Strengths and limitations of the draft classification of public health interventions in the World Health Organization's International Classification of Health Interventions:

A developmental appraisal

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A thesis submitted in fulfilment of the requirements
for the degree of Doctor of Philosophy

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For my mother, Annie

Supervisor's Certificate

This is to certify that the thesis entitled *Strengths and limitations of the draft classification of public health interventions in the World Health Organization's International Classification of Health Interventions: A developmental appraisal*, submitted by Elizabeth Nicola Fortune in fulfilment of the requirements for the degree of Doctor of Philosophy, is in a form ready for examination.

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This is to certify that, to the best of my knowledge, the content of this thesis is my own work. This thesis has not been submitted for any other degree or purposes. The intellectual content of this thesis is the product of my own work and all assistance received in preparing this thesis and sources have been acknowledged.

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Date: 30 August 2018

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In accordance with the University of Sydney policy on thesis editing, editorial assistance was sought in the final production of this thesis.

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Abstract

Statistical classifications provide a basis for collecting and analysing data, for building knowledge and communicating information. A classification of public health interventions is being developed as part of the World Health Organization's International Classification of Health Interventions (ICHI). This is a pioneering development, as there have been no previous efforts to produce a standard classification of public health interventions. A comprehensive developmental appraisal of the draft classification of public health interventions was undertaken to gain an understanding of its strengths and limitations, and to identify what should be done to improve its utility.

The classification was used to code three data sets of public health interventions, to identify problems encountered and to assess inter-coder reliability. Views of potential users were elicited through key-informant interviews. An analytical structure was developed, comprising a set of criteria concerning the desired features of a statistical classification and a model representing the main elements that make up a statistical classification. ICHI was found to have some utility for representing data on public health interventions. Limitations identified included coverage gaps, overlap between categories, lack of clarity concerning how the classification axes are operationalised for public health interventions, and difficulty splitting complex interventions into their constituent components for coding.

This study makes a significant and timely contribution to the development of the draft classification, by providing specific proposals for improvements to ICHI, explicating some fundamental conceptual issues that should be addressed, and indicating a path forward for the further development and use of ICHI in the field of public health. The analytical structure developed through the conduct of this research represents a novel methodological contribution to the field of classification development.

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Glossary of terms

Action	The second classification axis in ICHI, defined as ‘the deed done by an actor to the Target’
FCTC	Framework Convention on Tobacco Control
ICD	International Classification of Diseases
ICF	International Classification of Functioning, Disability and Health
ICHI	International Classification of Health Interventions
Means	The third classification axis in ICHI, defined as ‘the processes and methods by which the Action is carried out’
OPAL	Childhood obesity prevention program delivered in South Australia
Target	The first classification axis in ICHI, defined as ‘the entity on which the Action is carried out’
WHO	World Health Organization
WHO-FIC	World Health Organization Family of International Classifications

1. Introduction

This thesis reports on the developmental appraisal of the draft classification of public health interventions that is being developed as part of the World Health Organization's International Classification of Health Interventions (ICHI). This study has been undertaken to inform the ongoing development of the classification in order to assist in improving its utility for the field of public health.

Public health is concerned with health promotion and disease prevention efforts focused at population rather than individual level. An oft-cited definition of public health is 'the science and art of preventing disease, prolonging life and promoting health through the organized efforts of society' (Acheson 1998, p.1). Public health typically accounts for a small proportion of overall health expenditure – with OECD countries allocating, on average, less than 3% of total health spending to public health and prevention activities (Gmeinder et al. 2017) – and is a component of health system activity acknowledged to be particularly vulnerable to funding cuts when there is pressure to reduce spending (Masters et al. 2017). Description of health system activities often focuses primarily on those components of health systems concerned with the treatment and care of individuals who are unwell (Palmer & Short 2014, p.1). While in many countries data are routinely collected on interventions delivered in hospitals (European Commission 2003, Madden et al. 2007a), this is not the case for public health interventions. Indeed, there is no commonly-held understanding of what constitutes 'a public health intervention' (see Section 2.4.2), which inevitably poses challenges for the collection of data on public health interventions delivered. The inclusion of public health in a standard international classification is an important development: ICHI has the potential to raise the visibility of public health within health systems, and within the broader public policy arena.

Statistical classifications are information structures that provide a standard basis for collecting, organising and analysing data in a wide range of fields (Desrosieres 1998; Hancock 2013). In performing this function, they are important tools for building knowledge and communicating about a domain, and data produced through their application can inform policy and practice. Statistical classifications are developed and used in the context of information infrastructures, which may be described as the networks of technical components, human actors, systems, processes, practices and social norms constructed to accomplish the generation and sharing of information required to support a given domain of human endeavour (Ciborra & Hanseth 1998; Braa et al. 2007; Edwards et al. 2007). While the developers and users of statistical classifications typically view them primarily as technical tools, which can be judged as more or less suitable for producing robust, reliable data, they can also be understood as social artefacts, which frame knowledge in a particular way and thus have the

potential to shape the real-world contexts to which they relate (Ciborra & Hanseth 1998; Bowker & Star 1999; Salvador-Carulla et al. 2014; Sturmberg et al. 2014). Given their important role in providing a standard basis for collecting data that can be compared over space and time, and their capacity to interact with and to influence the 'reality' they classify, classifications warrant closer scrutiny than they often receive (Bowker & Star 1999). It is with this view of the draft classification of public health interventions in ICHI as both a technical tool and a social artefact that I have approached this study.

In this introductory chapter, I introduce the International Classification of Health Interventions and describe the context within which the current research is situated, before setting out the objectives of the study and providing an outline of the thesis.

1.1 A new international classification of public health interventions

In its 2007 framework for action on strengthening health systems to improve health outcomes, the World Health Organization (WHO) identified 'information' as one of six building blocks that make up the health system, alongside health services, health workforce, medical products, vaccines and technologies, health financing, and leadership and governance (World Health Organization 2007). The WHO plays an important role in promoting the production and use of health information globally, supporting countries to develop systems for data collection and management, and collating and reporting internationally comparable data; the provision of data standards, including statistical classifications, is an important aspect of this role (World Health Organization 2014).

The WHO Family of International Classifications (WHO-FIC) is a suite of classifications designed to provide internationally consistent information on different aspects of health and the healthcare system (World Health Organization 2016b). The three core members of the WHO-FIC are the long-established International Classification of Diseases (ICD), the more recently developed International Classification of Functioning, Disability and Health (ICF), and the International Classification of Health Interventions (ICHI), which is currently in development. The value of these classifications is illustrated by the range of uses to which the ICD and ICF are applied.

The ICD has become deeply embedded in health information infrastructures around the world, and is used in a range of clinical, administrative and statistical applications to systematically capture data on morbidity and cause of death. ICD-coded data are used for monitoring trends in population health, health service planning, and healthcare funding and reimbursement (Moriyama et al. 2011; Roberts et al. 2015); ICD categories are also extensively used in research (e.g., in specifying inclusion criteria for clinical trials).

Applications of the ICF in clinical contexts include the description of functioning and disability in specific patient groups, and the development of new assessment tools; in statistical applications, ICF is used as a basis for capturing data on functioning and disability in surveys (including the World Health Survey) and administrative systems, and for the re-analysis of existing surveys and data (Kostanjsek 2011; World Health Organization 2013). The ICF is recognised as having brought about cultural change, with its conceptualisation of functioning and disability progressively being embraced across a wide range of fields, and catalysing new directions in research, inquiry and knowledge-building (Jelsma 2009; Cerniauskaite et al. 2011; Madden & Bundy 2018).

Development of ICHI began in 2007, in response to the recognised lack of a standard to support the collection of internationally comparable data on health interventions. Unlike the various health interventions classifications in use at the national level in many countries, which focus mainly on diagnostic, medical and surgical interventions, it was agreed that ICHI would encompass interventions delivered across all sectors of the health system, including allied health, nursing, community health, mental health, rehabilitation and public health (Madden et al. 2007b). Health equity was a major consideration in this regard: failure to include non-medical interventions would encourage a policy and funding focus on higher-cost interventions, often accessible only to limited sections of the population, and render invisible the many lower-cost, widely-accessible interventions that can benefit populations more broadly (Madden et al. 2007c). ICHI is being developed by the WHO-FIC Network of Collaborating Centres (World Health Organization – Family of International Classifications Network 2014). The first alpha version[1] was produced in 2012, with revised alpha versions produced in 2014, 2015 and 2016. A beta version of ICHI was released for testing in 2017 (Madden et al. 2017), and a revised beta version is planned for release in October 2018, which will provide the basis for a formal program of beta testing to be conducted by the WHO.

[1] The WHO has adopted a convention used in computer software development of identifying 'alpha' and 'beta' phases in classification development (Ustun *et al.* 2003). In software development, 'alpha testing' is typically conducted at an early stage in the development of a new product, and is usually done internally by the developing organisation, while 'beta testing' occurs at a more advanced stage of its development and involves testing by external users with the aim of polishing and fine-tuning the product prior to finalisation and release (*www.webopedia.com*). During the alpha phase of classification development, there is a particular focus on its technical characteristics and broad-based consultation is advised to ensure that it is acceptable to stakeholders and fit for purpose (Madden *et al.* 2007a).

The 2016 alpha version of ICHI is the subject of this study (Almborg et al. 2016; Madden et al. 2016; World Health Organization 2016d). In that version, 'Health intervention' is defined as 'an act performed for, with or on behalf of a person or a population whose purpose is to improve, assess or modify health, functioning or health conditions' (Almborg et al. 2016; Madden et al. 2016; World Health Organization 2016d).[2] The classification has three axes that, together, describe specific interventions:

> Target — the entity on which the Action is carried out;
> Action — the deed done by an actor to the Target; and
> Means — the processes and methods by which the Action is carried out.

Each axis is a coded list of descriptive categories, and each intervention is represented by a title and a unique code denoting the Target, Action and Means for that intervention. Some additional information about an intervention can be recorded using extension codes. Intervention codes are grouped into three sections based on Target:

1. Interventions on Body Systems and Functions;
2. Interventions on Activities and Participation Domains; and
3. Interventions to Improve the Environment and Health-related Behaviour.

There is no designation of interventions as 'medical', 'primary care', 'public health', and so forth. Of the approximately 5,800 intervention codes in ICHI Alpha 2016, about 500 have been developed for the purpose of describing public health interventions. These codes have environmental factor or health-related behaviour Targets; some clearly describe population-level interventions (e.g., UBN PM QA 'Media campaign about water quality'), while others may be applicable for describing either population-level or individual-level interventions (e.g., VAA PM ZZ 'Education about alcohol use behaviours'). Public health content for ICHI was largely developed *de novo*, as no suitable classifications of public health interventions were available to draw upon (Fortune & Madden 2013; Fortune et al. 2014).

[2] ICHI Alpha 2016 is available at: https://mitel.dimi.uniud.it/ichi/. The Introduction to that version, cited in this thesis, has been replaced by a new Introduction to ICHI Beta 2018.

In the field of public health, there is no established culture of systematic data collection and reporting on interventions, as the outputs produced with public health funding. This situation is different to that which exists in the hospital sector in many countries, where data on interventions are routinely captured in administrative data systems. Without summary data on public health interventions, it is not possible to examine the mix of interventions delivered, to make comparisons between jurisdictions or programs, to monitor trends over time, or to examine interventions delivered in relation to population demographic variables or policy priorities. This lack of data may also be expected to put public health at a disadvantage with respect to other sectors of the health system in competing for funding. Data are a powerful advocacy tool, for communicating clear, concise messages to policy makers and the public about what interventions are delivered, where there are gaps, and what would be lost if funding is cut. Indeed, even reliable and comparable estimates of overall public health spending are not easy to obtain. In many countries, public health functions and services are dispersed across different sectors and levels of government, and funding flows are complicated and difficult to track (Gmeinder et al. 2017; Jackson & Shiell 2017; Leider et al. 2018).

There is recognition of the importance of data on public health activities, services, and interventions, as a component of the information systems needed to support health sector planning and funding decisions (Jorm et al. 2009; Madans et al. 2012; Schmidt et al. 2015). Also, in public health and related fields, the lack of common structures and agreed use of terms for communicating about interventions is seen as a constraint on knowledge translation and the development of an evidence base for practice (Michie et al. 2009; Lamb et al. 2011; Colquhoun et al. 2014; Dijkers 2014; Lokker et al. 2015; Guegan et al. 2016). Against this backdrop, the draft classification of public health interventions in ICHI promises to fill a real gap. The *Introduction* to ICHI Alpha 2016 states that:

> ICHI will provide a basis for collecting, reporting and analysing data on population-level health promotion and disease prevention efforts. ICHI has the potential to support accountability for use of public health resources, improve the quality and availability of information on public health interventions, and raise the profile of public health in the broader sphere of health policy. (Almborg et al. 2016; Madden et al. 2016; World Health Organization 2016d)

Also highlighted in the *Introduction* is the likely value of ICHI for tracking progress against health-related targets articulated under the United Nations' Sustainable Development Goals, and for monitoring the implementation of the WHO's Universal Health Coverage initiative (Boerma et al. 2014; World Health Organization 2015; World Health Organization & World Bank 2015). ICHI's broad scope would seem well-suited to such uses, which require data spanning promotive, preventive, curative and rehabilitative health interventions, delivered at both personal and population level. Other

applications of ICHI could include its use for specifying indicators for performance monitoring, developing expenditure reporting categories, specifying study inclusion criteria (e.g., for systematic reviews to examine intervention effectiveness), and 'tagging' information resources to facilitate knowledge management. It may be anticipated that, once ICHI is available, there will be exploration of the possible statistical applications of the classification in relation to public health interventions, as well as potential non-statistical uses within research, practice and policy contexts.

1.2 Objectives of the study

Testing is a normal and essential part of the classification development process. Broadly, the purpose of testing is to investigate the extent to which a classification is capable of performing the functions for which it is intended, and to identify modifications needed. Often, tests focus on specific aspects or characteristics of a classification, such as clinical utility, inter-rater reliability, domain coverage, or cross-cultural applicability (e.g., Trotter et al. 2001; Salvador-Carulla et al. 2013; First 2016; Forster et al. 2017; Fortune et al. 2017).

The overall aim of this study is to investigate the strengths and limitations of the draft classification of public health interventions in ICHI in terms of its capacity to function as a statistical classification. To do this, a comprehensive developmental appraisal of the draft classification is undertaken. I use the term 'developmental appraisal' to emphasise that this appraisal constitutes part of the development process, and is intended to assist in refining the classification (First 2016). This can be distinguished from a summative appraisal, conducted in order to inform prospective users as to the qualities and performance they may expect from a classification as a finished product.

The objectives of the developmental appraisal are to test the performance of the draft classification against a list of criteria that relate to the desired properties of a statistical classification and to identify problems and issues that should be addressed to improve its utility. Thus, in this thesis, I address the following research questions:

1. Does the draft classification of public health interventions in ICHI possess the desired features of a statistical classification?
2. What problems or shortcomings can be identified, and how could these be addressed to improve the utility of the classification?

In preparing to undertake this research, I sought an appropriate framework or list of criteria that would provide guidance concerning the aspects or properties of the classification that should be tested. Published literature on the developmental testing of classifications is relatively sparse, and reported research often focuses on testing just one or a few aspects of a classification. I was not able to identify

any single, authoritative source that provided a comprehensive scheme for the developmental appraisal of a statistical classification. Therefore, it is an additional objective of this study to develop and test an analytical structure within which to conduct the developmental appraisal of the draft classification of public health interventions in ICHI, and to make recommendations concerning its wider use for conducting developmental appraisals of other statistical classifications.

1.3 Outline of this thesis

This thesis is structured around three complementary research components, developed to test how well the draft classification functions when it is used to transmit and receive information about public health interventions. These are: 1) ICHI public health data coding study; 2) inter-coder comparison study; and 3) in-depth key-informant interviews. Results from the three research components are drawn together using the analytical structure developed for this study, to provide an overall appraisal of the draft classification of public health interventions in ICHI in terms of its strengths and limitations, and to explore how shortcomings identified could be addressed to improve its utility. In each of the research components, I have used three existing data sets containing descriptions of public health interventions as a basis for testing ICHI. These data sets represent interventions as they are understood by stakeholders in real-world contexts, and express the information needs of stakeholders. Table 1.1 sets out the structure of the thesis and provides a brief description of the content of each chapter.

This study makes a substantial and timely contribution to the development of the draft classification, by providing specific proposals for improvements, and identifying and analysing some fundamental conceptual issues that should be addressed. A recommended path forward for the further development and use of ICHI in the field of public health is set out, to be implemented in the context of the upcoming beta phase of development and testing planned to commence in October 2018. In addition, this study makes significant conceptual and methodological contributions to a currently under-developed body of knowledge concerning developmental testing and appraisal of statistical classifications. In particular, the analytical structure developed and demonstrated through this research will be relevant to future research in classification development.

Table 1.1: Outline of thesis

Chapter title	Chapter content
2. Context: understanding classifications and public health interventions	Chapter 2 presents an analytical survey of relevant literature in two broad fields of knowledge: 1. Classifications: their nature and characteristics, viewed both as technical tools and social artefacts; and 2. Public health interventions: how they are understood and what people need to know about them. This chapter also develops an analytical structure for use in the current research, comprising a framework of criteria relating to the required features of a statistical classification, against which to judge the draft classification, and a 4-tier model representing the main elements that make up a statistical classification, intended for use as a heuristic structure within which to locate issues identified and consider how they might be addressed.
3. Research methodology	Chapter 3 presents the theoretical perspective and rationale underpinning the approach taken to conducting the research, and describes the methods used for the three components of the research design.
4. Research component 1: ICHI public health data coding study	Chapter 4 reports results of the first research component, in which the draft classification was used to code descriptions of public health interventions contained in three existing data sets. This research component explores how well the classification relates to socially constructed understandings of public health interventions, as expressed through existing data collections.
5. Research component 2: Inter-coder comparison study	Chapter 5 reports results of the second research component, which evaluates inter-coder agreement in the assignment of ICHI axis categories and intervention codes to records in the three data sets, and explores reasons for discrepancies between coders.
6. Research component 3: In-depth key-informant interviews	Chapter 6 reports results of the third research component, in which semi-structured interviews were conducted with key-informants familiar with the three data sets, to gather stakeholder feedback on the draft classification and the utility of ICHI-coded data.
7. Appraisal of the draft classification of public health interventions within ICHI	Chapter 7 draws together the results of the three research components using the analytical structure developed in Chapter 2, and discusses what these results reveal in terms of the strengths and limitations of the draft classification, and how problems and issues identified could be addressed to improve its utility. This chapter also reflects on use of the framework of criteria and the 4-tier model and considers their potential value for future research in classification development.
8. Conclusions: a path forward for the classification of public health interventions within ICHI	Chapter 8 addresses the research questions and explores implications for the further development and use of ICHI in the field of public health.

2. Context: Understanding Classifications and Public Health Interventions

The classification of public health interventions in the International Classification of Health Interventions (ICHI) represents a pioneering development. While many countries have well-established statistical classifications of medical and surgical interventions, and an international classification of procedures in medicine was produced by the World Health Organization (WHO) in 1978, these classifications focus on interventions delivered to individual patients in hospitals and other clinical healthcare settings. Public health interventions as a classification domain is largely uncharted territory. To provide a foundation for the current research, which sets out to appraise the draft classification of public health interventions in ICHI, it is necessary to conduct a thorough survey of relevant literature in two broad and largely disjunct fields of knowledge. The first concerns statistical classifications – their nature and characteristics, and how their utility might be judged. The second concerns public health interventions – how they are understood and what people need to know about them.

In approaching the literature, I began with a small number of key works, to which I was directed by expert recommendation, and several term-based literature searches using the electronic databases Web of Science, Scopus and Google Scholar. Term-based searches were found to be limited in their effectiveness, largely because terms relating to key concepts, such as ‘classification’ and ‘public health intervention’, are ubiquitous in the literature and insufficiently specific to identify documents containing content of relevance to this research (e.g., addressing the definition of ‘public health intervention’), and a variety of related terms are used (e.g., ‘classification’, ‘typology’, ‘taxonomy’; ‘public health’, ‘population health’, ‘health promotion’, ‘behaviour change’; ‘intervention’, ‘action’, ‘program’). Thus, an exploratory and iterative approach was taken, using reference lists and citation searches for key works to identify additional relevant material, and conducting term-based searches to investigate specific issues. This approach facilitated the identification of relevant bodies of scholarship from across a broad range of fields, which are brought together here as a critical review (Grant & Booth 2009) to provide a context for and to inform the current research.

This chapter is divided into four main sections:

> *2.1 Statistical classifications – what are they and how should we understand them?* This section covers both technical and social approaches to understanding classifications, drawing on scholarship from a range of fields in order to engage a broader perspective on statistical classifications than is typical when they are viewed purely as information tools.

2.2 The International Classification of Health Interventions (ICHI) – a member of the WHO Family of International Classifications (WHO-FIC). The draft classification is introduced in its context as a member of the WHO-FIC, and the three reference classification members of the WHO-FIC are compared.

2.3 Developing an analytical structure within which to appraise the draft classification of public health interventions within ICHI. Relevant sources are drawn upon to develop a framework of criteria concerning the desired features of a statistical classification; a 4-tier model representing the main elements that make up a statistical classification is also proposed.

2.4 Public health interventions – the domain to be classified. This section explores conceptions of 'public health', the nature and characteristics of public health interventions, and expressed information needs concerning public health interventions; this provides a basis for considering how the draft classification relates to the domain classified.

In each of these sections, I introduce key concepts, principles, and ideas from the literature that I will use and reflect back on throughout this thesis, thus creating anchors for the research within established domains of knowledge and bringing insights from a range of different fields to bear on the task of appraising the draft classification.

2.1 Statistical classifications – what are they and how should we understand them?

Statistical classifications may be seen as a specific type within the broad universe of classification schemes. There is a rich and diverse literature on the topic of classification, spanning a range of fields and offering valuable insights to support a greater depth of understanding with regard to statistical classifications. Drawing on this literature, this section addresses the following questions:

- What is a statistical classification? (Section 2.1.1)
- What attributes can be used to describe and compare classifications? (Section 2.1.2)
- How do classifications relate to and interact with the domains they classify? (Section 2.1.3)

My purpose is to establish a repertoire of key constructs that are useful in understanding and analysing classifications in terms both of their technical attributes and their social characteristics.

2.1.1 What is a statistical classification?

Literature concerning classification and classification schemes is wide-ranging and stretches back in time to the thinking of Plato and Aristotle (Boyne 2006; Surjan 2011). Contemporary writing on classification spans many fields of study, including library and information science, cognitive science, biological systematics, statistics, sociology, philosophy, linguistics, and artificial intelligence. The development of thinking and scholarship on classification can be traced through the history of major classificatory efforts in different fields, including the natural sciences, anthropology, and the administrative machinery of the modern state (Desrosieres 1998). Taking a long historical view of the theory and philosophy of classification, a series of distinct eras can be identified in terms of how the nature and the role of classification has been understood in relation to knowledge, with major innovations in thinking attributable to Plato (in the 4th Century BC), René Descartes (in the 17th Century), Emile Durkheim and Marcel Mauss (in the late 19th and early 20th Centuries), and Claude Lévi-Strauss (in the 1970s) (Boyne 2006). Creation of knowledge requires the integration of facts about objects and processes within a context. By connecting concepts within a meaningful structure, classifications perform heuristic, descriptive, and explanatory functions central to the process of knowledge creation (Kwasnik 1999).

Drawing collectively on definitions offered by scholars across a range of fields (Bowker & Star 1999; Lambe 2007; Hjørland 2009; Wilkins & Ebach 2014), it may be said that, in the broadest sense, *a classification is a system for dividing up and grouping the content of a given domain*. This definition contains within it the key classificatory ideas of similarity or commonality (as a basis for grouping) and difference (as a basis for division). It also suggests the need for articulation of what it is that is grouped or divided up (the units of classification), and the scope and boundaries of the domain.

Standard statistical classifications exist across a wide range of fields of human endeavour, and collectively they play a crucial role in the functioning and administration of jurisdictions and economies (Desrosieres 1998; Boeda 2009). Most countries have national statistical agencies, responsible for producing statistical information required both domestically and to meet various international obligations, and their role includes the maintenance and implementation of classifications. The development of international standard classifications is integral to the work of the United Nations Statistics Division (UNSD), which hosts the 'Expert Group on International Statistical Classifications'. A set of 10 'Fundamental Principles of Official Statistics' was reconfirmed at the 73rd plenary meeting of the UNSD in 2014, with Principle 9 stating that 'The use by statistical agencies in each country of international concepts, classifications and methods promotes the consistency and efficiency of statistical systems at all official levels' (United Nations Statistics Division, 2017).

In the paper 'Best practice guidelines for developing international statistical classifications', the UNSD provides the following definition:

> A statistical classification is a classification having a set of discrete categories, which may be assigned to a specific variable registered in a statistical survey or in an administrative file, and used in the production and presentation of statistics. (Hancock 2013)

The UNSD further describes statistical classifications as systems that group and organise information in a meaningful and systematic way, using structured sets of exhaustive and mutually exclusive categories defined according to specified similarity criteria. Statistical classifications 'provide a simplification of the real world' and can be used to 'collect and organise statistical information in a standard way; aggregate and disaggregate data sets in a meaningful way for complex analysis; [and] support policy and decision making' (Hancock 2013). The companion UNSD paper, 'Standard statistical classifications: basic principles' (Hoffmann & Chamie 1999), describes the role of international reference classifications in providing a common framework to which data collected using national classifications can be linked to enable comparison. Both papers emphasise information stability, consistency of use, and comparability of data over space and time as fundamental objectives that guide classification development and maintenance.

International statistical classifications must inevitably be able to serve a range of user needs (Chamie 1990; Madden et al. 2007a). An essential task for classification developers is, therefore, to determine and balance the requirements of different users regarding distinctions that need to be captured by the classification, including in relation to different levels of detail required. As well as statistical uses, classifications may also be utilised for other purposes, for instance in legal or administrative contexts, and classification developers and custodians should be aware of these uses. The ability of a statistical classification to meet user needs depends not only on the qualities of the classification itself—its content and structure—but also on an extensive scaffold of supporting materials and processes, including indexes, explanatory notes, correspondence tables, coding tools, and maintenance and update procedures (Hoffmann & Chamie 1999; Hancock 2013).

A key design consideration is how the entities classified – the units of classification – are to be grouped and divided by categories and higher level groupings in a classification (Chamie 1990; Hancock 2013). All classifications are fundamentally about establishing similarity and difference. As a general principle, classification developers aim to minimise variance within categories and maximise variance between categories, 'so that each group is as different as possible from all other groups, but each group is internally as homogeneous as possible' (Bailey 1994). How this is done will depend on which characteristics of the entities classified are used to determine their similarity and difference, and the criteria used to make these determinations should be clearly stated. For example,

the instruction manual of the ICD-10 states that categories should group related conditions, although a disease that occurs with high frequency, or is of particular public health importance, should have its own category (World Health Organization 2016b). As noted by Desrosieres (1998), writing on the history of statistical reasoning, the choice of pertinent variables and how to construct classes of equivalence have been perennial concerns throughout the history of statistical classifications.

The following section focuses on key constructs relevant to the description of classification schemes. My purpose is to articulate a set of attributes and technical features on which classifications differ, for use in characterising and comparing classifications. These attributes are all matters about which choices are made (explicitly or implicitly) in the design and development of a classification, and so keeping these in mind when analysing a classification can assist in surfacing those choices and considering their implications.

2.1.2 What attributes can be used to describe and compare classifications?

As a basis for comparing classifications and considering how design choices influence their utility in different applications, it is helpful to identify a suite of technical attributes that can be used to characterise classification schemes. Two books useful for this purpose are: '*Organising knowledge: taxonomies, knowledge and organisational effectiveness'* (Lambe 2007), in which the author describes different types of classification schemes and notes their distinguishing features and their suitability for various uses, and '*Typologies and taxonomies: an introduction to classification techniques'* (Bailey 1994), which provides an overview of basic concepts and principles relevant to classification. These works are relevant here because they contrast and compare different types of classification, clearly address the parameters on which classification schemes vary, and provide definitions for key concepts. In this section, I draw on these two works, supplemented by other pertinent references, to introduce and define a number of key concepts that I will use throughout this thesis. These concepts are summarised in Box 2.1.

Most obviously, classifications differ in what they seek to classify – the classification *domain* and *unit of classification*. The domain is essentially the subject matter addressed by the classification, the boundaries of which may be more or less clearly specified. The units of classification (or primary statistical units) are the entities that are assigned to categories of the classification (Hoffmann & Chamie 1999). Defining the unit of classification is not always straightforward (Kwasnik 1999; Kutschenko 2011a; Wilkins & Ebach 2014); indeed, the question of how to define a 'species' has been debated over hundreds of years in the context of biological taxonomy (Wilkins 2010; Garnett & Christidis 2017).

Box 2.1: Attributes that can be used to describe and compare classification schemes

Classification domain	The subject matter addressed by the classification
Units of classification	The entities that are assigned to categories of the classification
Classification axes	Variables that represent properties of the units of classification and are used to define classification categories
Property space	The theoretical space defined by the classification axes
Structure – arrangement of categories	Flat structure – categories arranged in a single list with no hierarchical ordering
	Hierarchical structure – categories arranged in a hierarchy of superordinate and subordinate classes
Structure – coordination of axis values to define categories	Enumerative classification – axis values are pre-coordinated to define categories that divide up the entire property space
	Faceted classification – users combine (post-coordinate) values from the axes to produce classification categories
Basis for assignment of entities to categories	Aristotelian or classical classification – an entity is assigned to a category based on its possession of the necessary and sufficient properties defined for that category
	Prototypical classification – an entity is assigned to a category based on its similarity to an ideal exemplar or prototypical member of that category
Method of development	Top-down – development begins with a theory-based conceptual framework, to which empirical cases are assigned
	Bottom-up – development applies a grouping method to empirical cases in order to produce classes

In any given domain, classifications may differ in terms of the *axes* along which categories are defined. These axes (sometimes referred to as dimensions, variables, or principles of division) represent what are judged to be key properties of the units of classification. The choice of axes determines how entities will be grouped in the classification (Star 1998). The *property space* of a classification is the theoretical space described by the classification axes (Bailey 1994). The concept of property space is useful because it encourages scrutiny of the choices made about which of many possible variables are represented as axes, and consciousness of the resulting limitations of the classification for capturing other dimensions of relatedness and difference among entities (Star 1998).

Overall *structure* is a key characteristic on which classifications differ. Categories may be organised in a single level (flat) list, or in a hierarchy of superordinate and subordinate classes (Bailey 1994; Lambe 2007). In a hierarchical classification, the structure conveys information about relationships between classes (Kwasnik 1999; Jacob 2004). Another structural distinction can be made between

enumerative and *faceted* classification schemes. In an enumerative classification, values from the classification axes are *pre-coordinated* to define mutually exclusive categories that divide up the entire property space. Alternatively, it may be left to users to combine, or *post-coordinate*, categories from the separate classification axes. This is a *faceted classification*, and was the innovation of the librarian Ranganathan, whose 1932 'colon classification' comprised five dimensions, or 'facets', on which objects can be analysed and described, and a citation order that prescribes how values on each of the facets should be put together to produce the classification code (Lambe 2007).

The distinction between *classical,* or *Aristotelian*, and *prototypical* theories of classification (and related theories of concepts) concerns how category membership is determined (Sutcliffe 1993; Bowker & Star 1999; Hjørland 2009). In an Aristotelian classification, classes are defined by a set of necessary and sufficient properties, such that any given entity can be unambiguously assigned to the correct class; classes are *monothetic*, meaning that all members of the class possess the full set of necessary and sufficient properties (Bailey 1994). Prototype theory provides a more probabilistic view of classes (Rosch & Mervis 1975; Rosch et al. 1976). In a prototypical classification, an entity is assigned to a given class based on 'family resemblance', or similarity to an ideal exemplar or prototypical member for that class. Thus, boundaries between classes are not clearly delineated and classes are *polythetic*, meaning that they contain entities that are similar based on their possession of certain specified properties, but individual members of a class need not possess the full set of properties; this is a common characteristic of taxonomies developed by the grouping of empirical entities (Bailey 1994). In practice, many classifications display both Aristotelian and prototypical properties (Bowker & Star 1999).

Classifications may be developed *deductively*, through a '*top-down*' process, or *inductively*, through a *'bottom-up*' process. Top-down development starts with a conceptual framework, which is then populated by empirical cases. Bottom-up development starts with analysing empirical data, using a grouping method to form and arrange classes, then making a conceptual interpretation of the resulting structure and assigning labels to the classes (Bailey 1994; Jacob 2004). The development of health classifications can usefully be distinguished in this way, with top-down approaches based on theory and expert knowledge, and bottom-up approaches based on sources of information reflecting 'on the ground' experience and practice (e.g., local clinical documentation) (e.g., Stavri & Michie 2012; Dijkers et al. 2014; Harris et al. 2015).

The concepts introduced in this section relate to the technical parameters on which classifications differ. Together, they may be regarded as a conceptual tool-set for analysing and comparing classification schemes. Their use in comparing the three WHO-FIC classifications is illustrated in Appendix 2.1. In the following section I turn to focus on the social characteristics of classifications.

2.1.3 How do classifications relate to and interact with the domains they classify?

The choices that are made in developing a classification have social consequences. Thus, in addition to viewing classifications as tools that can be described and compared in terms of their technical attributes, it is important to understand how they relate to and interact with the domains they classify. In this section, I draw particularly on insights provided by Bowker and Star, whose research sits within science and technology studies. In their book '*Sorting things out: classification and its consequences'*, Bowker and Star (1999) discuss how classifications interact with the real-world contexts in which they are developed and used, illustrating their arguments with examples from a diverse range of classificatory schemes including two health classifications—the ICD and the Nursing Interventions Classification. Several other researchers have also made valuable contributions on these themes, coming from a range of disciplinary perspectives including knowledge management, library science, philosophy of information, and history and philosophy of medicine (e.g., Ciborra & Hanseth 1998; Jacob 2001; Jacob 2004; Lambe 2007; Feinberg 2010; Kutschenko 2011b; Kutschenko 2011a; Salvador-Carulla et al. 2014; Sturmberg et al. 2014; Binney 2015).

Developing a classification requires choices to be made about where and how divisions are placed. In this way, classifications 'model' the world, embodying judgements about what is important and what is not, what should be visible and what may remain hidden—they incorporate 'social, political, and organizational agendas into the scientific work of describing nature' (Bowker & Star 1999, p.102). The creation of categories inevitably implies that the differences between categories are of greater import than differences between the entities within categories (Jacob 2004). Thus, rather than seeing categories as reflecting purely technical decisions, they may be understood in terms of particular organisational, political, and social positions taken in relation to the entities classified (Olson 2002; Kutschenko 2011b). Indeed, a classification could be seen as 'a form of argument that advocates for a particular interpretation of the subject matter that the classification organizes' (Feinberg 2010, p.291).

Rather than providing a neutral, objective description of reality, then, classifications 'frame' knowledge (Salvador-Carulla et al. 2014; Sturmberg et al. 2014). In providing a basis for analysing issues, frames can be useful, but also constraining—they entrench commonly held understandings, and can constrain investigation and understanding by setting the boundaries of a domain, prescribing the language used to describe its contents, and asserting particular conceptual relationships between entities within it (Jacob 2001). In this way classifications can serve to limit thinking and questioning: 'a classification scheme determines not only what can and cannot be said within a knowledge domain but, more importantly, what can and cannot be known' (Jacob 2001, p.89).

