BACCH-BACAPH
Improving Services Series

Minimod: Understanding health and disease

Pathogenesis and salutogenesis

A practical framework for structuring interventions and implementing a life course approach.

Purpose

The purpose of this paper is to explore the development of health or disease in ways that can inform the planning, delivery and evaluation of interventions to improve outcomes and equity for children and families.

Introduction

There is accumulating evidence that both health and ill health in adulthood is determined by a combination of genetic and social potential and then subsequent exposure to positive and negative factors throughout life; generally these factors have most influence throughout childhood when both mind and body are still developing.

This is the basis of the "life course approach" that recognises the cumulative effect of these factors and in health policy terms seeks to influence them in ways to build resilience and health and thereby improve equity and life chances.

Influencing life course trajectories is a complex process that requires consistent, congruent and long-term strategies to create alignment and synergy between the efforts of public, private and voluntary sectors. Creating this congruence between different sectors within society requires a shared understanding of the development of disease and promotion of health.

This paper will briefly review:

- public health approaches,
- occupational health approaches,
- life course pathways,
- practical local policy interventions illustrated by tobacco, injury and obesity.

Public health approaches

Probably the most commonly reproduced image (figure 1) in the public health world is that from Dahlgren and Whitehead in 1981 which describes the interaction between the individual in the centre, their lifestyles and community networks (in orange and yellow) all sitting within a wider physical, socio-economic and cultural environment. All of these factors or determinants can influence health either positively or negatively.

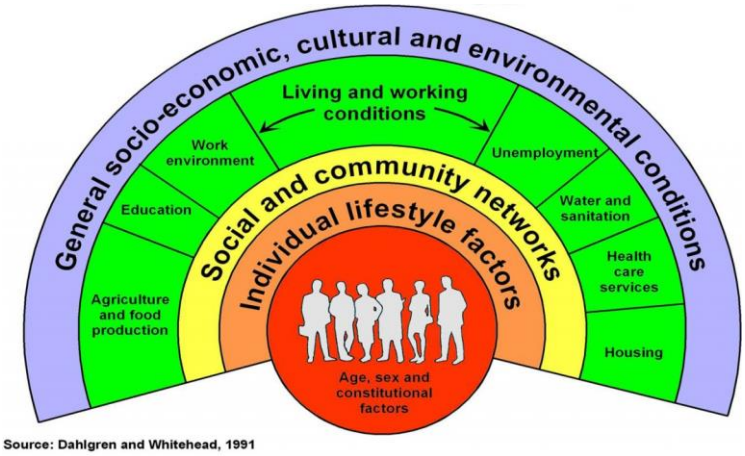

Figure 1: the Dahlgren and Whitehead representation of the interaction of health factors.

Traditionally public health has used the concepts of an interaction between an agent (causing the problem), the host (experiencing the problem) within the wider physical and social environment (that may help or hinder), as a model for understanding and structuring interventions to tackle health problems. See the Venn diagramme in figure 2. This conceptualisation has been applied to both infectious disease and non-communicable disease (for example agent: air pollution, host: children, environment: traffic density and proximity, condition: asthma). Interventions may be targeted on the agent, the host or the environment, but generally interventions to control the agent, backed by legislation, have been the most effective public health strategies.

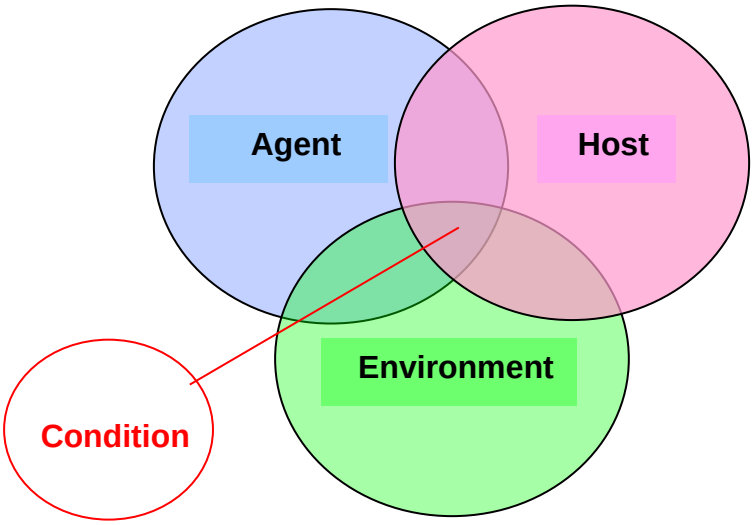

Figure 1: Venn diagramme of the interaction between an agent the host and the environment

The term pathogenesis (understanding of disease) is well understood in the scientific literature, but the word salutogenesis is rarely used but represents the opposite of pathogenesis, meaning the study of factors that create health. Traditional epidemiological research has tended to focus on the negative (pathogenic) explanation for disease or illness, for example, exposure to tobacco smoke causing lung disease. Increasingly there is interest in studying assets i.e. positive (salutogenic) factors that contribute to health and well-being, for example, healthy diets, exercise or increasing social capital.

