For those whose initial stock of endowments of primary goods (the basic goods of life) were below average, he contemplated compensation or a form of redress. The principle of redress provided a basis for compensating those with fewer native assets and to those born into the

less favourable social positions with genuine equality of opportunity, such as to spend more on the education of the less intelligent (Rawls 1999, p. 86).

Rather than direct income support, as in the welfare state, this reallocation was to provide equality of opportunity.

Rawls (1999, Preface to the revised edition of the *Theory of Justice*) understandably acknowledges the value of his discussions with Amartya Sen. It is a short step from the concept of 'primary goods', a stock of goods necessary to participate in society as a free and equal citizen to Sen's concept of capabilities. Sen acknowledges his debt to Rawls but considers the concept of primary goods as inadequately reflecting the requirements of human diversity. Different people need different amounts and different kinds of [primary] goods to reach the same levels of wellbeing or advantage (Robeyns 2005).

Capability approach

The core characteristic of the capability approach is a distinction between a person's capability and functionings. A capability is what people have the potential to be able to do and to be. A functioning is what that a person achieves or could have achieved with different resources and choices. That is there is a distinction between the realised and the effectively possible. What is ultimately important is that people have the freedoms to lead the kind of lives they want to lead, to do what they want to do and be the person they want to be (Robeyns 2003, p. 7).

The capability approach to wellbeing and development thus evaluates policies according to their impact on people's capabilities. It asks for instance, whether people are being healthy, and whether the resources necessary for this capability, such as clean water, access to medical doctors, protection from infections and diseases, and basic knowledge on health issues, are present. For some of these capabilities, the main input will be financial resources and economic production, but for others it can also be political practices, such as the effective guaranteeing and protection of freedom of thought, religion or political participation, or social or cultural practices, social structures, social institutions, public goods, social norms, traditions and habits (Robeyns 2003, p. 7).

Sen distinguished between three different levels at which the capability approach (CA) operates (Sen 1993):

1. A framework of thought for the evaluation of individual advantage and social arrangements (Dreze and Sen 2002).
2. A critique of other approaches to the evaluation of wellbeing and justice (Sen 1979, 1990).
3. A formula or algorithm to make interpersonal comparisons of welfare or wellbeing (e.g. Roemer 1996).

Sen uses the capability approach to criticise welfare economics and utilitarianism and income- or resources-based theories. Sen rejects welfarist theories because, whatever their further specifications, they rely exclusively on utility and thus exclude non-utility information from our moral judgements (e.g. Sen 1979). Thus Sen is concerned not only with the information that is included in a normative evaluation, but he is as much concerned with the information that is excluded. The non-utility-information that is excluded by utilitarianism could be a person's physical needs due to handicaps, but also social or moral aspects, such as the principle that men and women should be paid the same wage for the same work.

Economists use utility as the focal variable in theoretical work, but translate this into a focus on income in their applied work. Sen has argued that, while income can be an important means to advantage, it can only serve as a rough proxy for what intrinsically matters, namely people’s capabilities. He argues that ‘the informational bases of justice cannot be provided by comparisons of means to freedom’ (such as ‘primary goods’, ‘resources’ or ‘incomes’) (Sen 1990).

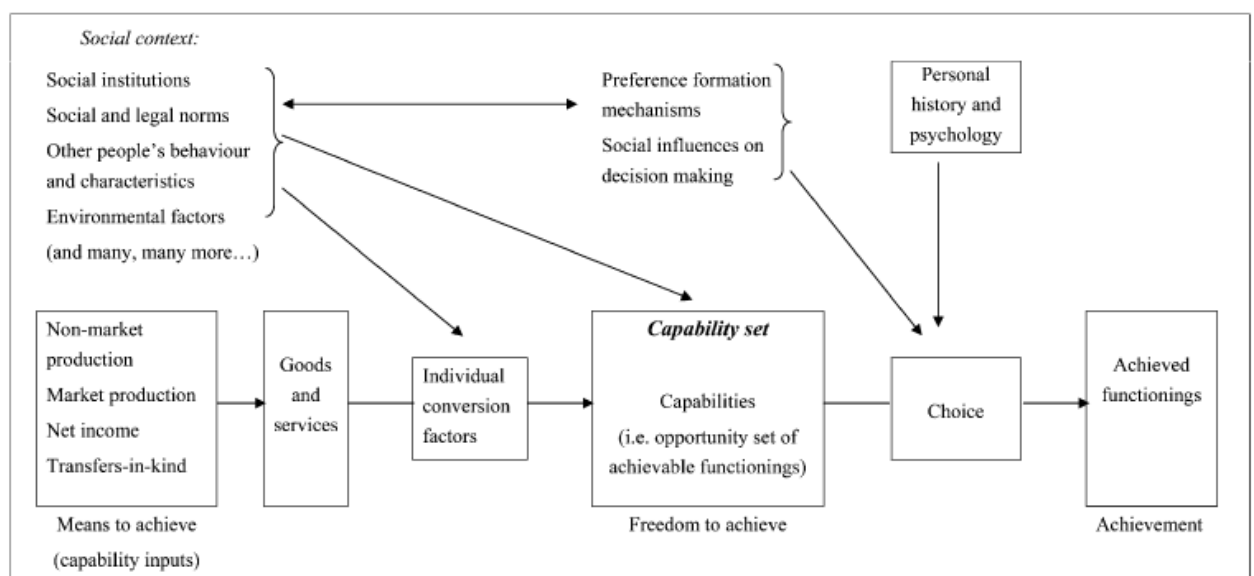
Sen acknowledges his debt to the philosopher John Rawls, but also criticised Rawls’s concentration on primary goods, because it neglects the importance of the diversity of human beings and therefore differences in the set of primary goods to reach the same levels of wellbeing or advantage.

As a formula for interpersonal comparisons of welfare, the capability approach could provide an algorithm to carry out empirical exercises in welfare comparisons. Some economists have tried to read Sen’s writings on the capability approach looking for such a formula or algorithm (e.g. Roemer 1996), and have consequently been disappointed when they discovered that this has not been Sen’s primary focus.

The three levels are however connected, with the first being the most general, and the second and third more specific and directed towards debates in the literature discussing wellbeing and advantage (Robeyns 2003).

The path from capability set to achieved functionings is not simply a matter of personal choice, but also reflects the social context in which the capability set can be developed and employed and choices made. Capabilities depend on a bundle of goods and services which are defined to include both market and non-market production and a range of transfers. These are capability inputs. The way in which goods and services can be used is both constrained and facilitated by the social context. For instance, access to the use of car may provide great freedom to a woman in the US, but only frustration to a woman in Saudi Arabia.

Figure 2 A stylised non-dynamic representation of a person’s capability set and her social and personal context



Source: Robeyns (2005).

Although the basic idea is concerned with people's capabilities and with their effective freedoms to be whom they want to be and do what they want to do, there are three theoretical refinements:

- (1) Focus on functionings and capabilities does not imply that no attention need be paid to resources, evaluation of social institutions, economic growth, etc. CA does in no way exclude integration of an analysis of resources (Dreze and Sen 2002).
- (2) There are cases where it makes more sense to investigate people's achieved functionings directly, instead of evaluating their capabilities. This includes circumstances where people deliberately adopt high risk behaviours that lower aspects of their functionings, e.g. a boxer who sustains physical injury and reduced functioning compared with a victim of domestic violence.
- (3) In practice two people with identical capability sets are likely to end up with different types and levels of achieved functionings, as they make different choices – dependent on their ideas of the good life or the kind of life they want to lead.

Human Development Index

An early and significant application of these ideas was in the construction of the Human Development Index (HDI) by a team commissioned by UNDP and led by Mahbub ul Haq with Amartya Sen as one of a group of consultants. The index explicitly adopted the capability approach.

Human development has two sides: the formation of human capabilities such as improved health, knowledge and skills – and the use people make of their acquired capabilities – for leisure, productive purposes or being active in cultural, social and political affairs. (UNDP 1990, p. 10)

The index also addressed the problem of developing a wider measure of human development, which incorporated not only the need for a decent standard of living, but also included broader measures of development, in particular health and knowledge.

Human development is a process of enlarging people's choices. The most critical ones are to lead a long and healthy life, to be educated and to enjoy a decent standard of living. Additional choices include political freedom, guaranteed human rights and self-respect. (UNDP 1990, p. 10)

The concept of human development incorporated both the *process* of widening people's choices and the *level* of achieved wellbeing. People were the ultimate ends and beneficiaries of this process. (UNDP 1990, p. 11).

The specific indicators adopted in formulating the Index were:

- life expectancy at birth;
- literacy; and
- GDP per capita (PPP basis).

These reflected not only their importance but also the ready availability of the data on these measures across many developing countries.

The first, longevity, reflected the common belief that a long life was both valuable in itself and also was closely associated with other benefits, such as nutrition and good health. While the second, literacy, was considered a relatively crude measure of access to education, and in particular good quality education, it was nonetheless a crucial first step in learning and knowledge-building.

At the time (1990), the measurement of GDP per capita was hampered by the difficulty of using exchange rates in international income measures. Fortunately the development of the Index coincided with a major initiative, the International Price Comparison Project, which was developing international comparisons based on purchasing power parity (PPP). It was a collaborative effort of the UN Statistical Office, the World Bank, EUROSTAT, OECD, ECE and ESCAP. Measures based on the outputs of this project were used in the index.