Bowker & Star (1999) describe how classifications can have material force in the world—they can be seen as active 'players' in the domains they classify. As a classification becomes progressively more integrated into the information infrastructure, people mould their behaviour to fit the classification and the classification's description of reality becomes true. This is 'convergence'—the two-way process of mutual constitution 'by which information artefacts and social worlds are fitted to each other and come together' (Bowker & Star 1999, pp.82, 311). Bowker and Star use the ICD to illustrate this idea. As the dominant classification of diseases, its structure underpins most medical and epidemiological studies; researchers could use alternative frameworks, but this would be more difficult and costly. Thus, the ICD 'makes a certain set of discoveries, which validate its own framework, much more likely than an alternative set outside of the framework' (p82). Reification – the tendency for the theoretical constructs of a classification to be treated as real entities – is another mechanism through which a classification can exert real-world influence in relation to the domain classified (Bailey 1994; Bowker & Star 1999; Hyman 2010).

The other side of the coin is that a classification may operate as a *lingua franca*, facilitating communication and translation between different communities of practice, and helping to overcome the barriers of exclusive, discipline-specific language and practices. Bowker & Star (1999) describe classifications that can perform this function as 'boundary objects':

> Boundary objects … inhabit several communities of practice and satisfy the informational requirements of each of them. ... are thus both plastic enough to adapt to local needs and constraints ... yet robust enough to maintain a common identity across sites.... Such objects have different meanings in different social worlds but their structure is common enough to more than one world to make them recognizable, a means of translation. (p.297)

In this way, classifications can enable collaboration across social boundaries in environments where there are multiple players and multiple different taxonomies in use (Star & Griesemer 1989; Albrechtsen & Jacob 1998; Lambe 2007). This idea is developed further by Kutschenko (2011a), who proposes that broadly-applied classifications such as the ICD can function as 'epistemic hubs'. Kutschenko argues that such classifications are characteristically 'heterogeneous and imprecise', and so do not function well as scientific taxonomies (i.e., the descriptions of entities they provide may not be adequate for establishing theoretical principles or providing a basis for explanation or prediction). However, they can perform a mediating role, providing a basis for connection and information exchange between diverse actors with different 'epistemic interests' employing a range of more precise and use-specific classification systems. Other authors have also argued the benefits of such 'taxonomic pluralism', pointing out that in any given domain there is no universally ideal

classification, and that different classificatory principles are suited to different purposes (Dupré 1993; Olson 2002; Dupré 2006; Binney 2015).

Thus, classifications can be viewed as information artefacts that embody cultural and political values, that help to reveal but also to conceal differences and relationships between entities, that facilitate but also constrain knowledge and communication, and that can have agency in the world. Their use can bring benefits, but also risks. Developers of a statistical classification may see it primarily as a tool for collecting consistent and comparable data, but they should also be aware of the potential social effects of its use, and how decisions made in its construction may ultimately have real-world consequences for the domain classified. The importance of being ever conscious and critical is a common theme in the writings of the authors cited in this section, all of whom would agree that classifications deserve more scrutiny than they generally receive. In the words of Lambe (2007, p.xv), we should always be 'conscious in our use of categories' and, as urged by Bowker and Star (1999), ever alert to the consequences of classification.

2.2 The International Classification of Health Interventions (ICHI) – a member of the WHO Family of International Classifications

The draft classification of public health interventions that is the focus of this study is embedded within the International Classification of Health Interventions (ICHI), which is currently being developed as a new member of the WHO Family of International Classifications (WHO-FIC). In this section, I introduce ICHI within the broader context of the WHO-FIC, briefly summarising its developmental history to date and comparing it with the two other core members of the WHO-FIC, the International Classification of Diseases (ICD) and the International Classification of Functioning, Disability and Health (ICF). This will provide the necessary background for understanding ICHI's characteristics and, in light of the research findings, considering how these affect its utility in relation to classifying public health interventions.

The WHO Family of International Classifications (WHO-FIC) is 'a suite of integrated classification products that share similar features and can be used singularly or jointly to provide information on different aspects of health and the healthcare system' (World Health Organization 2016b, p.4). Its purpose is to provide a conceptual framework and a common language to support communication and enable comparison of health-related data. The WHO-FIC consists of 'reference classifications' (ICD, ICF and ICHI), 'derived classifications', based on and consistent with one or more of the reference classifications, and 'related classifications', which cover 'important aspects of health or the health system not covered by reference or derived classifications' (Madden et al. 2007a, p.8). A number of designated WHO Collaborating Centres for the Family of International Classifications, together with WHO, comprise the WHO-FIC Network, which is responsible for 'the development, dissemination,

maintenance and use' of the WHO-FIC 'to support national and international health information systems, statistics and evidence' (http://www.who.int/classifications/network/en/).

The 'International List of Causes of Death', which became the ICD, was adopted at the 1893 meeting of the International Statistical Institute (Moriyama et al. 2011). Successive revisions have seen changes to the classification, including modifications of structure, expansion of content, and changes to the coding system. In 1948 (the Sixth Revision), the scope of the classification was expanded to cover morbidity as well as mortality, and it was adopted by the First World Health Assembly. The basic structure has changed little over its long history. In the Tenth Revision (ICD-10), 12 of the 22 chapters contain diagnoses grouped by body system, and other chapters reflect aetiology-based groupings such as neoplasms and congenital conditions, and related factors such as external causes of morbidity and mortality (World Health Organization 2016c). Within chapters, coded categories are arranged in a two-level hierarchy. The ICD-11, newly released in June 2018, retains this basic structure but features several innovations, including 'extension codes' for adding extra information about a diagnosis (e.g., severity or aetiology) (World Health Organization 2018). The ICD has become embedded in health information infrastructures around the world, with ICD-based data used in a range of clinical and administrative applications within countries, including casemix reimbursement systems (Roberts et al. 2015). Internationally comparable cause-of-death data are reported in 'World Health Statistics' (World Health Organization 2017a), and the OECD uses ICD codes for reporting morbidity and mortality data in 'Health at a Glance' (OECD 2017a).

The ICF provides 'a unified and standard language and framework for the description of health and health-related states', to record 'individuals' functioning, disability and health in various domains' (World Health Organization 2001, p.3). The predecessor to the ICF, the International Classification of Impairments, Disabilities and Handicaps, was published in 1980 and was used in a wide range of research, policy development, and clinical practice applications (Bickenbach et al. 1999). Following a process of revision, with extensive international consultation and testing, the ICF was endorsed by the World Health Assembly in 2001. Fundamental to the ICF is its conceptual model, which depicts the components of human functioning and disability and the interactions among these components. There are four separate classifications – Body Functions, Body Structures, Activities and Participation, and Environmental Factors – with categories arranged hierarchically within chapters. The four classifications can be used together to describe aspects of an individual's functioning. Category codes, which indicate the area of functioning, may be accompanied by 'qualifiers', which are 'numeric codes that specify the extent or the magnitude of the functioning or disability in that category, or the extent to which an environmental factor is a facilitator or barrier' (World Health Organization 2001, p.11).

As well as its envisaged statistical uses, the ICF has been viewed from the outset as having a key role to play in education, advocacy, and social change. The World Report on Disability adopts the ICF as its underpinning conceptual framework and states that 'a growing number of countries are using the ICF framework and related question sets in their national surveys and censuses' (World Health Organization & World Bank 2011, p.25). It has been used for collecting information on functioning in the World Health Survey, and to develop question sets for collecting standardised information on disability, such as the WHO Disability Assessment Schedule 2.0 (WHODAS 2.0) (World Health Organization 2013). Successive literature reviews examining applications of the ICF show that it has brought about cultural change, with its conceptualisation of functioning and disability progressively being more widely embraced, and has had substantial impacts on research, measurement and statistical data in relation to disability (Jelsma 2009; Cerniauskaite et al. 2011; Madden & Bundy 2018).

In contrast to ICD and ICF, in which categories are arranged hierarchically within chapters, ICHI is built on a tri-axial structure, with specific interventions described in terms of Target (the entity on which the Action is carried out), Action (the deed done by an actor to the Target), and Means (the processes and methods by which the Action is carried out). In the 2016 ICHI alpha version, 'Health intervention' is defined as 'an act performed for, with or on behalf of a person or a population whose purpose is to improve, assess or modify health, functioning or health conditions' (World Health Organization 2016a, Introduction).

A previous interventions classification, the International Classification of Procedures in Medicine (ICPM), had been developed in parallel with the 9th Revision of the ICD and published by the WHO in 1978 'for trial purposes' (World Health Organization 1978). Recognising the scale of consultation required to update it, a decision was taken not to revise the ICPM in conjunction with the 10th revision of the ICD, and it has not been maintained (World Health Organization 2016b, p.9). At the 2007 WHO-FIC Network meeting, two papers were presented proposing the development of an international classification of health interventions covering the full range of health interventions, not restricted to diagnostic, medical and surgical interventions as ICPM had been (Madden et al. 2007b; Madden et al. 2007c). The point was made that:

> Whole domains of health interventions, e.g. primary care, nursing and public health, are generally not covered by most national classifications. … The fact that non-medical interventions are generally not classified, and therefore not reported, can easily lead to health policy and funding unduly focused on medical interventions. That in turn can have equity impacts, with focus on expensive medical interventions only accessible by limited sections of the population but with high impact on health financing, while potentially high benefit, low

> cost primary care, allied health or public health interventions are ignored. (Madden et al. 2007b, p.3)

It was agreed that work should go forward to develop 'a sound structure consistent with relevant information standards' and to populate it drawing first on existing material and then progressively expanding the scope of content (WHO-FIC 2007, p.7). At subsequent WHO-FIC Network meetings, progress was reported on development of the tri-axial structure (based on the ISO health informatics standard for classifications of surgical procedures (International Organization for Standardization 2012), axis categories, coding scheme, and content model (e.g., WHO-FIC 2009).

Content development for ICHI began in 2011. For medical and surgical interventions, ICD-9-CM Volume 3 (US Department of Health and Human Services 1995)[3] was used as a starting point, supplemented by reference to a range of national classifications (Cumerlato & Best 2011; Madden 2011). Other areas of content were largely developed *de novo,* as there were no suitable existing classifications to draw upon. Domains from the ICF – Body Functions, Activities and Participation, and Environmental Factors – were included as Target categories and used to develop interventions relevant to rehabilitation and allied health, assistance with functioning, and mental health; relevant interventions in various national classifications were reviewed as part of this process (Martinuzzi & Meyer 2011).

Public health intervention codes were constructed using environmental factor and health-related behaviour Targets, with health-related behaviour categories based on a classification of 'determinants of health' that was developed as part of the Australian Public Health Classifications Project (New South Wales Department of Health 2010). Public health content was developed with reference to some existing lists, in particular the WHO-CHOICE initiative (Choosing Interventions that are Cost-effective) (World Health Organization), and with input from public health professionals via two rounds of consultation (Fortune & Madden 2013). Development of the classification is largely documented in meeting papers and posters archived on the WHO-FIC website (http://www.who.int/classifications/network/meetings/en/).

[3] The International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM), is an adaptation of the ICD-9 developed by the United States; it is freely available and used as a standard for coding diagnoses and procedures in several countries.

The first alpha version of ICHI was released in 2012, with updated alpha versions released annually up to 2016. The 2016 alpha version, used as the basis of this research, contains approximately 5,800 intervention codes, including around 500 codes for public health interventions (World Health Organization 2016d). Each axis is a coded list of descriptive categories, and each intervention is represented by a title and a unique code denoting the Target, Action and Means for that intervention (see Box 2.2 for examples). Additional information about an intervention can be recorded using extension codes, which include codes for assistive and therapeutic products and type of intervention recipient (e.g., 'individual', 'community', 'population group'). Intervention codes are grouped into three sections based on Target: (1) Interventions on Body Systems and Functions; (2) Interventions on Activities and Participation Domains; (3) Interventions to Improve the Environment and Health-related Behaviour. In the publicly accessible web-based 'ICHI Platform' (https://mitel.dimi.uniud.it/ichi/), intervention codes may be grouped by either Target, Action or Means. Relatively little attention had been given to coding guidance during the first 5 years of ICHI development, with the 2016 alpha version including only two pages of 'Guidelines for coders'.

The ICD, ICF and ICHI can be compared in terms of the classification attributes discussed in Section 2.1 to highlight their similarities and differences. This is useful because it reflects the different decisions made during their development. In the context of this research, such an analysis provides a basis for understanding ICHI's characteristics, considering how these might affect its utility, and suggesting changes that could be made to improve its utility. The three WHO-FIC reference classifications differ in terms of classification domain and unit of classification (and the precision with which these are specified), the information dimensions along which categories are defined, overall structure (hierarchical for ICD and ICF, tri-axial for ICHI), and method of development (largely bottom-up for ICD, largely top-down for ICF, and a mix of top-down and bottom-up for ICHI). All three are essentially enumerative, pre-coordinated classifications, though ICHI and ICD-11 provide for post-coordination of extension codes; because of its tri-axial structure, ICHI may be described as a pre-coordinated, faceted classification. In all three classifications, the mutual exclusivity of categories (required for statistical uses) is achieved by means of listing inclusions and exclusions, and by providing coding guidelines and supporting materials (most well-developed in ICD) that instruct users how to choose the appropriate category, and comprehensive domain coverage is achieved by means of residual codes (e.g., of the form '…, unspecified' or 'Other …, not elsewhere classified'). A fuller presentation of this comparative analysis is provided in Appendix 2.1.

Box 2.2: Examples of axis categories and intervention codes in ICHI Alpha 2016

Classification axes

Target — the entity on which the Action is carried out

Examples of Target axis categories:

UBL Indoor air quality – Nature of the air inside buildings or enclosed areas, as determined by odour, smoke, humidity, air conditioning (controlled air quality) or uncontrolled air quality, and which may provide useful information about the world (e.g. smell of leaking gas) or distractions (e.g. overpowering smell of perfume)

VCB Workplace safety behaviours – Behaviour concerning workplace practices that increase or reduce the risk of physical harm to individuals, including use of protective products and clothing

Action — the deed done by an actor to the Target

Examples of Action axis categories:

PM Education – Providing structured information in a manner conducive to improving knowledge about matters relevant to health and/or functioning

TK Public facilities or infrastructure development – Providing or making changes to public spaces, structures and amenities

Means — the processes and methods by which the Action is carried out

Examples of Means axis categories:

QA Media campaign – A planned series of communications using media including television, radio, newspapers, electronic media, social media, and public noticeboards, intended to reach a wide audience

QF Economic instruments – Economic policy measures that influence behaviour via their impact on market signals

Health interventions in ICHI

'Health intervention' is defined as 'an act performed for, with or on behalf of a person or a population whose purpose is to improve, assess or modify health, functioning or health conditions'.

Examples of health interventions:

VAA WG QF Economic incentives to encourage improved health behaviours relating to alcohol use

Target: VAA Alcohol use behaviours
Action: WG Applying incentives
Means: QF Economic instruments

UBN AA ZZ Assessment of water quality

Target: UBN Water quality
Action: AA Assessment
Means: ZZ Intervention using other method, without approach or not otherwise specified

Source: World Health Organization 2016a

This section has introduced ICHI, including the classification of public health interventions, placing it within the broader context of the WHO-FIC. The metaphor of the 'family' is an apt one: the three core members of the family share some similarities, but also differ in some of their attributes and in how they have been shaped by their respective developmental histories. It is a key principle of the WHO-FIC that member classifications are complementary and should be used together where applicable. The brief background and developmental history of the three WHO-FIC classifications outlined here, and their comparison in terms of the classification attributes discussed in Section 2.1, inform the development of a model representing the main elements that make up a statistical classification, presented below, which will form part of an analytical structure to be used in this research.

2.3 Developing an analytical structure within which to appraise the draft classification of public health interventions in ICHI

In this section, I address the question of how the draft classification of public health interventions in ICHI might appropriately be assessed. As some authors have noted, there is no 'ideal' classification for any given domain, and a classification that is intended to serve a broad range of uses will inevitably be better suited to some uses than to others (Dupré 2006; Kutschenko 2011b). Nonetheless, it is my intention to explore the strengths and limitations of the draft classification in relation to what are seen as the attributes required of a serviceable statistical classification, independent of any specific use.

There is no established, publicly-documented body of practice concerning the developmental appraisal of statistical classifications. The development or revision of a major statistical classification is a complex and resource-intensive undertaking that normally involves input from a wide spectrum of stakeholders. While some form of developmental testing is likely always to occur, it may often be less extensive and systematic than is ideal due to resource constraints, and publication of the process or results may not be seen as a priority. Detailed information about the development and developmental testing of the ICF has not been made publicly available by WHO, and only a small number of papers have been published describing what was done (e.g., Trotter et al. 2001; Ustun et al. 2003). Similarly, an extensive program of developmental testing for the ICD-11 was conducted (World Health Organization 2017b), but there is no publicly-available documentation setting out the overall methodological framework, or detailing which aspects of the classification were tested or what criteria were used. Relevant published research is often focused on testing specific aspects or characteristics of a classification, such as clinical utility, inter-rater reliability, domain coverage, or cross-cultural applicability (e.g., Trotter et al. 2001; Salvador-Carulla et al. 2013; First 2016; Forster et al. 2017; Fortune et al. 2017; Reed et al. 2018; Stausberg et al. 2018). The lack of a publicly-documented body of practice that can inform an overall approach to the developmental testing and appraisal of a

statistical classification means that those involved in such endeavours cannot readily draw on prior experience.

Principles concerning the desired attributes of statistical classifications have been articulated in a small number of key documents. Two important references concerning the design, testing, use, updating and revision of statistical classifications are the UNSD documents '*Standard statistical classifications: basic principles'* (Hoffmann & Chamie 1999) and '*Best practice guidelines for developing international statistical classifications'* (Hancock 2013). The former lists principles to be applied in the development or revision of statistical classifications and briefly addresses several 'methodological issues', including selecting the main variables of the classification, designing the structure, identifying the main statistical units, and gathering information required to describe and define categories. The '*Best practice guidelines'* document is a succinct guide for developers on the range of matters and considerations to be addressed in the development process, and lists 'essential components of a statistical classification'. A third key source document is '*World Health Organization Family of International Classifications: definition, scope and purpose*' (Madden et al. 2007a), which lists principles for including classifications in the WHO-FIC. A fourth source is a framework for evaluating health classifications used for statistical and reporting purposes (Bramley 2006), and a much earlier paper (Price 1982) articulates four 'attributes of an acceptable classification system'. Several principles concerning requirements of international classifications can also be found in the ICF (World Health Organization 2001). These sources are consistent and complement each other; together, they provide a sound basis for constructing a list of criteria that may be used to appraise the draft classification of public health interventions in ICHI.

Another area of literature that can provide some guidance concerns the parameters that have been described for assessing instruments designed to measure theoretical constructs (i.e., attributes that cannot be observed or measured directly, such as aptitude, motivation, or need for support) in the fields of health, behavioural and social science (Raykov & Marcoulides 2011). Measurement instruments vary widely in terms of their purpose and construction, but typically consist of several items intended to measure the construct of interest on one or more dimensions. Some of the parameters developed for the assessment of measurement instruments, such as reliability and feasibility, can also be applied to classifications (Salvador-Carulla & Gonzalez-Caballero 2010; Salvador-Carulla et al. 2011; First 2016).

Based on a synthesis of these sources, I propose a list of criteria, arranged under twelve headings, to use as a structure for conducting the developmental appraisal of ICHI (Box 2.3). This list is focused on attributes of the classification itself that can be judged during the development phase (i.e., before the classification is in active use). Some principles articulated in the source documents relate to

processes and infrastructure required to support the maintenance and consistent use of a classification, such as custodianship arrangements, version control mechanisms, updating and maintenance plans, and training materials. These are all important considerations that affect the quality and sustained utility of the classification, but they are not included here because they are beyond the scope of the current research. Appendix 2.2 shows how principles articulated in each of the source documents have contributed to developing the list of criteria set out in Box 2.3.

'Validity' is an important quality parameter for the assessment of measurement instruments – whether an instrument indeed measures what it purports to evaluate may be considered 'the bottom line of measurement' (Raykov & Marcoulides 2011, p.183). Messick (1995) argues persuasively that validity should be seen as a property of the meaning of scores produced through the application of an instrument, rather than a property of the instrument itself. He emphasises the importance of examining the value implications and social consequences of the scores produced, such as how the scores are used as a basis for making decisions (e.g., determining eligibility for a service). Thus, validity depends on the context in which the instrument is applied and how people use and respond to the scores produced. Messick's conception of validity can readily be applied to a consideration of how the data produced through application of a classification are used, and the consequences that flow from this use. In the case of a health interventions classification, consequences might include the effects of resource allocation decisions informed by data gathered using the classification. This conception of validity resonates strongly with Bowker and Star's (1999) approach to understanding classifications in terms of their consequences in the real-world contexts in which they are used. Validity is not included in the list of criteria in Box 2.3 because, with this view, it is to be evaluated in the context of a given application of an instrument or a classification. However, many of the criteria listed will inevitably have implications for validity. For example, it may be expected that the data produced in a given application would be considered valid only if the classification was sufficiently reliable (no. 9) and addressed dimensions of importance to users (no. 8).

The criteria listed in Box 2.3 are designed to provide a basis for examining the extent to which the draft classification possesses the desired features of a statistical classification. Problems or limitations identified against any of these criteria will indicate issues that should be addressed to improve its utility. (See Appendix 2.2 for further information concerning the development of the list of criteria.)

Box 2.3: Criteria for conducting a developmental appraisal of a statistical classification

1. Purpose and scope

a. The purpose of the classification should be clearly stated, including its intended statistical uses
b. The scope of the classification should be clear

2. Structure and organisational principles

a. The classification structure, its underlying concepts and organisational principles, should be clear and well-defined
b. The structure should be hierarchical or multi-axial, and reflect the descriptive and analytical needs the classification is intended to serve (including aggregation and retrieval of data)

3. Unit of classification

a. The unit of classification should be clearly identified

4. Comprehensiveness

a. The classification should cover the full scope of the domain, with categories available to allow all units of classification within the domain to be classified (including by providing residual categories)

5. Mutual exclusivity

a. Categories should not overlap and there should be only one code for each entity classified

6. Clearly defined categories

a. Category titles should be clear, meaningful and unambiguous
b. Categories should have definitions and explanatory notes
c. Category titles and definitions should use language that is accepted and in common usage in the domain

7. Level of detail and specificity

a. Level of detail should be appropriate to the domain and the intended uses of the classification
b. Concepts of particular importance should have their own unique category; there should not be unnecessary categories

8. Relevance

a. The classification should be meaningful and relevant, and should address dimensions of importance to users

9. Reliability

a. Different users, or users in different settings, should assign the same code for a given unit of classification

10. International applicability

a. The classification should be internationally applicable, across different cultures and systems

11. Ease of use

a. The classification should be relatively easy to use and compatible with users' work processes and information flows

12. Compatibility with other classifications

a. The classification should be compatible or comparable with other classifications in use in the domain

See Appendix 2.2 for further information concerning the development of this list of criteria

As a complement to this framework of criteria, I also propose a simple model to represent the main elements or layers that make up a statistical classification. The usefulness of such a model is in providing a heuristic structure within which to locate the origins and manifestations of particular issues, and thus to help think about how they might be addressed in the context of the classification. This model has been informed by the comparative analysis of the WHO-FIC reference classifications (ICD, ICF and ICHI), presented in Section 2.2, and also the essential components of a statistical classification as outlined by Hancock (2013). The model has four 'tiers' (Figure 2.1):

> Tier 1 – *Information dimensions and structure.* This tier represents the conceptual structure that is the foundation for the classification. Tier 1 issues are concerned with the definition and differentiation of classification axes, and how the axes are put together to create the overall architecture of the classification.
>
> Tier 2 – *Content: coded categories*. This tier represents the population of the classification structure with coded categories. Tier 2 issues are concerned with the specification of categories and their location within the overall structure.
>
> Tier 3 – *Category titles and definitions*. This tier represents the way the content of and delineation between categories is communicated within the classification itself. Tier 3 issues are concerned with category titles, definitions, descriptions, inclusions and exclusions.
>
> Tier 4 – *Supporting materials*. This tier represents the infrastructure of materials developed to support consistent use of the classification, and thus to promote stability of the data produced through its application. Tier 4 issues are concerned with indexes, user guidance, coding rules, reporting standards and education/training materials.

The process of developing or revising a classification can also be understood in terms of this model, with development activities focusing on different tiers at different times. Using ICHI as an example, initial developmental work from 2007 focused on establishing the tri-axial structure and coding scheme, and populating the axes (tiers 1 and 2). The next phase was concerted content development, with the generation of intervention codes by drawing on existing resources (particularly ICD-9-CM Volume 3) and by combining axis categories (tier 2). Then followed several years of expanding, reviewing and refining both axis categories and intervention codes, with particular attention to the wording of titles, definitions, inclusions and exclusions to clearly delineate categories (tiers 2 and 3). Development of an index, user guidance, coding rules and training materials (tier 4) is planned to occur during and following the beta phase, post 2016. Similarly, in the histories of both ICD and ICF development and revision, activities corresponding to each of the four tiers can readily be identified.

Use of the 4-tier model will aid in understanding the inter-relationships between issues, particularly highlighting where an issue at a higher level of the model (e.g., concerning apparent overlap between axis categories – tier 3) has its origins in, or is affected by, issues at a lower level (e.g., concerning definition of the classification axes – tier 1). Classification development is not a one-way, linear process. Although the lower tiers of the model can be seen as foundational to the tiers above, issues encountered during work focused at a higher tier may prompt review of decisions made at lower tiers. Thus, the relationships and connections between the four tiers are important, and there will be flow up and down the model.

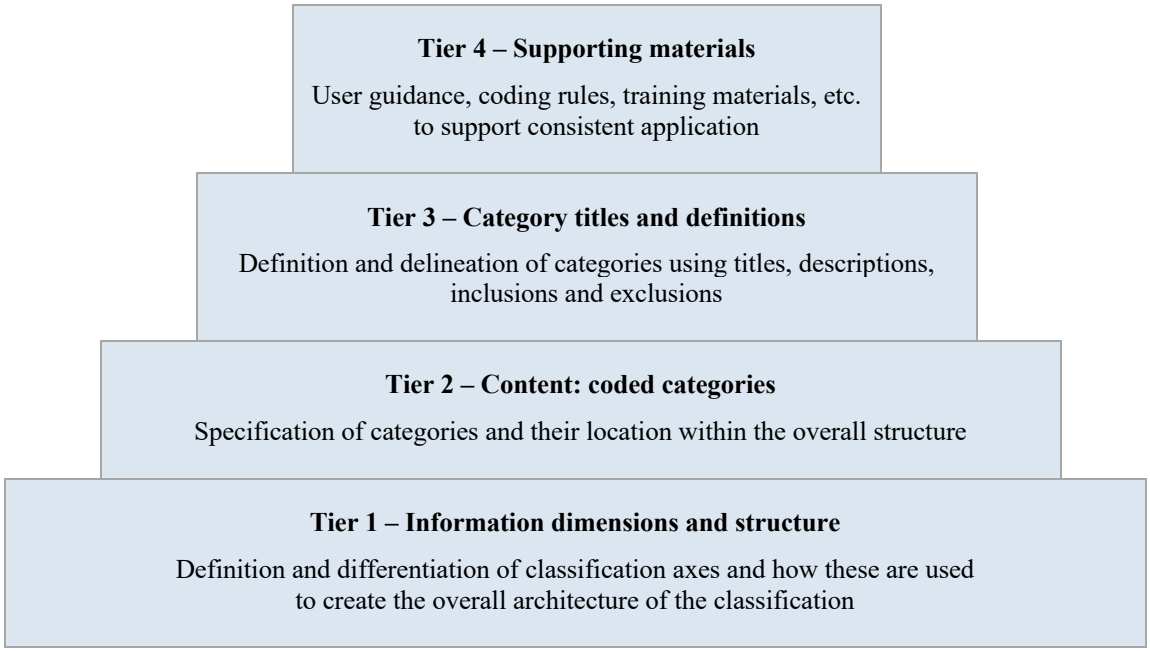

Figure 2.1: A 4-tier model representing key elements of a statistical classification

2.4 Public health interventions – the domain to be classified

Having constructed a foundation for understanding statistical classifications, introduced ICHI in the context of the WHO-FIC, and proposed an analytical structure within which to appraise the draft classification of public health interventions in ICHI, I now turn to examine public health interventions as a classification domain. Section 2.4.1 briefly reviews how the role and boundaries of public health are understood, and identifies key concepts and principles relevant to public health today. Section 2.4.2 then addresses the 'unit of classification', by seeking guidance from the literature on the nature of public health interventions, including how an individual intervention may be defined and delimited. Finally, in Section 2.4.3, I survey information needs related to public health interventions, as expressed in reporting guidelines and existing classification schemes. This exploration will provide the necessary background for examining how the structure and content of the draft classification relate to key concepts, theoretical approaches and dimensions of information that are used to understand and communicate about public health interventions. This is important because a classification must be able to engage with the classification domain in a meaningful way and be relevant to real information needs if it is to be used (Bowker & Star 1999; Szostak 2004).

2.4.1 What is public health?

Conceptions of public health have evolved over time, in terms of what is understood to constitute public health practice, and how the role of public health is viewed in the context of the health system and society more broadly. It is useful to begin with a definition of public health that has stood the test of time:

> Public health is the science and art of preventing disease, prolonging life and promoting health through the organized efforts of society. (Acheson 1998)

This definition was outlined in the report of the official inquiry into the future development of the public health function in England (Acheson 1988), and is closely based on the definition provided nearly 70 years before by Charles-Edward Amory Winslow (1920), inaugural Head of the Department of Public Health at Yale University. This definition (and variants of it) has been widely adopted (e.g., World Health Organization Regional Office for Europe 2012; Guest 2013), though a range of other definitions are found in the literature, some of which incorporate key public health principles, such as the goal of reducing health inequalities, or emphasise the population (as opposed to individual) focus of public health (e.g., Beaglehole & Dal Poz 2003; Australian Institute of Health and Welfare 2011; Gruszin et al. 2012).

A common approach to specifying the role of public health has been to identify 'core' or 'essential' public health functions, operations or services (e.g., Population Health and Wellness Ministry of

Health Services Province of British Columbia 2005; New Zealand Public Health Clinical Network 2011). For example, the 10 essential public health operations (EPHOs) identified by the WHO Regional Office for Europe (2012), are:

1. Surveillance of population health and well-being
2. Monitoring and response to health hazards and emergencies
3. Health protection including environmental, occupational, food safety and others
4. Health promotion including action to address social determinants and health inequity
5. Disease prevention, including early detection of illness
6. Assuring governance for health and well-being
7. Assuring a sufficient and competent public health workforce
8. Assuring sustainable organizational structures and financing
9. Advocacy, communication and social mobilization for health
10. Advancing public health research to inform policy and practice

Each of these operations is further elaborated, describing the nature of activities and health topics of focus. EPHOs 1 to 5 relate to 'core public health services', while EPHOs 6 to 10 are functions that enable the delivery of the core services. Such lists are intended to help clarify the capacities and infrastructure required to meet public health needs and challenges, to identify system gaps and areas where capacity is lacking, and to provide a basis for specifying performance standards (e.g., Corso et al. 2000; Department of Health 2001; Mays et al. 2004; Erwin et al. 2006; Corso et al. 2010).

Also relevant to considering how public health may be located in the context of the health system is '*A System of Health Accounts'* (SHA), an accounting framework for reporting internationally comparable data on health expenditure (OECD et al. 2011). The SHA includes a classification of health care functions (ICHA-HC), in which 'Preventive care' is a top-level category covering both individual and collective prevention. An activity should be included under preventive care if it is a health care activity (as defined in SHA) and its primary purpose is avoidance of disease or risk factors (primary prevention), or early detection of disease (secondary prevention) (OECD 2017b). The ICHA-HC classification also includes the category HCR.2 'Health promotion with a multi-sectoral approach', which is a 'health care related' memorandum item used to report expenditure on activities outside the SHA 'health care boundary' for which protecting public health is 'an important secondary goal rather than the primary purpose' (OECD 2017b, p.4) – for example, 'control of food hygiene and drinking water, environmental protection and the multi-sector promotion of healthy life styles' (OECD et al. 2011, p.53). The SHA does not identify 'public health' as a category of healthcare functions. While many public health activities would be classified to HC.6 'Preventive care', others

would be classified to HC.7 ‘Governance and health system and financing administration’ (e.g., health promotion partnerships), or HCR.2 ‘Health promotion with a multi-sectoral approach’.

The principles guiding public health thinking and practice over recent decades have been shaped by a series of international declarations and initiatives. The Declaration of Alma-Ata, adopted at the 1978 International Conference on Primary Health Care, is regarded as a health policy landmark (Declaration of Alma-Ata 1978; World Health Organization 1998). It decries the gross inequalities in health status within countries, and between developed and developing countries, and calls for economic and social development, intersectoral action, and the promotion of community and individual self-reliance and participation in planning, organizing, operating and controlling primary health care. These principles were taken up in 1981 by the ‘Global strategy for health for all by the year 2000’ (World Health Organization 1981). The Ottawa Charter, adopted at the first International Conference on Health Promotion in 1986, identifies five key action areas – building healthy public policy, creating supportive environments for health, strengthening community action for health, developing personal skills, and re-orienting health services for health promotion (World Health Organization 1986). It emphasises the goal of achieving equity in health, the need for coordinated action by all government and industry sectors, and the importance of community and individual empowerment. These principles have been further developed and elaborated in statements emanating from a series of subsequent international health promotion conferences (http://www.who.int/healthpromotion/conferences/en/). The most recent conference, held in Shanghai in 2016, confirmed the enduring relevance of the strategies and principles set out in the Ottawa Charter, and advocated utilising the UN Sustainable Development Goals as a vehicle for a comprehensive, integrated and multi-sectoral approach to health.

Addressing the social determinants of health and health equity has become an important public health focus over the past decade, driven particularly by the work of the Commission on Social Determinants of Health (Friel & Marmot 2011). The Commission was established by WHO in 2005 to gather evidence on social determinants and their impact on health inequity, and to make recommendations for action (Commission on Social Determinants of Health 2008). The Commission’s report highlights a broad and complex network of social determinants as the root causes of health inequalities, and has provided a powerful impetus for innovative public health action focused on addressing aspects of the social context and conditions in which people live, as illustrated by a set of case studies reported by Blas et al. (2011).

While these high-level articulations of values and principles, and calls to action, have powerfully influenced public health thinking, there remain many barriers to their translation into more effective public health practice, in particular where they are at odds with prevailing political and economic

ideologies (Lewis 2003; Baker et al. 2018; Baugh Littlejohns et al. 2018). The term ‘new public health’ has been used to describe the public health agenda flowing from the Ottawa Charter, characterised by an emphasis on promoting equity and social justice, intersectoral approaches and health in all policies, addressing social and environmental determinants, valuing participation and involvement, and calling for health-promoting services within a strong system of primary health care (Baum 2016). Various authors have summarised the history of public health practice over the past two centuries, describing a succession of different eras that have seen the focus of public health action shift and change in response to changing ideologies and advances in knowledge and technology, and often reflecting trends in the wider political and social climate (Davies et al. 2014; Baum 2016). At different times there has been particular emphasis on improvement of physical environmental conditions and infrastructure (e.g., sanitation), legislated infectious disease control measures, eugenics-inspired population health improvement initiatives, medicine (e.g., vaccination and antibiotics), individual lifestyle factors, settings-based health promotion approaches (e.g., Healthy Cities), and inter-sectoral public policy (e.g., bans on tobacco advertising) (Baum 2016).

The ‘new public health’ has not washed away all that came before it; rather, contemporary public health thinking and practice can be seen to have grown out of the knowledge and practices developed in successive earlier eras. Indeed, issues that might be considered more traditional concerns of public health, such as immunisation, population-based health screening, infectious disease control, lifestyle-associated risk factors, and environmental measures (e.g., to reduce air pollution), remain core features of public health practice, and are represented in the UN Sustainable Development Goals (World Health Organization 2017a).

The brief survey presented in this section shows that, as a field of inquiry, the scope of public health is broad, and its perimeter is not clearly drawn. It is not contained within the bounds of the healthcare system, and those aspects of it that are within the healthcare system are not always readily delineated with respect to other functions, such as primary care or governance. In addition, the public health workforce is diverse in nature, encompassing practitioners from a wide range of backgrounds, and public health functions are typically dispersed across different sectors and levels of government (Beaglehole & Dal Poz 2003; OECD et al. 2011; Palmer & Short 2014; Jackson & Shiell 2017; Leider et al. 2018). These factors may in part explain why there is no established culture of classification or systematic data collection in relation to public health interventions.