The traditional model therefore needs to be expanded to include both positive and negative factors linked to the agent, the host and the environment (see figure 3)

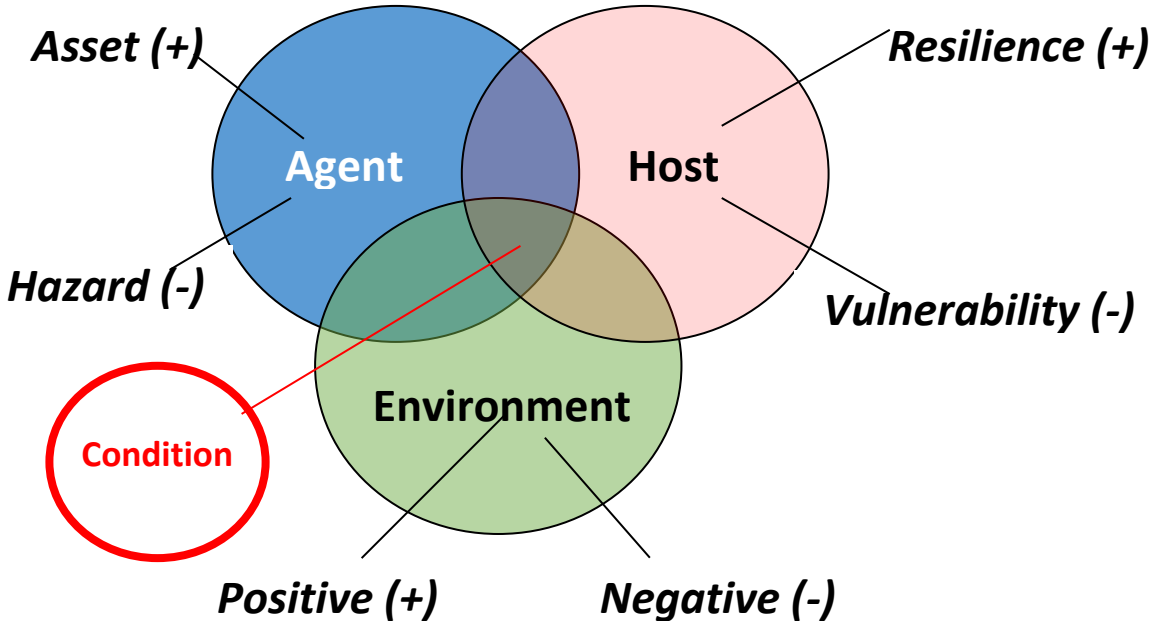

Figure 3: expanded Venn diagramme illustrating the interaction between positive (beneficial) and negative (harmful) factors relating to the host, the agent and the environment that are relevant to the creation of disease or promotion of health.

This relatively straightforward model must sometimes be expanded to include additional elements such as vectors (vectors carry the agent e.g. mosquitoes and malaria, cars and kinetic energy).

Since children generally live within families, family and child related determinants are often grouped together, but there are specific determinants that relate predominantly to outcomes for children (e.g. folate supplementation in pregnancy, reading and language exposure throughout the early years).