Consistent with the capability approach the Index was based on a composite which included *minimum* value (the maximum deprivation set equal to one) and a maximum or a *desirable* or *adequate* value (no deprivation set equal to zero). For instance a desirable level of life expectancy was set at Japan's 78 years and the minimum was 42 years, the average of three developing countries. Each country's position in this range placed them on an indexed scale which was averaged across the three measures to give the Human Development Index (HDI).

Commentary of Human Development Index (HDI)

The initial HDI in the Human Development Report (HDR) of 1990, prompted a range of criticisms from economists to which the United Nations Development Programme (UNDP) has been receptive and willing to change the index to accommodate the various perceived shortcomings. Hence, each of the following Human Development Reports (HDRs) has included updated changes to the HDI, and ever more complex measures to address the critiques.

The HDI has been criticised on various grounds including: the quality of the data, measurement errors, 'reinventing the wheel' – or being redundant, its failure to add income distribution, sustainability and gender issues.

Srinivasan pointed to weaknesses of the data in each of the components of HDI. As he says:

GNP data from several countries suffer from incomplete coverage, measurement errors, and biases. Furthermore, the severity and quantitative significance of these problems are likely to vary over time within a country and are not comparable across countries. (Srinivasan 1994, p. 240)

Srinivasan also quotes the Behrman et al. (1994) study that pointed out that for 19 (including developed countries) of a total of 145 countries, there were no data on adult literacy rates, or the data was very old and much of the school enrolment data was not internationally comparable.

Various studies have shown that many of the indicators that would explain wellbeing have been left out- for example, extent of civil and political liberties (Hopkins 1991; Dasgupta 1993; Atkinson et al. 1997); educational measures that would include stock and flow (Kelly 1991), inequality (Chowdhury 1991) and the environmental impacts of wellbeing and access to natural resources (Paul 1996; Atkinson et al. 1997).

Several critics have suggested that ‘the formula to calculate the HDI is arbitrary, unjustifiable and incorrect’ (Stanton 2007).

Chowdhury (1991) indicated two major problems with the HDI. Firstly he argues ‘the difficulty, if not impossibility of constructing an objectively determined unique measure, since in the ultimate analysis it will depend in the preference orderings of the evaluator’. From this he points out that if a composite index is sensitive to the weights attached to its components, then the rationale for using the particular weighting system needs to be convincingly argued – else it is arbitrary and undermines its usefulness. In constructing the HDI, he argues, equal weights were given to its three components, without providing any justification for doing so. Moreover, it is not known as to how sensitive the HDI is to changes in the weighting system employed – which leads to the ranking system to be illustrative rather than evaluative. Besides the arbitrariness of the weights attached to each indicator, he also sees problems with ‘the logic of the framework used, that is, the application of ratio scale operation on ordinal magnitudes’.

Kelly (1991) also criticised the arbitrariness of the weights used in the HDI, and suggested that it would have been more useful if ‘the Human Development Report (HDR) included tests of the sensitivity of HDI rankings to alternative endpoints’ (p. 318). In particular, he questioned the relative weight of income as compared to life expectancy and education. He also indicated that ‘as implemented, the HDI effectively assumes that little or no progress can be made by the developed countries’.

Most critics have disputed the way income above the threshold value is heavily discounted and many have proposed modified HDIs with more weight to high incomes (Noorbaksh 1998; Sagar and Najam 1998).

Alkire and Foster (2011) developed a multidimensional poverty measure, to ‘capture the multiple aspects that constitute poverty, wellbeing or empowerment’. They identify who is poor by considering the range of deprivations they suffer, and which can be broken down by geographic area, ethnicity, gender and other social groups. Key statistics include: incidence of poverty – percentage of multidimensional poor people; intensity of poverty – average proportion of deprivations poor people face at once; and the composition of poverty – the percentage of people who are poor and deprived in each indicator.

Their method is promoted through the Oxford Poverty and Human Development Initiative (OPHI) established by Sabina Alkire, and it attempts to broaden poverty measurement through the implementation of multi-dimensional measures of poverty, wellbeing and inequality, which go beyond traditional one-dimensional approaches. These measures attempt to incorporate dimensions such as health, education, living standards and quality of work. OPHI has developed tools to measure five missing dimensions of poverty data that poor people value, but which have been largely overlooked in international studies of poverty to date: Quality of Work, Empowerment, Physical Safety, The Ability to go About Without Shame and Psychological Wellbeing (OPHI).

The UNDP introduced two gender-related indicators in 1995. These were: the Gender-related Development Index (GDI) and the Gender Empowerment Measure (GEM). The GDI is a distribution-sensitive measure that accounts for the human-development impact of existing gender gaps in the three components of the HDI, while GEM was a more specialised measure focusing on the relative empowerment of women (Klasen 2006, p. 243). Klasen (2006) admits that while it is easy to criticise the narrow range of issues that receive

attention (and the many gender issues that are not reflected in the measure) and the implicit trade-offs and weights that are implied by the aggregation procedure – they do not constructively advance the debate about how best to generate summary measures of development.

Neumayer (2001) points out that though ‘importance was attached to environmental aspects and to the concept of sustainable development at the beginning of the 1990s, there have not been many calls for the ‘greening’ of the HDI. As such Neumayer (2001) proposes to qualify a country’s human development as potentially unsustainable if the net depreciation of its manufactured and natural capital stock is bigger than its investment. Linking the Human Development Index with sustainability in this way would allow the UNDP to form a view as to whether a country is ‘mortgaging the choices of future generations’.

3.3 Comprehensive measure of human wealth

The French President, Nicholas Sarkozy, commissioned Joseph Stiglitz (President of the Commission), Amartya Sen (Advisor) and Jean Paul Fitoussi (Coordinator) to create a Commission, subsequently called ‘The Commission on the Measurement of Economic Performance and Social Progress’ (CMEPSP) to identify the limits of GDP as an indicator of economic performance and social progress including measurement problems and what additional information might be required to develop more meaningful indicators (Stiglitz et al. 2009, p. 8).

The report is concerned with broadening the set of indicators used to measure economic performance and social progress. The shortcomings of GDP as a measure are noted. These include many that have been previously identified (Easterlin 2010). This includes difficulties of measuring the value of services, such as health and education, which tend to be measured by the value of their inputs rather than outputs. This leads to underestimating quality and therefore productivity improvements.

Others include:

- the exclusion of many household activities that are productive in an economic sense;
- the problems concerning the measurement of non-market output and its aggregation with market production;
- the fact that GDP is an aggregate and excludes income distribution effects; and
- the fact that it is only a measure of flows.

Of particular relevance to this paper is the focus in the report on broader quality of life measures and attempts to measure sustainability.

The report advocates a capability approach to the development of multidimensional measure of wellbeing. The dimensions include material wellbeing, health, education and personal and social activities and connections. It documents the divergence between GDP per capita and measures of health such as life expectancy (Stiglitz et al. 2009, p. 45). It also mentions the different trends in morbidity and mortality and the difficulty in developing indices that capture both dimensions (p. 46).

Education is highlighted as a factor in determining the quality of life independent of its role in providing the skills and competencies that underpin economic production. However the measures of education conceal important differences in educational performance by using

input measures such as enrolments and years of schooling and rather than outputs such as graduation rates or measures of educational quality and achievement. It is critical of the narrow coverage of educational assessment tools and the need to focus more on people's capabilities (p. 47).

The Commission's Working Paper 'Survey of Existing Approaches to Measuring Socio-Economic Progress' (Stiglitz et al. 2009a) outlines some of the difficulties in assembling multidimensional indices such as the ad hoc nature of indicator selection and lack of objective weights to calculate overall indicators.

The report addresses the question of sustainability of wellbeing across generations. This is largely discussed in terms of environmental sustainability. It adopts a wealth or 'stock' based approach. This seeks to answer the question as to whether current consumption levels will so diminish the stock of resources (in the broadest sense) to cause a decline in future consumption levels. While the concept of resources are broadly defined, they relate largely to the natural environment, land, forests, CO₂ emissions, etc. and the indicators selected designed to measure their depletion and degradation.

However the Report also quotes work by the UNECE/OECD/Eurostat working group on sustainability measurement which includes health adjusted life expectancy and percentage of the population with post-secondary education amongst a small set of sustainable development indicators emphasising the importance of health and education in sustainable wellbeing.

The subsequent report by the UNECE/OECD/Eurostat working group on sustainability measurement (UNECE (2014) introduces a conceptual and thematic categorization. The conceptual categorisation proposes a set of indicators that differentiates between the 'here and now', 'later' and 'elsewhere'. The first captures current human well-being, the 'later' the stock of comprehensive capital (economic, natural, human and social) on which future wellbeing is based, and the 'elsewhere' deals with the trans boundary issues in which the distribution of development, in particular the impact of countries on one another is taken in account.

Potentially these conceptualisations have broader application than to indicators of sustainability. They could also be applied to key transition stages through the life course and distinguish between indicators of the deficits at the transition point and those indicators pointing at later stages of the life course.