2.4.2 What is a public health intervention?

In the context of the current research, 'public health interventions' constitute the classification domain. It is therefore relevant to investigate what is meant by the term 'public health intervention'. This will provide a basis for considering how the scope of public health interventions represented in the draft classification, and the definition of 'health intervention' as the unit of classification, relate to public health interventions as they are understood by those working in the field. In this section I look at how the term 'public health intervention' is defined and used. I also explore characteristics of public health interventions that may be of particular relevance to their classification, including the multi-component or 'complex' nature of many public health interventions. Much of the literature I draw on in this and the following section is from a broad-based body of research that focuses on building the evidence base for public health. A fundamental concern in this literature is understanding how interventions work and what makes them effective.

Much of the literature that addresses public health interventions as entities, in policy or research contexts, does not provide a definition of 'intervention' (e.g., Mathers & Fogarty 1996; Richard et al. 1996; Nuffield Council on Bioethics 2007; Frieden 2010; Griffiths & West 2015). Often the term 'intervention' is used in association with terms such as action, activity, strategy, service and program, with the specific meanings of and relationships among these various terms not specified. The Cochrane Public Health Group, dedicated to supporting the production of Cochrane reviews on evidence concerning the effects of population-level public health interventions, does not provide a definition of 'intervention' in its resources for reviewers (http://ph.cochrane.org/). In their work on evidence-based public health, Rychetnik and colleagues define 'intervention' as 'a set of actions with a coherent objective to bring about change or produce identifiable outcomes', which can include policy, regulatory initiatives, single strategy projects or multi-component programs, laws, organisational or community development, education of individuals and communities, engineering and technical developments, service development and delivery, and communication, including social marketing (Rychetnik & Frommer 2000; Rychetnik et al. 2002; Rychetnik et al. 2004). In this definition, 'intervention' encompasses a wide range of different types and scales of action, united by the objective of impacting on population health. Hawe & Potvin (2009), however, suggest that a health-related objective is not necessary for an intervention to be of interest for population health intervention research; indeed, factory closure is given as an example of an intervention that may be worthy of study. Hawe et al. (2009) propose viewing interventions as 'events in systems'—that is, an intervention can be seen as 'a time limited series of events, new activity settings and technologies that have the potential to transform the system because of their interaction with the context and the capability created from this interaction' (p.274). The ideas of an intervention as temporally localised and effecting change are central to this definition, as they are to the definition provided by Rychetnik

and colleagues; however, for Hawe and colleagues, both those changes made with the objective of affecting health, and those that can be expected to have an effect on health, are of potential research interest in the context of building the evidence base for public health.

While there is no widely adopted definition of a public health intervention, there is a great deal in the literature concerning the nature and characteristics of public health interventions. A distinctive feature of public health interventions, as a class of entities, is that they are extraordinarily diverse, ranging from those that employ a single strategy to effect proximal change (e.g., an immunisation or screening campaign) to those that involve multiple strategies and multiple sectors, operating indirectly via social determinants to bring about more distal changes in health (Rehfuess & Akl 2013). Traits that may be considered typical of (though not common to all) public health interventions include that they are setting-specific and tailored to local circumstances, can change and evolve over time, and often involve multiple sectors, multiple-settings, and/or multiple system levels (Medical Research Council 2008; Pfadenhauer et al. 2017).

Many public health interventions can be described as 'complex', involving several components that interact with aspects of the context in which they are delivered (McLaren & Hawe 2005; Craig et al. 2008; Shiell et al. 2008; Hawe et al. 2009; Petticrew 2011; Attena 2014; Moore et al. 2014; Tremblay & Richard 2014). The health effects of an intervention in a given context can be difficult to predict (or indeed to ascertain) because the mechanisms by which it brings about change are characterised by synergistic interactions, time delays, non-linear causal pathways, and feedback loops (Medical Research Council 2008; Petticrew 2011). Complex interventions are a recognised phenomenon in many practice areas across the health system, including primary care, rehabilitation, behaviour change, and quality improvement (Campbell et al. 2007; Michie et al. 2009; Guise et al. 2014). Also, multi-component interventions are not a recent phenomenon in public health; as Gruszin et al. (2012) state in their review of Australia's public health achievements, 'interventions used a range of methods and many of the most successful were complex, multi-faceted and extensive, instituting concurrent public health action across different areas – for example, in legislation, fiscal incentives, social marketing, health promotion, and provision of public health services' (p.xx). Even for an intervention that appears 'simple' in terms of what is done, interactions with aspects of the system into which it is delivered may produce effects via complex rather than deterministic pathways (Medical Research Council 2008; Petticrew 2011; Noyes et al. 2013).

From the perspective of building the evidence base for public health, complexity poses challenges for 'standardising' interventions for replication, establishing the validity of findings on their effectiveness, and synthesising evidence (Hawe et al. 2004; Rychetnik et al. 2004; Brownson et al. 2009; Guise et al. 2014). In 2008, the Medical Research Council (UK) published revised guidelines

on ‘Developing and evaluating complex interventions’ (Craig et al. 2008; Medical Research Council 2008). They provide guidance concerning methodological choices and considerations relevant to evaluating complex interventions, and encourage more detailed and thorough reporting of the intervention (including its components, important aspects of the context in which it is delivered, its theoretical basis, and its variability). To aid in the design, understanding and evaluation of interventions, various authors have proposed the use of a range of analytical approaches for modelling and analysing complex systems, such as system-based logic models and social network analysis tools (Shiell et al. 2008; Hawe et al. 2009; Finegood 2011; Rohwer et al. 2017; Valente & Pitts 2017; Minary et al. 2018).

A key theme in this literature is the importance of theorising interventions: specifying the active intervention components and important aspects of the context, and articulating the mechanisms by which the intervention is expected to bring about change. In discussing how complex, multi-component interventions might be standardised for evaluation, Hawe and colleagues (Hawe et al. 2004) state: ‘what should be defined as standard are the steps in the change process that the elements are purporting to facilitate or the key functions that they are meant to have’. The form of the intervention (e.g., mode of delivery) may vary from setting to setting without changing the fundamental identity of the intervention (Hawe et al. 2004; Hawe & Potvin 2009). Other authors, likewise, distinguish between the active ingredients and change mechanisms that are central to the theory of the intervention, which should be specified and reported, and the methods for delivering them, which may be specific to a given local context (McKleroy et al. 2006; Armstrong et al. 2008; Durlak & DuPre 2008; Brownson et al. 2009; Wight et al. 2016). However, some authors note that it is not always easy to determine which aspects constitute the active ingredients essential to the function of an intervention (Shiell et al. 2008; Guise et al. 2014). In addition, several authors have discussed the difficulty of clearly delineating the boundaries of an intervention in order to differentiate it from the system within which it is delivered, that is, aspects of context, implementation and setting that interact with the intervention (Shiell et al. 2008; Trickett et al. 2011; Pfadenhauer et al. 2017; Rohwer et al. 2017; Minary et al. 2018).

From a classification perspective, this ‘complex systems’ approach to understanding public health interventions highlights some particular challenges for identifying units of classification. Challenges might be expected to include how a complex, multi-component intervention should be broken down into its constituent classifiable units for coding, and how to distinguish the intervention (as the thing to be coded) from aspects of the system in which it is delivered (not to be coded). This issue is picked up in Chapter 3, in the development of an operational definition of the unit of classification for use in this research.

2.4.3 Information needs related to public health interventions

Having interrogated the concept of 'public health intervention', in this section I turn to address information needs: what do people want and need to know about public health interventions, and for what purposes? In public health and related fields, the lack of a common language and the inconsistent use of terms for describing interventions is frequently lamented by researchers as a hindrance to knowledge translation and building an evidence base to inform practice and policy (Jorm et al. 2009; Lamb et al. 2011; Colquhoun et al. 2014; Dijkers 2014; Lokker et al. 2015; Guegan et al. 2016). Numerous frameworks, reporting guidelines and classifications have been developed for communicating, organising and analysing information on interventions. Their existence is evidence of the need for such information structures, and their content may be regarded as expressing the information needs they have been designed to serve. Therefore, the information dimensions represented in these structures indicate what it is that various stakeholders want or need to know about public health interventions. Below, I examine different types of such information structures and the purposes for which they have been developed. I then draw on these collectively to identify the dimensions of information used for describing and grouping public health interventions, summarised in Box 2.2.

Many authors have called for better reporting of 'practice-based evidence' concerning public health interventions, in order to strengthen the evidence base and facilitate the translation of research findings into practice (Green & Glasgow 2006; Leeman et al. 2006; Conn et al. 2008; Glasziou et al. 2008; Green et al. 2009; Leeman et al. 2012; Hoffmann et al. 2014; Fernandez et al. 2015; Lokker et al. 2015). A large number of guidelines and checklists have been published to support improved reporting of findings from original research and systematic reviews[4], several of which are relevant to public health interventions. For example, the 'Criteria for Reporting the Development and Evaluation of Complex Interventions in healthcare' (CReDECI 2) specify that information should be reported on the theoretical basis of the intervention, a description of all intervention components, intended interactions between components, delivery strategy, materials or tools used, and aspects of the context that are relevant for modelling the intervention (Mohler et al. 2015). Other information dimensions

[4] The EQUATOR Network (Enhancing the QUAlity and Transparency Of health Research) is an international initiative to 'improve the reliability and value of published health research literature by promoting transparent and accurate reporting and wider use of robust reporting guidelines' (http://www.equator-network.org/about-us/). The EQUATOR Library provides an extensive online collection of reporting guidelines.

specified in reporting guidelines include the outcomes the intervention is intended to achieve, the actors or system components towards which the intervention is directed, who delivers the intervention, the mechanisms by which the intervention is theorised to bring about change, intervention setting, quantification (e.g., intensity, dose), timing (e.g., duration), and characteristics of intervention recipients (Davidson et al. 2003; Des Jarlais et al. 2004; Boutron et al. 2008; Schulz et al. 2010; Proctor et al. 2013; Hoffmann et al. 2014; Borek et al. 2015; Mohler et al. 2015; Hales et al. 2016; Bragge et al. 2017). Thus, in the context of evidence-based practice, these information dimensions represent what it is researchers and practitioners need to know in order to evaluate and compare reports of intervention effectiveness, and faithfully implement them in new settings.

Many frameworks and classification schemes have been developed in research contexts for organising and analysing information on public health and similar types of interventions. Such schemes vary greatly in their form, level of detail, and the purposes for which they are designed. Some are developed within the context of a particular research project to meet the immediate need for an organising structure, and group interventions in a way that is suited to the task at hand. For example, Rehfuess & Akl (2013) group public health interventions into 8 broad types: health policy, health system, behavioural, nutrition, environmental, vaccination, screening, and clinical. Many examples of such ad hoc classifications can be found in the literature (e.g., Pollard et al. 2008; Hutchinson & Wilson 2012; MacNeil 2012; Tricco et al. 2012; Lorenc et al. 2013; Guise et al. 2014; Webster et al. 2014). Some authors have proposed classifications of interventions, or intervention strategies, as a basis for more effective communication among researchers and practitioners (e.g., Galbraith et al. 2011; Hollands et al. 2013; Mazza et al. 2013; Powell et al. 2015). However, often such schemes are tailored to particular intervention types (e.g., ‘choice architecture’ interventions or HIV/AIDS prevention interventions) and/or it is difficult to articulate the conceptual dimensions on which they are constructed.

Schemes that have been proposed for wider use in research and intervention design, and that provide more thoroughly articulated accounts of the underlying concepts, are useful for identifying information dimensions that are likely to be more generally applicable. For example, the ‘Behaviour Change Wheel’ (Michie et al. 2011) was developed as a tool for ‘characterising interventions and linking them to an analysis of the targeted behaviour’. It has three dimensions or ‘layers’: intervention functions (9 categories); policy categories (7 categories); and a behaviour system (a model comprising 6 components). Intervention functions can be theorised to affect particular components of the behaviour system (e.g., the intervention function ‘Incentivisation’ may act on ‘Reflective motivation’), and different policy measures can support or enable a given intervention function. Another example is an ecological coding scheme developed for assessing the integration of ecological approaches into health promotion programs (Richard et al. 1996). Ecological, or social-ecological,

perspectives in public health emphasise the multiple system levels at which interventions can be directed in order ultimately to achieve health outcomes for individuals (McLeroy et al. 1988; Green et al. 1996; Glanz & Bishop 2010; Richard et al. 2011). The ecological coding scheme has two independent dimensions – setting (4 categories) and target (5 system-level categories); targets are used as building blocks to describe intervention strategies according to their hypothesised change pathway. The coding scheme has been used in a number of studies to evaluate the degree of integration of ecological approaches into public health practice (e.g., Cargo et al. 2011; Richard et al. 2011; Richards et al. 2014; Safdie et al. 2014; Rowley et al. 2015). Such frameworks and tools are built around dimensions of information considered necessary to inform effective intervention design and the selection of interventions for implementation in particular contexts.

Other schemes are designed to support higher-level policy and resourcing decisions. In deciding how to intervene on public health issues, a range of factors inevitably come into play alongside evidence of intervention effectiveness, including stakeholder preferences, ethical considerations, community values, and available resources (Rychetnik et al. 2004; Rychetnik & Wise 2004; Brownson et al. 2009; Carter et al. 2011; Pettman et al. 2013; Carter 2014). The 'intervention ladder' is a model designed for comparing interventions in light of potentially conflicting policy goals, such as 'individual choice, preservation of autonomy, reduction of inequalities, protection of vulnerable groups and targeting of at-risk groups' (Nuffield Council on Bioethics 2007, p.31). The ladder has eight 'rungs', from 'Do nothing or simply monitor the current situation' at the bottom, through categories representing interventions seen as progressively more coercive, to 'Eliminate choice' at the top (e.g., compulsory isolation of people with infectious diseases). The argument is that interventions lower on the ladder are less restrictive of individual freedoms and will be seen as more acceptable, while more restrictive interventions will require stronger justification. Critical of the apparent assumption that personal autonomy is maximised by non-intervention, Griffiths & West (2015) have proposed an expanded intervention ladder, in which interventions that substantially restrict autonomy are at the bottom, while measures that substantially enhance autonomy are at the top (e.g., empowering individuals or communities). Another scheme designed to assist in selecting interventions is the 'health impact pyramid' (Frieden 2010). Interventions that require minimal engagement on the part of individuals but substantial political commitment and support from civil society sit at the base, while those that require most individual effort but little political commitment sit at the apex. The argument is that interventions towards the bottom of the pyramid are likely to be most effective, but may be politically difficult to implement. Such schemes reflect information needs related to decisions that must be made within broader policy contexts concerning the types of interventions that should be considered to address particular public health issues.

In Australia, the National Public Health Partnership commissioned a 'Public Health Classifications Project', which saw the development of a classification intended to capture the important dimensions of public health (National Public Health Partnership 2006). The classification is proposed for use to collect or organise information concerning a range of entities, including 'public health policies, programs and interventions, the population groups they target, and their outcomes' (Jorm et al. 2009). It has six dimensions: Functions ('the purpose of public health interventions, actions, activities and programs'); Health issues; Determinants of health; Methods; Settings; Resources and infrastructure. The second stage of the project further developed the 'Determinants of health' dimension of the classification, resulting in a hierarchical classification of 82 determinants (New South Wales Department of Health 2010). This classification has been designed to meet a broad range of information needs, with potential applications envisaged to include expenditure reporting, performance measurement, building models of good public health practice, and comparison of public health activity between jurisdictions or countries.

Another information dimension used for distinguishing between interventions in a policy context concerns whether and how an intervention is directed towards particular population groups. The Nuffield Council on Bioethics (2007) identifies three distinct approaches: targeting disadvantaged groups, targeting at-risk groups, and universal interventions. In some instances, universal interventions can deliver greater health gains to relatively advantaged groups within populations who are better placed to benefit from them. Thus, depending on how they are targeted, public health interventions can fail to deliver health benefits to disadvantaged, vulnerable or marginalised groups, potentially increasing health inequalities (Nuffield Council on Bioethics 2007; Frohlich & Potvin 2008; Benach et al. 2013; Lorenc & Oliver 2014). Other authors have also proposed typologies for distinguishing between interventions and health policies in terms of the equity impact of the targeting approach employed (Solar & Irwin 2010; Benach et al. 2013).

This review of reporting guidelines and classificatory schemes relevant to public health interventions is not exhaustive, but it does illustrate the range of types of information those in the field use to group and distinguish different types of intervention. The main purposes for which information about interventions is sought may be summed up, in broad terms, as: (1) to support design, implementation, replication, knowledge translation, and systematic review; (2) to understand and to communicate about what interventions are effective and why; and (3) to support decision-making in the context of public health policy and planning. Box 2.2 presents a summary of the types of information that may be required by stakeholders for describing and grouping interventions, based on ten reporting guidelines and the various classificatory schemes reviewed in this section (further information about each of the sources cited in Box 2.2 is given in Appendix 2.3).

The information types in Box 2.2 are taken to represent expressed information needs concerning public health interventions. The 10 headings are suggested as a simple organising structure, though alternative groupings could be used. Listing information dimensions in this way provides a sketch of the information landscape within which the draft classification of public health interventions in ICHI sits. The property space of the draft classification exists within the multidimensional information space described by the expressed (and yet-to-be-expressed) information needs of potential classification users. Investigating how the classification relates to this multidimensional information space is thus useful for developing an understanding of its strengths and limitations with respect to particular information needs.

Box 2.2: Types of information relevant for describing and grouping public health interventions

(reference numbers in parentheses)

Aims of intervention

- Outcomes likely to be affected (6, 7)
- Intended targets (actors, system components, etc.) (6, 7)
- Behaviour system components (11)
- Social-ecological system level (12)
- Health issues (16)
- Determinants of health (16)

Content of intervention

- Components; active ingredients; essential functions (1, 2, 5, 7, 10)
- Strategies; change techniques; actions; processes; steps (4, 6, 8, 9)

How intervention is hypothesised to work

- Theory; rationale; goals; theoretical justification (1, 3, 5, 6, 8, 9)
- Interactions between components (5)
- Mechanisms of action; change techniques; causal processes (4, 7, 8, 12)

Delivery of intervention

- Delivery method; materials; procedures; mode of delivery; strategies (1, 2, 3, 4, 5, 7, 8, 9, 10)
- Who delivers the intervention (1, 3, 4, 7, 8, 10)
- Unit of delivery (e.g., individual, group) (1, 2, 7, 8)
- Setting; location (1, 3, 4, 8, 9, 10, 12)

Quantification and timing

- Quantity; intensity; frequency; dose (1, 2, 6, 7, 8, 9, 10)
- Timing; schedule; sequencing (4, 6, 8)
- Time span; duration (1, 2, 8, 10)

Context of intervention

- Context (policy program context; all aspects relevant to modelling the intervention at macro, meso and micro level) (5, 9, 11)
- Characteristics of intervention recipients; whether recipient also target (8, 10)

Intervention variability

- Modification (during course of the study); adaptability (3, 4, 8)
- Tailoring to local circumstances (2, 3, 4)
- How intervention is standardised (2)

Implementation of intervention

- Activities to increase compliance/adherence (1, 2)
- Treatment implementation; strategies for implementation fidelity (3, 4)

Policy considerations

- Effect on individual autonomy (13, 14)
- Level of political support required (15)
- Degree of individual engagement needed (15)
- Resources/infrastructure (16)
- Population group targeting (13, 17, 18)

Box 2.2 (continued): Types of information relevant for describing and grouping public health interventions

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2.5 Conclusions

In this chapter, I have drawn together knowledge and insights from several rich bodies of scholarship that bear on my research, and have introduced key concepts, principles, and ideas that I will use and reflect on throughout this thesis.

The set of concepts identified for describing and comparing classifications (Section 2.1.2) and the analytical structure, comprising the framework of criteria and the 4-tier model (Section 2.3), focus mainly on the technical attributes of classifications. The framework (Box 2.3) sets out the criteria a statistical classification should meet, and thus provides a basis for appraising the draft classification; the model (Figure 2.1) functions as an organisational structure that helps explore inter-relationships between issues and consider options for addressing problems identified. But classifications must also be understood in terms of their social characteristics: they embody cultural and political values and agendas, they can help to reveal but also to conceal characteristics of and differences and relationships between entities, and they can facilitate but also constrain knowledge and communication. Classifications interact with the social worlds in which they are developed and used, and can operate to shape the ‘reality’ they classify. This articulation of the social nature of classifications provides a

sensitising lens that I will apply to my appraisal of the draft classification of public health interventions in ICHI.

Public health interventions are recognised to be diverse and often complex in nature; as such they inevitably pose challenges for classification. These challenges are likely to include devising a reliable basis for defining the unit of classification, distinguishing intervention components from aspects of the context in which they are delivered, and representing those components in ways that relate to how they are hypothesised to work. The diversity of classification schemes relevant to public health interventions suggests an unmet need in a field that currently lacks common structures, but also the challenge of developing a generally applicable classification, able to meet the information needs of a broad range of stakeholders.

The primary objective of the current research is to undertake a comprehensive developmental appraisal of the draft classification of public health interventions in ICHI, in order to gain an understanding of its strengths and limitations and to identify problems and issues that should be addressed to improve its utility. The literature reviewed in this chapter has served to provide an orientation, in terms of the nature and characteristics of statistical classifications and the public health information landscape within which ICHI is situated. The tools developed here – the framework of criteria and the 4-tier model – will be used in the conduct of the research. Based on the foundation developed in this chapter, the following chapter presents the theoretical perspective and rationale that underpins the approach I have chosen for conducting the research, outlines the research design, and describes the methods employed.

3. Research Methodology

In this chapter, I develop the rationale for my overall approach to conducting a developmental appraisal of the draft classification of public health interventions in the International Classification of Health Interventions (ICHI), and describe the methods used for the three components of the research design. Further detail on methods for each of the research components is provided in Chapters 4, 5 and 6. Section 3.1, below, describes the theoretical perspective that underpins this research, encompassing my philosophical stance and related assumptions; in particular, I discuss why social constructionism provides an appropriate epistemological approach for the task at hand. This discussion serves as foundation and rationale for the methodological approach and research design developed to answer my research questions, described in Section 3.2.

In this research I have used existing data sets containing descriptions of public health interventions as vehicles for testing the draft classification. Such data collections may be taken to express both information needs of stakeholders and how interventions are understood by stakeholders in real-world contexts. Section 3.3 describes the approach used to identify and select data sources for inclusion, and introduces the three data sets used. The following three sections (3.4 to 3.6) then describe the methods employed for each of the three research components. Section 3.7 explains how the findings from the three components are drawn together to address the research questions, and also considers the potential broader contributions of this research to a body of knowledge concerning the development of statistical classifications. In this final section of the chapter, I also reflect on my role as researcher and how my particular background and interests might shape my approach to the research.

3.1 Theoretical perspective

> [Classifications] do not describe the world as it is in any simple sense. They necessarily model it. This modeling within classification systems of all sorts is where the rubber hits the road in terms of the enfolding of social, political, and organizational agendas into the scientific work of describing nature (Bowker & Star 1999, p.101-2)

The theoretical perspective from which a piece of research is conducted entails the philosophical stance and related assumptions that the researcher brings to the research. This is informed by the researcher's ontological and epistemological beliefs in relation to the topic of study, that is, beliefs concerning the nature of things in the world ('what is'), and how valid knowledge of them can be obtained ('what it means to know') (Crotty 1998; Green & Thorogood 2014). Theoretical perspective provides the rationale for the methodology employed and the choice of particular methods. The

purpose of this section is to describe the theoretical perspective I bring to this research, including the assumptions on which my overall approach is founded.

Here, it is relevant to articulate two theoretical propositions, drawn from the work of Bowker and Star (1999) and others interested in the sociology of classifications, as discussed in Chapter 2. They are:

1. Classifications are information artefacts that embody cultural and political values and agendas, that can help to reveal but also to conceal characteristics of and differences and relationships between entities, and that facilitate but also constrain knowledge and communication. Far from passively mirroring some objectively knowable 'reality', classifications interact with the social worlds in which they are developed and used, and can operate to shape the 'reality' they classify.
2. This understanding of the nature of classifications underlines the importance of critically examining the decisions that are made in the process of their construction, and of always being 'conscious' in how we use them so that we can recognise and make allowance for the potential limitations of information produced through their use.

These propositions constitute the philosophical position from which I approach the research – these are the terms in which I view the draft classification of public health interventions in ICHI that is the focus of my explorations.

In embarking on the research, my aim has been to explore how the classification relates to public health interventions as they are understood by those working in the field and, from this perspective, appraise its potential utility and identify how it can be improved. In setting out to do this, I make certain assumptions about the classification itself and the appropriate way to test it, and put these together to give an account of the overall logic of my approach, as follows:

1. The classification is a tool, so it must be fit for purpose.
2. Its purpose is to provide a basis for capturing and communicating information about public health interventions.
3. It can be tested by seeing how well it functions when people use it to transmit and receive information about public health interventions.
4. Existing public health interventions data sets provide a context within which the classification can be tested – these data sets represent interventions as they are understood by stakeholders in real-world contexts, and express the information needs of stakeholders.
5. It is possible to specify the criteria a statistical classification should meet, as a basis for appraising the draft classification.

6. Using the classification to code descriptions of public health interventions in existing data sets, and analysing the results of this process against the criteria specified, will facilitate a meaningful appraisal of the classification and a basis on which to identify how it can be improved.

Social constructionism may be defined as 'the view that all knowledge, and therefore all meaningful reality as such, is contingent upon human practices, being constructed in and out of interaction between human beings and their world, and developed and transmitted within an essentially social context' (Crotty 1998, p.42). Humans are seen as 'born into a world of meaning' in the form of a culture that provides us with a set of symbols and lenses through which to view the world: 'Our culture brings things into view for us and endows them with meaning and, by the same token, leads us to ignore other things' (Crotty 1998, p.54). This view of meaning and how it is possible to 'know' about things resonates with Bowker and Star's (1999) analysis of classifications as information artefacts that shape and are shaped by the social worlds in which they exist, that give voice to some interests and silence others. Classifications, formal and informal, embody the social construction of a given domain and may be seen as key elements in the social process of constructing meaning. Therefore, social constructionism provides a natural fit as the epistemological approach underpinning this research.

This section has described my theoretical perspective and, consistent with this, has set out the overall logic of my approach to the research. This provides a backdrop and rationale for my choice of methodology and of particular methods, which are described in the following sections.

3.2 Methodology and research design

This study is a developmental appraisal of the draft classification of public health interventions in ICHI. It is intended to be part of the development process, such that the research findings will contribute to the ongoing development and improvement of the classification. The study addresses two overarching research questions, set out in Chapter 1:

1. Does the draft classification of public health interventions in ICHI possess the desired features of a statistical classification?
2. What problems or shortcomings can be identified and how could these be addressed to improve the utility of the classification?

Classifications interact with the social worlds in which they are developed and used. Therefore, a developmental appraisal of a classification should, as much as possible, view the classification in terms of such interactions: how it is applied by users to produce data and how data produced through its application are used. It may be expected that, in applying the classification and in responding to the

data produced, users will the seek alignment between their own understanding of the domain and the classification's construction of the domain; sometimes the classification will align well and provide a good 'fit', capturing information that the user sees as important; sometimes there will be misalignment, with the user finding that the categories of the classification do not fit with the distinctions they see as important, lumping different things together or making inappropriate distinctions. Different users will have different ways of understanding the classification domain and different information needs. The methodology I have developed for this study reflects a social constructionist perspective, viewing the classification as one way of constructing meaning concerning public health interventions, and appraising it in light of how meaning concerning public health interventions is constructed among potential users.

Existing data sets on public health interventions are expressions of real-world information needs. How interventions are described in such data sets, through both the content of textual intervention descriptions and categorical data fields, reflects how they are understood by stakeholders. I have therefore chosen to use existing data sets as a basis for the developmental appraisal of ICHI. The classification may be applied to code intervention descriptions and produce a summary of the data set viewed through the ICHI 'lens'; the ICHI-coded data may then be reflected back to stakeholders to elicit their responses concerning the extent to which the classification captures important distinctions and provides a useful summary. Both steps of this process can provide valuable insights into the classification in relation to real-world information needs. This methodological approach is operationalised as three research components designed to explore interaction between the draft classification and the domain classified:

1. ***ICHI public health data coding study***. The draft classification is applied to code descriptions of public health interventions in three existing data sets. Descriptive analyses (frequency distributions) of the resulting ICHI-coded data and thematic analysis of detailed coding notes are conducted. This research component provides for an intensive exploration of the interaction between the classification and the domain as manifested through the existing data sets. *How well does the classification 'mesh' with these manifestations of socially constructed understandings of public health interventions?*
2. ***Inter-coder comparison study***. The draft classification is applied independently by two coders to a subset of records from each of the three data sets. Rates of agreement between the two coders are calculated and reasons for coding discrepancies are explored. *Do coders differ in their interpretation of classification categories and how these relate to the interventions described? What are the implications of coding discrepancies in terms of the reliability of data produced?*

3. ***In-depth key-informant interviews***. Semi-structured interviews are conducted to obtain feedback from key-informants associated with each of the data sets, concerning the structure and content of the draft classification, and its utility for representing and analysing data on public health interventions. This research component allows for an examination of how potential users interact with ICHI-coded data. *Does ICHI capture information about public health interventions that is seen as important, and to what extent will ICHI-coded data meet information needs?*

This research design may be described as mixed qualitative research methods. The three components represent different but complementary approaches to exploring conceptual and practical issues encountered when applying the draft classification. Rigour is afforded by the use of the analytical structure developed in Chapter 2 – comprising the framework of criteria and the 4-tier model – and by the use of established methods for gathering and analysing qualitative data, as described in the following sections of this Chapter. Table 3.1 sets out the main structural elements of the research design. The framework of criteria articulates the desired features of a statistical classification, and therefore provides the structure within which to organise the findings from the three research components in order to address the first research question: '*Does the draft classification of public health interventions in ICHI possess the desired features of a statistical classification?*' The 4-tier model represents the main elements or layers that make up a statistical classification. As such, it provides a useful structure within which to locate the origins and manifestations of particular problems or issues identified, and to consider how they might be addressed. Thus, it assists in bringing the research findings to bear on the second question: *'What problems or shortcomings can be identified and how could these be addressed to improve the utility of the classification?'* In Section 3.3, below, I outline my approach to identifying data sources for use in this research and introduce the three data sets selected. The following three sections (3.4 to 3.6) then describe the methods employed for each of the three research components.

Table 3.1: Main structural elements of the research design

Three research components

1. ICHI public health data coding study: *How well does the classification 'mesh' with these manifestations of socially constructed understandings of public health interventions?*

2. Inter-coder comparison study: *Do coders differ in their interpretation of classification categories and how these relate to the interventions described? What are the implications of coding discrepancies in terms of the reliability of data produced?*

3. In-depth key informant interviews: *Does ICHI capture information about public health interventions that is seen as important, and to what extent will ICHI-coded data meet information needs?*

Framework of criteria	**4-tier model**
Desired features of a statistical classification: 1. Purpose and scope 2. Structure and organisational principles 3. Unit of classification 4. Comprehensiveness 5. Mutual exclusivity 6. Clearly defined categories 7. Level of detail and specificity 8. Relevance 9. Reliability 10. International applicability 11. Ease of use 12. Compatibility with other classifications	Phases of classification development / elements of the classification: Tier 1 – Information dimensions and structure Tier 2 – Content: coded categories Tier 3 – Category titles and definitions Tier 4 – Supporting materials

3.3 Data sources and sampling

Using existing data sets as a basis for the developmental appraisal of ICHI provides a way of investigating how well the classification captures information about public health interventions as they are understood within real-world contexts to meet particular information needs. Existing data sources have been used to test classification schemes during their development in several studies reported in the literature (Michie et al. 2013; Salvador-Carulla et al. 2013; Salvador-Carulla et al. 2015; Fortune et al. 2017). Other approaches for testing classification schemes include the use of vignettes or case studies (Evenboer et al. 2012; Johansson et al. 2013; Salvador-Carulla et al. 2013; Salvador-Carulla et al. 2015; First 2016; Keeley et al. 2016; Forster et al. 2017) and existing terminologies (Hardiker & Rector 2001; Park et al. 2010; Juve Udina et al. 2012); however, such sources are not readily available for public health interventions.

In discussing approaches to data collection in qualitative research, Ritchie & Lewis (2003) identify two broad types of data: naturally occurring data and data generated through the conduct of the research. Naturally occurring data represent ‘an 'enactment' of social behaviour in its own social setting, rather than a 'recounting' of it generated specifically for the research study’, and thus ‘allow investigation of phenomena in their natural settings’ (Ritchie & Lewis 2003, p.34). In the context of my research, existing data sets may be regarded as ‘naturally occurring data’. Applying ICHI to these data sets results in the production of ‘generated data’, which are analysed and brought to bear on my research questions. As Bowker and Star (1999) point out, classification development typically presents a ‘bootstrapping problem’ (p.276) – decisions about the classificatory elements to incorporate into the new scheme (such as axes and cut-points to define categories) must be informed by a body of data that relies on the classification scheme that is yet to be developed. Existing data sets, and the varied information needs they embody, offer alternative and less self-referential frames through which to view and appraise the draft classification. Different data sets will present different issues and challenges, and will enable testing across a variety of public health practice areas.

Identifying appropriate data sets was the first step for this research. Unlike sampling in quantitative research, samples in qualitative research are not intended to be statistically representative because the aim is not to generalise findings from the sample to a broader population, but rather to thoroughly investigate the phenomenon of interest (Rice & Ezzy 1999; Blaikie 2000). Thus a purposive sampling approach was used to select data sets containing descriptions of public health interventions for use in this research; in purposive sampling, units or cases are selected ‘because they hold a characteristic that is known or expected to be salient to the research study’ (Ritchie & Lewis 2003, p.107). As the aims of ICHI are broadly stated, and it is intended to cover all types of public health interventions, a maximum variation sampling approach was adopted (Rice & Ezzy 1999); the sampling frame was all existing sets of data containing descriptions of public health interventions. The sampling criteria were: (i) the data sets must have been constructed to meet real-world information needs; (ii) the data sets should represent different types of intervention and different information needs; (iii) data sets operating at different scales (such as program-, national-, and international-level data sets) should be included.

To identify candidate data sets, inquiries were made through a variety of organisations, forums and research networks, explaining the nature of the research and asking for information on existing data sets containing descriptions of public health interventions. Inquiries were made via email and/or verbally as follows:

- The Centre of Excellence in Intervention and Prevention Science (Australia) – meetings and email inquiries (February – April 2015)

- Australian government health agencies – email inquiries to contacts in VicHealth, NSW Health and SA Health (March – April 2015)
- WHO-FIC Network – email inquiries to WHO-FIC Network colleagues in eight countries (May 2015); poster presentation at WHO-FIC Network annual meeting (October 2015)
- WHO-FIC Asia Pacific Network – announcement and email inquiry to participants at Asia Pacific Network meeting (June 2015)
- Emerging Health Policy Research Conference – oral presentation and follow-up discussions (July 2015)
- Population Health Congress (Australia) – oral presentation and follow-up discussions (September 2015)
- Public Health England – meeting with members of Knowledge Management team (October 2015)
- National Centre for Classification in Health (Australia) – seminar presentation (November 2016)
- The Sax Institute and The Australian Prevention Partnership Centre (Australia) – seminar presentation (November 2016).

Through early inquiries, it became apparent that existing public health intervention data sets are scarce. Five potential data sets were identified:

- South Australian obesity prevention program database: the OPAL Single Platform
- Netherlands online inventory of lifestyle interventions (https://www.loketgezondleven.nl/)
- New South Wales Population Health Intervention Management System
- Canadian Best Practices Portal – searchable online information repository on 'best practice' interventions (http://cbpp-pcpe.phac-aspc.gc.ca/)
- Canadian Institutes of Health Research database containing abstracts for intervention research projects funded under the funding mechanism 'Operating Grant: Intervention Research'.