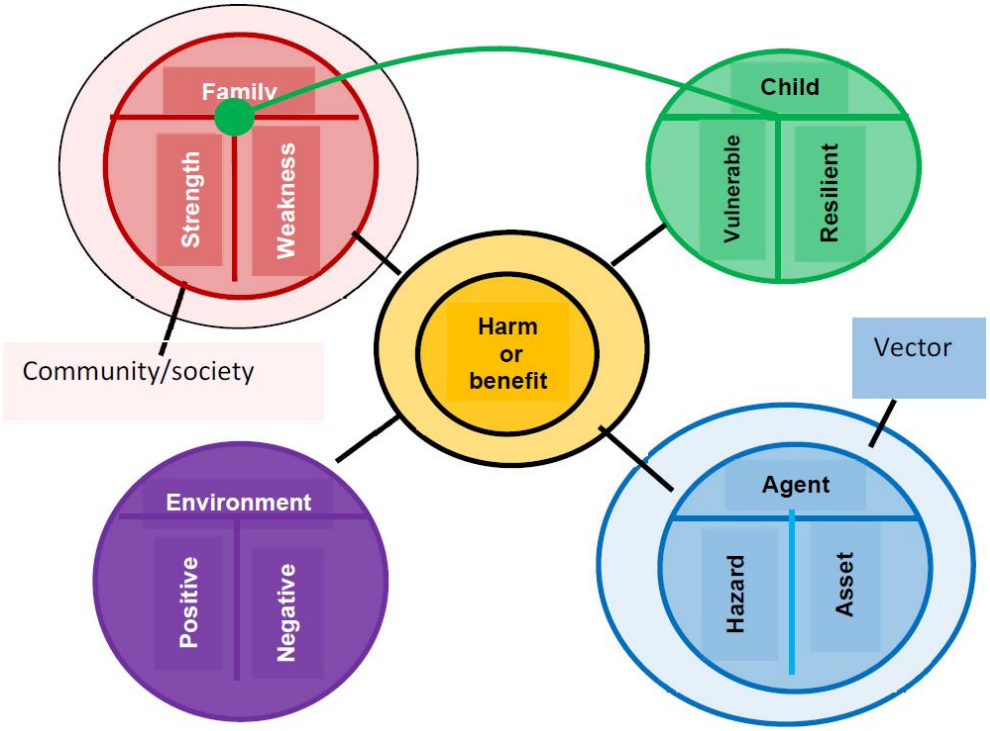

Figure 4: further expanded Venn diagramme including child factors separately and vectors.

The concept of "host" can also be expanded to include a child and their family, the local community where they reside or the wider society in which they live and that some determinant factors, such as poverty, operate at more than one level.

Expanding the concept of “environment” for example into both social and physical can also include an element of expectation or responsibility - lifestyles factors are generally the responsibility of individuals, whereas health determinant factors could be defined as being outside the immediate control of individuals.

This model therefore helps to define who is responsible for which interventions, for example interventions which are the responsibility of “public health” (e.g. fluoridation of water, residential traffic speeds) or the NHS (e.g. screening, child health promotion) or home maintenance the responsibility of families whereas parks are the responsibility of local councils .

Occupational health approaches

The occupational health literature provides a helpful model to understand the interaction between hazards, exposure and harm. Hazards all have the potential to cause harm, then there is the likelihood of exposure which should be considered then following exposure, there is the probability of harm. Likelihood and probability combined contribute to overall risk of harm, illustrated in figure 6.

Interventions may be orientated to protecting (decreasing exposure) for individuals, communities or societies against harmful determinants (hazards) or promoting increased exposure to positive determinants (assets) which can promote the health and well-being of individuals, communities or whole societies.