Arrow's comprehensive wealth measure

In response to identified shortcomings of previous attempts to measure wellbeing, Arrow et al. (2012) have developed a comprehensive measure of wealth. By comprehensive, Arrow et al. mean that it includes natural, human capital, and health capital in addition to 'traditional' productive or 'reproducible' capital such a buildings, machines and other fixed assets. The Arrow paper follows work undertaken by the World Bank (1997) and others seeking to define measures that reflect intergenerational sustainability. Their particular concern is that increases in productive capital may occur at the expense of natural capital so as to be unsustainable. In other words the depletion and degradation of natural capital may be so large as to offset the gains in productive capital. With a declining capital stock, consumption at its current levels is not sustainable. Consumption in the following or next period cannot reach the present level without further reducing capital stock – a path that is unsustainable in the longer term.

The measure of capital developed by the World Bank (1997) however only included separate estimates of natural and human capital in addition to 'reproducible' capital. It created an estimate of total capital as the discounted value of future consumption. The residual value, that is the value of total capital less the three components mentioned above, was styled as 'intangible' capital.

Arrow et al.'s innovation was to develop an estimate of health capital, which based on the value of a statistical life (VSL), exceeds the sum of all the other individual components of capital. The measurements also include the effects of technological change and changes in institutional quality.

The calculations of the components of comprehensive wealth follow a model of capital which is grounded in welfare economics (Arrow et al. 2012, p. 321) and uses shadow prices to provide the weights of the components of the capital to sum together to equal comprehensive capital. The shadow prices represent the marginal contribution to well-being provided by the particular form of capital. The ratios of the shadow prices are the rates at which the different forms of capital can substitute for one another (Arrow et al. 2012, p. 340).

Given that this review forms part of a search for indicators of education and health, the focus of this discussion of comprehensive capital is on the measurement of these two forms of capital.

Here we are concerned with two aspects of human capital: education and health. Each is simultaneously a productive factor and a constituent of wellbeing. In other words, each is both a means and an end. In what follows we simplify our empirical work by regarding education solely as an input in the production of wellbeing and health solely as a constituent of wellbeing. (Arrow et al. 2012, p. 331)

The calculation of human capital is based on labour productivity associated with different levels of education rather than some approaches based on public expenditure in education. The approach adopted by Arrow et al. is to base the value of human capital on the return to one year's education (8.5%) times the average years of education. This value of capital is related to the total real wages bill to provide a return on human capital. That is the shadow price of human capital is the real wages bill divided by the stock of human capital. For the US a unit of human capital is over \$100,000 (p. 390).

In the calculation of health capital, improvements in health are measured entirely through increased life expectancy. Reductions in morbidity are not included. The value of health is based on the value of a statistical life (VSL) saved which is the value an individual places on living an additional year. This can be calculated in a number of ways. The most common is from an estimate based on the wage premium for occupations with a high risk death (Viscusi and Aldy 2003). For the US, Arrow et al. use \$6.3m as the value of a statistical life and the value of a statistical life year (VSLY) is \$392,000. This is the shadow price of a unit of health capital.

As indicated above health dominates the measure of comprehensive capital. In per capita terms the values of the individual forms of wealth for the US in 2000, were; health (VSL) \$6.3m, human capital (education) \$225,000, natural capital \$20,000 and reproducible capital \$50,000.

The value of capital arising from improvements in health have been challenged by the World Bank. Hamilton (2012) has argued that the VSL represents not a measure of health capital alone, but is a measure of total capital. In Hamilton's view, VSL represents everything that people value in life, consumption of goods and services, environmental amenities, family and friends etc., in addition to good health

In a rejoinder, Arrow et al. (2013) seek to establish that no double counting is involved. The additional life lived it is argued is entirely due to the value of health capital. It is assumed that increasing the probability of living an extra year is a function of additional health expenditure. That a VSL is a measure of per capita health capital only, appears to hinge directly on this assumption. Presumably the increase in probability of survival depends also on the services obtained from other forms of capital such the environment, reproducible capital, etc. Clearly the measures require further work.

3.4 Summary and stocktake of international literature

The utilitarian approach, which led to GDP per capita as the measure of human wellbeing, has a number of shortcomings. Utilitarianism itself failed to deal conclusively with income distribution. Did utility decline at the margin with increasing income? Were some goods and services necessary to basic utility while others provided more ephemeral pleasures? The early utilitarians, such as Marshall, thought so, but Lord Robbins view, that there was no basis for thinking that transfers from the rich to poor would increase total welfare, became the dominant view.

Rawls challenged this approach arguing for a basic allocation of primary goods as being necessary for people to have an equal opportunity to live full lives. From this concept it was a small step to develop a capability approach which distinguished between capabilities and actual functionings.

The capability set depend on a supply of goods and services drawn from income transfers and both the market and nonmarket which within a social context are converted by the individual to capabilities. Given a set of individual choices, these capabilities are converted to functionings. The richness of the capability set is dependent on access to a supply of good and services. Those with goods and services deficits are likely to have a reduced capability set and lower functionings. An adequate capability set requires a wide range of basic resources, including health and education, available to all so as to enable them to function near their capabilities.

Employing this approach, the HDI incorporated measures of health and education, as well as GDP per capita, as relevant indicators for human development. However despite its broader base, the HDI did not address either income distribution or sustainability across generations. There was also much discussion of the particular indicators chosen and the poor methodological basis for those selected, over others perhaps equally deserving. Some of these shortcomings were addressed by the development of ever more complex multidimensional indicators

These failings were given a thorough review by the Stiglitz Commission, which among other recommendations, suggested a greater focus on the value of wealth stocks, particularly those that were important to intergenerational sustainability. This had been addressed by a World Bank team which released its first report in 1997 and recently taken up in a comprehensive fashion by Arrow and his team (2012, 2013). This work developed a model of

comprehensive wealth and estimated values for each of its components, including capital values reflecting education, health and the environment as well as productive capital for six very different countries.

The lessons from this literature review for the purposes of developing a relevant set of health and education indicators over the life course could be summarised as follows:

- GDP per capita is not an adequate measure of human wellbeing because it omits many aspects essential to the opportunity to realise full capabilities.
- Wellbeing is not simply determined by flows of goods and services captured by the national accounts, but also by the stocks of various types of capital.
- These stocks enable individuals to sustain their capabilities across the life course and for society in general to sustain its standard of living across generations.
- An individual's capability is both historically shaped by and, at a point in time, partly determined by broader features of the individual's community and society – what she is able to do, and to become, is influenced by a complex set of societal stocks and flows.

Health and education are both essential features of the stock of assets and flow of services that determine the realisation of one's capabilities over the life course. They are of course co-determined by many other socio-economic factors of the individual and her family. In section 5, evidence from the literature will be used to identify the complex relationships that exist between health and education and other relevant variables.

4. Review of Australian Literature on Indicators of Human Wellbeing

The global concerns regarding the adequacy of GDP as a measure of wellbeing have also been reflected in Australia. A range of alternative indices (that is composite indicators) have been developed to measure the relative performance in wellbeing of countries. These indicators include a range of policy domains.

In Australia, early attempts to create composite indices included the Genuine Progress Indicator (GPI) by the Australia Institute. The GPI combines impacts that derive from changes in the natural environment and in social conditions, and it incorporates impacts due to both changes in flows and changes in stocks (Hamilton and Denniss 2000). The methodological foundations of the Australian GPI were laid out in Hamilton (1997). However, human capital, which 'represents the accumulation of health, skills, knowledge and experience in humans that makes them more productive than brute labourers' (Hamilton and Denniss 2000), was not considered in the GPI 'because of the conceptual and measurement difficulties involved'. This inability to measure human capital has been criticised by Gruen (2006a, 2006b).

The Australian Centre on Quality of Life at Deakin University collaborated with Australian Unity to measure wellbeing and happiness with the Australian Unity Wellbeing Index – AUWI (Mead and Cummins 2010) which comprised a survey to calculate the personal Wellbeing index (PWI) and the National Wellbeing Index (NWI).

The ABS's Measurement of Australia's Progress MAP (ABS 2002) covered a range of indicators including: Health, Education and training, Work, and Knowledge and Innovation.

MAP measured progress but not sustainability. Hall (2005) points out that the ABS did not measure sustainability as 'it did not feel confident about pronouncing on sustainable development, when there is little consensus among experts about the term, other than in very general terms' (p. 720). Carmody's (2012) problem with the ABS's approach, is that there is no guidance on how to weight the various stocks to assess the overall wellbeing at a given time.

4.1 The Australian Treasury's wellbeing framework

The Treasury's wellbeing framework, first conceived in the early 2000s and then revised in 2011, focuses on 'a person's substantive freedom to lead a life they have reason to value' (Gorecki and Kelly 2012). It is based on five dimensions: freedom and opportunity; consumption possibilities; distribution; risk and complexity (Gruen and Wilkie 2009). The framework includes the set of opportunities available to people and their distribution, and notably, the sustainability of those opportunities available over time. In particular, consideration is given to whether the productive base needed to generate opportunities (the total stock of capital, including human, physical, social and natural assets) is maintained for current and future generations; and the overall level and allocation of risk borne by individuals and the complexity of the choices faced by them.

Henry (2009) describes the Treasury's wellbeing framework as adopting 'a generalised-utilitarian' approach. Thus, in addition to income and (material) consumption, a policy relevant assessment of wellbeing, both at the individual and social level, will depend on health, education, social relationships, crime rates, air and water quality, biodiversity, and a myriad of other aspects of life experience that people have reason to value.'