The first two of these data sets met the sampling criteria, were able to be accessed for the research, and represented program- and national-level data sets, respectively. The remaining three data sets were excluded after further investigation, either because they were not readily accessible or because they did not contain descriptions of public health interventions in a form suitable for extraction and coding. Subsequent to these inquiries, the set of indicators used to monitor implementation of the WHO's Framework Convention on Tobacco Control was identified as an international-level data set that met the sampling criteria. The three data sets included in the research are described below.

3.3.1 South Australian obesity prevention program database: the OPAL Single Platform

OPAL (Obesity Prevention and Lifestyle) was a 'multi-site, multi-setting, multi-strategy community based childhood obesity prevention program' delivered in 20 communities across South Australia (Flinders University 2016). The South Australian Department for Health and Ageing launched OPAL in 2009 and funding for the program ceased in July 2017. Within participating OPAL communities, individual projects were developed and delivered at local government level, and in collaboration with stakeholders in the community. Information about projects implemented in each community was entered directly by OPAL staff onto the OPAL Single Platform, a purpose-built online data repository. Single Platform data were used for program management and evaluation (Jones et al. 2016).

For this research, an extract from the OPAL Single Platform was obtained, consisting of over 5,000 project records. Ethical approval to use the OPAL data was granted by the South Australian Department for Health and Ageing Human Research Ethics Committee in June 2016 (Project number HREC/16/SAH/38; Appendix 3.1). A licence agreement to obtain access to the data was finalised between the University of Sydney and the Minister for Health, South Australia, in July 2016. The data extract was provided by SA Health as an Excel data file on an encrypted USB device in September 2016; the extract contained OPAL Single Platform data items requested by the researcher for all closed project records (that is, excluding active records for projects not yet finalised within the database).

Two data fields – 'rationale' and 'description' – contained free text descriptions of OPAL projects (i.e., the interventions delivered) and were used as the basis for ICHI coding; the text in these data fields varied in length from one sentence to three paragraphs. Several categorical data items were included in the extract (e.g., Goal, Theme, Strategy, Sector, Setting, Population), which were defined in the OPAL data dictionary and related to particular elements of the OPAL Program Logic Model (Jones et al. 2016); these were not used for ICHI coding, but were used for identifying other dimensions of information seen as useful for understanding or grouping interventions.

A sample of 552 OPAL project records was randomly selected from the full extract, stratified by the data item 'Site' to ensure that representation across OPAL communities in the sample matched that for the full extract. This was done by using the '=Rand()' function in Excel to randomly sort records

within site, then selecting the first 13% of records for each site for inclusion in the sample.[5] Within the sample, the '=Rand()' function was again used to randomly sort the project records. The reason for randomisation was to ensure that a diverse spread of OPAL projects would be included for coding. Because of the way the OPAL program was rolled out within communities, there was likely to be some clustering of similar types of projects in the original data extract, reflecting when those projects were delivered. Frequency distributions for all categorical OPAL data items showed that their distribution in the sample matched that in the full extract. Coding continued through the sample until it was determined that saturation had been reached in terms of coding-related issues identified, i.e., that no new insights would be obtained by coding more records (Ritchie & Lewis 2003). This was verified during the thematic analysis of coding notes by coding an additional 20 records to check that no new themes were identified.

The sample of OPAL project records represents a sub-national or program-level public health interventions data set.

3.3.2 Online inventory of lifestyle interventions in the Netherlands

The RIVM (National Institute for Public Health and the Environment) Centre for Healthy Living supports best practice health promotion in the Netherlands. To promote use of the most appropriate interventions, the Centre maintains information on available interventions, planning instruments, communication materials and links to relevant organisations on the portal Loketgezondleven.nl (https://www.loketgezondleven.nl). The portal includes a searchable database of interventions. Organisations can request to have their intervention included in the database by providing information about it using a standard submission form (Brug et al. 2010). Expert committees assess the interventions, including evidence for their effectiveness, and assign a recognition level category (e.g., 'theoretically sound', 'probable effectiveness', 'established effectiveness', or 'established cost effectiveness').

To extract records for coding, Google Translate was used to translate text in the interventions database from Dutch into English. Google Translate is freely available, web-based machine translation software that uses statistical algorithms to produce translations, based on patterns detected

[5] A sample size of 550 was decided based on statistical advice, as it was originally planned to conduct statistical analyses using the ICHI coded data, e.g., to look for associations between ICHI intervention codes and OPAL 'Goal' and 'Theme' categories.

in documents that have already been translated by human translators (Khanna et al. 2011). Studies exploring the accuracy and reliability of Google Translate translations for various purposes have reached mixed conclusions. For instance, in translating student essays from Malaysian and Chinese, Google translation was found 'to produce stretches of clear and accurate English', but accuracy was 'patchy' (Groves & Mundt 2015). In one study, Google Translate was found to have 'limited usefulness' for translating medical phrases in the context of communication between doctor and patient (Patil & Davies 2014), in another study it 'performed comparably to professional human translation in terms of preserving information and meaning' for translating patient educational material (Khanna et al. 2011), and in a third study it was judged largely reliable for translating German scientific literature into English (Zulfiqar et al. 2018). Translation accuracy tends to be higher for languages for which there is a bigger pool of already translated documents on which the statistical algorithms can draw (Patil & Davies 2014; Groves & Mundt 2015).

An initial review of the translations of intervention descriptions produced by Google Translate found them to be comprehensible, with descriptions clear enough to identify the information needed in order to assign ICHI axis categories and intervention codes. It was therefore decided that this would be a satisfactory way of translating intervention descriptions from Dutch into English for the purpose of this research. In a small number of instances, a Dutch-speaking colleague provided assistance with translation where an English phrase produced by Google Translate did not make sense in the context of the intervention description.

Based on advice from the database custodian, a search was conducted using the criterion 'Species prevention = universal prevention', to capture all records for interventions delivered at a population level. Only 'recognised' or 'approved' interventions were included. This search returned 186 intervention records, and all were used in the research. For each record, information fields containing descriptive information about the intervention were copied into an Excel data file. ICHI coding was based on text contained in three information fields: 'Short description', 'Purpose' and 'Approach in brief'. As this is a publicly available database, ethics approval was not required to use this data source.

Intervention records extracted from the online inventory represent a national-level public health interventions data set.

3.3.3 Implementation indicators for the WHO Framework Convention on Tobacco Control

The WHO Framework Convention on Tobacco Control is the World's first public health treaty. As stated in the foreword to the Convention, it is 'an evidence-based treaty that reaffirms the right of all people to the highest standard of health' (World Health Organization 2003). The Convention was

developed in recognition of the need for international cooperative action to combat the global tobacco epidemic, particularly because of the supranational nature of many of the factors that drive tobacco consumption, such as trade liberalisation, global marketing, and illicit trade across national borders. It was adopted by the World Health Assembly on 21 May 2003 and entered into force on 27 February 2005, and it has since become one of the most rapidly and widely embraced of all United Nations treaties. As a global governance instrument, it is recognised to have had significant positive impacts on tobacco control efforts within countries, regions and globally. It is believed to be an important factor underpinning the encouraging 'first signs of a general downward trend in tobacco use prevalence' (World Health Organization 2016a, p.4), and is seen as a model for other areas of public health.

The articles of the Convention set out evidence-based tobacco control measures to be implemented by Parties, with 'tobacco control' defined as 'a range of supply, demand and harm reduction strategies that aim to improve the health of a population by eliminating or reducing their consumption of tobacco products and exposure to tobacco smoke'. Article 21 requires that all parties report on implementation of the Convention. A reporting instrument has been developed and this is used to gather implementation data at country level (http://apps.who.int/fctc/reporting/reporting_instrument/en/). The Convention Secretariat maintains an implementation database and produces implementation reports.

A set of indicators derived from the reporting tool is used to assess implementation against substantive articles of the Convention (World Health Organization 2016a). As these indicators describe tobacco control measures, they were judged to constitute a data set suitable for use in this research. The full set of indicators listed in Annex 1 of the '2016 global progress report on implementation of the WHO Framework Convention on Tobacco Control' was copied into an Excel data file for ICHI coding. As this is a publicly available indicator set, ethics approval was not required to use this data source.

The set of indicators for monitoring implementation of the WHO Framework Convention on Tobacco Control represents an international-level public health interventions data set.

3.4 Research component 1: ICHI public health data coding study

The method used for applying ICHI to code descriptions of public health interventions in the three data sets is related to the technique often termed 'mapping', which is used for linking content between health terminologies and classification schemes. As described in Fortune et al. (2017), mapping may be done for a variety of purposes, including migrating health information from one system to another, allowing data collected for one purpose to be reused for another purpose, and conducting longitudinal

data analysis (Barrows Jr. et al. 1994; Imel & Campbell 2003; Giannangelo & Fenton 2005); it is also used for examining and comparing structure and content between different terminologies and classifications (Hyun & Park 2002; Ivory 2016; Fortune et al. 2017). Mapping involves using terms in a 'source' scheme to evaluate content of the 'target' scheme being studied. When no corresponding term or category is present in the target scheme, this indicates a coverage gap. As well as noting gaps, the type of relationship between concepts matched across the two schemes may be recorded, for example by designating maps as 'complete' or 'partial' (Hyun & Park 2002; Dhombres & Bodenreider 2016), or by describing terms or categories in the target scheme as 'broader' or 'narrower' than those in the source scheme (Hardiker et al. 2014).

A detailed coding protocol was developed for the current research, informed by the methods used in mapping studies reported in the literature and cited above. The purpose was to provide a standard method for applying the classification to code records in the three data sets, and recording notes on issues encountered during the coding process. The following sub-sections describe key elements of the method employed for this research component: operational definition of the 'unit of classification' (3.4.1), record inclusion criteria (3.4.2), coding protocol (3.4.3), descriptive analysis of the coded data (3.4.4), and thematic analysis of the coding notes (3.4.5).

3.4.1 Defining the unit of classification for the ICHI public health data coding study

The 'unit of classification' is the entity to which codes of the classification are assigned. Clear definition of the unit of classification is essential to ensure consistent use of the classification – if different users apply the classification to different types of unit without making explicit how these relate to the primary 'unit of classification', this can undermine meaningful interpretation of the resulting data (Hoffmann & Chamie 1999). In ICHI Alpha 2016, 'health intervention' is defined as 'an act performed for, with or on behalf of a person or a population whose purpose is to improve, assess or modify health, functioning or health conditions' (Almborg et al. 2016; Madden et al. 2016; World Health Organization 2016d).

As discussed in Chapter 2, public health interventions are often complex and multi-component. Initial review of the data sets found that some records described multi-component interventions that could not adequately be captured by a single ICHI intervention code – for example, an intervention in the Netherlands data set involved delivering lessons to students aimed at preventing alcohol, tobacco and drug use, and also implementing improved school policies around drug use. It was decided that codes should be assigned at the level of intervention component, so that a multi-component intervention could be represented by a cluster of two or more ICHI codes. This raised the issue of how to

operationally define the unit of classification for public health interventions as a basis for assigning ICHI codes, to ensure consistent application of the classification.

There is considerable discussion in the public health literature concerning the nature of intervention components. In addressing the question of how complex, multi-component interventions can be standardised for evaluation, Hawe and colleagues (2004) propose that the *function of an intervention*, or its underlying *mechanism of action*, is the key feature: 'what should be defined as standard are the steps in the change process that the elements are purporting to facilitate or the key functions that they are meant to have' (p.1562). The form of the intervention (e.g., mode of delivery) may vary from setting to setting without changing the fundamental identity of the intervention (Hawe et al. 2004; Hawe & Potvin 2009); thus, interventions should be standardised by 'the function different components play in the theorized change process instead of imposing the same form of components on each site' (Hawe 2015, p.317). In their guide for public health intervention development, Wight and colleagues also distinguish between the change mechanisms, to be articulated in the program theory, and the methods for delivering them, which may be specific to a given local context (Wight et al. 2016). Other authors have emphasised the importance of specifying and reporting the *theoretically important components* (Durlak & DuPre 2008), *active ingredients* (Brownson et al. 2009), and *core elements* 'that embody the theory and internal logic of the intervention' (McKleroy et al. 2006). Understanding how components are intended to exert an effect is central to their identification as key components in the context of theorising the intervention (Armstrong et al. 2008; Moore et al. 2014; Mohler et al. 2015; Moore et al. 2015).

A key message from this literature is that, to properly characterise an intervention, it is important to identify its constituent components, and that the identity of these components relates to their function or hypothesised mechanism of action in achieving change, rather than their form. Those aspects of an intervention that are not critical to how it is intended to work can be modified to suit the local implementation context, and are not central to the identity of the intervention. It was decided that the unit of classification, as defined for the purpose of this study, should reflect this understanding of intervention components, in order to connect with contemporary thinking in the field on how public health interventions should be specified. Thus, the unit of classification for coding public health interventions, termed 'intervention unit' (IU), is operationally defined as follows:

> *An 'intervention unit' (IU) is a key functional component of an intervention with a distinct Target, Action and Means, where 'function' relates to an explicit or inferred mechanism of action (i.e., the hypothesised means by which the intervention will achieve the desired result).*

Identifying IUs therefore involves deciding, from the description provided, whether a given record within a data set comprises one or more key components distinguished by their hypothesised function or mechanism of action.

3.4.2 Record inclusion criteria

Inclusion criteria were specified to screen out records that could not feasibly be coded, either because they did not satisfy the ICHI definition of 'health intervention' or they did not include sufficient information to identify at least one intervention unit (IU). The following criteria were applied:

- It must be reasonable to regard the record as describing at least one 'health intervention', as defined in ICHI.
- It must be possible to identify at least one IU, as operationally defined. An IU must be a component of the intervention as it is intended to be implemented, and not merely an aspect of the implementation process (e.g., providing staff training materials to support delivery of the intervention).
- For at least one IU, there must be sufficient information to determine a Target and an Action (as defined in ICHI). (Sufficient information to determine a Means was not included as a criterion because, in many cases, the distinction between 'Action' and 'Means' was unclear in intervention descriptions, and a high proportion of ICHI codes have Means category ZZ 'Intervention using other method, without approach or not otherwise specified').

3.4.3 Coding protocol

A coding protocol was devised to standardise the process of applying ICHI to code intervention descriptions in the three data sets (see Appendix 3.2). The protocol was informed by a previous coding study conducted to test ICHI's coverage of nursing interventions (Fortune et al. 2017) and methods used in other mapping studies cited above, and by coding principles set out in the Australian Coding Standards (National Centre for Classification in Health 2010). The draft protocol was pilot tested on ten records randomly selected from the obesity prevention data set, which led to some minor refinements. A template spreadsheet was developed to accompany the protocol, with columns for each of the information fields to be recorded. The coding process set out in the protocol comprised the following steps:

1. ***Identify intervention units (IUs).*** Based on the descriptive information in the record, one or more 'intervention units' (as operationally defined above in Section 3.4.1) was identified. A short, one sentence description of each IU was written (IUs were individually numbered and extra rows added to the spreadsheet to accommodate multiple IUs per record, as needed).

2. ***Assign ICHI axis categories.*** Appropriate ICHI axis categories were recorded for each IU. Up to three Target and Action categories and up to two Means categories could be recorded. Where an ICHI axis category could not be found to match the Target, Action or Means concept identified for the IU, 'C' was recorded to denote a 'coverage issue'; where the information in the record was not sufficient to determine a Target, Action or Means for the IU, 'D' was recorded to denote a 'definability issue'.

3. ***Record notes on fit of ICHI axis categories.*** Brief notes were written on how well the ICHI axis categories captured the corresponding concepts in the IU, including whether or not the language used in ICHI axis category titles and/or definitions matched with the language used in describing the IU; 'GF' was recorded where the ICHI axis category was judged to be a good fit.

4. ***Assign an ICHI intervention code.*** An ICHI intervention code was recorded for each IU. Where an appropriate specific code could not be found for a given Target, a residual code of the form 'Other interventions…' (Action code 'ZY') was recorded.

5. ***Record notes on fit of ICHI intervention code.*** Brief notes were made on any issues concerning how well the ICHI intervention code captured the IU, e.g., where the code did not capture all aspects of the IU; 'GF' was recorded where the code was judged to be a good fit.

6. ***Additional notes.*** Any additional comments or observations made during the coding process were recorded, e.g., ease of identification of IUs, ambiguity in the record or in ICHI intervention code titles, axis category titles, or textual definitions.

3.4.4 Descriptive analysis of coded data

For each data set, the following descriptive analyses were conducted using the ICHI-coded data:

- Number of IUs per record
- Number of Target, Action and Means categories per IU
- Frequency distributions of ICHI Target, Action and Means categories
- Frequency distributions of ICHI intervention codes

These analyses illustrated the use of ICHI to provide summary profiles of each data set, grouping IUs by Target, Action, Means, and intervention code. Their purpose was to facilitate consideration of the utility of ICHI for providing meaningful summary information about the interventions included in each data set. In research component 3 (in-depth key-informant interviews, see Section 3.6, below) interviewees were asked to respond to the outputs of these analyses, in the form of data tables and figures, in terms of their usefulness.

3.4.5 Thematic analysis of coding notes

The coding notes generated in the process of applying ICHI to code descriptions of public health interventions in the three data sets are a source of qualitative data, akin to field notes or observational notes commonly recorded by researchers conducting qualitative studies. In qualitative data analysis, findings are built from the original, often textual, data using a systematic process of developing and applying an organising conceptual structure (Ritchie & Lewis 2003). 'Thematic analysis' is an umbrella term used to describe a range of qualitative data analysis techniques employed as a way of 'identifying, analysing and reporting patterns (themes) within data' (Braun & Clarke 2006, p.79). Several authors have provided step-by-step guides to conducting thematic analysis (Ritchie & Lewis 2003; Braun & Clarke 2006; Gale et al. 2013; Brooks et al. 2015). Common elements in the methods described are the generation of codes (i.e., descriptive labels that are assigned to meaningful units identified within the data), systematic application of these codes to the full data set (often termed 'indexing'), development of a thematic framework based on the codes, and a method for linking the raw data to the elements of the thematic framework. Hallmarks of thematic analysis are a deep engagement with the raw data, and an iterative process through which the researcher continually moves between the data and the analytic structure, refining the structure to fit with the data, as well as to meet the needs of the research.

A theme can be defined as 'something important about the data in relation to the research question, and represents some patterned response or meaning within the data set' (Braun & Clarke 2006, p.82), or an interpretive concept or proposition that describes or explains an aspect of the data (Gale et al. 2013). The researcher plays an active role in deciding what counts as a theme, and also in deciding whether to adopt a deductive or inductive approach in analysing the data. A deductive approach involves use of a pre-existing coding frame (e.g., based on prior research or theory), while an inductive approach involves generating themes from the data through the process of open coding; a combined deductive-inductive approach is common (Gale et al. 2013). Thus, themes do not 'emerge' from the data but are articulated by the researcher, and the final analytic account is influenced by decisions made at the outset and as the analysis proceeds. The thematic framework produced assists the researcher in developing a coherent, logical account that is based firmly in the data (Ritchie & Lewis 2003).

Thematic analysis was used to extract findings from the coding notes to address the research questions. The content of the coding notes was very granular; for example, notes often concerned specific details such as the wording of an axis category definition or difficulty deciding whether multiple IUs should be identified for a particular record. Because the content of the notes can be related most immediately to steps in the coding process, the coding protocol was used as a basis for defining an *a priori* coding frame consisting of the following broad categories: Intervention units;

Targets; Actions; Means; Intervention codes; Other. Open coding was conducted within this broad structure, with descriptive labels generated to describe different types of issues under each of these headings. Unique IU identifiers were used to record IUs against each code within the developing thematic framework. Through an iterative process, the structure of detailed codes produced by the 'first cut' analysis was refined by combining some codes to produce a logically coherent structure with hierarchically-nested themes.

Analysis was conducted separately for the three data sets. The common high-level structure of the *a priori* coding frame enabled comparison between the data sets in terms of the different types of issues identified under each of the broad headings. The level of detail of the final thematic framework for each data set reflected a trade-off between the retention of specific information relevant to future modification of the classification to improve its utility, and sufficient generalisation so that the resulting account could inform an overall appraisal of the classification. In thematic analysis, the objective is not to measure the prevalence of different themes – quantification of themes would not be meaningful because the 'sampling in qualitative research is not designed to be representative of a wider population, but purposive to capture diversity around a phenomenon' (Gale et al. 2013). In the context of this research, an issue identified only once or twice across the three data sets could be an issue that affects the majority of records in another data set, and should not be considered less important by virtue only of its low prevalence.

3.5 Research component 2: Inter-coder comparison study

The aims of this research component are:

1. To measure rates of inter-coder agreement as an indication of the reliability of ICHI-coded data
2. To explore the nature of and reasons for coding discrepancies in order to inform improvement of the classification

Coding discrepancies have implications for reliability and the level of confidence that may be placed in ICHI-coded data. The concept of reliability concerns the reproducibility of data generated using a coding scheme or assessment instrument. Measures of reliability provide an indication of the extent to which similar data will be produced under different circumstances for a given set of units coded or rated (Streiner et al. 2015). Reliability studies commonly investigate agreement between different users (inter-rater reliability) and/or the stability of rating or coding produced by a single user (intra-rater reliability) (e.g., Nilsson et al. 2000; Ross et al. 2004; Soberg et al. 2008; Stausberg et al. 2008; Kohler et al. 2013). Reliability is a fundamental requirement that must be met if the data produced through the application of a classification are to serve the purposes for which they are collected (Ogonowski et al. 2004; Kronk et al. 2005; Madden et al. 2007a; Stausberg et al. 2008).

In the context of my overall research design, as described in Section 3.2, my interest here is in exploring differences between coders in their interpretation of classification categories, and how categories relate to the interventions described. The method used in this research component follows the general approach for inter-coder comparison studies, which usually involve two or more coders independently applying a coding scheme to a sample of units, and is described in Section 3.5.1. Data analysis is described in Section 3.5.2.

3.5.1 Gathering the inter-coder comparison data

For a classification scheme, inter-coder agreement concerns the extent to which independent users agree on the coding of individual units (Ross et al. 2004). Inter-coder comparison studies may be used to identify changes needed to improve a classification, or to investigate the effects of changes made (e.g., Hilfiker et al. 2009; First 2016; Reed et al. 2018). In the context of the developmental appraisal of ICHI, the main purpose of this research component is to gain an understanding of the nature of and reasons for coding discrepancies in order to inform changes needed, not to provide a summative assessment of reliability. Therefore, it is important to examine the step-by-step process of ICHI code assignment, to identify specific sources of disagreement (Keeley et al. 2016).

For each of the three data sets, 50 records were randomly selected for use in the inter-coder comparison study. Three additional coders (one per data set) were identified through the researcher's professional networks. The professional background and classification experience of the coders is outlined in Chapter 5 – Box 5.1. Data records were independently coded by the additional coders, in accordance with the coding protocol (Appendix 3.2). Results at each step of the coding process were compared with results of the initial coding conducted by the researcher in the first research component.

3.5.2 Analysis of the inter-coder comparison data

In analysing the inter-coder data, two types of comparisons were made for each data set:

- Comparison of ICHI axis category and ICHI intervention code assignment between the two coders for 'equivalent intervention units'; and
- Comparison of the overall profile of the coded data set between the two coders.

Because the two coders could identify different numbers of IUs per record, it was necessary to identify 'equivalent IUs' in order to compare codes assigned. Further detail on this step of the analysis is provided in Chapter 5. Inter-coder agreement rates for Target, Action, Means and intervention code assignment were calculated based on equivalent IUs. Comparison of the overall profile of the coded data between the two coders (i.e., frequency distributions of all coded IUs by Target, Action, Means

and intervention codes) was conducted to explore the effects of different coding choices on the summary view provided by the coded data.

Reasons for discrepancies between coders were investigated by comparing IU wording, axis category assignment, and intervention code assignment for each coder, record by record; coding notes were used to help determine likely explanations for differences in code assignment. Patterns were sought, so that apparent reasons for discrepancies could be grouped into types, thus providing a basis for identifying issues that should be addressed in order to improve the reliability of ICHI-coded data.

Inter-coder agreement was calculated as percentage agreement for each pair of coders, that is, the number of equivalent IUs for which both coders assigned the same axis category or intervention code, as a percentage of all equivalent IUs. In reliability studies, it is conventional to report inter-rater agreement coefficients that quantify the extent of agreement among raters with some adjustment for chance agreement, as a basis for comparing results for different instruments or different studies (Gwet 2014). The rationale for this is that 'a certain amount of agreement is to be expected by chance' (Cohen 1960), and agreement attributable to chance should be excluded from the overall measure. Researchers may choose from several coefficients that differ in various ways, including how they calculate the amount of agreement expected by chance in order to exclude it (Gwet 2014; Streiner et al. 2015). There is considerable discussion in the literature about the relative merits of different coefficients, and several authors have pointed out the importance of understanding the sensitivities of a given coefficient to data characteristics, such as the distribution of coding responses across categories, and how this may affect the conclusions that can be drawn and the ability to meaningfully compare coefficients between studies (Cicchetti & Feinstein 1990; Feinstein & Cicchetti 1990; Gwet 2002; Ross et al. 2004; Gwet 2014). I have chosen to use percentage agreement as a straightforward and intuitive measure of the *actual* level of agreement. This may include some 'chance' agreement, but can nonetheless be concretely interpreted in terms of the percentage of units likely to be affected by coder disagreement – if a high percentage of units in a given coded data set might have been coded differently by another coder, this undermines the confidence that may be placed in the data. The level of disagreement that is deemed acceptable will depend on the purpose for which the data are to be used.

In the context of this developmental appraisal of ICHI, there is a particular interest in those instances in which coders disagree in their assignment of axis categories and intervention codes. Knowing how often disagreement occurs is necessary for considering the confidence that may be placed in ICHI-coded data; understanding why disagreements occur can shed light on the nature of the impact this might have on the data generated (e.g., does disagreement happen more for certain categories, or for certain types of intervention?). Together, measures of coding agreement (and disagreement),

investigation of coding discrepancies at individual record level, and comparison of overall data profiles between coders, provide a strong basis for diagnosing problems and suggesting changes to the classification needed to improve the reliability of data produced through its use (First 2016).

3.6 Research component 3: In-depth key-informant interviews

The aim of this component of the research is to gather input from potential classification users concerning the utility of ICHI. In-depth, semi-structured interviews were conducted to obtain feedback from key-informants familiar with each of the data sets used for the ICHI public health data coding study, concerning the structure and content of the draft classification and its utility for representing and analysing data on public health interventions.

3.6.1 Conduct of the in-depth key-informant interviews

As a qualitative research method, in-depth interviews provide a means of gathering rich information from participants concerning their experiences, views and perspectives on a particular subject (Rice & Ezzy 1999; Ritchie & Lewis 2003). The interviewer has an active role in the interview process, which takes the form of an in-depth, interactive exploration, with the aim of achieving breadth of coverage across key issues and sufficient depth of coverage within each (Ritchie & Lewis 2003). Rather than being simply a way to capture pre-existing information and views held by the participant, meanings and interpretations may be constructed and evolve during the interview itself, often with both interviewer and participant having a role to play in this process. The researcher's role is as facilitator, using 'a range of probes and other techniques to achieve depth of answer in terms of penetration, exploration and explanation' (Ritchie & Lewis 2003, p.141).

In-depth interviews combine structure with flexibility; they can be seen as lying on a continuum, positioned between the structured interviews characteristic of survey research and unstructured, open-ended interviews (Rice & Ezzy 1999). For this research component, a short (10 question) interview schedule was developed to provide a basic structure. This was supplemented during the interview with prompts (additional questions to elicit responses on more detailed issues concerning the classification) and probes (follow-up questions to encourage the participant to further explain or expand on an issue) (Ritchie & Lewis 2003). The interview schedule was designed to elicit responses from participants on the classification axes, axis categories, ICHI-coded data, and the operational definition of 'intervention unit', both in relation to the particular data set in question, and in relation to information on public health interventions more broadly (Appendix 3.3 – interview schedule).

The objective was to interview up to three participants for each of the data sets included in the study, with participants for each data set representing a range of different perspectives in terms of their relationship to the data set and their associated information needs. Participants were identified through

personal networks and by asking primary contacts for each data set if they could suggest others who might be willing to participate. Prior to their interview, each participant was sent a document providing information about ICHI, a link to the online browser version of ICHI Alpha 2016, and summary results of the ICHI public health data coding study for their data set, as well as the interview schedule, a Participant Information Statement and a Participant Consent Form.

Ethical approval to conduct the interviews was obtained from the University of Sydney Human Research Ethics Committee (Project number 2016/809; see Appendix 3.4). A pilot interview was conducted with two health promotion researchers. Notes on the pilot interview process and feedback provided by the participants informed refinement of the interview materials, including the interview schedule.

3.6.2 Thematic analysis of key-informant interview data

All interviews were electronically recorded, and detailed transcripts were produced. The transcripts were used as a basis for conducting a thematic analysis using a method adapted from those described in the literature (Ritchie & Lewis 2003; Braun & Clarke 2006; Gale et al. 2013; Brooks et al. 2015) and discussed above (Section 3.4.5). As is typical for thematic analysis, the process involved repeatedly reading over the interview transcripts and iteratively refining the structure of the developing thematic framework. The method consisted of the following steps:

Step 1. Identifying 'message units'. Each transcript was read carefully and 'message units' identified – these were discrete comments, views, points, or questions expressed by the participant. Message units were uniquely numbered and collated for each interview.

Step 2. Grouping message units into topics and sub-topics. The message units from all interviews were grouped together under the headings of the *a priori* coding frame used for the thematic analysis of coding notes (Section 3.4.5): Intervention units; Targets; Actions; Means; Intervention codes; Other. These broad topic headings correspond to the key aspects of the classification to which interview participants were asked to respond. Some additional topic headings were generated inductively during the analysis. Message units within each topic were further grouped into sub-topics, which were generated inductively based on the content of the message units.

Step 3. Articulating themes within sub-topics. Themes were identified as separate points or views expressed on a particular sub-topic. Each theme was articulated as a sentence, drawing on the message units identified for that theme. These theme sentences represented the finest level of detail in the thematic framework produced. For each sub-topic the themes articulated were used to draw together the key messages, which were written up as a paragraph of text.

3.7 Contributions of this research

This developmental appraisal of the draft classification of public health interventions in ICHI fits within the tradition of case study research (Gillham 2000; Flyvbjerg 2006; Creswell 2013). As discussed in Chapter 2 and illustrated by a comparison of the three reference classifications of the WHO-FIC, classifications vary greatly in their structure, content, purpose, and methods of development. While it is not my intention to generalise my findings to classifications more broadly, the insights gained can be expected to have relevance for others involved in classification development and for scholars of classification. In social science research, the accumulation of context-situated knowledge in the form of case studies is essential in developing depth of knowledge and real understanding in any area of learning (Flyvbjerg 2006). This, indeed, is a major contribution of Bowker and Star's (1999) book – through their in-depth investigation of a variety of classifications, they illustrate the commonalities and differences, and weave their case studies together into a dense fabric of knowledge and understanding.

The primary purpose, and immediate importance, of this research is to contribute to the development and improvement of the classification of public health interventions in ICHI, and this is the focus of the two research questions set out in the introductory chapter. However, I hope also to make valuable conceptual and methodological contributions to a growing body of knowledge concerning the development and use of statistical classifications, viewed not merely in technical terms as instruments for data collection and analysis, but also as information artefacts that reflect socially constructed meanings and embody cultural and political values and agendas. Thus, it is my intention to respond to Bowker and Star's call for a more conscious and critical approach to the development and use of classifications.

The framework of criteria relating to the characteristics required of a statistical classification, and the 4-tier model representing the main elements or layers of a statistical classification, together provide the analytic structure within which the findings from the three research components are brought together to address the research questions. While this structure may be seen as essentially technical in nature, I apply it in light of a more sociological understanding of the interactions between classifications and the real-world contexts in which they are developed and used. This research will offer the framework and model as new tools for use in the development and developmental appraisal of statistical classifications, and illustrate the value of bringing an explicitly social constructionist perspective to bear on the technical work of classification development.

Before presenting the results of this study in the following chapters, it is necessary to acknowledge the nature of my role as researcher, and to consider the influence my particular background and interests might have on my approach to the research and how I interpret the research findings. Reflexivity is a

central value in social science research, flowing from an acceptance that 'objectivity' of the researcher is not practically attainable or even meaningful as an ideal to strive towards; rather, the researcher's role in shaping the research should be made explicit through embracing practices of self-disclosure and critical self-scrutiny (Crotty 1998; Rice & Ezzy 1999; Blaikie 2000; Darlaston-Jones 2007; Creswell 2013). My history of work with WHO-FIC classifications and membership of the WHO-FIC network is clearly relevant in this regard. I was involved in the development and early implementation of the ICF and have continued to interact with it in a variety of ways over the years since its completion in 2001, including participating the ICF update process managed by the WHO-FIC Functioning and Disability Reference Group (http://www.who.int/classifications/committees/fdrg/en/). I have also had input into the ICD-11 revision process, and have used the ICD in various research projects over the years, including a project aiming to develop a basis for collecting comparable hospital utilisation data and indicators across European Union Member States (European Commission 2003). Most importantly, I have been closely involved in the development of ICHI since 2011, particularly focusing on public health content within the broader classification.

My interest in classification goes back further, however, to my training in botany. Classifications of biological taxa are quite different in nature from statistical classifications, but they are no less socially constructed; like all classifications they interact with the social worlds in which they are developed and used, and can operate to shape the 'reality' they classify (Dupré 1993; Dupré 2001; Raposo et al. 2017). I have long been attracted by the sense of order classifications suggest may be possible. In my work involving classification development and use, I have frequently found myself driven by a desire to achieve conceptual purity and a robust and logical framework for information; very often I have been frustrated. Reading the work of classification theorists as I embarked on this research has been a revelation for me. It is exciting to have the opportunity to bring their insights to bear in setting out to appraise the draft classification of public health interventions in ICHI.

The scope for my own interests and perspective to shape this research is perhaps magnified because of the methods I have chosen to employ. In the first component of the research design (ICHI coding of data on public health interventions), *I* apply the draft classification to the three data sets, and the coding notes reflect issues noted by *me*; in the second component (inter-coder comparison), *I* am one of the two coders for each data sample; in the third component, interviewees respond to summary data that reflects *my* application of ICHI to the data set they are familiar with, and because of the conversational style of the interviews, *my* interests may at times guide the interview in a particular direction. The research findings must be considered with this in mind. Nonetheless, I have endeavoured to minimise the influence of my own interests and perspective on the research. I am conscious to avoid focusing too much on issues that have become 'bees in my bonnet' through my

work over the years as a member of the ICHI development team, and strive to be open to the full range of issues that may be interrogated through the data. Application of the framework of criteria is helpful for ensuring a thorough and systematic approach in this regard.

Being close to the subject of the research does not necessarily imply a higher risk of bias or subjectivity. Flyvbjerg (2006) contrasts the in-depth, qualitative methods typical of case study research with quantitative research methods in which choices made early on about categories and variables can limit what is in view. The very closeness of the researcher to the subject of study means that there is more opportunity for the researcher's preconceptions to be corrected by the data, and the intense observation that is characteristic of case study is conducive to producing new insights: 'The case study contains no greater bias toward verification of the researcher's preconceived notions than other methods of inquiry. On the contrary, experience indicates that the case study contains a greater bias toward falsification of preconceived notions than toward verification.' (Flyvbjerg 2006, p.237).

The following three chapters present results of the three research components. In Chapter 7, findings from the three components are brought together under the twelve headings of the framework of criteria (Box 2.2), to examine the extent to which the draft classification of public health interventions in ICHI exhibits the desired features of a statistical classification. The findings are then further considered using the structure of the 4-tier model (Figure 2.2), to locate the origins and manifestations of particular problems and issues identified, and to consider how they might be addressed. Detailed findings from the three research components, and associated proposals for changes to the classification, are set out in Appendix 7.1, which is intended as a resource to inform the further development of ICHI.