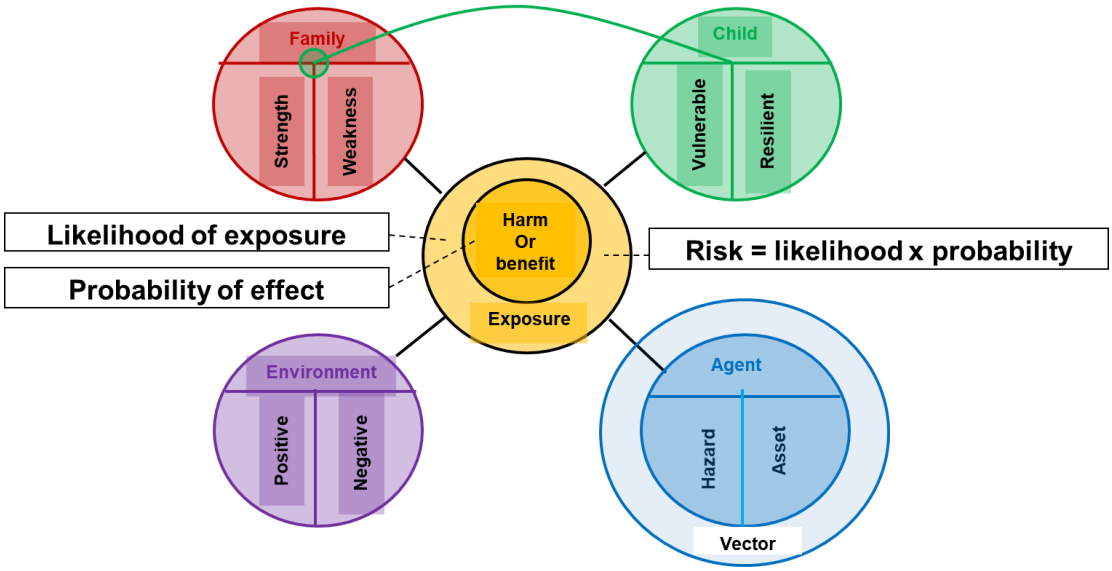

Figure 6: Combining likelihood and probability to form overall risk.

While this generic framework is generally helpful, it must be remembered that some agents can be both positive and negative, for example, sunlight is vital for vitamin D metabolism and the prevention of rickets, but overexposure is harmful in terms of sunburn and development of melanoma. Likewise there is overlap between determinants of health and lifestyles, for example, poverty may be part of macroeconomic policy and increasing inequalities but individuals may also use their own limited resources unwisely.

The Haddon Matrix

William Haddon was an injury epidemiologist that created this framework (table 1) for structuring interventions to reduce the impact of road traffic injuries. Pre-injury interventions intend to prevent any injury occurring - so are primary prevention. Interventions at the time of injury intend to prevent the severity of injury - effectively secondary prevention. Post injury interventions include a range of options including learning from the event to preparing people for emergencies for example CPR training.

Haddon matrix			
	Human (host)	**Vehicle (agent)**	**Environment (physical/social)**
pre-injury	child behavior e.g. parental control	Vehicle condition e.g. braking capacity	visibility e.g. parked cars
injury	resistance to injury e.g. helmets	vehicle design e.g. sharp edges	street design e.g. road surface
post injury	Threat to life e.g. hemorrhage airway	Vehicle inspection (RTA investigation)	emergency response e.g. first aid abilities of passers by ambulance

Table 1: a Haddon matrix for road traffic injury.

The Haddon matrix is particularly good for structuring thinking when designing programmes to prevent negative events but could also be used to enhance health through positive events.

- Prevent the hazard
- Reduce the hazard
- Prevent the release of a hazard that exists
- Separate the hazard and the victim in time
- Separate the hazard and the victim in place
- Modify the hazard
- Protect the victim
- Reducer the damage
- Repair the victim

While the Haddon matrix is especially appropriate for acute events (both infectious and noncommunicable) the time scale can be expanded to include interventions over a life time - effectively a life course approach. Table 2 demonstrates the approach when applied to obesity and includes both positive and negative factors.

Haddon matrix			
Age	**Human (host)**	**Agent (food)**	**Environment (physical/social)**
Pre-school	P Breastfeeding N early weening	P healthy options N sugar drinks	P breast feeding options N attitudes to breasts
School	P Healthy lunches N tuck shops	P 5 a day N no PHSE	P affordable fruits N advertising SFS
Post school	P healthy choices N fast food	P food labelling N TV snacks	P regulation N food subsidies poverty

Table 2 : a Haddon matrix for obesity (P=positive N=negative influence)

Life course pathways

This simple matrix model represents the interaction of host, agent and environment at one moment in time and is particularly relevant for acute conditions, for example, an injury or infectious disease. The life course pathway approach is more relevant to long-term conditions, particularly non-communicable disease and recognises that health and ill-health, is created through a series of cumulative exposures to both positive and negative lifestyles and determinants throughout life from conception through to adulthood, illustrated in figure 7.