Gorecki et al. (2011) indicate the need to improve measures of wellbeing and sustainability. They indicate that currently there are two ways to use the stock based approach to measure sustainability. The first is consistent with the Adjusted Net Savings, and tries to convert all stock, economic, environmental and social into a monetary equivalent, which assumes that different forms of capital are substitutable or shadow prices can be correctly estimated. The second examines variation in each stock separately, with the degree of substitutability a matter of judgement, but with the main focus on ensuring a particular stock does not fall below a critical threshold. However, as placing a monetary value of some stocks, e.g. environmental and social capital is difficult, it would be useful to complement the monetary index of sustainability by a limited set on physical indicators to monitor the environment – particularly in the case of irreversible or discontinuous alterations (as recommended by Stiglitz et al. 2009). They further suggest that the Australian Government's 2010 Intergenerational Report was an attempt to do this.

Gorecki et al. (2011) point to the difference between current wellbeing and sustainability as outlined by Stiglitz et al. (2009) who argued for a separate measurements of current wellbeing and sustainability, '... current wellbeing is affected by the way in which current resources are used, while sustainability is only affected if the stock of resources itself is affected' (p. 9). Gorecki et al. (2011) also suggest that 'while most sustainability measures are focussed on intergenerational equity, measures such as the Index of Sustainable Economic Welfare and the Genuine Progress Indicator, attempt to combine measures of current wellbeing and intergenerational issues together. Other measures of sustainability, such as environmental sustainability focus solely on intergenerational issues and can be divided into two distinct approaches: those where various forms of capital are assumed to be substitutable, at least to some extent (weak sustainability) and those where substitutability is rejected (strong sustainability). An interpretation of sustainability which is

consistent with the Treasury's wellbeing framework 'requires that at least the current level of wellbeing per capita be maintained for future generations'. The choices made by a generation, they argue, dictates the quantity and quality of the stock of resources available to future generations.'

Henry (2010) indicates that sustainable wellbeing requires at least maintaining the current level of wellbeing for future generations that is, preserving the value of the aggregate stock of the community's resources – including natural resources and the environmental amenity associated with them, human capital, social capital and physical capital. He argues that the maintenance of our resources involves investment, which also means postponing consumption. To develop human capital in this and future generations, he suggests:

...we can work to improve opportunities for those facing, or at risk of entrenched disadvantage. We can help the next generation by developing capability in our children – especially those in disadvantaged circumstances. Public policy has a role to play here, in putting in place structures that will enable future generations to grow up healthy, acquire the capabilities they will need to be able to choose a life they can value. (p. xx)

Carmody (2012) traces the range of theoretical approaches to sustainability that has been developed and indicates 'that a lack of information regarding the future makes choosing between them difficult, with implications for the choice of discount rates'. She concludes, however, that:

...as techniques for measuring sustainability continue to be refined, a practical, best efforts way to consider future generations appropriately requires monitoring, changing levels of stocks, their substitutability and their thresholds, and protecting parts of stocks where future compensation for their loss is uncertain'.

4.2 Other Australian Government measures of sustainability

The Department of Sustainability and Environment, Water, Population and Communities has a Measuring Sustainability program¹, which is a \$10.1 million program committed to establishing a National Sustainability Council and a set of sustainability indicators for Australia. These will provide information on:

- social and human capital (skills and education; health; employment; security, institutions, governance and community engagements);
- natural capital (climate and atmosphere; land, ecosystems and biodiversity, natural resources; water and waste); and
- economic capital (wealth and income, housing, transport and infrastructure, productivity and innovation).

Sustainable Australia Report 2013: Conversations with the Future (Department of the Environment 2013) provides a picture of Australia and how it has changed over the last 30 years. It highlights a number of trends in Australia and the world that are set to have a significant impact on the next generation of Australians, including the need to plan for an

¹ At <http://www.environment.gov.au/topics/sustainable-communities/measuring-sustainability>

ageing population, rising health costs, growing cities and changes in traditional work and family roles.

4.3 Other Australian measures of wellbeing

Salvaris (2013) focuses on a new Australian project, the Australian National Development Index (ANDI), which will develop a composite index of national progress and key progress 'domains' through a national community engagement process supported by a cross-disciplinary research program. Salvaris suggests that the ANDI will use the ABS' Measures of Australia's Progress (MAP) dashboard approach and its use of indices will complement those of MAP.

Sonrexia and Moodie (2013) point out the number of problems with composite indicators, including the requirement of a quantitative judgement, or weight; the incommensurability of some indicators (e.g. education not valued for its own sake, but to some extent as input into productivity of the subsequently employed. Thus the level of income which ultimately derives from productivity embodies a contribution from education); and since composite indicators are ordinal – they do not allow quantitative judgements when comparing countries.

Lancy and Gruen (2013) summarise a contemporary attempt to construct an Australian index of wellbeing and discuss the key conceptual and methodological trade-offs faced to offer policy alternatives. They document the different wellbeing index methodologies used to date in Australia and overseas and discuss how the various dimensions could be weighted. Australian attempts of Wellbeing indices have included the GPI, The Australian Unity Wellbeing Index (AUWI), and the ABS' (MAP). The AUWI measured subjective 'wellbeing' and is an 'alternative measure of population wellbeing to such economic indicators as Gross Domestic Product and other objective indicators such as population health, literacy and crime statistics'. Cummins (2010) MAP has a 'dashboard' approach and 'collect(s) data over a range of dimensions whilst discouraging any definitive aggregation of the information' (Lancy and Gruen 2013).

The Herald/Age – Lateral Economics Index of Australia's Wellbeing (HALE Index) claims to be informed by the preceding methodologies, though it ultimately seeks to adjust the national accounts to arrive at a single dollar-denominated measure of wellbeing.' It seeks to measure human capital

...accretion and destruction, looking at early childhood development, school performance and retention, post-secondary school education and training, as well as destruction of human capital through longer term unemployment. To account for other informal methods of learning and innovation, we also monitor changes in capitalised average multi-factor productivity growth. (Lancy and Gruen, p. 97)

The HALE also considered some non-economic domains (listed in Table 1). The index was anchored in the national accounts, which provided 'a base upon which to calibrate the relative importance of other non-economic aspects of wellbeing'.

Table 1 Summary of non-economic domains included in The Herald/Age, Lateral Economics Index of Australia's Wellbeing

| Dimension | Sub-indicators | Weighting |
|--|---|---|
| Health | | Health expenditure as a percentage of GDP |
| Physical health | Life expectancy Preventable hospitalisations | |
| Significant disease burdens | | Impact of subjective wellbeing |
| | Obesity Mental illness | |
| Employment-related satisfaction | | Impact of subjective wellbeing |
| | Unemployment Under-employment Over-work | |

Note: (a) GDP denotes gross domestic product.

Source: Lancy and Gruen 2013.

4.4 Australian education indices

The Programme for International Students Assessment (PISA) run by the OECD, is included in Australia, in the National Assessment Program. Together with the IEA's Trends in International Mathematics and Science Study (TIMSS), PISA provides data from internationally standardised tests that enables Australia to compare and monitor its performance with that of other countries. The other studies that are part of the National Assessment Program include the National Assessment Program – Literacy and Numeracy (NAPLAN) undertaken by all students in Years 3, 5, 7 and 9, the three-yearly assessments of samples of students in Science at Year 6, Civics and Citizenship at Years 6 and 10, and Information and Communications Technology at Years 6 and 10.

Oberklaid et al. (2010) use the Australian Early Development Index (AEDI) to capture national data on Early Childhood Development (ECD) in Australian children, aggregated across geographic local communities and provide these communities with training and support materials to make use of the AEDI data. They also provide a background to the AEDI, which is an adaptation of the Canadian Early Developmental Instrument and is completed by teachers during the first year of a child's full time schooling. The AEDI covers five developmental domains considered to be important for school readiness and to children's later outcomes, including physical health and wellbeing and language and cognitive skills. Data from 15,991 teachers from 7420 schools (96% of schools in Australia) on 261,203 children (97.9% of eligible children) living in 660 communities was collected and then disseminated in the form of 'school developmental profile', with tables and maps of children's vulnerability in different domains, linked to demographic and socio-economic data grouped by locality.

Brinkman et al. (2013) linked the AEDI with children's literacy and numeracy assessments in years 3, 5 and 7 (n=1823) and found that AEDI predicts children's literacy and numeracy outcomes throughout their primary school.

Li et al. (2007) found some limitations of the AEDI as a universal screening tool, particularly with regard to children from culturally and linguistically diverse backgrounds (CALD); and to alert readers to the potential negative implications of the current AEDI for communities and

society, and recommend ways for improvement so that the AEDI will become a valid and culturally appropriate screening tool for monitoring early development in CALD children.

Janus et al. (2009) responded to Li et al. (2007) pointing out a number of misconceptions and errors made by the latter and indicating that an increasing amount of effort both in Canada and Australia had been made to engage Indigenous/Aboriginal populations. The misconceptions and errors included:

- (1) the AEDI was not a screening or testing tool as assumed by Li et al. but a measuring tool. It stresses that AEDI data cannot be interpreted as the individual child level, but only at group levels.
- (2) Li et al. argued that the AEDI 'set the stage for subsequent targeted programs' – whereas the AEDI research network unanimously recommended universal programs over targeted programs.
- (3) Li et al. asserted that the AEDI assumed English to be the only communication tool – which Janus et al. suggest that the EDI measures social competence, and emotional maturity as well as non-linguistic cognitive skills and the AEDI is now being used in many non-English speaking countries without problems. As above EDIs or AEDI.