4. Research Component 1: ICHI Public Health Data Coding Study

This chapter reports results of the first research component, in which the draft classification was used to code descriptions of public health interventions within three existing data sets. The aim of this component is to explore the interaction between the classification and the domain classified, as manifested through the three data sets, which are taken to express both information needs of stakeholders and how interventions are understood by stakeholders.

The three data sets have been described in Section 3.4. They are:

- the 'OPAL data set', comprising project records extracted from a South Australian obesity prevention program database, the 'OPAL Single Platform' – a sub-national or program-level data set;
- the 'Netherlands data set', comprising intervention descriptions extracted from an online inventory of lifestyle interventions in the Netherlands, the RIVM Centre for Healthy Living interventions database – a national-level data set; and
- the 'Tobacco Control data set', comprising indicators used for monitoring global implementation of the WHO Framework Convention on Tobacco Control – an international-level data set.

The method for this research component has been described in Section 3.4, and is briefly summarised below in Section 4.1. Results are presented in the following two sections: descriptive analysis of the ICHI-coded data (Section 4.2) and thematic analysis of the coding notes (Section 4.3). Section 4.4 highlights the main findings of this research component. Additional detailed findings are included in Appendix 7.1 (Detailed findings to inform further development of ICHI).

4.1 Methods

The inclusion criteria (see Section 3.4.2) were applied to each record in each of the three data sets, to screen out records that did not satisfy the ICHI definition of 'health intervention' or did not include sufficient information to identify at least one intervention unit (IU). Coding of included records was based on textual descriptions of interventions provided in the three data sets. The coding process followed the steps set out in the coding protocol (see Appendix 3.2):

1. ***Identify intervention units (IUs).*** More than one IU per record could be identified; a short, one sentence description of each IU was written.

2. ***Assign ICHI axis categories.*** Up to three Target and Action categories and up to two Means categories could be recorded per IU; where an applicable ICHI axis category could not be found, 'C' was recorded to denote a 'coverage issue'; where the information in the record was not sufficient to determine Target, Action or Means, 'D' was recorded to denote a 'definability issue'.
3. ***Record notes on fit of ICHI axis categories.*** Brief notes were recorded on how well the ICHI axis categories captured the corresponding concepts in the IU.
4. ***Assign an ICHI intervention code.*** A single ICHI intervention code was recorded per IU.
5. ***Record notes on fit of ICHI intervention code.*** Brief notes were recorded on any issues concerning how well the ICHI intervention code captured the IU.
6. ***Additional notes.*** Additional comments or observations made during the coding process were recorded.

The coding process was recorded within a template spreadsheet, with columns for each of the information fields to be recorded (Figure 4.1). On completion of coding for the three data sets, descriptive analyses were conducted using the ICHI-coded data, and thematic analyses of the coding notes were undertaken.

No.	Name	Intervention Unit	T-cod	T-cod	T-cod	A-cod	A-co	A-co	M-c	M-c	T-notes	A-notes	M-notes	ICHI-Code	ICHI Descriptor	Code-notes	Addition
27	Prepared in t	Digital learning program to influence	VAA	VAB		PM			C		GF	Definition c	Mixed - dig	VAA PM ZZ	Education about i	Does not capt	Descrip
28	Grow up with	Course of three group sessions to hel	VEF			PM			QB		Too narrow	GF	GF	VEF PM QB	Education about :	T too narrow	Ecologi
29	Do not misur	Group education sessions on topics c	SSM	VEF		PM			C		Dual target	ICHI definiti	Video vign	SSM PM ZZ	Education about i	Does not capt	Variabl
30.1	The healthy :	Lessons delivered to students aimed	VAA	VAB	VAC	PM			QB		3-T	GF	GF	VAA PM QE	Education about i	Doesn't captu	Descrip
30.2	The healthy :	Creating and maintaining good schoo	VAA	VAB	VAC	C			D		3-T	Developing,	Not descril	VAA ZY ZZ	Other interventio	Need A for policy devel	
31	Barcode - de	Course delivered to hospitality staff a	VAA	VAC		PH			QB		GF - dual T	Training an	GF	VAA PH ZZ	Training to influe	VAA PH QB mi	Doesn't
33	Girls' Choice	Facilitated board game for girls addre	VEF			PM			C		Sexual beha	ICHI definiti	M is facilit	VEF PM ZZ	Education about :	Code does no	Variabl
34	Smaaklesse	Course of five lessons aimed at gettir	VEA			PM			QB		GF	Definition r	Does cours	VEA PM QB	Education about	Doesn't capture intera	
35	Super Chefs	Series of cooking workshops for child	VEA			PH	PM		QB		GF	Mix of educ	OK	VEA PH ZZ	Training to influe	VEA PH QB missing; trai	
36	Relationship	Course of lessons delivered to childre	VEF			PM			QB		Narrow: cur	GF	GF	VEF PM QB	Education about :	Doesn't captu	IU frame

Figure 4.1: Screen shot showing coding within template spreadsheet

In addition to the textual descriptions on which ICHI coding was based, each of the data sets also contained other information about interventions, which may be regarded as representing expressed information needs of stakeholders – dimensions of information that are seen as useful for understanding or grouping interventions in the context of that particular data set. These dimensions of information were recorded to enable consideration of whether they are (or could be) captured in ICHI axes or extension codes, and any implications of their not being captured by the classification.

Detailed information about the selection and extraction of data records for coding is provided in Section 3.3. Data coding, analysis of the coded data, and thematic analysis of the coding notes for the three data sets was undertaken over the period from August 2016 to April 2017. Data coding and analysis of the coded data was conducted using Excel. Data and analysis files for the Netherlands and Tobacco Control data sets, and data analysis files for the OPAL data sets were stored on a password-protected laptop. Data files for the OPAL data set that included OPAL project records were stored on

an encrypted USB device in a locked filing cabinet, in accordance with data security requirements stipulated in the Licence Agreement for that data set. All coding and analysis for this research component was conducted by the researcher.

4.2 Results – ICHI-coded data on public health interventions

This section reports on preparation of records for coding by application of the inclusion criteria, then presents descriptive analyses of the ICHI-coded data. Comparison of ICHI-coded data for the three data sets illustrates how ICHI may be used to summarise and characterise sets of data on public health interventions, highlighting similarities and differences. Finally, other dimensions of information identified in the three data sets are reported.

4.2.1 Screening intervention records against inclusion criteria

Determining whether or not a given record met the inclusion criteria was sometimes not clear-cut; the practice adopted was to err towards inclusion, on the grounds that applying ICHI to code records at the boundaries of the classification domain could provide valuable insights. The number of records excluded and reasons for exclusion are summarised here for the three data sets:

> ***OPAL data set***. Thirteen records were excluded (7% of the 200 records). Common reasons for exclusion were that the description of what was done was unclear or that the record described implementation activities rather than the intervention delivered (e.g., providing funding or training staff in using an intervention resource). Two records were excluded because they described promoting OPAL itself as a program and were judged not to constitute health interventions according to the ICHI definition; however, several similar records were not excluded, with their inclusion noted as a 'close call' (e.g., a record describing articles published in a local newspaper to raise awareness of OPAL Goals, Themes and activities).
>
> ***Netherlands data set***. Twenty records were excluded (11% of the 186 records). The majority of these were multi-component interventions for which intervention components were not described clearly enough to identify them as IUs with distinct Targets and Actions. Three records were excluded because the main objective was to increase sports club membership and a health purpose was not expressed, thus they did not meet the ICHI definition of 'health intervention'; however, several records describing interventions that aimed to increase club membership were included where a health purpose was also expressed.
>
> ***Tobacco Control data set***. This data set was different in nature, comprising a list of indicators rather than descriptions of individual interventions delivered. Of the 228 indicators in Annex 1 of the 2016 global progress report (World Health Organization 2016a), 159 (70%) were

excluded. An indicator was included if it could readily be interpreted as an intervention with identifiable Target and Action, for example, 'Tobacco smoking banned in all public places' was included. Indicators that only provided additional information about an intervention were excluded, for example, 16 indicators relating to the comprehensiveness of smoking bans in different settings were excluded ('Comprehensiveness of protection in government buildings', 'Comprehensiveness of protection in airplanes', etc.). There were several groups of indicators within which individual indicators differed only in terms of variables not captured by the ICHI axes, such as service setting or profession. These indicators were collapsed into a single record, and the variable used to differentiate indicators within the group was noted (see Table 4.3, below). For example, a group of nine indicators concerning counselling services provided by different professionals ('Dentists offering counseling services', 'Family doctors offering counseling services', etc.) was collapsed into 'Tobacco cessation counselling offered by health professionals and community workers'. Some indicators were excluded because the nature of interventions related to the indicator was not sufficiently clear. For example, 'viable alternatives for tobacco growers promoted' was excluded because there was not enough information provided to identify an Action concept.

4.2.2 Descriptive analysis of the ICHI-coded data

This section presents an overall summary of the results of ICHI coding for each of the data sets (Table 4.1), followed by descriptive analyses based on frequencies of ICHI axis categories and intervention codes assigned to intervention units (IUs).

For each record, the first step was to identify one or more IUs from the descriptive information provided. The term 'record' is used to include OPAL project records, intervention records in the Netherlands data set, and indicators in the Tobacco Control data set. As shown in Table 4.1, the data sets varied in terms of the proportion of records with single versus multiple IUs. All records in the Tobacco Control data set had a single IU, whereas for the OPAL and Netherlands data sets some records had two or more IUs (2% and 11%, respectively); in the Netherlands data set, there were 26 records with two IUs and 11 records with between three and seven IUs. Intervention units, not records, are used as the unit of analysis. It should be noted that the descriptive analyses of ICHI-coded data presented in the tables and figures below show the percentage of IUs for which different ICHI axis categories were assigned, but the sum of these percentages across axis categories may be greater than 100% because more than one category for each axis could be assigned per IU. For intervention codes, percentages do sum to 100 as a single code was assigned per IU.

Table 4.1: Summary results of ICHI coding for the three data sets

	OPAL	Netherlands	Tobacco control
Records and intervention units (IUs):			
Records (N)	200	186	228
Records excluded (% of all records)	7%	11%	70% [1]
Records coded (N)	187	166	69
Coded records with single IU (%)	98%	79%	100%
IUs (N)	194	219	69
ICHI axis categories:			
Target categories (N)	8	23	3
Targets accounting for ≥10% of IUs (N)	2	3	2
IUs with >1 Target (%) [2]	15%	21%	59%
IUs with 'missing' Target (%) [2, 3]	2%	0%	0%
Action categories (N)	11	20	16
Actions accounting for ≥10% of IUs (N)	3	4	4
IUs with >1 Action (%) [2]	13%	29%	16%
IUs with 'missing' Action (%) [2, 3]	26%	13%	6%
Means categories (N)	3	5	6
Means accounting for ≥10% of IUs (N)	0	1	1
IUs with 'missing' Means (%) [2, 3]	96%	72%	39%
ICHI intervention codes:			
ICHI intervention codes (N)	23	60	18
ICHI codes accounting for ≥10% of IUs (N)	2	3	3
IUs with 'ZY ZZ' codes (%) [4]	28%	24%	26%

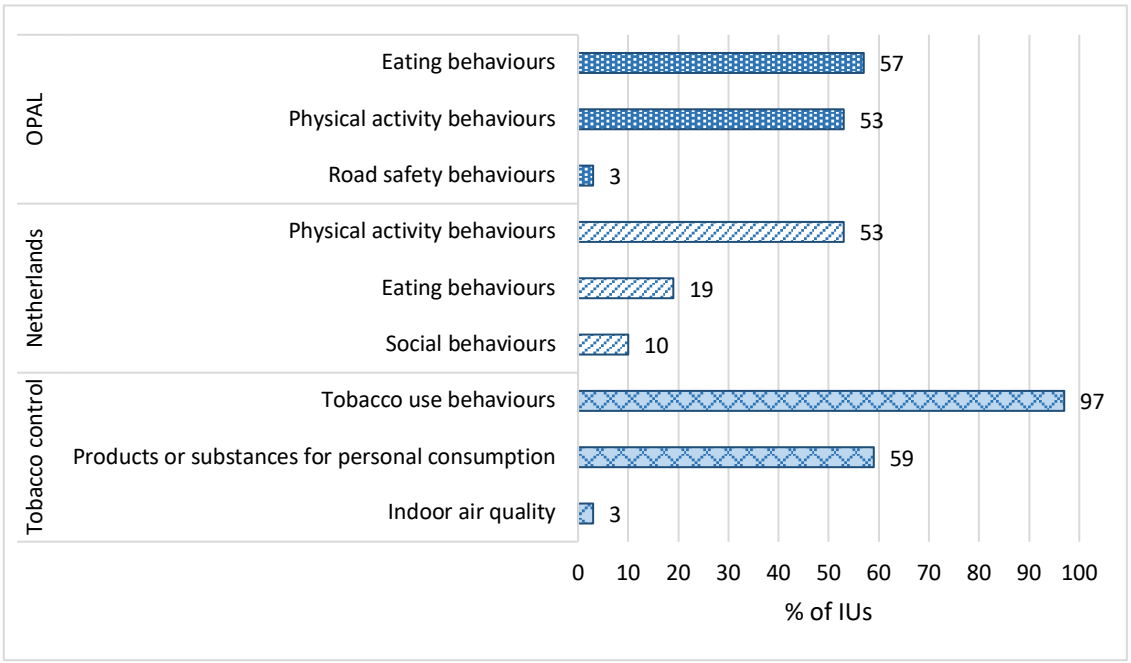
1. This includes 111 indicators that did not meet the inclusion criteria plus 48 indicators that were collapsed together with other indicators and thus not coded separately – see explanation in text (Section 2.4.1).

2. Percentages are calculated using the following denominators: OPAL N=194; Netherlands N=219; Tobacco control N=69.

3. 'Missing' indicates that an ICHI axis category could not be found to match a Target, Action or Means concept identified for the IU (a 'coverage issue') or that the information in the record was not sufficient to determine a Target, Action or Means for the IU (a 'definability issue').

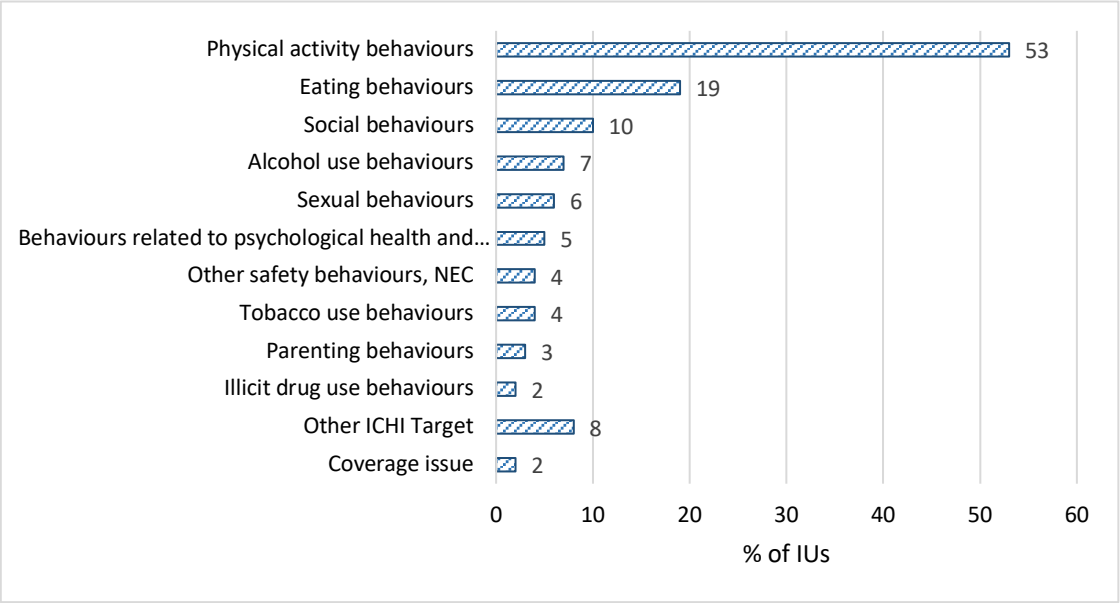
4. 'ZY ZZ' codes are residual intervention codes that have a specific Target but other/unspecified Action and Means, and code titles of the form 'Other interventions … not elsewhere classified'.

The three data sets varied considerably in terms of the number of ICHI Target categories represented in the coded data, with only three Targets represented in the Tobacco Control data set and 23 in the Netherlands data set (Table 4.1). There was also variation in the proportion of IUs for which more than one Target was assigned, which was highest for the Tobacco Control data set (59%) and lowest for OPAL (15%). 'Eating behaviours' and 'Physical activity behaviours' were the top two Targets for the OPAL and Netherlands data sets, while 'Tobacco use behaviours' and 'Products or substances for personal consumption' were most common for the Tobacco Control data set (Figure 4.2). Figure 4.3 shows the range of different Target categories assigned to IUs in the Netherlands data set.



Percentages are calculated using the following denominators: OPAL N=194; Netherlands N=219; Tobacco control N=69. Percentages may sum to more than 100 as more than one Target can be assigned per IU.

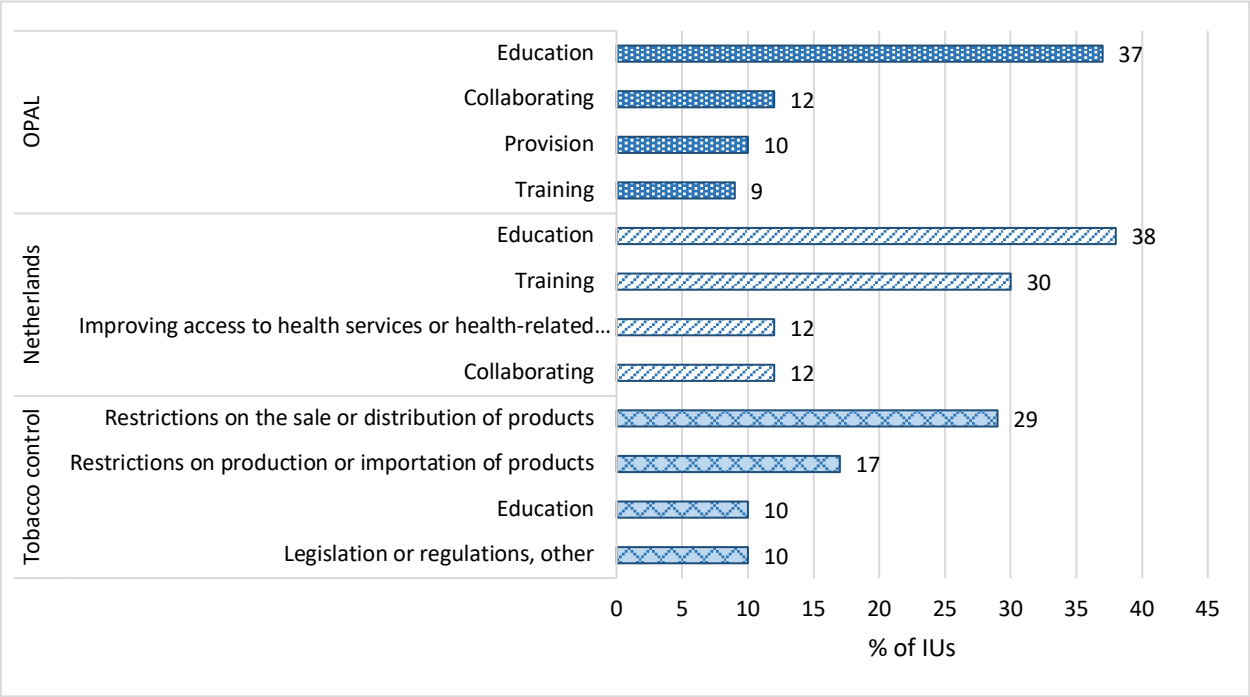
Figure 4.2: Frequency of top 3 Target categories for each data set



N=219. Percentages sum to more than 100 as more than one Target can be assigned per IU.

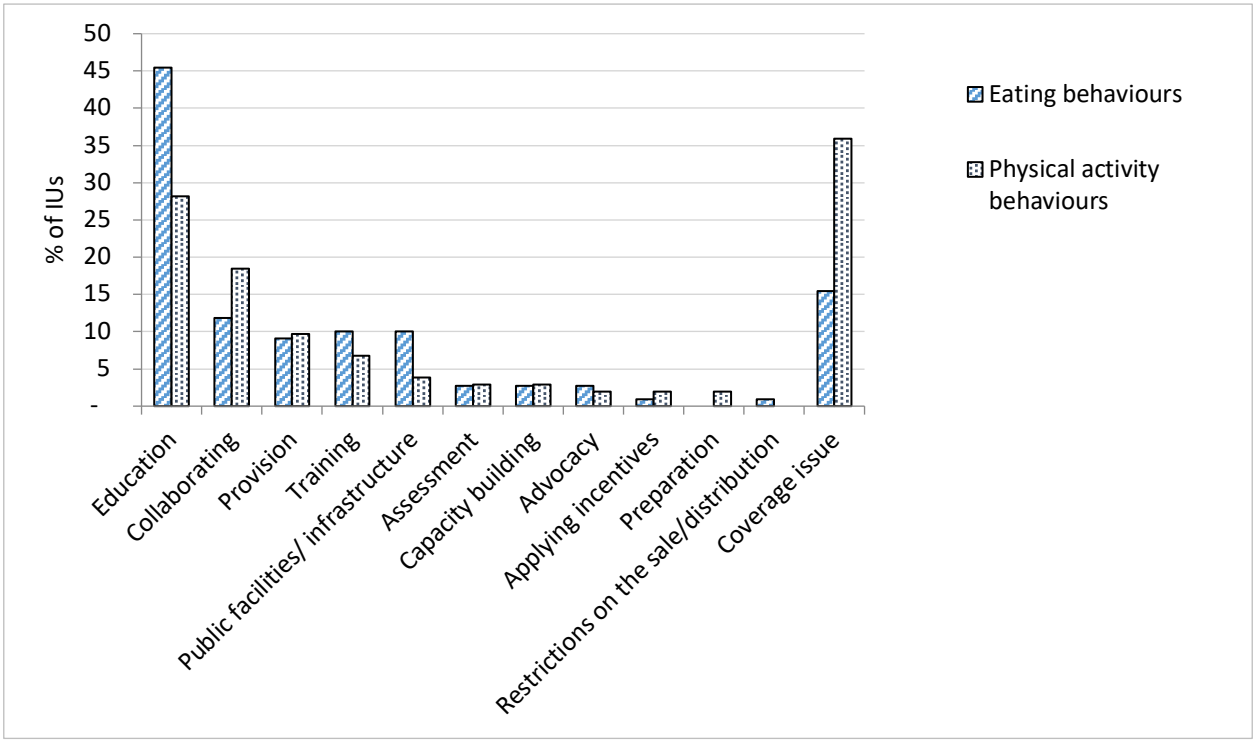
Figure 4.3: Netherlands data set – frequency of ICHI Target categories assigned

There was also variation between data sets in the number of ICHI Action categories represented in the coded data, ranging from 11 in the OPAL data set to 20 in the Netherlands data set, and the proportion of IUs for which more than one Action was assigned (Table 4.1). 'Education' was the most common Action for both the OPAL and Netherlands data sets, assigned for 37% and 38% of IUs, respectively, compared with only 10% of IUs in the Tobacco Control data set (Figure 4.4). 'Training' and 'Collaborating' ranked among the top four Actions in the OPAL and Netherlands data sets; in the Tobacco Control data set the top two Actions were regulatory in nature ('Restrictions on the sale or distribution of products' and 'Restrictions on the production or importation of products'). Figure 4.5 shows how ICHI Actions varied by Target in the OPAL data set, for the two most frequently assigned Target categories. 'Education' was more commonly recorded for IUs with Target 'Eating behaviours', while 'Collaborating' was more common for IUs with Target 'Physical activity behaviours'. Action coverage issues (i.e., no ICHI Action available to capture an Action concept identified) were more commonly recorded for IUs targeting physical activity behaviours (36%) than for IUs targeting eating behaviours (15%).



Percentages are calculated using the following denominators: OPAL N=194; Netherlands N=219; Tobacco control N=69. Percentages may sum to more than 100 as more than one Action can be assigned per IU.

Figure 4.4: Frequency of top 4 Action categories for each data set



Percentages are calculated using the following denominators: Eating behaviours N=110; Physical activity behaviours N=103. Percentages may sum to more than 100 as more than one Action can be assigned per IU.

Figure 4.5: OPAL data set – frequency of Actions for Targets 'Eating behaviours' and 'Physical activity behaviours'

In all three data sets, a high proportion of IUs had no Means category assigned (Table 4.1), either because an ICHI Means could not be found to match the Means concept identified for the IU (a 'coverage issue') or because there was not sufficient information in the record to determine a Means (a 'definability issue')[6]. The number of Means categories represented in the coded data ranged from 3 in the OPAL data set to 6 in the Tobacco Control data set. In the Tobacco Control data set, ICHI Means 'Enactment' accounted for 51% of IUs, 'Enforcement' for 4% of IUs, and the other 4 Means represented accounted for just 1% of IUs each.

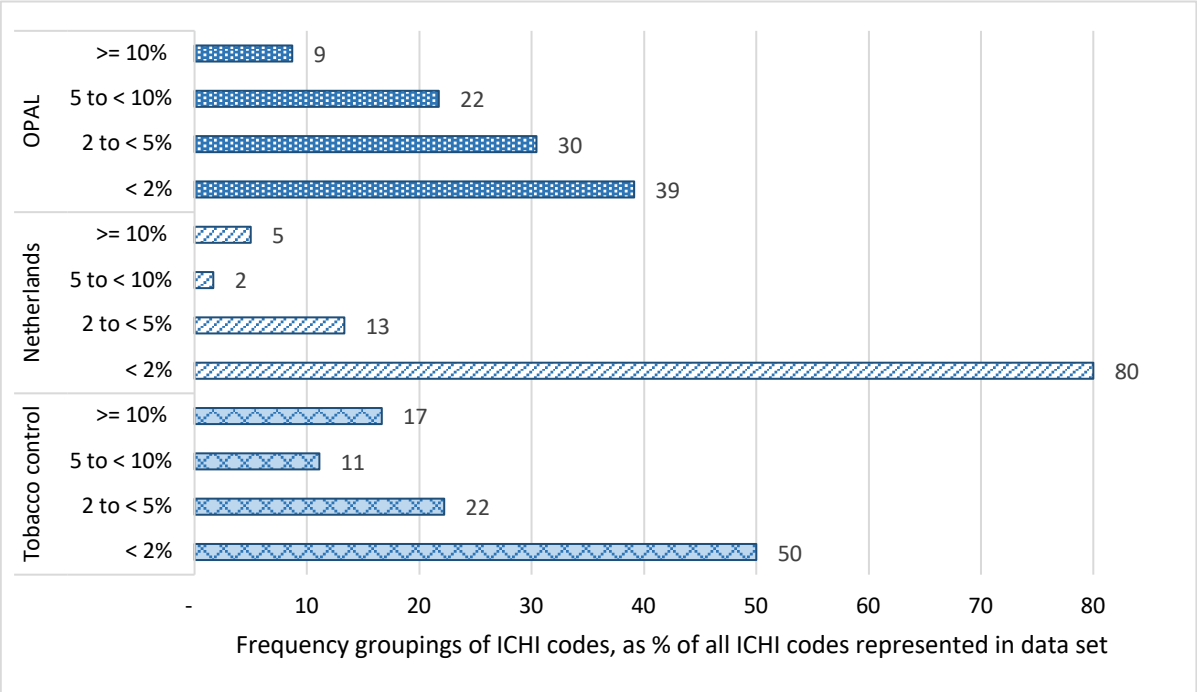
The number of ICHI intervention codes represented in the coded data ranged from 18 for the Tobacco Control data set to 60 for the Netherlands data set (Table 4.1). Table 4.2 lists the five most commonly assigned intervention codes for the three data sets. In the Tobacco Control data set, the top five intervention codes account for 75% of IUs, while in the Netherlands data set they account for 47% of IUs. Compared with the other two data sets, the Netherlands data set had a high proportion of low-frequency codes, with 80% of codes assigned to fewer than 2% of IUs (Figure 4.6). The percentage of IUs for which a residual ICHI code of the form 'Other interventions … not elsewhere classified' (i.e., a 'ZY ZZ' code) was assigned was similar across the three data sets, ranging from 24% to 28% of IUs (Table 4.1). These intervention codes are specific only as to Target, with residual Action and Means categories. Residual codes were assigned where either the required combination of Target and Action was not available as an ICHI intervention code, or an appropriate Action category could not be found.

[6] The Coding Protocol states that 'C' should be recorded to denote a 'coverage issue' where a matching ICHI axis category cannot be found for the Target, Action or Means concept identified for the IU, and that 'D' should be recorded to denote a 'definability issue' where the information provided is not sufficient to determine a Target, Action or Means for the IU. While this instruction was followed, the distinction between coverage and definability issues was often not clear in practice; therefore, data are not presented separately for these two categories.

Table 4.2: Frequency of ICHI codes assigned by data set

ICHI code title	N	%
OPAL data set		
Education about eating behaviours	43	22
Other interventions targeting physical activity behaviours, NEC	36	19
Other interventions targeting eating behaviours, NEC	17	9
Education about physical activity behaviours	15	8
Public facilities or infrastructure development to support healthy eating behaviours	11	6
Other ICHI code	*72*	*37*
Total IUs	**194**	**100**
Netherlands data set		
Training to influence physical activity behaviours	31	14
Other interventions targeting physical activity behaviours, NEC	29	13
Improving access to services [1]	23	11
Other interventions to targeting social behaviours, NEC	11	5
Education about eating behaviours	9	4
Other ICHI code	*116*	*53*
Total IUs	**219**	**100**
Tobacco Control data set		
Restrictions or requirements concerning the sale or distribution of tobacco products—enactment of legislation or regulations	19	28
Other interventions targeting tobacco use behaviours, not elsewhere classified	16	23
Restrictions or requirements concerning the production or importation of tobacco products—enactment of legislation or regulations	7	10
Stakeholder partnership interventions targeting tobacco use behaviours	6	9
Restrictions or requirements concerning the advertising, promotion or sponsorship of tobacco products—enactment of legislation or regulations	4	6
Other ICHI code	*17*	*25*
Total IUs	**69**	**100**

1. This code has a ‘code also’ rule, instructing users to record an ‘additional code describing the individual intervention delivered via this public health intervention’. In the Netherlands data set for all IUs where ‘Improving access to services was assigned the additional code recorded was VEB ZY ZZ ‘Other interventions targeting physical activity behaviours, not elsewhere classified’.



Percentages are calculated using the following denominators: OPAL N=23; Netherlands N=60; Tobacco control N=18.

Figure 4.6: Of the ICHI codes represented in each data set, percentage accounting for at least 10% of IUs, 5–<10%, 2–<5%, and under 2%

4.2.3 Other dimensions of information identified in the three data sets

In addition to the textual descriptions on which ICHI coding was based, each of the data sets contained other information about interventions. This may be regarded as information seen as useful for understanding or grouping interventions in the context of a particular data set, thus representing expressed information needs of stakeholders. These dimensions of information were recorded to enable consideration of whether they are (or could be) captured in ICHI axes or extension codes, and any implications of their not being captured by the classification. Table 4.3 sets out these information dimensions used to describe or differentiate interventions in the three data sets; the headings in Table 4.3 are taken from Box 2.2, which lists 'Types of information relevant for describing and grouping public health interventions', as identified from a range of reporting guidelines and classificatory schemes (Section 2.4.3). For the OPAL data set, these information dimensions are represented as data fields in the OPAL Single Platform, and also as elements in the OPAL Logic Model that describes the overall program theory (Jones et al. 2016). For the Netherlands data set, they are data fields in the structured form within which information about each intervention is set out; some of these information dimensions can be used as database search filters to identify sub-sets of interventions. In the Tobacco Control data set, they are less formally present, but can be discerned by identifying the variables used to distinguish individual indicators within groups of similar indicators; in most cases, these variables represent a more granular level of detail in describing tobacco control measures (e.g., particular service settings in which tobacco cessation programs are delivered).

Table 4.3: Domains of information about interventions contained in the three data sets

OPAL[1]	Netherlands[2]	Tobacco control[3]
Aims of intervention		
Goal (intervention points – behavioural and environmental) Theme (specific behaviours) Healthy behaviour/ Unhealthy behaviour	Theme (health issue; behavioural or environmental determinant)	Behavioural or environmental determinant (as topic of research or information exchange)
Content of intervention		
Strategy (intervention types, e.g., Environments & Infrastructure, Marketing & Awareness)	Method used (e.g., Adjust outside environment, Empowerment, Advice/consultation)	
How intervention is hypothesised to work		
Benefits/costs experienced by individual undertaking healthy/unhealthy behaviour Environmental and individual factors that influence Action/behaviour (via which intervention is hypothesised to achieve desired outcomes) Change pathway (changes at various levels of the social-ecological system with ultimate impact on individual behaviour)		
Delivery of intervention		
Project role (role of OPAL staff) Setting Recruitment location	Materials used (e.g., CD, DVD, video, movie, poster, presentation, grant application) Setting	Administrative infrastructure used to implement the measure Degree of legal force Additional detail about the measure (e.g., % of packaging occupied by health warnings) Professional group delivering intervention Type of medication/therapy Service setting
Quantification and timing		
Duration (Elapsed days of project) Time invested (hours) Dose (various measures)		
Context of intervention		
Sector Population (Age, Gender, Suburb, Culture)	Target audience (Age, Sex, other characteristics)	Sector in which stakeholders located Service sector Professional group to which intervention directed

OPAL[1]	Netherlands[2]	Tobacco control[3]
Policy considerations		
Budget (Dollars invested) Principles (Equity, Inclusive, Innovative, etc.)	Type of prevention (Indicated, Selective, Universal, Care-oriented) Rating (level of evidence for intervention effectiveness)	

1. Data items in OPAL Single Platform that represent elements in OPAL Program Logic Model.
2. Search fields in RIVM intervention database.
3. Variables that distinguish between indicators within groups of similar/related indicators.

4.3 Results – thematic analysis of coding notes

Thematic analysis was conducted separately for each data set. As described in Section 3.4.5., the analysis involved open coding within an *a priori* coding frame consisting of six broad headings which correspond to the steps in the coding process and structural components of the classification itself: Intervention units; Targets; Actions; Means; Intervention codes; Other (subsequently changed to 'Information not captured by ICHI', to better reflect the issues under this heading). Within this structure, themes and sub-themes were iteratively developed to separately identify and articulate the issues that arose when applying ICHI to code intervention descriptions. On reviewing the results of the analysis, it was found that many of the issues were common to two or all three data sets. Therefore, for coherence and to avoid duplication, the results for the three data sets are presented together, using a single level of sub-headings under each of the broad headings, as set out in Box 4.1. The objective of the analysis is to identify issues, not specifically to compare the three data sets or to quantify or rank issues in terms of frequency or importance. Examples from individual records are presented, where appropriate, to illustrate the issues described. The system for numbering examples uses a leading letter to indicate the data set from which the example is drawn – OPAL obesity prevention (O), Netherlands lifestyle interventions (N), or Tobacco Control (T) – followed by the number of the particular IU within that data set.