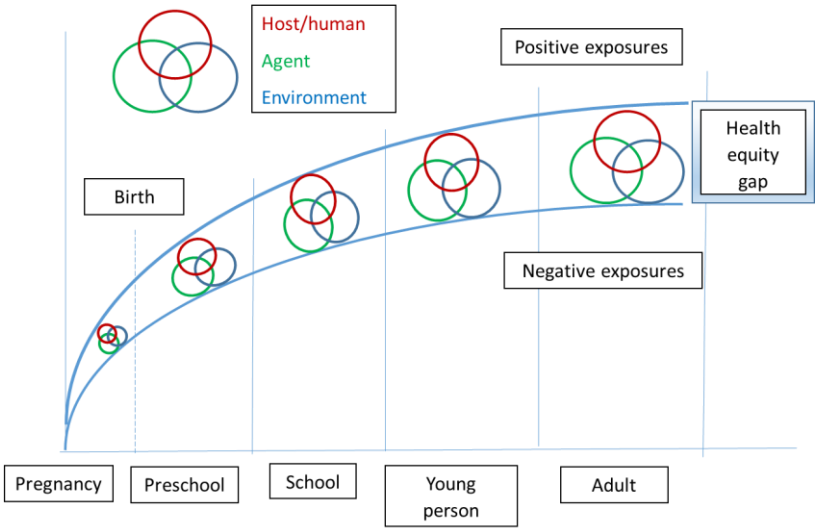

Figure 7: illustrating accumulating health/ill-health over time through different exposures to lifestyles, determinants or PH programmes creating a QALY gap between the best and worst exposures over time.

Figure 7 has age on the horizontal axis and quality of life on the vertical axis. Three overlapping circles represent interventions relating to lifestyles, determinants and services. Two trajectories for life course pathways are illustrated, the upper line represents greater exposure to positives, the lower line represents greater exposure to negatives and the long-term difference between the two illustrated by the QALY gap. The desired public health outcomes would be both to improve health and quality of life, duration and improve equity to narrow the gap.

This concept of accumulating health or ill-health depending on exposure to either assets or hazards throughout life can be expressed as a diagram (figure 8) with the orange triangle representing the needs of the child, family or community, while the green triangle represents the outcomes (measures

of health, equity and sustainability) with lifestyles (assets and hazards) and determinants (assets and hazards) influencing the sequential life stages. Services are represented by a blue filled oval.

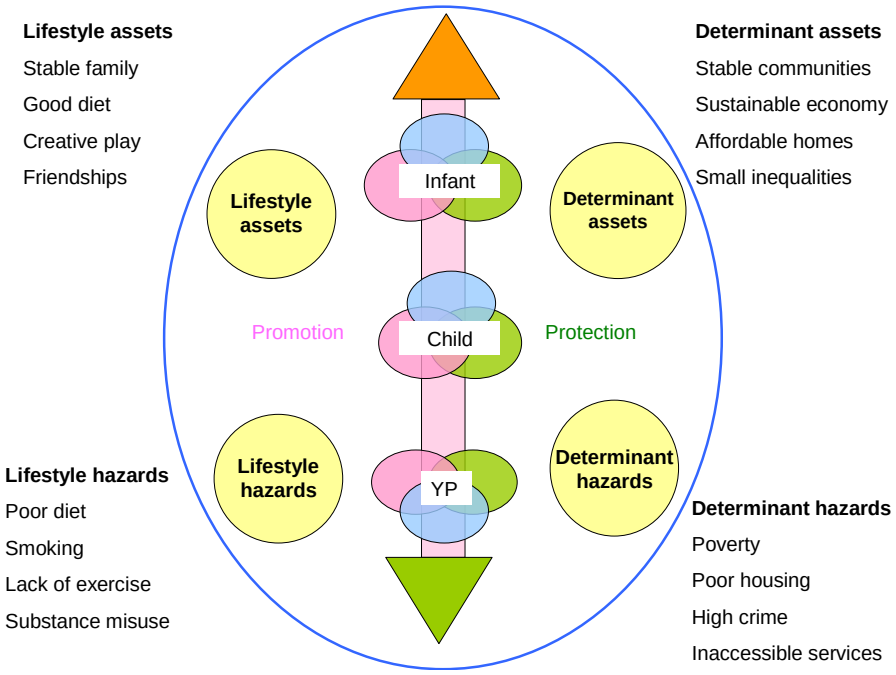

Figure 8: the central vertical line represents the life course of the child from infancy to young person (YP). On the left-hand side are the lifestyle assets and hazards, on the right side assets and hazards relating to the wider determinants.

Age. The dominant factors/agents which have influence are very different in the antenatal period compared to those acting during school age or the period of young adulthood. The model therefore may need to be expanded to include different ages/stages of development. The obvious choices would be:

- Antenatal/perinatal
- Preschool children
- School-aged
- Young person

Social environment. Children do not live in isolation from their families, who have a major influence on their health and well-being. Poor parental mental health, domestic violence, learning difficulties and substance misuse have a huge negative influence on the outcomes for individual children. Conversely good parental mental health, employment and stability provide the basis for resilience and good health. Interventions orientated towards parents, siblings and extended family members must be included in a more comprehensive model.