Peers (2011) addressed the cultural significance of the Australian Early Development Index and discussed changes that the discourse of this instrument makes to the way in which the child is conceptualised. He argues that scholarly discourse has so far failed to address the broader context of neo-liberal economic and social reform from which the AEDI – and its Canadian predecessor, the Early Development Instrument (EDI) – initially emerged. He therefore interrogates the EDI and the AEDI as mechanisms for refining and expanding markets in the management and regulation of children from disadvantaged backgrounds and their accompanying vulnerability.

The Report Card: The Wellbeing of Young Australians by the Australian Research Alliance for Children and Youth (ARACY 2013) measures the wellbeing of young Australians in established key result areas (KRAs). The first *Report Card* was produced by ARACY in 2008, and it compared indicators of wellbeing for children and youth (aged 0–24 years) for the total Australian population, the Indigenous Australian population and international comparators. The second *Report Card* builds on the first, by not only including these parameters, but also reflects what young people and families say is important to them in improving child and youth wellbeing.

4.5 Australian health indices

Current health indices in Australia include one established by the Australian Institute of Health and Welfare (AIHW). The AIHW developed these to reflect the National Healthcare Agreement signed in 2008 between the Commonwealth, State and Territory governments. The indicators were to allow for reciprocal public performance reporting and to cover the entire health and aged care system comprehensively (AIHW 2008). The set of the indicators consists of 40 performance indicators, some of which are 'composite' indicators and they reflect the range of major services provided by the health system in Australia. Almost all of the performance indicators could be used to demonstrate differences between Indigenous and other Australians, among Australians from different socio-economic groups, and among residents of cities, rural and remote areas.

The AIHW publishes a range of reports, based on the information gathered by these indicators, including 'Australia's Health', which is a biennial health report and provides a

commentary on: determinants of health and keys to prevention; diseases and injury; how health varies across population groups; health across the life stages; health services, expenditure and workforce; the health sector's performance.

The AIHW also publishes 'Australia's Welfare' based on a conceptual framework that specified three domains and adapted from AIHW (Bricknell et al. 2004):

- Healthy living, which embodies the most basic human needs—good health, shelter and freedom from harm.
- Autonomy and participation, which is a concept that reflects the value people place on the opportunity to realise their potential, be self-sufficient and participate in their community.
- Social cohesion, which indicates the importance to individuals of relationships, both at the personal and societal level. (AIHW 2013).

Healthy living

The indicators of good health included: life expectancy; infant mortality; psychological distress; harm from alcohol; intake of fruit and vegetables; physical activity and obesity.

Indicators of shelter and housing included: types of housing tenure; housing stress; and homelessness.

Indicators of safety included: feelings of safety; crime victimisation and serious injury.

Autonomy and participation

The conceptual framework defined five components of autonomy and participation (p. 422): education and knowledge; economic resources and security; labour force participation; transport and communication and recreation and leisure.

The indicators for autonomy were the following.

- Education and knowledge included: retention rate; education participation; educational attainment; literacy among schoolchildren and population literacy.
- Economic resources and security included: household income; income disadvantage and household wealth.
- Labour force participation include: labour force participation; unemployment and underutilisation; part-time and casual employment; and working hours.

The indicators for participation were the following.

- Transport and communication included: transport difficulty and internet access.
- Recreation and leisure included: sport and physical activity; and cultural attendance.

Social cohesion

The conceptual framework defines four components of social cohesion (AIHW 2013, p. 441): family formation and functioning; support networks and social detachment, trust and community and civic engagement.

The AIA Australia's Healthy Living Index has been constructed to reflect respondents' participation in four key behaviours: eating and drinking; amount of sleep; frequency of exercise and medical checkups; and satisfaction on 12 key drivers of healthy living. The index

is weighted towards the four behaviours, and contributes two thirds of the index figure result. The remaining one third of the index is based on respondents' satisfaction with their health (AIA 2012).

4.6 Summary and stocktake of the Australian literature

This review of Australian literature outlining both the theoretical discussion, such as that led by the Australian Treasury, and a range of initiatives taken to design particular indicators, such as the HALE index and AEDI, traverse much the same territory as the international literature and encounter similar problems in developing broader measures of human wellbeing.

In particular, attempts to design broader indicators lack strong methodological reasons for inclusion of one indicator over another and little rationale for weighting each indicator in arriving at a single numerical measure.

The Treasury project tackles the problem of sustainability across generations and suggests the use of changes in the value of stocks of assets to measure intergenerational wellbeing. Again many issues remain about how such stocks should be developed.

Few of the indicators developed have sought to define behavioural relationships between the various indicators adopted or utilise the considerable empirical literature on the relationships between different indicators. Most are content to give the arithmetical sum of separate indicators as the value of the Index.

The AEDI and the health indicators assembled by the AIHW represent useful sets of indicators for Australia.

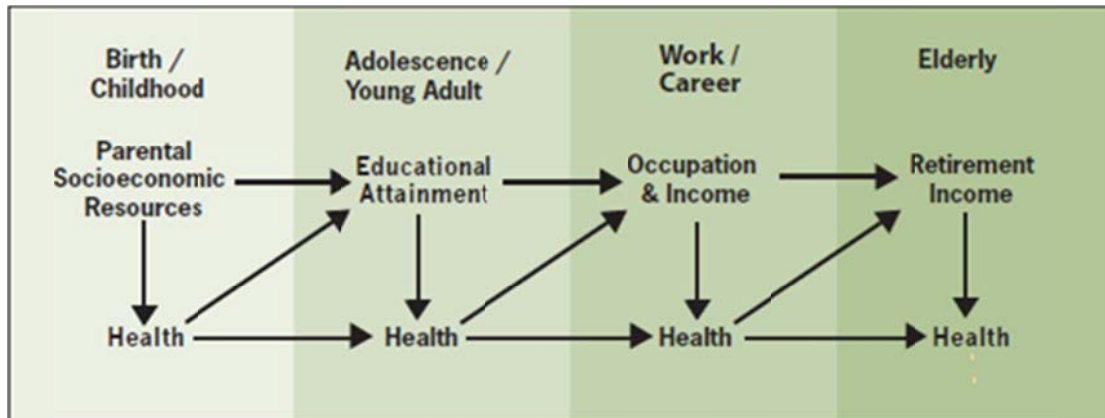
As outlined in the Introduction to this paper, we are seeking to develop indicators that will shed light on the relationship between health, education and other variables at each stage in the life course. Accordingly we are seeking indicators or variables that will help explain the relationships between indicators of health and education and their outcomes across the life course.

Therefore both the work on intergenerational comparisons reflected in the use of stocks of assets (e.g. Arrow et al. 2012) and the specialised work on the relationship between health and education indicators are pertinent to this exercise. In providing a possible basis for the development of relevant indicators, the next section provides a review the international empirical literature on the relationship between education, health and other relevant variables.

5. The Complex Relationship Between Health and Education

There is a strong correlation between health and education outcomes, but whether one causes the other is more difficult to establish. In Figure 3 Adler et al (2008) postulate that the relationship between the two varies across the life course. In early childhood for instance, health has an impact on education performance through such transmission channels as poor nutrition on cognitive development. However, even this apparently straight forward relationship is complicated by the likelihood that the education level of the parents is a major determinant of the initial health of the child. Secondly education acts indirectly on health through occupation and income.

Figure 3 Complex interactions between health and a range of variables, including education over the life course



Source: Adler et al. 2008.

Causality is important from a policy point of view. If better health causes higher educational performance, then policy should focus on health with an expectation of positively influencing education as well as health. If it runs the other way, then education should be the focus of policy.

There are two principal techniques used to test for causation. The first are 'natural experiments'. These use some random event, e.g. a natural disaster or sudden change of long standing policy to create two groups randomly assigned, effectively a treatment group and the other a control group to test the causal hypotheses. The other method is to use Instrument Variables (IV) to which health and education are separately correlated. An IV is one that is related to say health only through its impact on education. For example the cost of education could be used as an IV in seeking to test a causal relationship of education on health. So if we find a relationship between health and the cost of education (e.g. an increase in the cost of education produces a decline in health outcomes) then this suggests a causal relationship between education and health. The difficulty of finding an effective IV has limited the number of such studies. Most of the tests of causal relationships rely on natural experiments.

Many studies however use other methods to isolate the relationships between health and education and at least demonstrate association even where the bar of establishing causation is too high. For instance some studies use fixed effects models in which many of the confounding socio economic co determinants are variables in the model and allow the influence on health and education variables to be isolated.

The relationship between health and education is complex in part because health and education outcomes share the same socio economic determinants. For instance, the level of mother's education impacts on both the child's health and education. Moreover much of the literature is concerned with risk factors that affect health and education outcomes. These are important from a policy perspective because they represent behaviours that potentially can be changed through public education campaigns or other, e.g. taxation, policies. For instance, this literature addresses the impact of the mother's smoking and alcohol consumption behaviour during pregnancy on the new born child's health.

The literature therefore is concerned not only with the relationship between health and education, but also with the influence of other factors on health and education. In particular

it deals with determining the influence of behaviours, such as tobacco smoking, excess alcohol consumption or poor diet that lead to adverse health and education outcomes. In developing a set of health and education indices at each stage of the life course, consideration needs to be given, not only to health and education outcomes, but also to the relevant risk factors that are known to influence these outcomes.