Box 4.1: Headings under which thematic analysis results are presented

1. Intervention units (IU) – identifying and framing

- Difficulty deciding what qualifies as an IU
- Splitting versus lumping components of an intervention
- Framing an IU for ICHI coding

2. Target – concepts and categories

- More than one Target category applicable
- Target concepts not adequately captured by ICHI
- Target concepts not explicitly expressed or difficult to articulate
- Definition and scope of ICHI Target categories

3. Action – concepts and categories

- More than one Action category applicable
- Form versus function approach when assigning Action categories
- Action concepts not adequately captured by ICHI
- Definition and scope of ICHI Action categories

4. Means – concepts and categories

- Difficulty identifying Means concept
- Unclear distinction between 'Action' and 'Means'
- Mix of Means in a single IU
- Means concepts not adequately captured by ICHI
- Definition and scope of ICHI Means categories

5. Intervention code

- Additional axis categories not captured by intervention code
- Wording of ICHI intervention code titles
- Missing ICHI intervention codes
- Overlap between ICHI intervention codes
- Use of environmental factor or health-related behaviour as Target
- Information not captured by ICHI
- System level at which intervention directed
- Other distinctions not captured by ICHI codes

4.3.1. Intervention units (IUs)—identifying and framing

> Intervention unit – a key functional component of an intervention with a distinct Target, Action and Means, where 'functional' relates to the explicit or inferred mechanism of action (i.e., the hypothesised process by which the intervention will achieve the desired result)
> *(Definition from coding protocol developed for ICHI public health data coding study, Appendix 3.2)*

Difficulty deciding what qualifies as an IU

In some instances, it was difficult to decide whether an activity described in a record should be regarded as a 'functional component' of an intervention, to be identified as an IU for coding, or as an element of the development or implementation of the intervention. For those records that described providing resources for or training staff to deliver a particular intervention, the IU was usually identified as the intervention that would ultimately be delivered (e.g., O36, Table 4.4). However, in some cases training those involved in an intervention was judged to be a 'functional component' and thus identified as a separate IU for ICHI coding (e.g., O1.2). Similarly, activities such as conducting needs or outcome assessments were judged to be 'functional components' in some instances (e.g., N73.1, N177.1), but not in others (e.g., N124).

Differing emphasis in the descriptive information provided was noted to influence the number and nature of IUs identified; in some cases, this resulted in records describing broadly similar interventions being coded differently. Some records in the OPAL data set describe activities carried out by OPAL staff in the course of bringing an intervention to fruition, such as advocacy, collaboration and advising. In such cases, the record was usually treated as describing a single IU reflecting the intervention ultimately delivered, with the result that the advocacy, collaboration or advising involved were not represented as IUs for coding (e.g., O99). Other records describe advocacy and partnership-building activities as stand-alone OPAL projects, and were included as IUs (e.g., O149). Whether or not advocacy or partnership activities were treated as a 'functional component' was also influenced by how clearly other activities were described – for example, an IU focusing on collaboration might be identified when there was no clear description of what was done by the partner organisations in delivering the intervention (e.g., O173).

Table 4.4: Examples – difficulty deciding what qualifies as an IU

Example no. and data set	Example IU	Comments
O36 OPAL	36. 'Delivery of eat-a-rainbow program to promote consumption of fruit and veg by children'.	This record mentioned that OPAL had organised training for staff and volunteers, but this was treated as an implementation activity and not identified as a separate IU. This is contrasted with record no. 28, describing eat-a-rainbow professional development training, which was included as an IU for coding.
O1.2 OPAL	1.1. 'Establishing new or developing existing school gardens to promote healthy eating'. 1.2. 'Professional development workshops to upskill schools re operating edible school gardens'.	For this record, training school staff was judged to be a 'functional component' of the intervention and identified as a separate IU.
N73.1 Netherlands	73.1. Record described a multi-component healthy eating and physical activity intervention delivered in preschools. 'Measuring and weighing children to track success of the program' was one of 7 IUs.	'Measuring and weighing' was included as a separate IU, with a query as to whether this should instead be regarded as aspect of program evaluation not to be coded.
N177.1 Netherlands	177.1. 'Applying 'sports choice test' to determine what sport individual children are best suited to, to support sustainable participation in sport'. 77.2. 'Introductory sports lessons provided at school and club'.	Noted that importance of applying the 'sports choice test' was emphasised in the description and seemed central to the hypothesised mechanism of action (i.e., introducing child to the right type of sport so that they will continue in the long term), thus it was identified as a separate IU and not regarded as merely an aspect of implementation.
N124 Netherlands	124. 'Strategy for recruitment and retention of girls in football clubs to increase physical activity levels of girls'.	Multiple steps described for this intervention were treated as aspects of intervention implementation or evaluation and not identified as separate IUs.
O99 OPAL	99. Record describes installation of a water fountain in a park, emphasising OPAL's role in lobbying Council staff. Single IU identified as 'Installation of water fountain in park'.	Noted that this IU does not capture OPAL's advocacy role.
O149 OPAL	149. 'OPAL advocacy to encourage Council to put breastfeeding-friendly policies in place and make council venues breastfeeding-friendly'.	Record focused on OPAL's advocacy rather than ultimate implementation of breastfeeding-friendly policies by Council.
O173 OPAL	173. Record describes OPAL staff partnering with local youth centre to support the delivery of healthy eating and physical activity programs. Single IU identified: 'Partnering with youth centre to provide healthy lifestyle programs'.	Noted that the IU was framed in this way because the healthy eating and physical activity programs mentioned were not clearly described, so it was difficult to frame the IU as the programs delivered.

Splitting versus lumping components of an intervention

For records that described interventions involving several elements, such as multiple linked activities, decisions about whether and how to split them into separate IUs were sometimes difficult. Such records were split into separate IUs in some instances but not in others; sometimes intervention components were mentioned but not articulated clearly enough to enable them to be identified as IUs (e.g., O55, O105, Table 4.5). For records that described setting-wide interventions with multiple elements designed to work synergistically to bring about change (e.g., a school-wide anti-bullying intervention), it was often difficult to decide whether the whole intervention should be a single IU or, if not, how the different elements should be grouped into IUs. Such decisions were influenced by the amount of detail provided – less detailed records were less likely to be split into separate IUs (e.g., N12.2). Thus, some intervention records were coded at a coarser level and others at a more granular level. It was also noted that interventions were split into separate IUs along different dimensions of information, depending on the structure of the intervention and how it was described. In some cases, an intervention was split according to 'phases', as set out in the intervention description, while in other cases the split reflected different mechanisms of action, recipient groups (e.g., children and parents), or ecological levels to which the intervention was directed (e.g., organisation and individual).

Table 4.5: Examples – identifying separate IUs within a record

Example no. and data set	Example IU	Comments
O55 OPAL	55. Record described early childhood program comprising several components including taking children on regular walks, road safety education, and homework activities for families. Two IUs identified: (1) taking children on regular walks, (2) road safety education.	Two activities described were identified as separate IUs; noted that there was insufficient information to identify and describe other IUs that may have been part of this intervention.
O105 OPAL	105. Record described guided walks and pedometer challenge to encourage children to be physically active outside. This was treated as a single IU.	The two activities (guided walks and pedometer challenge) were similar in nature and included in a single IU; queried whether they should be separate IUs as they are separate activities intended to work synergistically and reinforce each other.
N12.2 Netherlands	12.2. School-wide capacity-building to foster democratic citizenship, including provision of a trained counsellor, training and support of teachers, training student mediators, parent meetings, and establishment of a steering committee to support implementation across the school and track progress. This was treated as a single IU.	Lack of detailed description of individual components influenced the decision to represent this record as a single IU. This is contrasted with no.73, a two-year, school-wide healthy eating and exercise intervention described in more detail for which 7 IUs were identified.

Framing an IU for ICHI coding

In many instances, it was noted that the IU identified could be framed in different ways, depending on which mechanism of action or which step in the change pathway was emphasised, or which actor perspective was taken, and that this had flow-on effects in terms of the ICHI axis categories assigned. The operational definition of IU focuses on 'function' or 'mechanism of action' as central to the identification of a unit of classification. The coding protocol instructs that a short, one-sentence description of each IU should be written, but it does not say whether the mechanism of action should be the focus of this description. Often more than one mechanism of action could be inferred for a given IU, that is, the deed done could be understood to bring about change via more than one pathway. Also, where more than one actor was involved, there was often scope to identify more than one mechanism of action, depending on which actor perspective was taken. For example, a health promotion program provider can *offer an incentive* to an organisation to *make environmental changes* that will encourage individuals within that organisation to make healthier choices. In some cases, the short description focused on one mechanism of action, while in others it left open the question of mechanism of action, so that this interpretation was effectively made at the next step when ICHI axis categories were selected (e.g., O38, O104, O22, N87, Table 4.6).

Table 4.6: Examples – framing an IU for ICHI coding

Example no. and data set	Example IU	Comments
O38 OPAL	38. Record describes funding provided for students to attend a basketball carnival, stating 'Basketball camp will provide a purpose for students to be active at school, as well as provide context for learning about healthy lifestyles. Condition of funding was that school would promote other OPAL messages'. Single IU identified as 'Funding for students to attend disability basketball carnival provided on condition that school will promote other OPAL messages'.	Three mechanisms of action are discernible: motivating students to increase physical activity in anticipation of the carnival, facilitating learning about healthy lifestyles, and applying an incentive to the school to promote OPAL messages. Wording of IU is not explicit about mechanism of action; noted that choice of ICHI axis categories will be affected by which mechanism of action is viewed as the primary one for this IU.
O104 OPAL	104. Healthy breakfast show presented to primary school children. Rationale states: 'offered as complementary incentive for schools to sign up to our Healthy Brekky Grants… also provides an opportunity for awareness of the Healthy Brekky theme to all junior primary school students with educational components to why a Healthy Brekky is important'. Single IU identified as 'Healthy breakfast show presented to primary school children'.	Noted that two mechanisms of action are suggested – incentivising schools and raising awareness among children – neither is explicitly captured in IU description.

Example no. and data set	Example IU	Comments
O22 OPAL	22. Record describes development and distribution of a road safety resource 'to assist early childhood educators to introduce road safety themes through stories and activities'. Single IU identified as 'Road safety education for pre-schoolers'.	This framing of the IU reflects what is delivered by early childhood educators to pre-schoolers (i.e., an education intervention). Alternatively, it could be framed as provision of a resource to early childhood educators (i.e., a provision or intervention).
N87 Netherlands	87. Record describes an intervention involving expert coaching of school PE teachers in delivering a special series of lessons to classes, in order to improve the quality of sports lessons delivered to students. Two IUs identified: 87.1 'Series of special sports lessons provided to primary school students', 87.2 'Coaching of school PE teacher by movement consultant'.	The two IUs reflect different actor perspectives: the school PE teacher delivers enhanced sports lessons to students; the movement consultant delivers coaching to the PE teacher. Query as to whether only a single IU should be identified and, if so, which view should be reflected.

4.3.2. Targets—concepts and categories

The coding protocol provides the following instructions for assigning axis categories to IUs:

> Identify ICHI axis categories that best fit the Target, Action and Means for the IU and record the corresponding codes in the relevant columns. Up to three Target and Action categories and up to two Means categories may be recorded. If it is possible to determine the primary or main Target/Action/Means, record this one in the first position (i.e., T-code(1), A-code(1), M-code(1)). Choice of ICHI axis categories should be based on information actually provided in the record; no inferences or assumptions should be made.

More than one Target category applicable

In all three data sets, it was common for more than one ICHI Target to be assigned per IU (Table 4.1). In some cases, the two or more Targets were of equal status, for example an intervention targeting both alcohol and tobacco use (e.g., N27, Table 4.7). In other cases, one Target could be identified as the proximate Target to which the Action is directed, and another as the ultimate Target that the intervention seeks to change (e.g., O52.4, T15.09). The coding protocol did not provide guidance on which should be regarded as the 'primary or main' Target in such cases. This situation was particularly common in the Tobacco Control data set – many indicators relate to measures that are directed towards tobacco products with the ultimate aim of influencing tobacco use.

Table 4.7: Examples – dual or multiple Targets for a single IU

Example no. and data set	Example IU	Comments
N27 Netherlands	27: Digital learning program to influence students' knowledge, attitudes and behaviour concerning smoking and alcohol use.	Assigned VAA 'Alcohol use behaviours' and VAB 'Tobacco use behaviours' – equal Targets.
O52.4 OPAL	52.4. Bike safety education delivered as part of a set of 'Think feet first' activities to increase active transport.	Assigned VEB 'Physical activity behaviours' (ultimate Target) and VCA 'Road safety behaviours' (proximate Target)
T15.09 Tobacco Control	15.09. Enactment of legislation against illicit trade in tobacco products.	Assigned VAB 'Tobacco use behaviours' (ultimate Target) and UAA 'Products and substances for personal consumption' (proximate Target).

Target concepts not adequately captured by ICHI

Some Target concepts identified in IUs could be seen as characteristics or properties of an individual, a family or a community, and these were not adequately captured by ICHI Target categories (e.g., N151, N162, Table 4.8). These Target concepts included self-efficacy, resilience, self-esteem, problem solving, coping skills, assertiveness, social-emotional skills, personal development, social connectedness or isolation, social cohesion, family functioning, risk for anxiety or depression, and motor skills. Such Targets do not readily fit into the broader grouping of ICHI Target categories – 'Body functions', 'Activities and participation domains', 'Health-related behaviours' and 'Environmental factors'. In some cases, the IU aimed to enhance a characteristic such as self-efficacy in order to influence other health-related behaviours, and an ICHI Target describing the behaviour ultimately targeted was assigned (e.g., N62.3). Where no category could be found to capture a Target concept identified for an IU, 'C' was recorded to denote a coverage issue.

There were some IUs for which the ICHI Target assigned was noted not to capture the full scope or the level of detail of the Target concept in the IU description. In the Netherlands data set, there were 8 IUs for which the residual Target 'Other safety behaviours, NEC' was assigned; in all cases, the Target concept was a topic of significant public health relevance (e.g., sports safety, falls prevention, child safety), but no more specific ICHI Target was available (e.g., N41). Also in the Netherlands data set, there were several IUs for which ICHI Target VEF 'Sexual behaviours' was assigned, but for which this category did not adequately capture the Target concept in the description; these interventions usually addressed broader topics related to sexuality and relationships (e.g., N33).

Table 4.8: Examples – Target concept not adequately captured by ICHI Targets

Example no. and data set	Example IU	Comments
N151 Netherlands	151. Program of 7 weekly classes aimed at building resilience of children (increasing the physical and mental toughness, improving self-esteem, self-awareness and self-confidence, and enhancing social skills) through Aikido.	Assigned VEK 'Social behaviours', noting that the Target was actually personal resilience rather than social behaviour.
N162 Netherlands	162. Creating opportunities to participate in organised sports, tailored to the local community, in order to improve social cohesion in disadvantaged neighbourhoods.	Assigned VEB 'Physical activity behaviours' and 'C' in second Target position, noting that there is no ICHI Target to capture 'Social cohesion' as a property of the local community.
N62.3 Netherlands	62.3. Assertiveness training with physical and creative assignments and group discussions aimed at preventing sexual behaviour issues.	Assigned VEF 'Sexual behaviours', noting that the Target concept of 'Assertiveness' could not be captured by ICHI.
N41 Netherlands	41. Provision of oral, written and digital information to parents of young children about safety risks and how to avoid accidents.	Assigned VCD 'Other safety behaviours, NEC'; does not capture child safety as specific Target.
N33 Netherlands	33. Facilitated board game for girls addressing topics around sexuality and relationships.	Assigned VEF 'Sexual behaviours', noting that this only partially captures Target, which includes relationships.

Target concepts not explicitly expressed or difficult to articulate

It was sometimes necessary to infer the Target of an intervention when this was implied rather than explicitly expressed in the description. For example, some OPAL records referred to 'OPAL Goals' rather than specifying what behaviour/s the intervention aimed to change. As the six OPAL Goals all relate to either healthy eating or physical activity, ICHI Targets 'Eating behaviours' and 'Physical activity behaviours' were both recorded for such IUs (e.g., O47, Table 4.9). Similarly, some tobacco control indicators refer only to 'tobacco control measures', not specifying whether the measure is directed towards tobacco products, tobacco use behaviours and/or other Targets. In the Framework Convention, 'tobacco control' is used as an umbrella term that covers measures aimed at influencing both demand for and supply of tobacco products; therefore, in such cases ICHI Targets 'Tobacco use behaviours' and 'Products and substances for personal consumption' were both recorded (e.g., T20.08).

In some cases, it was difficult to articulate the Target of an IU, and the Target code/s assigned were noted to be a poor fit (e.g., N47). For some IUs, the proximate Target involved aspects of the environment hypothesised to influence people's behavioural choices (e.g., the designation of an area for parking, or walkability of a neighbourhood); in such cases no applicable environmental factor Target could be found and an ICHI Target was assigned only for the ultimate health-related behaviour Target (e.g., O187).

Table 4.9: Examples – Target concept/s implied but not explicit in description

Example no. and data set	Example IU	Comments
O47 OPAL	47. 'Articles in local newspaper to raise awareness of OPAL Goals, Themes and activities'.	Assigned VEA 'Eating behaviours' and VEB 'Physical activity behaviours'.
T20.08 Tobacco Control	20.08 'Training for those engaged in tobacco control'.	Assigned VAB 'Tobacco use behaviours' and UAA 'Products and substances for personal consumption'.
N47 Netherlands	47. A course of six home visits by a nurse to provide informational support to parents of new babies with the aim of reducing/preventing future developmental problems and domestic violence/child abuse.	Target concept is difficult to articulate; assigned VBB 'Family and partner violence behaviours' and VEJ 'Parenting behaviours'.
O187 OPAL	187. Research into the local take-away food outlets, investigating menus, prices, specials, and scoping potential interventions to improve the healthy choices available.	Proximate Target is an environmental factor related to food availability, and no ICHI Target provides a good fit; assigned only VEA 'Eating behaviours' (ultimate Target).

Definition and scope of ICHI Target categories

Some coding notes suggested the need for greater clarity concerning the scope of particular ICHI Targets. For instance, several IUs in the OPAL data set describe interventions that aim to get people drinking water instead of sweetened drinks; in these cases, Target VEA 'Eating behaviours' was assigned, with a note that 'drinking' should be listed as an inclusion for this category. The Target VEL 'Behaviours related to psychological health and wellbeing' has an exclusion for 'Handling stress and other psychological demands (SDJ)', which is a Target category in the 'Activities and participation domains' group; this exclusion was noted to be confusing, making it unclear whether or not Target VEL should be used to code *behaviours* related to handling stress.

4.3.3. Actions—concepts and categories

> 'Action – the deed done by an actor to a Target' (ICHI 2016)

More than one Action category applicable

Across all three data sets there were many IUs for which more than one Action category was assigned (Table 4.1). For some IUs, the Action concept identified from the intervention description involved a mix of ICHI Actions, such as 'Education' and 'Training', or 'Provision' and 'Public facilities or infrastructure development'; that is, elements from the definitions of two ICHI Actions were present in the description of an IU and it was not possible to identify a main or primary Action (e.g., O16, N71.1, Table 4.10). In other cases, an activity that could be described by one ICHI Action was undertaken in order to achieve a result that could be captured by another ICHI Action – e.g., providing information (PM 'Education') to build stakeholder partnerships (TD 'Collaborating'), or

providing training (PH 'Training') to build capacity (VA 'Capacity building') (e.g., O56). For IUs involving collaboration or cooperation between different stakeholders, the Action 'Collaborating' was often assigned along with another ICHI Action describing what was done through the collaboration (e.g., T13.26). Thus, as was the case with Targets, for IUs where multiple Actions were assigned, the nature of the relationship between these Actions varied.

In some instances, alternative ways of framing the central Action for an IU were possible, with implications for Action category assignment. For example, in the Netherlands data set, there were several IUs that involved facilitating participation in a sport or other physical activity, but for which it was difficult to determine whether the main Action should be framed as developing skills, providing an opportunity to participate in a sport or activity, or improving access to relevant services in the community (e.g., N42.1, N118). Such choices about Action framing often relate to what is seen to be the main mechanism of action by which the intervention is intended to work, and this was usually not made explicit in the description.

Table 4.10: Examples – more than one applicable ICHI Action

Example no. and data set	Example IU	Comments
O16 OPAL	16. Program to provide children and families with resources and skills to enable them to grow vegetables at home, and to educate them about preparing healthy meals.	Assigned PM 'Education' and PH 'Training'.
N71.1 Netherlands	71.1. Making changes to the playground environment so it is more conducive to play, including creating different zones, providing game materials, and supervision in the play environment.	Assigned TK 'Public facilities or infrastructure development' and RD 'Provision'; supervision aspect not captured.
O56 OPAL	56. Training and supporting 'community foodies' as a means of building community capacity for making healthier food choices.	Assigned VA 'Capacity building' and PH 'Training'.
T13.26 Tobacco Control	13.26. International collaboration on the elimination of cross-border advertising.	Assigned TD 'Collaborating' and WD 'Restrictions on advertising, promotion or sponsorship of products'.
N42.1 Netherlands	42.1. Ten-week physical activity program delivered to students in school time.	Assigned PH 'Training', with note 'Is this training or facilitating participation in physical activity?'
N118 Netherlands	118. Introductory basketball program (in school and after-school sessions) with aim of making participating in basketball more accessible by providing low cost and local opportunities.	Assigned PH 'Training' and VP 'Improving access to health services or health-related services'.

'Form' versus 'function' approach when assigning Action categories

Across the three data sets several comments picked up the distinction between describing what was actually done ('form') versus how it was intended to work ('function'), and noting that ICHI Actions vary in the degree to which they convey information about form and/or function. Some ICHI Action titles and definitions reflect a focus purely on form – e.g., RD 'Provision', defined as 'Providing products and services to improve health, functioning, or environmental factors', does not suggest how this Action might work to effect change (e.g., by enabling people to do something, promoting a message or raising awareness, or applying a motivational stimulus). Some Actions focus on function – e.g., VA 'Capacity building', defined as 'Strategies and activities that aim to tap and strengthen the existing abilities of individuals, communities, organisations or systems to increase involvement, decision-making and ownership of issues in order to promote sustainable health behaviours and support healthy environments', does not say what form the strategies and activities might take but describes the effect they are expected to have. Others are a mix of form and function – e.g., PH 'Training', defined as 'Teaching, enhancing or developing skills through context-specific practice', where 'teaching' and 'context-specific practice' describe what is done, while 'enhancing or developing skills' describes the effect it is expected to have. For several IUs, it was noted that an Action category describing just what was done can fail to capture the nature of the IU in terms of how it was intended to work (e.g., O75, N174.2, Table 4.11). For some IUs, two Actions were found to be applicable, one describing form and the other function (e.g., N86.1).

Table 4.11: Examples – 'form' versus 'function' approach when assigning Action categories

Example no. and data set	Example IU	Comments
O75 OPAL	75. Packs containing pedometers and promotional material/information distributed to school children.	Assigned RD 'Provision', noting that this does not capture the nature of this IU as an awareness-raising intervention.
N174.2 Netherlands	174.2. Monitoring adherence to lifestyle plan as a motivational mechanism – self-monitoring and supervision by trainer.	Assigned AI 'Monitoring', noting that this does not capture motivational effect of monitoring.
N86.1 Netherlands	86.1. PE teacher receives on-the-job coaching from movement consultant to improve the quality of sports classes delivered in primary school.	Assigned PH 'Training' and VA 'Capacity building', noting that 'Training' describes what was done and 'Capacity building describes the intended effect (i.e., to build capacity of the PE teacher).

Action concepts not adequately captured by ICHI

There were several Action concepts identified in IU descriptions for which an ICHI Action could not be found, or for which the Action category assigned was noted to be a poor fit. These included running an event or activity in which people could participate, raising awareness, environmental change intended to influence people's behavioural choices, providing a motivational stimulus, coaching and mentoring, policy change, development of legal or administrative infrastructure, development of guidelines, and public health research. Examples are given in Table 4.12 (further detail is provided in Appendix 7.1).

Table 4.12: Examples – Action concepts not adequately captured by ICHI Actions

Action concept	Example IUs
Awareness-raising: Awareness-raising IUs were present in all three data sets. In some instances, the Action 'Education' was assigned, noting that this was not a good fit. In relation to the 'form' versus 'function' issue, raised above, 'awareness-raising' describes the intended function of the intervention, rather than the form it takes, i.e., what is done to raise awareness.	Netherlands no.114. 12-month intervention to raise awareness about healthy eating within workplaces. Tobacco Control no.12.01. Implementation of educational and public awareness programs about health risks of tobacco consumption and exposure to tobacco smoke, and adverse consequences of tobacco production.
Small-scale or temporary environment change: Some IUs involved local or small-scale environmental change intended to influence people's behavioural choices, often called 'nudge' or 'choice architecture' interventions. Action TK 'Public facilities or infrastructure development' was judged not to be applicable to capture small scale, subtle or temporary environmental change.	OPAL no.52.2. Stencil shoe art within school grounds to encourage walking. Netherlands no.57.1. Changes to the physical environment of event venues to encourage responsible alcohol consumption.
Policy change: No ICHI Action was available to capture IUs involving developing, changing, or maintaining policy on a particular topic within an organisation or a jurisdiction.	OPAL no.48: Implementation of Council healthy food and drink policy to improve availability and accessibility of healthy food and drink choices at council-funded functions, meetings, and events. Tobacco Control no.5.01. Development of comprehensive multisectoral national tobacco control strategy.

Definition and scope of ICHI Action categories

Coding notes often related to issues concerning the ambiguity of ICHI Action category titles and/or definitions, or queries about their applicability in relation to a particular IU, suggesting the need for clarification of the intended scope of some ICHI Actions. Examples are given in Table 4.13 (further detail is provided in Appendix 7.1).

Table 4.13: Issues concerning wording of ICHI Action category titles and definitions

ICHI Action category and definition	Issues noted
SI 'Preparation' Preparing for an upcoming or future intervention *Incl*: Modelling; Rehearsal; Simulation *Excl*: planning (TB)	The scope of this Action in relation to public health interventions was noted, e.g., should 'Preparation' be assigned for a community consultation to inform a planned park redevelopment?
TK 'Public facilities or infrastructure development' Providing or making changes to public spaces, structures and amenities *Incl*: Providing or making changes to transport or communication systems, community layout, lighting in public places	The need for clarification as to what counts as 'public' was noted, e.g., is developing a school vegetable garden or installing a drinking fountain in a kindergarten covered? There were also queries regarding whether this Action includes small scale or temporary changes to physical spaces, e.g., stencil art in school playground to encourage walking, or display of foods in a canteen.
WD 'Restrictions on advertising, promotion or sponsorship of products' Placing limitations on the advertising, promotion or sponsorship of particular articles, substances or materials	For some IUs in the Tobacco Control data set, it was difficult to decide whether they should be regarded as restrictions on sale or on advertising, e.g., a ban on display of tobacco products at points of sales or a ban on the sale of objects in the form of tobacco products.

4.3.4. Means—concepts and categories

'Means – the processes and methods by which the Action is carried out' (ICHI 2016).

Difficulty identifying Means concept

Often it was difficult to articulate the Means concept for an IU, even where enough information was provided to have a clear picture of what the intervention entailed. The coding categories 'C' (coverage issue) and 'D' (definability issue) were applied somewhat inconsistently in these cases because, in practice, it was difficult to draw a clear distinction between situations in which information about Means was not provided in the description and situations in which information on Means was provided but could not be captured by ICHI. Coding notes raised the question of what information could usefully be captured by ICHI Means categories that would provide a basis for grouping similar interventions in a meaningful way (e.g., O2, O15, N18.1, Table 4.14).

Table 4.14: Examples – difficulty identifying 'Means' concept

Example no. and data set	Example IU	Comments
O2 OPAL	2. Providing input to council planning processes to ensure they meet requirements of Public Health Act.	Assigned Action TD 'Collaborating'; coding note: 'What is 'Means' for collaborating - description of nature of collaboration? Advocacy and policy input?'
O15 OPAL	15. Creation of an edible garden in a park to encourage community members to engage with the garden and learn about growing fruit and vegetables.	Assigned Action TK 'Public facilities or infrastructure development'; coding note: 'Should Means be nature of environmental change?'
N18.1 Netherlands	18.1. Provision of free fruit to be eaten by children in the classroom.	Assigned Action RD 'Provision'; coding note: 'How to define Means for provision interventions? Could be nature of what is provided?'

Unclear distinction between 'Action' and 'Means'

For many IUs, it was difficult to separately identify Action and Means. In ICHI terms, concepts such as coaching and policy change (identified as not captured by ICHI axis categories) could arguably be viewed as either 'Action' ('the deed done by an actor to the Target') or 'Means' ('the processes and methods by which the Action is carried out'). Similarly, in some situations 'collaborating' could be seen as the Means of delivering an intervention rather than the Action (e.g., when it is the partnership between two or more community organisations that makes an intervention possible) (e.g., N103, N124, Table 4.15).

Table 4.15: Examples – unclear distinction between 'Action' and 'Means'

Example no. and data set	Example IU	Comments
N103 Netherlands	103. Establishing school-linked sports club to make participation in structured sport more accessible for primary school children.	Query whether 'collaborating' could be seen as the Means here (rather than the Action), to describe establishing the link between school and sports club.
N124 Netherlands	124. Strategy for recruitment and retention of girls in football clubs, to increase physical activity levels of girls.	Query whether 'active recruitment' should be seen as Action or Means

Mix of Means in a single IU

There were many IUs involving delivery of education, training or advice using a combination of tools and methods, e.g., website, information and communications technologies, information-sharing, discussion forum, promotional products, theatre performances. No ICHI Means categories were available to capture these tools and methods, individually or in combination (e.g., O101, N78, Table 4.16).

Table 4.16: Examples – mix of Means in a single IU

Example no. and data set	Example IU	Comments
O101 OPAL	101. Information stall on nutrition for babies and children.	Means recorded as 'C' (to denote a coverage issue) and described as 'Mixed Means: provision of written information, promotional materials, healthy snack tastings, and verbal information/advice'.
N78 Netherlands	78. Online information resource and linked information service (phone and email) on topics around sexual identity and avoiding unsafe sexual behaviours.	Means recorded as 'C' and described as 'online information resource and phone/email info service'.

Means concepts not adequately captured by ICHI

There were several Means concepts identified in IU descriptions for which an ICHI Means could not be found. These included participatory learning, discussion, workshop, game/s, presentation, meetings, interactive website, mobile app, home visit, survey, community consultation, community event, and theatre performance. Many IUs involved group delivery of education or training, and in some cases group interaction was central to how the learning process was intended to work; no ICHI Means was available to describe 'group delivery' (e.g., O21, Table 4.17).

Table 4.17: Example – 'group delivery' as Means

Example no. and data set	Example IU	Comments
O21 OPAL	21. Education and awareness raising about sexuality and relationships through group discussions, using DVD and accompanying materials.	Means recorded as 'C' and described as 'group discussion with supporting materials (DVD and guide)'.

Definition and scope of ICHI Means categories

Some issues concerning the scope of applicability of ICHI Means categories were noted. Examples are given in Table 4.18 (further detail is provided in Appendix 7.1).

Table 4.18: Examples – issues concerning wording of ICHI Means category titles and definitions

ICHI Means category and definition	Issues noted
Means QB 'Curriculum' Lessons and information content taught as part of a course of study	The meaning of 'course of study' was queried, e.g., should 'Curriculum' be used to describe one or more workshops or group learning sessions, content for inclusion in classroom curriculum, or a course of judo lessons?
QE 'Enforcement'	This category does not have a definition. The need for clarification of scope was noted. Is 'Enforcement' only applicable to interventions that involve legally enforceable rules? Can enforcement include allocation of resources for enforcement?

4.3.5. Intervention code

Additional axis categories not captured by intervention code

One of the foremost issues noted in relation to ICHI intervention codes was that, where two or more applicable Target or Action categories had been identified for the IU, the assigned intervention code could capture only one category for each axis, thus the code was judged to not fully capture the nature of the IU (e.g., O24, N35, Table 4.19). However, for many IUs in the Tobacco Control data set where both 'Tobacco use behaviours' and 'Products and substances for personal consumption' were recorded as Targets, it was noted that both the behaviour and environment Targets were reflected in the code assigned because the product as the proximate Target is conveyed by the Action category, while the behaviour as the ultimate Target is conveyed by the Target category (e.g., no T16.09).

Table 4.19: Examples – additional axis categories not captured in intervention code

Example no. and data set	Example IU	Comments
O24 OPAL	24. Information packs to promote healthy eating and active transport to parents of preschool children.	Assigned VEA PM ZZ 'Education about eating behaviours'; noted that Target 'physical activity behaviours' not captured.
N35 Netherlands	35. Series of cooking workshops for children to encourage healthy eating and develop their cooking skills.	Assigned VEA PH ZZ 'Training to influence eating behaviours'; noted that Action 'Education' not captured
T16.09 Tobacco Control	16.09. Ban on distribution of free tobacco products to minors.	Assigned VAB WC QD 'Restrictions or requirements concerning the sale or distribution of tobacco products—enactment of legislation or regulations'; Target is 'Tobacco use behaviours', while Action 'Restrictions on the sale or distribution of products' captures proximate Target (tobacco products).

Wording of ICHI intervention code titles

Many ICHI code titles indicate the nature of the relationship between the Action and the Target; this may not match how a given intervention is intended to work, particularly where the intervention involves an indirect pathway via an intermediate Target, or where the intervention is directed to people other than those whose behaviour it ultimately aims to influence (e.g., directed to teachers in order to influence the behaviour of students). For 'Education' intervention codes, the title wording is of the form 'Education *about* … [Target]' – while the education is intended ultimately to cause a change in the Target, the immediate focus of the education may be something other than the ultimate Target (e.g., O43, T14.27, Table 4.20). Some code titles suggest the nature of the effect that the Action is expected to have on the Target (e.g., 'Provision of products and services *to support* [Target]'), which may misrepresent some interventions (e.g., O59).

Several IUs in the Tobacco Control data set focused on cooperation between Parties to strengthen tobacco control efforts. For these IUs, the ICHI Action TD 'Collaborating', defined as 'Working together and cooperating with the person/client, health providers, and other relevant stakeholders', was assigned. Titles of ICHI codes using Action 'Collaborating' are of the form 'Stakeholder partnership interventions targeting…'; it was noted that the term 'stakeholder partnership' does not provide a good fit for interventions involving exchange of information or other less invested modes of cooperation (e.g., T22.07).

Table 4.20: Examples – issues concerning wording of intervention code titles and definitions

Example no. and data set	Example IU	Comments
O43 OPAL	43. Audit of the walkability of local shopping centres.	Assigned VEB AA ZZ 'Assessment of physical activity behaviours'; noted that ultimate aim was to improve physical activity behaviours, but assessment was of the physical environment.
T14.27 Tobacco Control	14.27. Tobacco dependence treatment incorporated into the curricula of medical schools.	Assigned VAB PM QB 'Education about tobacco use behaviours delivered through a curriculum'; noted that the education delivered in medical schools is about treatment, rather than behaviours.
O59 OPAL	59. Provision of brekky bowls to participants at school holiday program activities.	Assigned VEA RD ZZ 'Provision of products or services to support improved eating behaviours'; provision was intended to 'raise awareness about' rather than 'support'.

Example no. and data set	Example IU	Comments
T22.07 Tobacco Control	22.07. Cooperation between Parties to strengthen their capacity on tobacco control.	Assigned VAB TD ZZ 'Stakeholder partnership interventions targeting tobacco use behaviours'; noted that the code title is not a good fit, as collaboration does not imply partnership.

Missing ICHI intervention codes

For some IUs there was no ICHI intervention code available combining the axis categories selected for the IU. In such cases a residual code of the form 'Other interventions…' was recorded (e.g., VEA ZY ZZ 'Other interventions targeting eating behaviours, not elsewhere classified'). These instances suggest gaps in ICHI that could be filled by adding new intervention codes combining existing axis categories (e.g., O148, N150.5, T26.01, Table 4.21). In addition, residual codes were assigned for IUs where no ICHI Action could be identified (e.g., N73.7).

Table 4.21: Examples – missing ICHI intervention codes

Example no. and data set	Example IU	Comments
O148 OPAL	148. OPAL advocacy to encourage Council to put breastfeeding-friendly policies in place and make council venues breastfeeding-friendly.	No code available combining Target 'Breastfeeding behaviours' and Action 'Advocacy'.
N150.5 Netherlands	150.5. App that enables students to earn points by participating in physical activities and nutrition workshops; can win individual and class prizes.	No code available combining Target 'Eating behaviours' or 'Physical activity behaviours' and Action 'Applying incentives'.
T26.01 Tobacco Control	26.01. Encouraging development institutions to assist developing-country Parties to implement tobacco control.	No code available combining Target 'Tobacco use behaviours' and Action 'Advocacy'.
N73.7 Netherlands	73.7. Modification to school policies regarding healthy eating.	Assigned VEA ZY ZZ 'Other interventions targeting eating behaviours, not elsewhere classified'; note that no ICHI Action available to capture policy change.