- Parents/siblings
- Extended family
- Community
- Societal culture

Physical environment. The "physical" environment includes all the non-social (people) elements that have an influence on health and illness and would include physical resources such as housing, air quality, heating, security, access to play space, school, fiscal policy etc. Conceptually these may be organised around the themes of:

- Home
- Neighbourhood
- School
- Society

Interventions can be helpfully be divided by who is predominantly responsible, as this then can help structure recommendations.

- ***Lifestyles*** - actions individuals and families can take or have control over.
- ***Determinants*** - generally outside the control of the individual, actions that communities/society can make sometimes divided into local and national actions.
- ***NHS*/Public Health** - interventions that are the responsibility of the public/health service.

These then can then be further divided into interventions to promote and protect health. *Promotion* being the process of increasing exposure to assets that have positive health effects and *protection* being the process of decreasing exposure to hazards that have a negative health effects.

An example of this structure is illustrated in table 3 focusing on tobacco control, linking interventions that act synergistically and have the greatest likelihood of success in practice.

		Lifestyles	Determinants	Services
Child	***Preschool***		Parental smoking Smoking in media	Asthma services
	School			Health education in schools
	Young person	Health education Smoking enquiry in clinical consultations	Access to cigarettes near schools	Smoke stop services
Family	***Parents***	Tackling smoking in pregnancy		Nicotine replacement
	Siblings		Access to cigarettes	
	Extended family	Smoking cessation advertising	Tobacco taxation	Nicotine replacement
Community	***Home***	Smoke-free homes	Smoke free cars.	SUDI information
	Neighborhood	Smoke-free cars	No advertising Smoke free shops + leisure	
	Society	Smoke-free public places	Legislation increasing age of access to tobacco Control of illegal imports	Health services

Table 3: A worked example of interventions to reduce exposure to tobacco and manage the consequences.

Policy interventions - tackling local and national determinants

Policy is a set of ideas or plans that are used to inform decision-making and while traditionally associated with politics, it is equally relevant to agencies, organisations and businesses. Policy can be enacted in many different ways ranging from legislation (and regulations to interpret legislation), resource allocation, including fiscal measures, public education, professional education (including curriculum development and professional development), organisational change, research priorities and service quality improvement.

Improvement of health and well-being is dependent on social, environmental and economic determinants interacting with human biology. Each element requires a different approach and successful public health programmes are dependent upon bringing together evidence of what works relevant to local communities. Creating alignment and synergy between different policy strands is extremely important for public health programme success.

Tobacco control is a good example of where legislation (age of smoking, import regulations) must align with societal expectations (health promotion), lifestyle advice (health education) and services to help manage nicotine addiction as well as the health impacts of smoking (clinical services).

Table 3 illustrates the multiple policy interventions required to reduce the harm caused by tobacco consumption, using a life course pathway approach.

Practical next steps

Policy does not implement itself! Policymakers within government are best lobbied by alliances of interested parties who can both present a problem and the solutions requiring Ministerial endorsement to enable action or legislation. Sometimes awareness of the issue followed by discussion about possible actions must be presented to the public before there is sufficient popular opinion to change practice. Campaigns or programmes require an understanding of where decision-makers stand and a variety of methods will be needed to effect change. National and local actions require similar steps, but the organisations and individuals involved will necessarily be different, as illustrated below.

National

1. Prioritise interventions for national implementation.
2. Create an alliance with other interested organisations.
3. Develop a strategy to implement national interventions.
4. Create a metrics framework with which to measure effect of the strategy.
5. Learn from the process.

Local

1. Assemble a local partnership of committed local stakeholders.
2. Review what services/programs currently exist and their effectiveness.
3. Assemble local data on the incidence/prevalence and local inequalities.
4. Prioritise interventions for local action.
5. Evaluating the impact of local strategies.
6. Share best practice.

Summary

The design and delivery of successful health improvement services requires a fundamental understanding of how health or disease develops and how interventions might influence the natural course of events. This mini module provides a basic understanding of the interaction between a host experiencing the problem, the agent causing the problem and the environment which may help or hinder the interaction between host and agent. This basic understanding is important for individuals and organisations contributing to Integrated Health Systems in order to create a shared approach to promoting health and preventing disease.

This interaction will be referred to again in both the service pathway and life course pathway mini modules.

References

http://www.bacch.org.uk/policy/BACCH%20Family%20Friendly%20Framework%20final.pdf