The so called 'evidence papers' (Rasmussen and Welsh 2014; Maharaj 2014; Hurley 2014) provide a summary and analysis of the evidence, as presented in the literature, of the relationships between health, education and other relevant variables for each major transition in the life course. The next sections draw on those papers to outline the complex linkages between health, education and other relevant variables over the life course. Where possible an assessment is provided of the levels of causation established by the various referenced studies.

5.1 Effect of education on health

Level of education appears to have a considerable bearing on how long one lives, but the reason for this is far from well established. In the US, those with a college education not only live significantly longer than those who didn't manage to complete high school, but the gap has been widening. In the US in 2006 college educated male 25 year olds could expect to live 9 years longer than their peers with no high school diploma, an increase of 2 years in the decade from 1996 (NCHS 2012). It might be expected that this result at the end the life course might be explained by different behaviours at key transition points of the life course.

While behaviours adopted in adolescence are known to have a major influence on later stage health outcomes (WHO 2014a), differences in behaviours do not appear to be explained by education. For instance, one hypothesis is that the better educated have a lower tendency to high risk behaviour, e.g. lower smoking rates. However, Cutler et al. (2011) conclude that despite the importance of smoking, obesity, hypertension and cholesterol as determinants of population health, they do not explain the widening educational gradient. The persistence of this gradient has led Mackenbach (2012) to suggest that they reflect social selection in that 'the lower social strata have become more exclusively composed of individuals with personal characteristics that increase the risks of ill-health' (p. 766) which is reinforced by a failure to make behavioural changes.

Nonetheless a number of studies attempt to find a causal link between education and health using the methodologies, such as natural experiments, discussed above. Some of these have found a causal link between length of schooling and mortality.

One 'natural experiment' of relevance to education is a change in years of schooling through a change in the compulsory schooling age. This has an effect on schooling years but is uncorrelated with health outcomes. In terms of the relationships postulated in Figure 3, these studies test for a causal relationship between health and adolescent educational attainment.

There are a number of studies, such as Lleras-Muney (2005) and Lillard and Molloy (2010), which find that an extra years schooling by virtue of a change in compulsory school age produces a reduction in mortality in the next 10 years of between 3-6 percentage points and 2-3 percentage points respectively. However, a number of studies such as those by Mazumder (2008) and Clark and Royer (2010) do not show a causal relationship.

Studies which have dependent health variables, other than mortality, include a study of self-reported health status and an extra years schooling (Silles 2009), which concludes that the extra year increases the probability of good health by 4.5 and 5.5 percentage points. Oreopoulos et al. (2008) obtains results of a similar magnitude in a study that embraces US, UK and Canada.

A study based on data of Australian identical twins (Webbink et al. 2010) finds that a year of extra education lowers the probability of being overweight by 2-4 percentage points.

There is a range of other tests summarised in Eide and Showalter (2011) that seek to establish causation between education and health. Some studies are successful in finding such a relationship, others less so.

Overall, there are a number of studies which find a small positive and causal relationship of education on health but equally there are many studies that don't. Eide and Showalter (2011) suggest that the studies that are successful in establishing the link employ data that is finer grained, with smaller cohorts and smaller sample populations. This suggests that technical issues may be a problem for some of the 'null' studies.

5.2 The effect of health on education

The causal impact of health on education is better established than that between education and health discussed above. The association is particularly strong in the early years of the life course. Indeed there are number of studies linking high risk behaviours by pregnant women to poor health outcomes for their babies that have far reaching implications for educational performance. In adolescence, substance abuse and mental illness adversely affect school performance.

Pre natal and early childhood

Maharaj (2014) outlines the results of a range of studies of the pre natal and *in utero* impact of mother's alcohol abuse and smoking on subsequent education and health outcomes for their children. Olsen et al (1992) found that prenatal alcohol exposure was associated with achievement difficulties and poor school performance. Ornay and Ergaz (2010) found evidence from a literature review of a range of negative health outcomes, including growth deficiency, specific craniofacial dysmorphic features, mental retardation, and behavioural changes arising from high levels of alcohol abuse.

There is good evidence linking low birth weight causally to educational outcomes. The Barker foetal origins hypothesis suggests that nutritional deprivation *in utero* results in low birth weight and is a contributing cause to a number of chronic diseases including coronary heart disease, hypertension, stroke and Type2 diabetes. His studies indicate that these health problems are linked to lower educational outcomes and lower lifetime earnings.

Barker's research has been based on a number of longitudinal studies. His early work established the association between birth weight and coronary heart disease for a cohort of 16,000 Hertfordshire men and women. This showed death rates from coronary heart disease halving between the lower and upper ends of the birth weight distribution (Barker 1989). Barker (1997) reviews evidence, by his team and others, of the association between child health indicators and a range of diseases in adult life, including insulin resistance (leading to Type 2 diabetes) and raised blood pressure (hypertension).

He studied the human capital implications of poor child health in his analysis of a group of 4360 men born in Helsinki, Finland during the period 1934-44, which related their height at 1 year with their educational attainment and personal income as adults (Barker et al. 2005). This showed a strong association between height, highest level of education, personal taxable income and nature of occupation (see Table 2).

Table 2 Length of 4630 men at 1 year of age related to later education, income and occupation

| Length at age year 1 (cm) | Reached high level education (%) | Personal taxable income in 1990 | | Became a labourer (%) |
|------------------------------|-------------------------------------|---------------------------------|--------------|--------------------------|
| | | Finnish marks | Pounds | |
| -72 | 9 (303) | 104.6 | 15370 (276) | 44 ((232) |
| -74 | 17 (678) | 130.2 | 19140 (623) | 32 (534) |
| -76 | 22 (1044) | 136.8 | 20100 (967) | 27 (850) |
| -78 | 20 (1103) | 138.1 | 20300 (1035) | 28 (914) |
| -80 | 17 (703) | 138.5 | 23060 (650) | 26 (598) |
| >80 | 22 (421) | 151.5 | 22270 (388) | 20 (352) |
| All | 19 (4252) | 135.2 | 19866 (3939) | 29 (3480) |
| p value for trend | 0.001 | <0.0001 | | <0.0001 |

Note: Number of men in brackets.

Source: Barker 2005, p. 272.

The potential for the confounding influences of family characteristics on this association, between birth condition indicators and educational attainment and adult earnings, has led researchers to more carefully consider the causal relationship between poor child health and adult health status, educational attainment and earnings.

Behrman and Rosenzweig (2004) base their analysis on data on monozygotic female twins from the Minnesota Twins Registry, the largest birth-certificate-based twins registry in the United States. Analysis using twins controls for a range of genetic and other family endowment effects. The study focuses on the relationship between foetal growth and schooling attainment and labour market payoffs. It finds that foetal growth (ounces per week of pregnancy) is significantly and positively associated with schooling attainment. A one pound increase in birth weight would increase schooling by one third of a year. Such an increase translates into an increase in adult earnings of 7%.

Black et al. (2007) also based a study on twins using Norwegian birth records matched to other administrative records, including military, education and labour market records. The study finds that a 10% increase in birth weight increases the probability of high school completion by 1 percentage point and raises full time earnings by 1 per cent. (Black et al. 2007, p. 424). Other studies such as Oreopoulos et al. (2008) and Royer (2009) employed different techniques and data, and reach similar conclusions about the effect of birth weight.

Breastfeeding has been linked in a number of studies to developmental and educational benefits. Tawia (2013) reviewed recent evidence for 'the effect of breastfeeding on cognitive development, but goes beyond IQ, beyond just a number, and looks at just what kind of brain development happens when infants are breastfed and what developmental, educational and social consequences occur when infants are artificially fed'.

Other studies use shocks during early childhood and the prenatal period to test for long lasting effects on health and education. Almond (2006) examines the impact of the 1918 influenza pandemic on the cohort, which was *in utero* during the pandemic. This study indicates that this cohort was 4-5 per cent less likely to complete high school.

Nilsson (2008) examines a different kind of *in utero* shock which relates to prenatal alcohol consumption. In Sweden in 1967-68, the ban on 'off premises' sales of strong beer were relaxed and in some neighbourhoods consumption of strong beer, particularly by younger ages, increased dramatically. Males conceived during this period in these neighbourhoods under performed at school and had significantly lower earnings. Nilsson found that males had 0.47 fewer years of schooling, a 3.9 per cent lower chance of graduating from high school and, even more remarkably, the exposed cohort was found to be earning 24 per cent less aged 32.

A number of studies have attempted to measure the causal effect of post-neonatal conditions on educational outcomes in later life. These use a form of a health shock to establish causation. One is by Bleakey (2007) who investigated the impact of a hookworm eradication program funded by the Rockefeller Foundation in the US South in 1910-15. Hookworm causes listlessness, anaemia and stunted growth. The study finds that a child infected with hookworm was 20 per cent less likely to be enrolled in school and suffered a 43 per cent reduction in wages.

Another study by Nilsson (2009) demonstrates that children less exposed to high lead levels through a phase out of leaded petrol experienced improved scholastic performance, cognitive ability and labour market outcomes.

Vujic et al. (2008) examine conduct disorders amongst Australian twins to measure the impact on education. Not only did they find that conduct disorders led to a 5-16 per cent decrease in high school graduation but it also increased the probability of being arrested by 100-228 per cent.