Overlap between ICHI intervention codes

Some instances of apparent overlap between ICHI codes were noted, where two applicable codes were identified, based on wording of the code title, definition and inclusions (e.g., N136, N174.1, Table 4.22). For several IUs in the Tobacco Control data set, it was noted that the choice between different 'restrictions or requirements' codes was not clear, because of difficulty deciding whether a particular measure should be described as limiting sale and distribution, advertising promotion and sponsorship, or production and importation (e.g., T13.02).

Table 4.22: Examples – overlap between ICHI intervention codes

Example no. and data set	Example IU	Comments
N136 Netherlands	136. Yoga classes offered in the workplace to reduce stress and improve physical and mental health of employees.	Assigned PZA PG EE 'Holistic exercise involving physical, mental and spiritual elements' *incl.* 'Pilates; Tai Chi; Yoga'; noted alternate code SDJ PG EF 'Other relaxation exercises'.
N174.1 Netherlands	174.1. Provision of a tailored lifestyle plan (nutrition, exercise and motivation) to help participants achieve and sustain a more active lifestyle.	Assigned VEB PN ZZ 'Advising about physical activity behaviours'; noted alternate code VEB TI ZZ 'Prescription for physical activity behaviours', *incl.* 'Exercise prescription'.
T13.02 Tobacco Control	13.02: 'Instituting ban on display of tobacco products at points of sales'.	Assigned VAB WC QD 'Restrictions or requirements concerning the sale or distribution of tobacco products—enactment of legislation or regulations'; query whether this should be regarded as a restriction on advertising rather than sale.

Use of environmental factor or health-related behaviour as Target

The issue of proximate and ultimate Targets, discussed above, was noted in relation to intervention code assignment for several IUs in the Tobacco Control data set. For many tobacco control measures, the proximate Target is tobacco products, covered by the ICHI Target 'Products or substances for personal consumption'. While the ultimate Target for most measures is 'Tobacco use behaviours' (e.g., restricting advertising or sales), some measures are intended to make tobacco products less harmful, rather than modify tobacco use behaviours (e.g., testing and regulating contents and emissions of tobacco products); for some measures, air quality may be viewed as the ultimate Target, with the proximate Target being tobacco use behaviours (e.g., T11.14, T9.02, T8.02, Table 4.23). Coding notes raised the question of whether ICHI codes for all tobacco control interventions should have the Target 'Tobacco use behaviours' so they can be readily identified. On a point of consistency,

it was noted that 'restrictions or requirements' codes for interventions directed towards tobacco products are constructed using the health behaviour as the Target, with the Action providing information that a product is involved, whereas other product-directed intervention codes are constructed using an environmental factor Target category (e.g., UA1 WC ZZ 'Restrictions or requirements concerning the sale or distribution of products or technologies', for which the Target is 'Products and technology').

Table 4.23: Examples – environmental factor or behaviour as Target in intervention codes

Example no. and data set	Example IU	Comments
T11.14 Tobacco Control	11.14. Requirement to display information on emissions on packages.	Assigned VAB WC QD 'Restrictions or requirements concerning the sale or distribution of tobacco products – enactment of legislation or regulations'; Target is 'Tobacco use behaviours' (ultimate Target) not tobacco products (proximate Target).
T9.02 Tobacco Control	9.02. Testing and measuring the emissions of tobacco products.	Assigned UA1 ZY ZZ 'Other interventions targeting products and technology, not elsewhere classified'; noted that no applicable code with Target 'Products or substances for personal consumption' was available, and also that code UA1 ZY ZZ does not capture that this is a tobacco control intervention.
T8.02 Tobacco Control	8.02. Ban on tobacco smoking in all public places.	VAB WF ZZ 'Restrictions or requirements concerning the consumption or use of tobacco products'; noted that VAB 'Tobacco use behaviours' is proximate Target and UBL 'indoor air quality' is ultimate Target.

4.3.6. Information not captured by ICHI

System level at which intervention directed

In some cases, the content of an intervention is delivered directly to those people whose behaviour it is ultimately intended to influence, while in other cases it is directed towards elements in the broader environment or system. ICHI intervention codes do not capture this distinction. Thus a 'Training' code would not capture the difference between a 'train-the-trainer' intervention and training provided directly to those people whose behaviour it is sought to change. Often the same ICHI code was applied to IUs that were different in nature due to the different system levels at which they were directed, and the correspondingly different mechanisms of action that could be inferred (e.g., O87, N25.1, T20.08, Table 4.24). For instance, delivering physical activity training to children would be

intended to impact directly on the behaviour of the children, while delivering training to kindergarten teachers about how to facilitate physical activity within the kindergarten would be intended to impact on the behaviour of the children via an indirect pathway – both would be coded VEB PH ZZ 'Training to influence physical activity behaviours'.

Table 4.24: Examples – system level at which intervention directed

Example no. and data set	Example IU	Comments
O87. OPAL	87. Professional development workshops and grants to assist education sites implement nature play initiatives.	Assigned VEB VA ZZ 'Capacity building interventions targeting physical activity behaviours'; does not capture that intervention is building organisation-level capacity to better support individual-level behaviour change.
N25.1 Netherlands	25.1. Course of 8 group sessions on issues relevant to siblings of children with autism spectrum, to prevent mental health problems in siblings of a child with autism; no. 25.2: Course of 4 group sessions for parents of siblings of a child with autism spectrum, to equip them to support the approach delivered in the siblings' group in their home environment.	Assigned VEL PM QB 'Education about behaviours related to psychological health and wellbeing delivered through a curriculum' for both IUs; noted that the ecological nature of this intervention, comprising child and parent components, is not captured.
T20.08 Tobacco Control	20.08. Training for those engaged in tobacco control.	Assigned VAB PH ZZ 'Training to influence tobacco use behaviours'; noted that this does not capture that training is delivered to professionals working in tobacco control.

Other distinctions not captured by ICHI codes

Some additional dimensions of information for describing and distinguishing between interventions were identified that could not be captured by ICHI. In the Netherlands data set, a number of IUs involved facilitating access to organised sports, often by creating links between sports clubs/associations and other organisations (e.g., schools, workplaces). For these IUs, the intervention code UE1 VP ZZ 'Improving access to services', defined as 'Removing barriers that prevent people accessing services (e.g. cultural, socioeconomic, or physical barriers) in order to achieve improved health outcomes' was assigned. There is a 'code also' rule for this code instructing the user to record an 'additional code describing the individual intervention delivered via this public health intervention'; in all instances the additional code recorded was VEB ZY ZZ 'Other interventions targeting physical activity behaviours, not elsewhere classified'. For several IUs, it was noted that the codes assigned (i.e., UE1 VP ZZ + VEB ZY ZZ) did not capture the nature of the services to which access was improved (i.e., sports clubs) (e.g., N172, Table 4.25).

Another distinction not captured by ICHI concerned IUs that aim to reduce the incidence of negative interactions between people (e.g., bullying, sexual assault, violence), for which the approach used may be to modify the behaviour of potential perpetrators and/or to build resilience in potential victims. It was noted that this distinction is not captured by ICHI (e.g., N74).

Table 4.25: Other distinctions not captured by ICHI codes

Example no. and data set	Example IU	Comments
N172 Netherlands	172. Program to facilitate increased involvement of kids in organised sport – introductory sessions during school, then encouragement to participate in after-school sport, club tournament, free trial sessions at club, and finally club membership.	Assigned UE1 VP ZZ 'Improving access to services' plus VEB ZY ZZ 'Other interventions targeting physical activity behaviours, not elsewhere classified'; noted that this does not capture nature of services to which access improved, or linking between schools and sports clubs.
N74 Netherlands	74. Interactive online game to develop awareness of and strategies to avoid risky sexual situations.	Assigned VEF PM ZZ 'Education about sexual behaviours'; noted that this IU is about equipping individuals to avoid becoming victims of sexual misconduct, rather than reducing perpetration.

4.4. Discussion of findings from ICHI public health data coding study

The descriptive analysis of ICHI-coded data, based on frequency counts of axis categories and intervention codes, illustrates the use of ICHI for characterising and comparing sets of data on public health interventions in a way that is not easily done if interventions are represented only by textual descriptions. Differences between the three data sets are evident in terms of the number and frequency distribution of axis categories and intervention codes, conveying information about the diversity of interventions within each of the data sets, as well as the types of interventions. The Netherlands data set is by far the most diverse, with the greatest number of Targets, Actions and ICHI intervention codes represented. Comparing the other two data sets, the OPAL data set has a greater diversity of Targets while the Tobacco Control data set has a greater diversity of Actions. These two data sets would be expected to have fewer Target categories than the Netherlands data set as they are both focused on a single health topic – obesity in the case of OPAL, and tobacco use in the case of the Framework Convention indicators. The Netherlands data set covers lifestyle interventions generally, but interventions targeting physical activity and eating behaviours are most common, as illustrated in Figure 4.3. It is notable that education interventions dominate both the OPAL and Netherlands data sets (Figure 4.4).

The analysis also reveals some patterns that indicate possible shortcomings of the classification. The high frequency of residual intervention codes, accounting for around a quarter of IUs in all three data sets (Table 4.1), suggests limitations in the capacity of ICHI to adequately represent the full range of public health interventions described. Residual codes only provide information on Target, with no indication of what was actually done. For the OPAL and Netherlands data sets, a comparison of the percentage of IUs with 'missing' Action and the percentage with a residual code assigned (Table 4.1) suggests that, in many cases, assignment of residual codes is a result of gaps in the ICHI Action axis. For the Tobacco Control data set, only 6% of IUs were not assigned an ICHI Action, yet 26% were assigned a residual code, indicating that, for 20% of IUs, the required combination of Target and Action was not available as an ICHI code. The substantial proportions of IUs for which more than one Target or Action was recorded signals an issue with how well the ICHI intervention code actually reflects the nature of the intervention, because only a single Target, Action and Means is represented in each code. The Means axis displayed little utility for distinguishing between or grouping interventions in any of the three data sets, with only a few Means categories represented in the coded data, and many IUs without a Means assigned.

The thematic analysis of coding notes enabled identification and exploration of the range of issues that arose in the course of applying ICHI to code intervention descriptions in the three data sets. The results of this analysis provide a more in-depth understanding of the shortcomings indicated by the analysis of ICHI-coded data, and also highlight some additional problems. Some of the issues identified point to specific changes needed to improve the utility of the classification, such as additional axis categories, clarification concerning the scope of existing axis categories, and changes to the wording of intervention code titles. Other issues, such as the difficulties associated with deciding how to identify and frame IUs and the observation that different types of Targets may be identified for a given IU, indicate more fundamental challenges. These issues suggest that the classification has shortcomings in terms of capturing or accommodating certain aspects of how public health interventions are described and understood in practice.

The first stage of the coding process – identification of IUs for coding – posed a number of difficulties. In many instances, choices needed to be made concerning whether or not activities described should be considered 'functional components' of an intervention, whether and how to split an intervention into its constituent components, and how to frame an IU (including which actor perspective to take). These choices have flow-on effects in terms of ICHI axis categories and intervention codes assigned. The operational definition of 'intervention unit' developed for this research (Section 3.4.1) was intended to standardise how units of classification would be identified for multi-component interventions, but it did not serve this function very well in practice. The wording of the definition refers to an IU as having 'a distinct Target, Action and Means' and 'an explicit or

inferred mechanism of action'. The definition does not anticipate that it may be possible to identify more than one Target, Action, Means and mechanism of action for what appears, intuitively, to be a single component of an intervention, which was often found to be the case. Also, the protocol does not provide instructions on how to frame the IU when alternative framings are possible. The overall impression was of insufficient guidance to standardise the identification of IUs.

The process of assigning axis categories to IUs revealed conceptual issues affecting each of the three axes. For Target, the possibility of multiple Targets of different types for a single IU – proximate Targets, ultimate Targets, and enabling factors – presents challenges apparently not anticipated in the design of the classification. The Action for an IU can be framed in terms of form (the deed done) or function (how it was intended to work), and ICHI Action categories were found to vary in terms of the extent to which they convey information about form and/or function. This creates mutual exclusivity problems for categories on the Action axis, and also raises questions about how data grouped by Action might meaningfully be interpreted. The ICHI concept of Means was found to pose particular challenges, with the 'Means' for an IU often difficult to articulate and the distinction between 'Action' and 'Means' sometimes unclear in the context of the descriptive information provided.

Other dimensions of information used to describe and group interventions were identified from each of the data sets (Table 4.3), and these can readily be related to the information dimensions represented in existing frameworks and classificatory schemes of relevance to public health interventions (Section 2.4.3). From the thematic analysis of coding notes, the system level at which the intervention is directed was picked up across all three data sets as an important dimension of information not captured by ICHI. This information was readily inferred from the textual descriptions of interventions (e.g., whether the intervention was directed to children, parents, council staff, medical students, etc.); the inability for this to be captured by ICHI was identified as a limitation, particularly where the IU was directed to higher system levels. The OPAL data set included a data item to record the hypothesised 'change pathway' for OPAL projects in terms of the system level to which the intervention was immediately directed and the consequent changes at other system levels expected. This data item was based on the ecological coding scheme developed by Richard et al. (1996), and could potentially be considered as a basis for developing an ICHI extension code to capture information on system level.

The range of problems and issues identified from the thematic analysis of coding notes underlines the need to interpret ICHI-coded data with caution. Different choices made concerning IU identification (e.g., splitting versus lumping), IU framing (e.g., which actor perspective to represent), Target assignment (e.g., proximate versus ultimate), and Action assignment (e.g., form versus function) inevitably affect the characterisation of individual intervention records, and thus the characterisation

of the whole data set. When such choices are subject to uncertainty, this has implications for the reliability and meaningfulness of the resulting coded data.

The following two chapters build on and elaborate the findings presented here. Chapter 5 presents results of research component 2, the inter-coder comparison study, which provide further insights into the reliability of ICHI-coded data and investigate reasons for discrepancies between coders. Chapter 6 presents results of research component 3, in-depth key-informant interviews, which explore how potential users respond to the classification and to summary characterisations of public health intervention data sets using ICHI-coded data. In Chapter 7, the results of the three research components are brought together to examine the extent to which the draft classification exhibits the characteristics required of a statistical classification.

5. Research Component 2: Inter-Coder Comparison Study

This chapter reports results of the second research component, in which ICHI coding undertaken by two independent coders was compared for a subset of records from each of the three data sets used in the first research component (ICHI public health data coding study). Specific aims of the inter-coder comparison study are:

- To measure rates of inter-coder agreement as an indication of the reliability of ICHI-coded data.
- To explore the nature of and reasons for coding discrepancies in order to inform improvement of the classification.

The method for this research component, described in Section 3.6, is briefly outlined below and the approach taken to analysing the inter-coder data is explained (Section 5.1). Section 5.2 presents results of both quantitative analyses (measures of agreement between coders and coded data profiles) and qualitative analyses (exploration of reasons for discrepancies between coders). The main findings of this research component are discussed in Section 5.3.

5.1 Methods

This research component used the same three data sets as were used for the ICHI public health data coding study, which are described in Section 3.4: the OPAL obesity prevention interventions data set, the Netherlands lifestyle interventions data set, and the Tobacco Control data set. For each data set, 50 records were randomly selected from the data sample used in the ICHI public health data coding study.

Three additional coders, one for each data set, undertook the coding of the records on a voluntary basis. All three coders were familiar with the use of health classifications, but did not have an in-depth knowledge of ICHI before their participation in this research; only one of the coders worked in the field of public health. The professional background and classification experience of the coders is outlined in Box 5.1. Each coder was provided with the following materials prior to undertaking the coding work:

- A background document introducing ICHI, explaining the purpose of the inter-coder comparison study in the context of the overall research project, and describing the data set to be coded.
- The coding protocol, providing step-by-step instructions for the coding process (Appendix 3.2).

- A template spreadsheet containing the data records to be coded (i.e., intervention descriptions) and providing columns for each of the information fields to be recorded (as specified in the coding protocol); examples of coded data records were provided in a separate tab.
- A list of ICHI Target, Action and Means categories relevant for public health interventions, with definitions and inclusions/exclusions, for easy reference.
- ICHI 2016 in Excel format, containing all Target, Action and Means categories and a subset of the full ICHI tabular list of intervention codes containing only those relevant for public health; coders were also provided with the link to the online browser version of ICHI 2016.

A telephone briefing was held with each coder before the work began, to talk through the coding process and provide clarification where necessary. Each coder then conducted the coding independently and supplied their results in the template spreadsheet. Data coding by the volunteer coders was undertaken over the period from December 2016 to July 2017. The coding results were compared with the initial coding conducted for the ICHI public health data coding study, to provide measures of inter-coder agreement and to explore reasons for discrepancies between coders at each step of the coding process.

Box 5.1: Background and classification experience of voluntary coders for the inter-coder study

OPAL data set: A senior public health researcher and member of WHO-FIC Collaborating Centre in Germany; experience in use of the International Classification of Functioning, Disability and Health (ICF).

Netherlands data set: Mental health nurse and PhD candidate; experience using and testing the DESDE-LTC, a classification of long term care services (Salvador-Carulla et al. 2011).

Tobacco Control data set: Occupational therapist and recent PhD graduate; experience in the development of a taxonomy for describing case management (Lukersmith et al. 2016).

In analysing the inter-coder data, two types of comparisons were made for each data set:

- Comparison of ICHI axis category and ICHI intervention code assignment between the two coders (i.e., the researcher and a volunteer coder) for ‘equivalent intervention units’; and
- Comparison of the overall profile of the coded data set between the two coders.

The first step of the coding process is to identify one or more intervention units (IU) per record. The coder writes a short, one-sentence description of each IU identified and then proceeds to assign appropriate axis categories and an intervention code. Because the two coders could identify different numbers of IUs per record, it was necessary to identify ‘equivalent IUs’ in order to compare codes assigned. Where both coders identified a single IU for a given record these were treated as equivalent (even where the two coders framed the IU differently in their one-sentence description). Where one or

both coders identified multiple IUs for a single record, IUs were paired for best matching of content and these pairs were regarded as equivalent IUs; any remaining, unpaired IUs were not included in the comparison of coding, but were included for the purpose of comparing the overall profile of the coded data in terms of axis categories and intervention codes assigned. Inter-coder agreement for Target, Action, Means and intervention code assignment was calculated based on equivalent IUs.

Inter-coder agreement was measured separately for Target, Action, Means and intervention codes as the percentage of equivalent IUs for which the two coders assigned matching codes[7]. The percentage of IUs with a 'partial match' was also calculated for Target and Action, that is, where the two coders assigned at least one matching category, but additional non-matching categories were also assigned.

Reasons for differences between the two coders were investigated by comparing IU wording, axis category assignment, and intervention code assignment for each coder, record by record. An initial review showed that, for many IUs, there were no, or only very brief, coding notes recorded by the volunteer coders. It was therefore decided not to use coding notes as a basis for a formal thematic analysis; instead, where they were present, notes were used to help determine likely explanations for coding decisions. Informal 'debriefing' meetings were held with two of the three volunteer coders. These meetings enabled a small number of coding errors to be corrected and allowed the researcher to gain a better understanding of the reasons for coding choices made by the volunteer coders; however, the information provided during these meetings is not used as data for the analysis, and the results presented are based solely on the coding and coding notes as entered into the template spreadsheet. The detailed, record-level comparison of coding choices enabled 'types' of apparent reasons for inter-coder differences to be identified and articulated. In Section 5.2, below, examples are provided to illustrate these types; frequency data are not presented because of the varying level of certainty with which individual instances could be assigned to a particular type, and because in many cases a mix of factors appeared to contribute to the different coding decisions reached.

Comparison of the overall profile of the coded data is valuable in addition to comparison of code assignment for equivalent IUs, as this powerfully illustrates the effects of different coding choices on the summary view provided by the coded data. As ICHI is a tri-axial classification, ICHI-coded data can be used to summarise a data set in terms of the frequency of different Targets, Actions or Means categories represented, as well as by the frequency of different intervention codes. Thus, frequency

[7] See Section 3.6.2 for an explanation of why this measure of inter-coder agreement was chosen.

distributions of all coded IUs by Target, Action, Means and intervention codes were compared between coders.

5.2 Results – inter-coder comparison study

Results are presented below under five headings (Box 5.2). As explained above, results under each heading compare both code assignment for equivalent IUs and overall profile of the data set for each coder. Examples drawn from the three data sets are presented to illustrate the different choices made by coders. The term 'record' is used to refer to the intervention description in the source data set. For all three data sets, 'Coder 1' is the volunteer coder and 'Coder 2' is the researcher. The system for numbering examples uses a leading letter to indicate the data set from which the example is drawn – OPAL obesity prevention (O), Netherlands lifestyle interventions (N), or Tobacco Control (T) – followed by the number of the particular IU within that data set.

Box 5.2: Headings under which inter-coder comparison results are presented

1. Intervention units – identification and framing
2. Target category assignment
3. Action category assignment
4. Means category assignment
5. Intervention code assignment

5.2.1 Intervention units – identification and framing

> Intervention unit – a key functional component of an intervention with a distinct Target, Action and Means, where 'functional' relates to the explicit or inferred mechanism of action (i.e., the hypothesised process by which the intervention will achieve the desired result).
> *(Definition from coding protocol developed for ICHI public health data coding study, Appendix 3.2)*

Differences in patterns of IU identification between the two coders are shown in Table 5.1 for each of the three data sets. For the Tobacco Control data set, both coders identified a single IU for all of the records. However, for both the OPAL and Netherlands data sets, there were differences between coders in the total number of IUs identified and the proportion of records for which more than one IU was identified. The difference between coders was greatest for the OPAL data set – Coder 1 identified multiple IUs for 46% of records, compared with 6% of records for Coder 2, and the two coders identified the same number of IUs for only 52% of records. There were 50 equivalent IUs for both the OPAL and Tobacco Control data sets and 60 equivalent IUs for the Netherlands data set. These equivalent IUs are used for comparing axis category and intervention code assignment between the two coders in the following sections.

Table 5.1: Identification of intervention units (IUs) by the two coders, by data set

	OPAL	Netherlands	Tobacco Control
Records (N)	50	48	50
IUs identified for the whole data set (N)			
Coder 1	82	71	50
Coder 2	58	64	50
Records for which multiple IUs identified (%)			
Coder 1	46	27	100
Coder 2	6	17	100
Records for which same number of IUs identified by both coders (%)	52	81	100
Equivalent IUs (N)	**50**	**60**	**50**

Table 5.2 shows comparisons for particular records from the three data sets to illustrate the nature of inter-coder differences for IU identification and framing. Comments in italics are the researcher's own interpretation of the comparison, to highlight the point being illustrated. These examples relate to the findings described in the text below.

- Reasons for differences between the two coders in the number of IUs per record were explored by comparing how each coder worded the constituent IUs they identified. This comparison was undertaken for each record across the three data sets. Differences were of three main types:
- Splitting versus lumping – one coder bundled together two or three different 'things done' while the other split them into separate IUs (e.g., O9, N2.3).
- One coder identified a separate element in the intervention description not mentioned by the other coder (e.g., N115.1).
- The two coders viewed the intervention described at different scales or levels of detail, so that one coder identified a single IU for the overall intervention while the other identified multiple IUs for its component parts (e.g., O55).

Table 5.2: Examples – comparison of IU identification

Example no. and data set	**Coder 1** IU number/s	**Coder 2** IU number/s
O9 OPAL	9.1. To provide children and families with the resources and skills they need to grow vegetables at home by providing the Magic Harvest Program. 9.2. To teach children and families about preparing healthy meals using the produce grown by providing the Magic Harvest Program. *Coder 1 split these elements into separate IUs, whereas Coder 2 regarded them as aspects of a single IU.*	9. 8-week program to provide children and families with resources and skills for growing vegetables at home and preparing healthy meals.
N2.3 Netherlands	2.3. Education program for children on risks of early alcohol consumption 2.4. Forum for children's discussion of issues related to education program. *Coder 1 split these elements into separate IUs, whereas Coder 2 regarded them as aspects of a single IU.*	2.2. Four digital lessons and one paper lesson about alcohol use delivered to students in class time; students have opportunity to exchange opinions through a discussion forum.
N115.1 Netherlands	115.1. Sticker based reward system for healthy eating or exercise behaviours 115.2. Supportive handbook and website providing additional information.	115. Motivation scheme (calendar and stickers) for use at home to encourage healthy eating and exercise among children aged 2-12. *Coder 2 did not mention handbook and website, identified as a separate IU by Coder 1.*
O55 OPAL	55. Implementing Think Feet First to increase the number of families with preschool children engaging in active travel for short trips to preschool or child care and in their local community. *Coder 1 identifies a single IU for the record and does not mention the more detailed intervention content split into separate IUs by Coder 2.*	55.1. Taking children on regular walks as part of active travel program delivered through kindergarten. 55.2. Road safety education as part of active travel program delivered through kindergarten. 55.3. Encouraging families to go on regular short walks as part of active travel program delivered through kindergarten.

In addition to differences in the number of IUs identified, there were differences in how the coders framed IUs, as expressed in the short, one-sentence description provided for each IU identified. In some cases, the description of an IU by the two coders emphasised different aspects of the intervention or conveyed different views of the essential nature of the intervention (e.g., O29, O40, Table 5.3). For some records, the intervention description suggested multiple actors were involved in delivering the intervention, so that the coder faced a choice as to whose perspective they would take in framing the IU (e.g., N72). For many of the equivalent IUs in the Tobacco Control data set, Coder 1 worded the IU more broadly to encompass other elements in the relevant Article of the Framework Convention, while Coder 2 based the description of the IU more closely on the wording of the indicator (e.g., T5.01).

Table 5.3: Examples – comparison of IU framing

Example no. and data set	**Coder 1** IU number/s	**Coder 2** IU number/s
O29 OPAL	29. To raise awareness and promote active leisure time for children by using the Imagination Playground. *Wording emphasises raising awareness; does not mention that equipment was provided.*	29. Provision of special playground equipment to encourage physical activity. *Wording emphasises provision of playground equipment; does not mention awareness raising as an aim.*
O40 OPAL	40. Collaborating with HCI in a walking event. *Focus is on the collaboration.*	40. Community walk to promote 'think feet first' message. *Focus is on the activity organised.*
N72 Netherlands	72. Provision of materials and advice to support schools to be completely non-smoking. *Focus is on provision of resources to schools – intervention developer perspective.*	72. Implementation of smoke-free school grounds. *Focus is on schools implementing smoke-free policy – school perspective.*
T5.01 Tobacco Control	**Article 5.1.** Each Party shall develop, implement, periodically update and review comprehensive multisectoral national tobacco control strategies, plans and programmes in accordance with this Convention and the protocols to which it is a Party. Indicator 5.01: Comprehensive multisectoral national tobacco control strategy developed.	
	5.01. Develop, implement and review national tobacco control strategy and program. *Wording reflects full scope of Article 5.1.*	5.01. Development of comprehensive multisectoral national tobacco control strategy. *Wording reflects narrower scope of indicator 5.01.*

5.2.2 Target category assignment

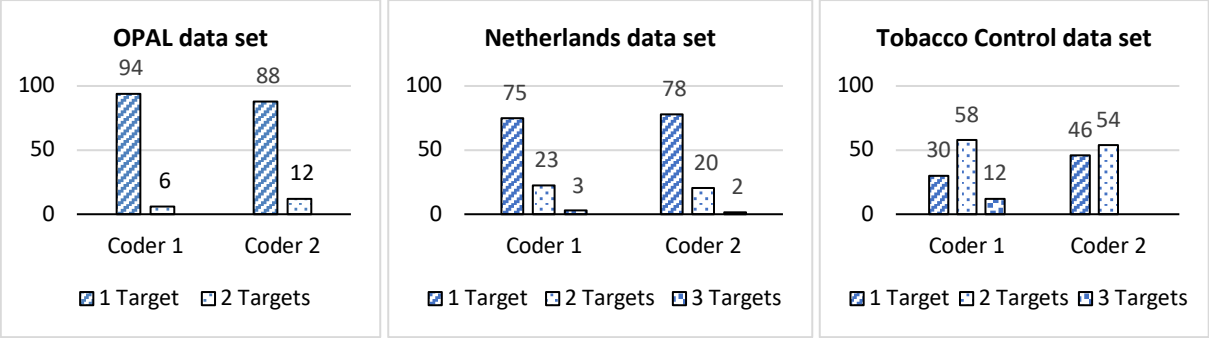
'Target – the entity on which the Action is carried out' (ICHI 2016).

Rates of agreement on Target category assignment between the two coders varied across the three data sets (Table 5.4). A complete match was recorded when both coders assigned the same Target category or categories. When one coder identified a single Target while the other identified the same Target plus an additional Target, or when both coders identified two or three Targets but there was a match for only one Target, this was deemed to be a 'partial match'. For the OPAL and Netherlands data sets, the percentage of equivalent IUs for which there was a complete or partial match in Target category assignment between the two coders was relatively high (94% for OPAL and 93% for the Netherlands data set). For the Tobacco Control data set, there was a complete match in Target assignment for only 12% of equivalent IUs, a partial match for 44% and no match for 44%. For each of the three data sets, the two coders also differed in the number of Target categories assigned per IU (Figure 5.1).

Table 5.4: Assignment of Target categories by the two coders, equivalent IUs, by data set

	OPAL	Netherlands	Tobacco Ctrl
IUs with matching Target/s assigned (%)	88	80 [1]	12
IUs with partial match in Target assignment [2] (%)	6	13	44
IUs with no match in Target assignment [3] (%)	6	7	44
Equivalent IUs (N)	**50**	**60**	**50**

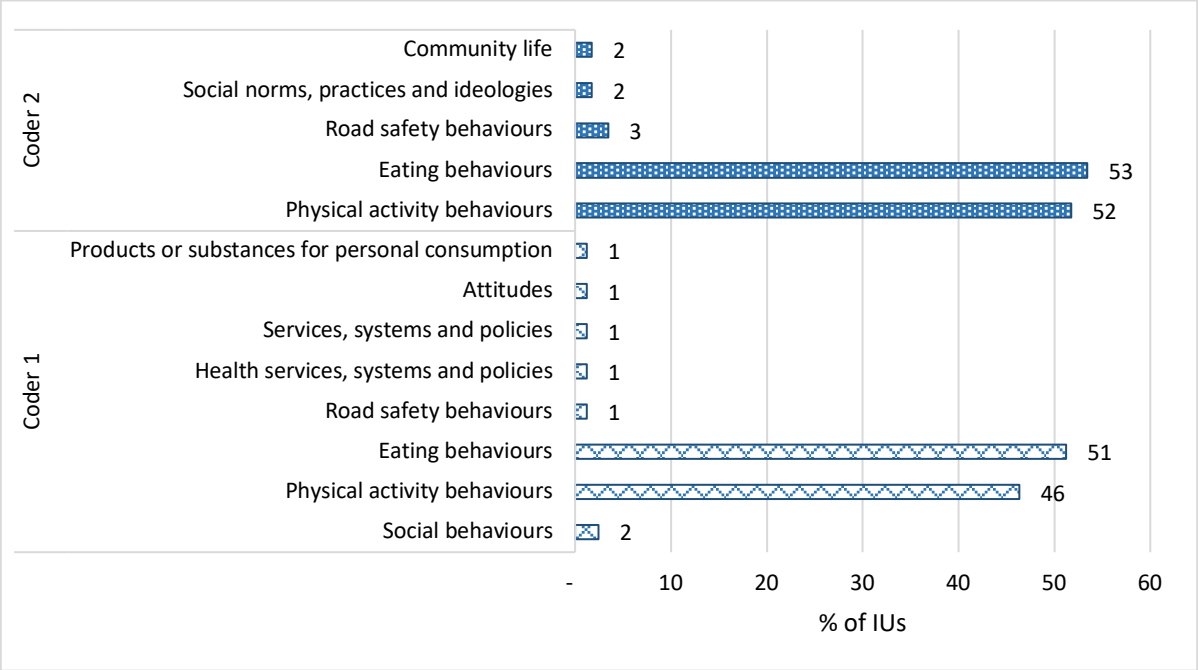
1. Includes one IU for which the same Target categories were assigned but in a different order.
2. Partial match includes: one coder identifies single Target while other coder identifies same Target plus additional Target; both coders identify two or three Targets but there is a match for only one Target.
3. No match includes: one coder assigns an ICHI Target while other records 'C' to denote a coverage issue (i.e., no applicable category found).



Percentages are calculated using the following denominators: OPAL Coder 1 N=82, Coder 2 N=58; Netherlands Coder 1 N=71, Coder 2 N=64; Tobacco control Coder 1 N=50, Coder 2 N=50.

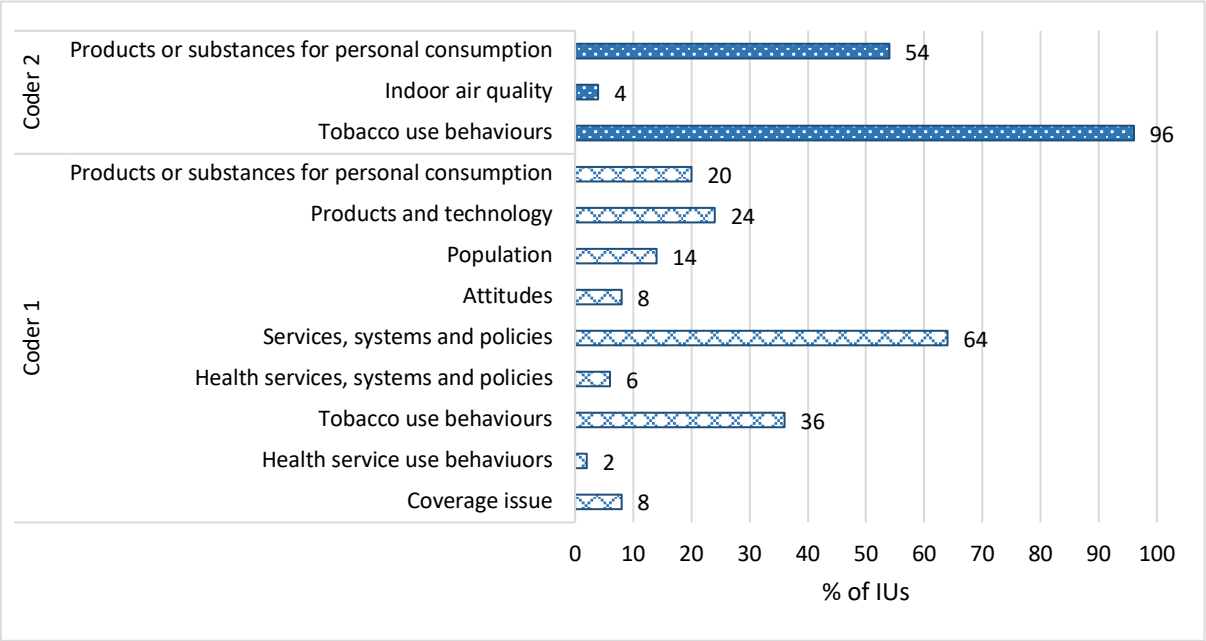
Figure 5.1: Number of Targets assigned per IU, as % of IUs, by coder, for the three data sets

For each data set, differences in Target assignment between the coders resulted in different Target profiles in terms of what health-related behaviours and environmental factors the interventions were directed towards. This is illustrated by Figure 5.2 for the OPAL data set, showing a broadly similar profile – for both coders, 'Eating behaviours' was the most commonly assigned Target, followed by 'Physical activity behaviours' – contrasted against Figure 5.3 for the Tobacco Control data set, where different patterns of Target assignment by the two coders resulted in very different profiles of the data set.