Currie and Stabile (2006) produce similar findings using US and Canadian data for children aged 4-12, who suffer from ADHD. Those suffering severe hyperactivity had a probability of grade repetition of 6% in Canada and 7% in the US. Despite the higher prevalence amongst low income families, the test scores were invariant across income although children from low income families were more likely to repeat.

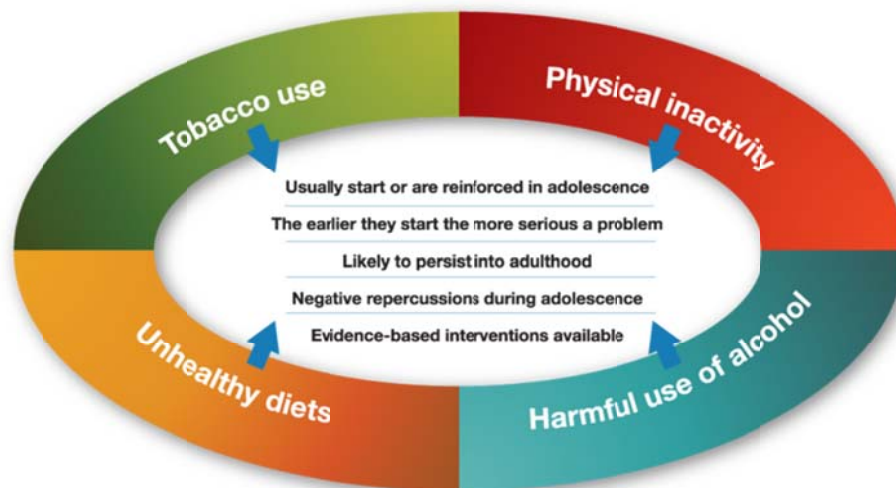
A number of studies have found that child health and nutrition are strongly associated with educational achievement. While acknowledging the difficulties of establishing causation between health and education, Suhrcke and de Paz Nieves (2011), reviewed the evidence of the impact of health and health behaviours on educational outcomes in high-income countries and found number of studies that undertook serious efforts to tackle the challenge of proving causality in the relationship between health and education. (see Maharaj 2014)

Obesity has been found to adversely affect child development. Cawley and Spiess (2008) investigated the link between obesity and skill attainment in early childhood (2-3 years) and found that among boys, obesity is associated with reduced verbal skills, social skills, motor skills, and activities of daily living. Among girls, obesity is associated with reduced verbal skills.

Adolescence

Most adolescents enjoy robust physical health, but the future patterns of adult health, as suggested in Figure 4, are set by behaviours established in adolescence. In particular, unhealthy diets, tobacco and harmful alcohol use, and physical inactivity establish high risk behaviour patterns with implications for later life.

Figure 4 Short and longer term implications for health of high risk behaviours in adolescence



Source: WHO 2014a, at http://apps.who.int/adolescent/second-decade/section/section_1/level1_3_page5.php

Mental health issues are more prominent and a sizeable proportion of adolescents suffer from various forms of mental illness. The recent results for Australia of the Global Burden of Disease study found that for both males and females the greatest burden is due to mental and behavioural disorders. They represent 36% of the total disease burden and 43% of the total, if neurological conditions are included (see Rasmussen and Welsh 2014 for more detailed discussion). Adolescence is a period of emotional development with periods of poor self-identity, alternating with periods of high expectation. The tendency to distance themselves from parents and a drive for independence can be destabilising for some adolescents (Sawyer et al. 2012).

Adolescent health is affected by structural determinants, such as national income, access to education and relevant health services, and support from and connectedness to family and school (Sawyer et al. 2012). Mental health has been found to have a serious impact on school performance and on re-enrolment and dropout rates.

Fletcher (2008) use the National Longitudinal Study of Adolescent Health (Add Health) to study the relationship between depression in high school, subsequent attainment and propensity to enrol in college. The study employs a range of control variables, such as mother's education, income level, family structure and neighbourhood characteristics, to exclude the effects of socioeconomic status and other variables on the relationship between depression and education. The association is found to be particularly robust for females but not males. Females with depression were 3.5 % less likely to graduate from high school and 6% less likely to enrol in college, and particularly less likely to enrol in a four-year college. In a follow up study, Fletcher (2010) controlled for family variables by confining the study to siblings. The study indicates that depression reduces years of schooling largely by those depressed dropping out. The study did not however report on gender effects.

Cornaglia et al. (2012) conduct a somewhat similar study to the one undertaken by Fletcher (2008), but use the Longitudinal Survey of Young People in England which incorporates the General Health Questionnaire, a self-reported measure of psychological morbidity. The methodology does not use one of the accepted methods to establish causation, but the authors argue that there is sufficiently comprehensive set of indicators to control for a very large number of individual and family characteristics. The study investigates both the importance of mental health on examination performance and schooling decisions, e.g.

dropping out. The study finds that 'poor mental health in early adolescence has a strong negative association with subsequent examination performance and drop-out from the labour market and education' (p. 42). The pattern is stronger for girls than for boys, which is consistent with other literature such as Fletcher (2008).

Ding et al. (2009) tackle the problem of establishing causation in an innovative way using longitudinal data which includes genetic markers. These are used as instrumental variables to relate independently to health status and education performance. The study finds that depression and obesity both lead to a 0.45 reduction in GPA score or roughly one standard deviation reduction in performance. The study found that females were adversely affected by negative health conditions, but not males.

5.3 The relationship between health, education and earnings over the life course

Case et al. (2005) seek to establish which of three hypotheses, each seeking to explain the relationship between child health and adult health and earnings, holds. The three hypotheses are: (i) *foetal origins hypothesis* as put forward by Barker which suggests that nutrition in utero can effect health and economic status in middle age; (ii) *life course models* which emphasise the lasting effects on adult health of child illness; and (iii) *pathway models* which suggest adult health is determined largely by adult SES. To the extent that adult SES is influenced by early life circumstances, then this hypothesis suggests low SES in childhood indirectly leads to poor health in adulthood.

Their study is based on the UK 1958 National Child Development Study (NCDS, Centre for Longitudinal Studies, Bedford Group for Life course and Statistical Studies, Institute of Education²). The results of this detailed survey enabled the authors to control for many family characteristics, such as parental income, education and social class. It also had access to data for a number of intrauterine indicators including birth weight and maternal smoking. It concluded that children with low birth weight had significantly lower educational attainment (number of O level exams passed) and that the impact of these intrauterine indicators on adult health status became more significant with later age, thus supporting the foetal origins hypothesis. It also found support for the suggestions put forward in the life course models, that child ill health, as represented by the number chronic conditions at age 7 and 16, significantly adversely effects adult health.

Both factors, chronic childhood ill health and poor uterine environment, had an adverse influence on employment and economic status (occupational status). Their study provides however less support for the pathways model.

Smith (2008) however, argues that the control variables used by Case et al. (2005) are insufficient to rule out the possibility that the observed relationship is the product of unobserved characteristics of the family or home environment. He conducts a study based on health data reported by siblings to eliminate family effects using the Panel Study of Income Dynamics (PSID), a longitudinal panel survey of American families. However, this data base only provides relatively high level childhood health data and in particular lacks the birth condition indicators available to the Case et al. (2005) study. Nonetheless, Smith's study confirms that childhood health significantly effects adult health and economic status. Indeed, his study estimates that within siblings, those reporting good to excellent child

² <http://www.cls.ioe.ac.uk/>

health had 25% higher earnings. This could be considered a further confirmation of the life course model.

5.4 Summary and implications of the relationship between health and education over the life course

The results of these studies establish that a range of health conditions have a strong bearing on educational outcomes. The evidence for the adverse and lasting impact on educational outcomes and lifetime earnings of health conditions, which affect the unborn child in utero and the child post neo natal, is especially strong. Other studies of conditions, which affect young children, such as mental health, hookworm and high lead levels, show the enduring impact of adverse health conditions on the educational performance of young children.

This research supports the proposition outlined in Figure 3 that health at birth or early childhood has a significant and causal impact on education outcomes in adolescence.

The evidence that education has a causal impact on health is less well established. This may be due to technical estimation problems, in particular the limited 'natural experiments' available on which to test the relationship. The most used natural experiment is the extension of compulsory schooling which produces fairly muted health outcomes. Nonetheless there is some evidence for this relationship.

There is in fact stronger evidence that poor health, especially mental health, such as depression in adolescence, has a significantly adverse effect on educational attainment. The study by Ding et al. (2009) which uses genetic markers to establish causation is especially relevant.

There is also strong evidence that health at birth or early childhood has a significant impact on health in later life and that health factors have an ongoing bearing on occupation and lifetime earnings. There is strong support for the Barker hypothesis that adverse *in utero* shocks have long term consequences in terms of the incidence of chronic disease and implications for educational attainment and lifetime earnings.

5.5 Impact of parental SES on Health

The relationship between parental SES and health is complex, in part because each of the variables is in itself multifaceted. Factors generally used to measure SES include income, education and occupation. Parental SES is a combination of individual and household measures of these indicators. Health status is also a composite variable. Many of the studies focus on just one health condition to overcome this problem but as a consequence this limits the degree to which the results can be generalised.

Currie (2009) surveys the quite extensive literature that establishes a correlation between parental SES and child health. This literature demonstrates a significant health gradient with respect to SES factors. For instance Case, Lubotsky and Paxson (2002) for the US, Currie and Stabile (2006) for Canada and Case, Lee and Paxson (2007) for the UK, show that the gradient with respect to income increases with child age. The results for Canada and the UK are particularly notable given the access to universal health care.

However, the literature seeking to establish causality of SES on health is more limited. While the health gradient with respect to a range of parental SES factors is well established this

does not by itself establish causation. A third factor may be involved. For instance parents who are themselves in poor health are likely to have lower earnings.

Because of the complexity of establishing causality between the multi-dimensional SES and health variables, a number of studies examine the link between maternal education and health. Some of these studies have been discussed above in the section on health and education. Some studies discover a causal link while others don't.

Carneiro, Meghir and Patey (2007) using US National Longitudinal Survey of Youth (NLSY) data and employing an IV design, find a strong correlation between maternal education and cognitive outcomes and behaviour problems, a possible proxy for mental health conditions. One study by Thomas, Strauss and Henriques (1991) based on Brazilian data indicated that much of the correlation with child height was explained by the mother's access to information, rather than maternal education *per se*.

A number of studies have examined the link between income and child health. Berger, Paxson and Waldfogel (2005) found the effect of income to be statistically significant but small. Burgess et al. (2004) also found the effect of income to be small, with other factors more closely related to the mother, such as her own health, were more important.

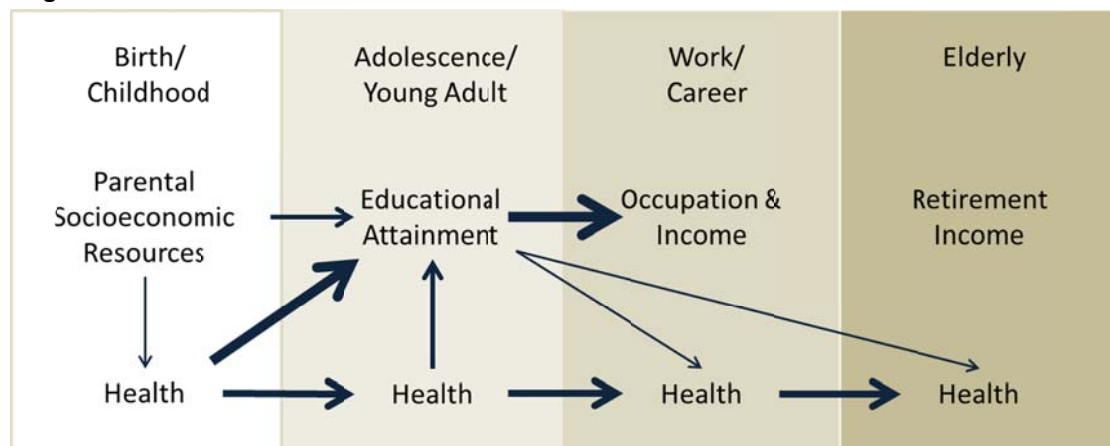
So while the correlation between parental SES and child health is strong, causation is more difficult to establish. Currie (2009) suggests maternal SES matters, particularly for the child's mental health.

5.6 An assessment of the evidence from the literature in terms of the hypothesised life course model

The search for evidence from the literature of the causal relationships hypothesised in Figure 5 between health, education and a range of SES variables has been focussed to date on the early stages of the life course, birth/childhood, and adolescence/young adult. Little attention has been paid to the later stages of the life course at this stage.

Figure 5 presents the results of this evidence gathering process in terms of the life course model hypothesised in Figure 3 for the two early stages of the life course model.

Figure 5 Evidence from the literature on relationships between health and education over the early stages of the life course



The arrows represent the direction of the effect and the thicker lines represent the level of causation established by the literature. Thinner lines indicate lower levels of confidence in the causal effect or simply correlation supporting hypotheses without causal effect.

As discussed above, the strongest causal relationship is between health at birth or early childhood and educational attainment in adolescence. This causal relationship has been well established in the literature for a number of health conditions. The causal relationship between health and educational achievement in adolescence and level of occupation and income later in life is also well established.

However, the relationship between parental SES and health is not well established, although a number of studies find there to be a significant correlation. One reason is that the reverse causation also applies. Namely that families in poor health tend to have low SES.

The evidence for two relationships is different in the literature to that hypothesised in Figure 3. There is not support in the literature for educational attainment having an effect on health at the same stage of the life course. In fact the larger effect at adolescence seems to be health on educational attainment. This is largely due to the impact of mental health issues on educational performance. Rather educational performance appears to effect health in later life course stages. Life expectancy appears to be extended by higher educational levels and those with higher education levels experience better health. In the studies reviewed while correlation is established, although causation was not.

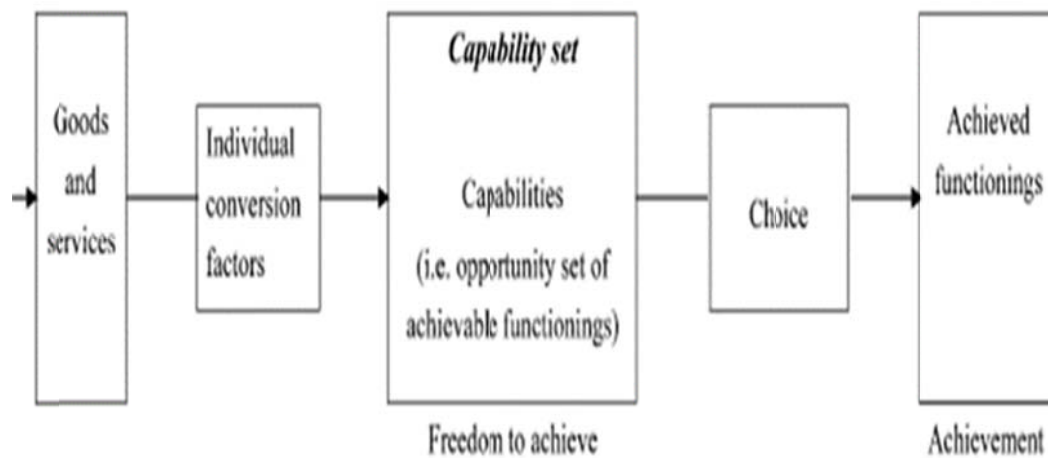
6. Capability and the Life Course

The proposed health and education indicators are designed to identify deficits in capabilities in health, education and other relevant factors based on this review of the empirical literature at each stage of the life course.

As outlined in section 3.2 and summarised in figure 2 above, the realisation of an individual's capabilities needs goods and services to be resourced at a level that enables a desired level of functionings, based on a set choices, to be achieved. Part of figure 2 focusing on the relationship between the availability of goods and services, the capability set and achieved functionings is reproduced as figure 6.

This chart illustrates the fundamental role of an endowment of goods and services in determining and opportunity set of capabilities which, with an appropriate set of individual choices, establishes the individual's achieved functionings. Those with a larger set of goods and services are able, depending on their individual conversion factors, to have access to a more expansive capability set and in turn to a higher level of functionings. Those with severe resource deficits will have a constrained set of choices and experience difficulty in achieving their desired level of functionings.

Figure 6 Part of a stylised non-dynamic representation of a person’s capability set excluding social and personal context



Source: From Robeyns (2005).

While not advocating an equality in total goods and services between individuals, the Rawlsian approach suggests that everyone should have a basic set of resources, to provide a reasonable equality of opportunity, to achieve a high level of functionings appropriate to their capabilities and individual choices. Inequalities in initial resource endowments are mitigated by transfers to individuals with deficits in key resource endowments.

The purpose of the empirical evidence gathered in this project, from the vast academic literature, is to identify those elements that are crucial determinants of success in achieving health and education outcomes that permit the development of capabilities and fully achieved functionings. In theory, providing the data are available this should allow us to develop indicators that are based on the crucial variables, as determined by the literature, in health and education that will identify critical deficits in resources preventing capabilities being realised as functionings.

As discussed above the relationships between health, education and a range of socioeconomic determinants and high complex and interrelated. Some of these relationships are well established causally and provide a basis for confident indicator selection. For others the direction and level of causation remains in doubt.

Figure 3 is designed to capture the mechanism by which resources and capabilities interact for functionings to be fully achieved at a single point in the life course. This paper postulates that there are a series of key transition points across the life course. Being able to convert well developed capabilities at each transition point into full functionings is of critical importance. The success at each transition point in the life course is heavily dependent on a successful transition at the earlier stage in the life course.

The resources that help determine the capability set and in turn the individual’s functionings, comprise both a flow of goods and services and a complex stock of social, human and financial capital. The relationship between the supply of goods and services and the

accumulation and use of the stocks of capital have an important bearing on the successful transition from one life stage to another.

This is particularly critical in the early years, when the financial and social capital provided by family is so important for successful transition to later life stages. For adolescents the transition to adulthood has become increasingly fraught. The transition duration has increased and the paths and outcomes more uncertain (Rasmussen 2014). For a successful transition access to quality education and health services is crucial. However for those who miss-step then access to the accumulated capital of family and others may be vital. This capital, human and social is itself the product of the successful conversion of capabilities to functionings for a previous generation. That this earlier generation may be healthy and well educated may determine its capability to successfully support the younger generation in its transition. Much of this dynamic feedback loop is captured in the family formation stage. In the later stages of the life course the individual is more dependent on his own capital than other family members.

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