Percentages are calculated using the following denominators: Coder 1 N=82; Coder 2 N=58. Percentages may sum to more than 100 as more than one Target can be assigned per IU.

Figure 5.2: OPAL data set – frequency of Target categories assigned overall, by coder



Percentages are calculated using the following denominators: Coder 1 N=50; Coder 2 N=50. Percentages may sum to more than 100 as more than one Target can be assigned per IU.

Figure 5.3: Tobacco Control data set – frequency of Target categories assigned overall, by coder

To illustrate the nature of inter-coder differences, Table 5.5 presents examples of Target category assignment by the two coders for particular records. Reasons for differences were explored by looking at IU wording and Target assignment for each coder and reading coding notes where these were available. The most common apparent reasons for inter-coder differences in Target assignment were:

- Different decisions about the splitting of a project record into separate IUs (e.g., O8).
- Different framing of the IU by the two coders (e.g., O2).
- Different views on what environmental factor or health-related behaviour the intervention was primarily directed towards, or different weight ascribed to multiple envisaged benefits of the intervention (e.g., N98).
- Difficulty finding a Target category that was a good fit for the IU (e.g., N41).
- Different approaches to coding proximate and ultimate Targets of an intervention (e.g., T6).

Table 5.5: Examples – comparison of Target assignment

Example no. and data set	Coder 1 IU number/s	Coder 2 IU number/s
O8 OPAL	8.1. Provision of funds aiming to inspire families with new ideas through healthy caterings during (new) community programs. T-code(1): VEA – Eating behaviours 8.2. Provision of funds to inspire families with new ideas through physical activities during (new) community programs. T-code(1): VEB – Physical activity	8. Funding local groups to offer healthy community events and activities. T-code(1): VEB – Physical activity T-code(2): VEA – Eating behaviours *Coder 1 split record into two IUs and assigned a different Target to each; Coder 2 identified a single IU and assigned two Targets.*
O2 OPAL	2. Public Health Act is implemented aiming to establish a strong commitment to partnership to get started in the OPAL staff's planning process. T-code(1): UE1 – Services, systems and policies T-code(2): UEP – Health services, systems and policies *IU wording and Target assignment suggest Coder 1 has framed IU as primarily about making system changes to support the OPAL Program.*	2. Providing input to council planning processes to ensure they meet requirements of Public Health Act, in particular promoting partnership and collaboration between different levels of government. T-code(1): VEA – Eating behaviours T-code(2): VEB – Physical activity behaviours *IU wording and Target assignment suggests Coder 2 has framed IU as primarily about requirements of the Act, i.e., promotion of healthy eating and physical activity.*
N98 Netherlands	98. Series of classes teaching basketball and broader sportsmanship skills. T-code(1): VEB – Physical activity behaviours *Coder 1 saw IU as primarily aiming to impact on physical activity.*	98. Course of basketball classes aimed at developing Sportsmanship, Teamwork, Acceptance and Respect. T-code(1): VEK – Social behaviours *Coder 2 saw IU as primarily aiming to impact on sportsmanship, teamwork, acceptance and respect.*
N41 Netherlands	41. Provision of safety information materials for parents of young children. T-code(1): VEJ – Parenting behaviours T-code(2): VCC – Home safety behaviours T-code(3): VCD – Other safety behaviours, NEC *Coder 1 used three Targets to capture child safety.*	41. Provision of oral, written and digital information to parents of young children about safety risks and how to avoid accidents. T-code(1): VCD – Other safety behaviours, NEC *Coder 2 used single residual safety Target to capture child safety.*
T6 Tobacco Control	6.07. Develop and implement tax policies to reduce tobacco consumption. T-code(1): UE1 – Services, systems and policies T-code(2): VAB – Tobacco use behaviours *Coder 1 recorded UE1 as T-code(1) to convey that this was the proximate Target (i.e., system change), and VEB as T-code(2) to convey that this was the ultimate Target.*	6.07. Implementing tax policies to reduce tobacco consumption. T-code(1): VAB – Tobacco use behaviours *Coder 2 recorded only VAB as the ultimate Target for the IU.*

Where both a proximate and an ultimate Target could be identified for a given IU, coders often differed in terms of which they recorded first in the template spreadsheet. The coding protocol instructed coders to record the 'primary or main' Target in the first position (i.e., T-code(1)). However, it did not advise whether the proximate or the ultimate Target should be regarded as the 'primary or main' Target. For the Tobacco Control data set, in particular, the two coders differed on this – Coder 1 used the T-code(1) field to record proximate Target and Coder 2 used it to record ultimate Target. Thus Coder 2 assigned 'Tobacco use behaviours' for 96% of IUs, almost always as T-code(1), and the environmental factor Target 'Products and substances for personal consumption' for 54% of IUs, almost always as T-code(2). In contrast, Coder 1 most often assigned environmental factor Targets as T-code(1) (80% of IUs); where 'Tobacco use behaviours' was assigned it was more often assigned as T-code(2).

5.2.3 Action category assignment

> 'Action – the deed done by an actor to the Target' (ICHI 2016).

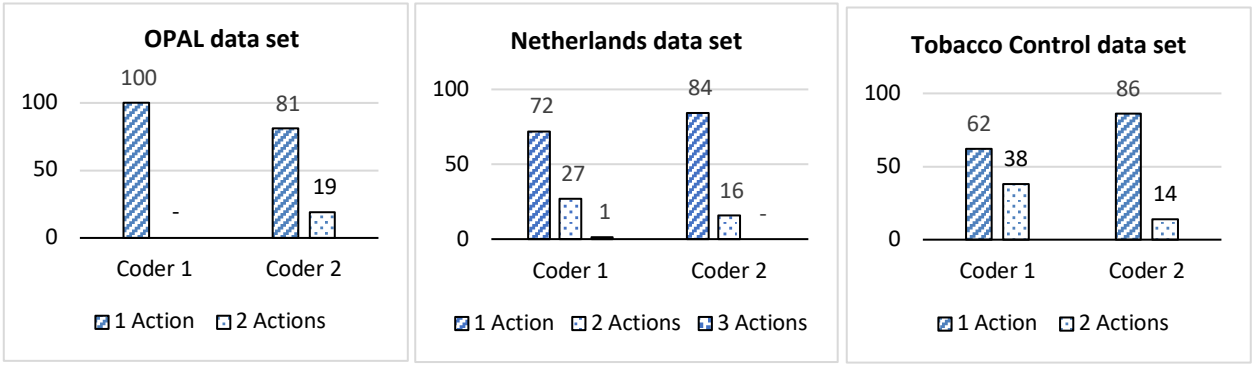
Rates of agreement on Action category assignment between the two coders varied across the three data sets (Table 5.6). The percentage of equivalent IUs for which there was a complete match was highest for the Netherlands data set at 33%. For both the Netherlands and Tobacco Control data sets, there was a complete or partial match for just over half of all equivalent IUs. For the OPAL data set, there was a complete match in Action assignment for only 20% of equivalent IUs and no match for 74%. For each of the three data sets, the two coders also differed in the number of Action categories assigned per IU (Figure 5.4).

Table 5.6: Assignment of Action categories by the two coders, equivalent IUs, by data set

	OPAL	Netherlands	Tobacco ctrl
IUs with matching Action/s assigned (%)	20	33	24
IUs with partial match in Action assignment [1] (%)	6	23	28
IUs with no match in Action assignment [2] (%)	74	44	48
Equivalent IUs (N)	**50**	**60**	**50**

1. Partial match includes: one coder identifies single Action while other coder identifies same Action plus additional Action; both coders identify two Actions but there is a match for only one Action.

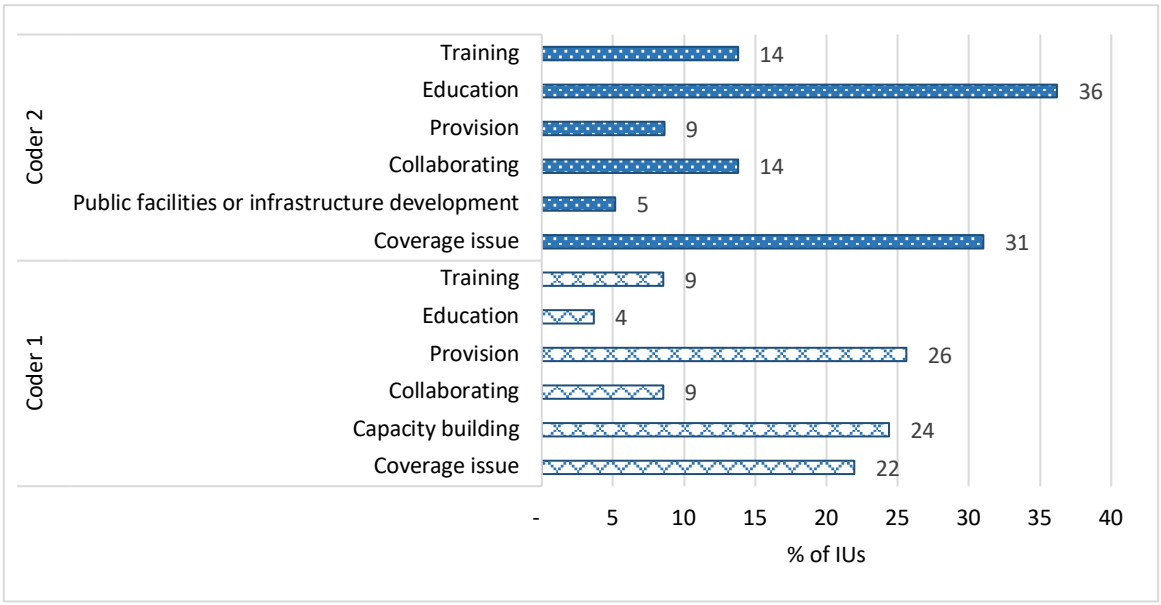
2. No match includes: one coder assigns an ICHI Action while other records 'C' to denote a coverage issue (i.e., no applicable category found); both coders record 'C'.



Percentages are calculated using the following denominators: OPAL Coder 1 N=82, Coder 2 N=58; Netherlands Coder 1 N=71, Coder 2 N=64; Tobacco control Coder 1 N=50, Coder 2 N=50.

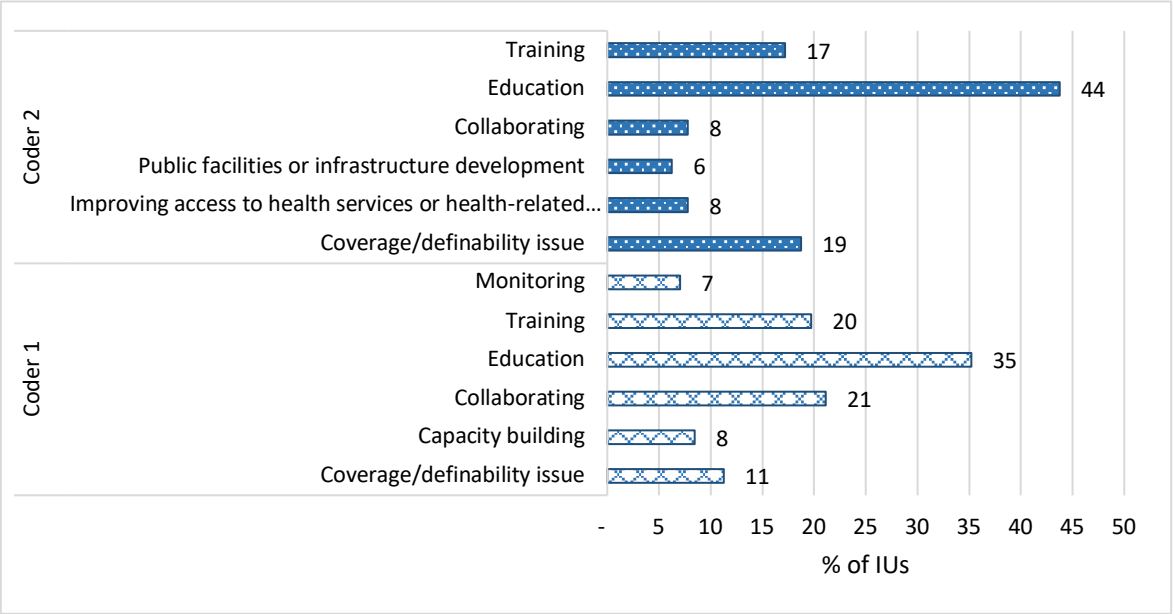
Figure 5.4: Number of Actions assigned per IU, as % of IUs, by coder, for the three data sets

For each data set, differences in Action assignment between the coders resulted in different Action profiles. This is illustrated by Figures 5.5 to 5.7, which show the most frequently assigned Action categories for the two coders for each of the data sets. For example, in the OPAL data set, 'Provision' and 'Capacity building' were each assigned for around a quarter of all IUs by Coder 1, while Coder 2 assigned 'Provision' for only 9% of IUs and did not assign 'Capacity building' for any IUs; Coder 1 assigned 'Education' for only 4% of IUs while Coder 2 did so for 36% of IUs. 'Coverage issue' means that the coder did not assign an ICHI Action category because no applicable category could be found to match the Action concept in the IU; the frequency of coverage issues also varied between coders for all three data sets.



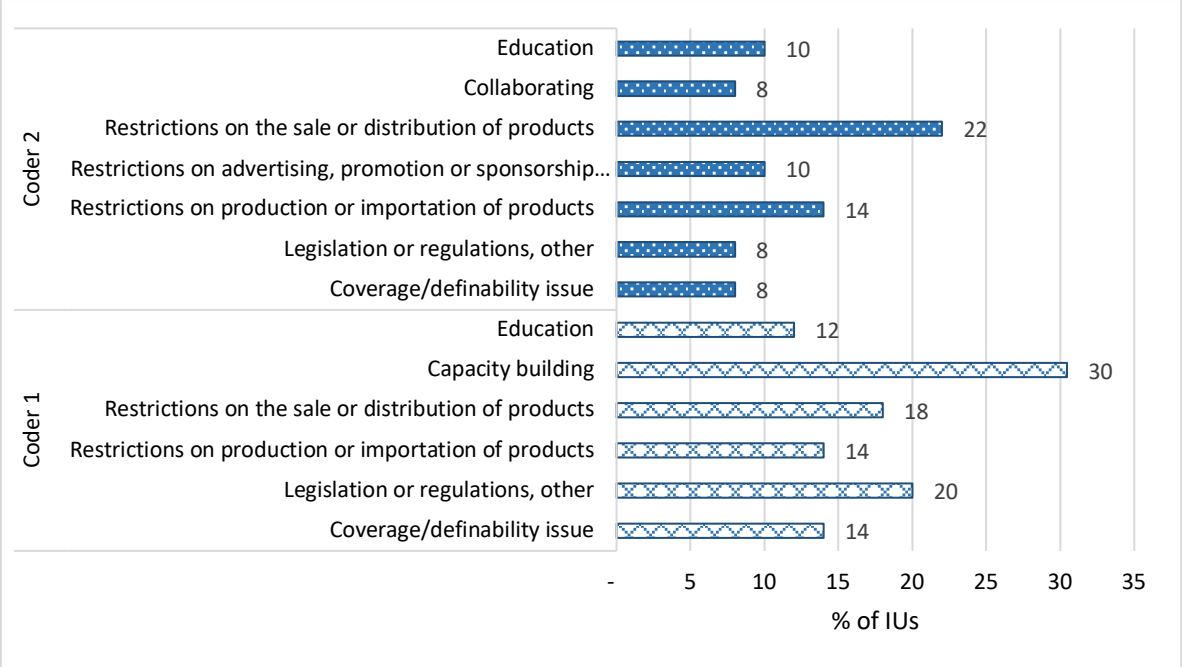
Percentages are calculated using the following denominators: Coder 1 N=82; Coder 2 N=58. Percentages may sum to more than 100 as more than one Action can be assigned per IU.

Figure 5.5: OPAL data set – most frequently assigned Action categories, by coder



Percentages are calculated using the following denominators: Coder 1 N=71; Coder 2 N=64. Percentages may sum to more than 100 as more than one Action can be assigned per IU.

Figure 5.6: Netherlands data set – most frequently assigned Action categories, by coder



Percentages are calculated using the following denominators: Coder 1 N=50; Coder 2 N=50. Percentages may sum to more than 100 as more than one Action can be assigned per IU.

Figure 5.7: Tobacco Control data set – most frequently assigned Action categories, by coder

To illustrate the nature of inter-coder differences, Table 5.7 presents examples of Action category assignment by the two coders for particular records. Reasons for differences were explored by looking at IU wording and Action assignment for each coder and reading coding notes where these were available. The most common apparent reasons for inter-coder differences were:

- Different framing of IUs (e.g., N40, T19.06).
- Different ways of describing what was done, or a focus on different aspects of the IU (e.g., N115, T14.09).
- Different choices of Action assignment where more than one category was seen as applicable (e.g., N41).
- Choice of an Action describing 'what was done' versus an Action describing the intended effect of what was done (e.g., N115, T15.05, N63).
- Different interpretation of the scope of particular ICHI Action categories (e.g., T16.08).

Some patterns of difference were also evident concerning particular Actions:

- *Capacity building (VA).* For both the OPAL and Netherlands data sets, 'Capacity building' was assigned more frequently by Coder 1 than Coder 2. For IUs that could be viewed as building capacity in some way at individual or organisation level, Coder 1 tended to assign 'Capacity building', whereas Coder 2 tended to assign 'Education' or 'Training', or record 'C' (coverage issue) (e.g., N63, O12.1). Coder 1 for the Netherlands data set commented that 'Any "train the trainer" program is really also about capacity building'.
- *Provision (RD).* For the OPAL data set, Coder 1 appeared to interpret the Action 'Provision' more broadly than Coder 2 and assigned it for a wide range of IUs to convey that a program or activity was provided (e.g., O10).
- *Collaborating (TD).* For the Netherlands data set, Coder 1 commonly assigned 'Collaborating' as the first Action (A-code(1)) where the intervention involved collaboration, cooperation or a partnership relationship between different actors (e.g., school and local sports clubs), or was characterised by active involvement of intervention recipients (e.g., group discussion), whereas Coder 2 assigned 'Collaborating' only as the second Action (A-code(2)) and only for IUs that particularly emphasised community-level stakeholder partnerships. Similarly, for the OPAL data set, Coder 1 was more inclined than Coder 2 to regard 'Collaborating' as the main Action for an IU (e.g., O47).

- *Education (PM).* For the OPAL data set, Coder 2 appeared to interpret the Action 'Education' more broadly than Coder 1 and assigned it for IUs involving awareness raising, for which Coder 1 often recorded 'C' (coverage issue) (e.g., O26).
- *Legislation and regulations, other (WI).* For the Tobacco Control data set, this Action was used differently by the two coders. Coder 1 used it in instances where putting legislation in place was required to implement the IU (e.g., T11.02). Coder 2 used it as a residual category where the IU involved making or enforcing rules, and where no other Action category was applicable. Often where Coder 1 assigned WI, Coder 2 instead assigned an Action describing the intended effect of the rules, e.g., WE 'Restrictions on the production or importation of tobacco products'. Discussion during the informal 'debriefing' meeting conducted after coding was completed revealed that Coder 1 did not regard WI as a residual category.

Table 5.7: Examples – comparison of Action assignment

Example no. and data set	**Coder 1** IU number/s	**Coder 2** IU number/s
N40 OPAL	40. Collaborating with HCI in a walking event. A-code(1): TD – 'Collaborating' *Action assignment reflects framing of IU as primarily about the collaboration between OPAL and a partner organisation in the community.*	40. Community walk to promote 'think feet first' message. A-code(1): C – coverage issue *Action assignment reflects framing of IU as primarily about the community walk event.*
T19.06 Tobacco Control	19.06. Enable any citizen to launch criminal or civil liability action against tobacco industry. A-code(1): VA – 'Capacity building' *Action assignment reflects framing of IU as enabling citizens to take legal action.*	19.06. Civil or criminal liability action launched by any person. A-code(1): WI – 'Legislation or regulations, other' *Action assignment reflects framing of IU as taking legal action, i.e., enforcing a legislative provision*.
N115 Netherlands	115. Sticker based reward system for healthy eating or exercise behaviours A-code(1): WG – Applying incentives. *Coder 1 focuses on the incentive aspect of this IU.*	115. Motivation scheme (calendar and stickers) for use at home to encourage healthy eating and exercise among children aged 2-12. A-code(1): RD – 'Provision' *Coder 2 focuses on the provision aspect of this IU.*
T14.09 Tobacco Control	14.09. Include diagnosis and treatment of tobacco dependence in health or health-related services. A-code(1): VA – 'Capacity building' A-code(1): VO – 'Marshalling health services or health-related services' *Coder 1 describes what was done as building capacity in the system and marshalling existing services.*	14.09. Inclusion of diagnosis and treatment of tobacco dependence within national tobacco control programs. A-code(1): VN – 'Establishing health services or health-related services' *Coder 2 describes what was done as establishing new services or infrastructure.*

Table 5.7 (continued): Examples – comparison of Action assignment

Example no. and data set	Coder 1 IU number/s	Coder 2 IU number/s
N41 Netherlands	41. Provision of safety information materials for parents of young children. A-code(1): PN – 'Advising' *Coder 1 notes that 'Education is part of this but I think it is more appropriately coded as advising'.*	41. Provision of oral, written and digital information to parents of young children about safety risks and how to avoid accidents. A-code(1): PM – 'Education'
T15.05 Tobacco Control	15.05. Develop a distribution tracking system. A-code(1): WC – 'Restrictions on the sale or distribution of products' *Action assignment describes intended effect of tracking system (to reduce illicit trade in tobacco products).*	15.05. Develop tracking system to assist in the investigation of illicit trade. A-code(1): AI – 'Monitoring' *Action assignment describes what tracking system does (monitoring), not intended effect (to reduce illicit trade in tobacco products).*
N63 Netherlands	63.1. Curriculum package for teaching staff providing tools for the implementation of the mandatory reporting code. A-code(1): VA – 'Capacity building' *Action assignment describes intended effect, i.e., building capacity of teaching staff to implement the reporting code.*	63. Education and support for teachers to help schools implement mandatory domestic violence reporting code. A-code(1): PM – 'Education' *Action assignment describes what was done, i.e., education was provided to teaching staff.*
T16.08 Tobacco Control	16.08. Prohibit free distribution of tobacco products to the public. A-code(1): WD – 'Restrictions on advertising, promotion or sponsorship of products' *Coder 1 sees prohibiting distribution of free products as restriction on advertising or promotion.*	16.08. Ban on distribution of free tobacco products to the public. A-code(1): WC – 'Restrictions on the sale or distribution of products' *Coder 2 sees prohibiting distribution of free products as restriction on sale or distribution.*
O12.1 OPAL	12.1. To empower the community to learn from each other, community members are trained to become facilitators of the Magic Harvest Program. A-code(1): VA – 'Capacity building' *Action assignment describes IU as building community capacity.*	12. Training community members to teach others in the community the principals of growing their own food using the magic square gardening principals. A-code(1): PH – 'Training' *Action assignment describes IU as delivering training.*
O10 OPAL	10. To enable children to participate in and learn how to prepare a healthy meal with a focus on healthy snacks by providing a cooking project. A-code(1): RD – 'Provision' *Action assignment conveys that a cooking project was provided.*	10. School cooking project to enable children to participate in and learn how to prepare healthy food. A-code(1): PM – 'Education' A-code(2): PH – 'Training' *Action assignment conveys education and training as what was delivered in the cooking project.*

Table 5.7 (continued): Examples – comparison of Action assignment

Example no. and data set	Coder 1 IU number/s	Coder 2 IU number/s
O47 OPAL	47. Increase awareness of the OPAL Program, Goals and Themes and activities available in the community by contribution to the local Newsletter and Website. A-code(1): TD – 'Collaborating' *Coder 1 sees 'Collaborating' as main action.*	47. Articles in local newspaper to raise awareness of OPAL Goals, Themes and activities. A-code(1): PM – 'Education' A-code(2): TD – 'Collaborating' *Coder 2 sees 'Education' as main action; coding note that 'promoting partnership with local newspaper is part of rationale'.*
O26 OPAL	26. To distribute healthy eating 'Transition Packs' linked to the 'Make it a Fresh Snack' theme to families in preschools. A-code(1): C – coverage issue *Coder 1 sees this kind of awareness raising intervention as not captured by any of the ICHI Action categories.*	26. 'Transition packs' for preschool children to encourage healthy eating; packs contain info and promotional merchandise. A-code(1): PM – 'Education' *Coder 2 sees this kind of awareness raising intervention as within the scope of 'Education'.*
T11.02 Tobacco Control	11.02. Prohibition of misleading packaging and labelling of tobacco products. A-code(1): WI – 'Legislation or regulations, other' A-code(2): PM – 'Education' *Action assignment conveys putting legislation in place on a matter concerning education of the public in relation to tobacco products.*	11.02. Ban of misleading descriptions on tobacco product packaging and labelling. A-code(1): WD – 'Restrictions on advertising, promotion or sponsorship of products' *Action assignment conveys intended effect, i.e., to restrict a form of tobacco product promotion.*

5.2.4 Means category assignment

'Means – the processes and methods by which the Action is carried out' (ICHI 2016).

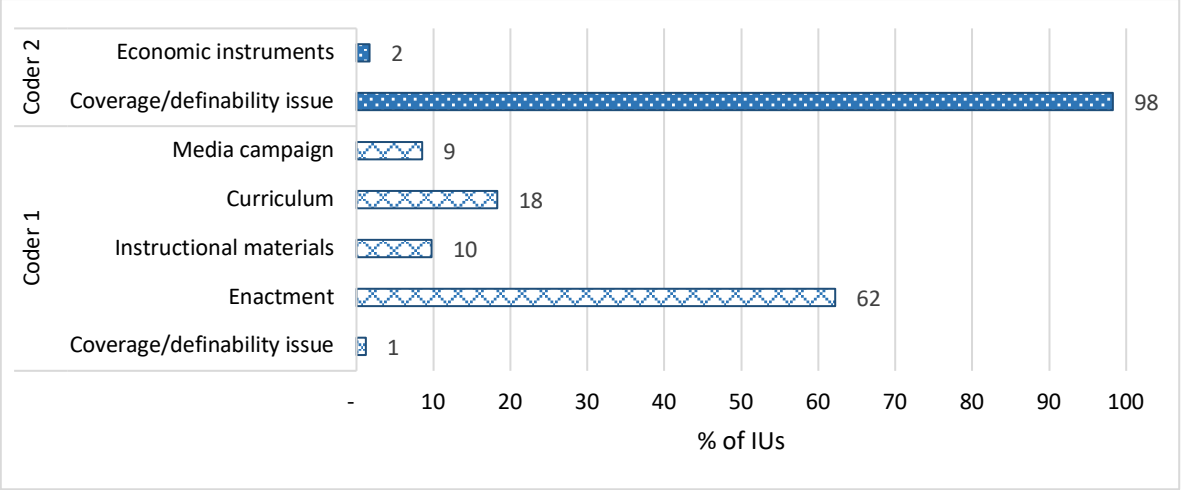
Rates of agreement on Means category assignment between the two coders were low for all three data sets, with no match for 86% to 100% of equivalent IUs (Table 5.8). In general, only one Means category was assigned per IU, with the exception of Coder 2 for the Tobacco Control data set who assigned two Means categories for 12% of IUs.

Table 5.8: Assignment of Means categories by the two coders, equivalent IUs, by data set

	OPAL	Netherlands	Tobacco ctrl
IUs with matching Means assigned (%)	0	12	14
IUs with no match in Means assignment [1] (%)	100	88	86
Equivalent IUs (N)	**50**	**60**	**50**

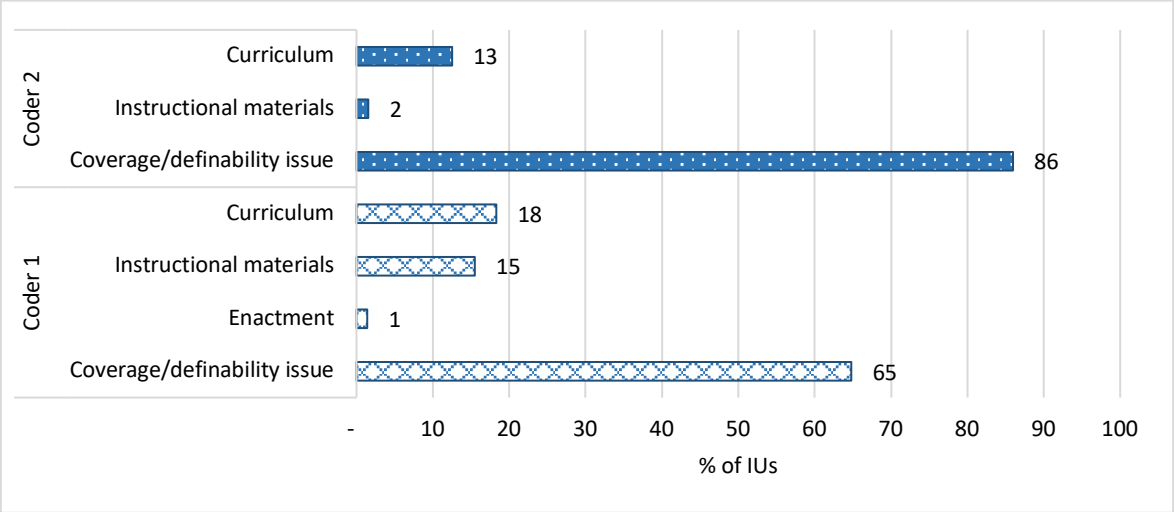
1. No match includes: one or both coders record 'C' to denote a coverage issue (i.e., no applicable category found) or 'D' to denote a 'definability issue' (i.e., insufficient information to determine the Means for the IU).

For each data set, differences in Means assignment between the coders resulted in different Means profiles. This is illustrated by Figures 5.8 to 5.10, which show Means assignment for the two coders for each of the data sets. It is striking that all but one of these figures shows a high proportion of IUs for which no Means was assigned (in Figures 5.8 to 5.10 'Coverage issue' includes both instances in which no applicable ICHI Means was available and instances in which there was insufficient information to determine Means for the IU). The high frequency of assignment of 'Enactment' by Coder 1 for the OPAL data set (Figure 5.8) suggests 'Enactment' may have effectively been used as a residual category by this coder to indicate that something was done, where no other applicable Means category was available.



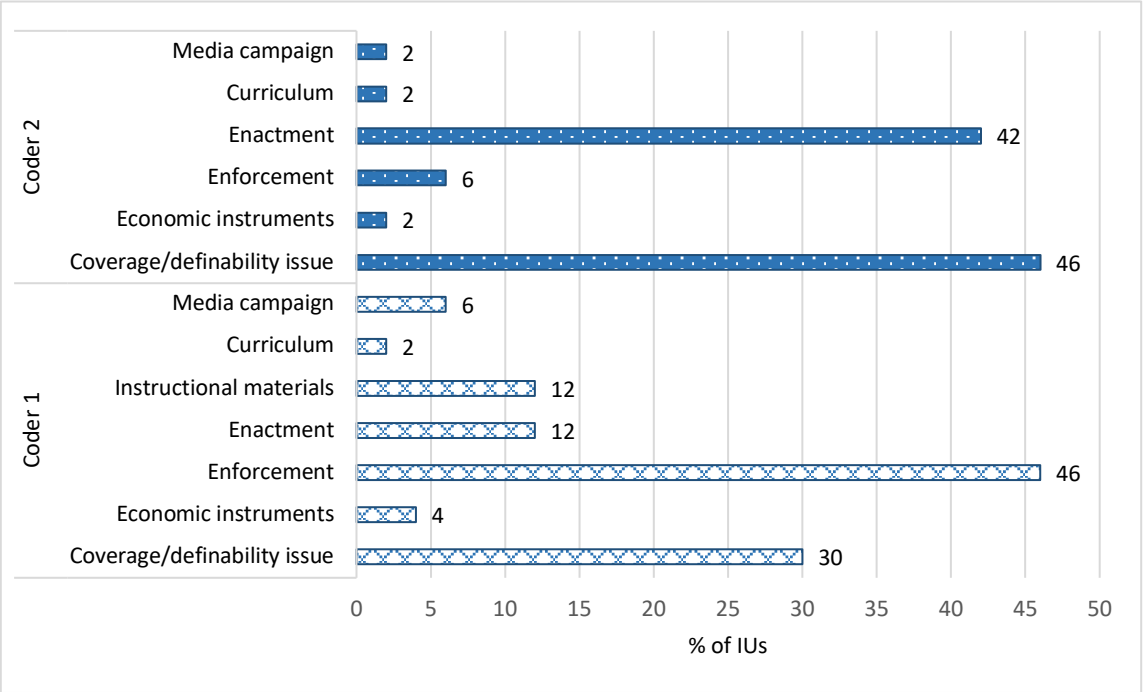
Percentages are calculated using the following denominators: Coder 1 N=82; Coder 2 N=58. Percentages may sum to more than 100 as more than one Means can be assigned per IU.

Figure 5.8: OPAL data set – most frequently assigned Means categories, by coder



Percentages are calculated using the following denominators: Coder 1 N=71; Coder 2 N=64. Percentages may sum to more than 100 as more than one Means can be assigned per IU.

Figure 5.9: Netherlands data set – most frequently assigned Means categories, by coder



Percentages are calculated using the following denominators: Coder 1 N=50; Coder 2 N=50. Percentages may sum to more than 100 as more than one Means can be assigned per IU.

Figure 5.10: Tobacco Control data set – most frequently assigned Means categories, by coder

To illustrate the nature of inter-coder differences, Table 5.9 presents examples of Means category assignment by the two coders for particular records. Reasons for differences were explored by looking at IU wording and Means assignment for each coder, and reading coding notes where these were available. The most common apparent reason for inter-coder differences was different interpretation of the scope of particular ICHI Means categories:

- *Media campaign (QA)*, *Curriculum (QB)* and *Instructional materials (QC)*: For both the OPAL and Netherlands data sets, Coder 1 appeared to interpret 'Curriculum' and 'Instructional materials' more broadly than Coder 2 (e.g., N39, N21). This was also the case for 'Media campaign' for the OPAL data set (O25).
- *Enactment (QD)* and *Enforcement (QE)*: For several IUs in the Tobacco Control data set, bans or prohibitions were regarded as 'Enforcement' by Coder 1 and 'Enactment' by Coder 2 (e.g., T16.06).
- *Economic instruments (QF)*: For the Tobacco Control data set, Coder 1 used Means 'Economic instruments' more broadly than Coder 2, assigning it for IUs involving some sort of financial measure or having a financial effect; Coder 2 used 'Economic instruments' only together with Action WG 'Applying incentives' (e.g., T14.31).

For the Tobacco Control data set, it was apparent that in some instances different Means recorded by the two coders reflected the differences in how the IU was expressed (e.g., T13.01) or different Actions assigned (e.g., T15.07). Further, in some instances Coder 1 inferred the Means, while Coder 2 recorded 'D' (e.g., T12.01).

Table 5.9: Examples – comparison of Means assignment

Example no. and data set	**Coder 1** IU number/s	**Coder 2** IU number/s
N39 Netherlands	39. Workshop for parents to teach them how to encourage good eating habits in their children through understanding taste development. M-code(1): QB – 'Curriculum' *Coder 1 viewed 'Curriculum' as a good fit for describing a workshop.*	39. Workshop for parents of young children to provide them with skills to help their children develop good eating habits. M-code(1): C – Coverage issue *Coder 2 did not identify an applicable ICHI Means and recorded coding note 'Means is workshop'.*
N21 Netherlands	21. DVD and guide to support discussion with groups of young people around sexual health, relationships, roles etc. M-code(1): QC – Instructional materials *Coder 1 viewed 'Instructional materials' as a good fit for describing DVD and guide to support discussion.*	21. Education and awareness raising about sexuality and relationships through group discussions, using DVD and accompanying materials. M-code(1): C – Coverage issue *Coder 2 did not identify an applicable ICHI Means and recorded coding note 'Means is group discussion with supporting materials (DVD and guide)'.*
O25 OPAL	25.1. To raise awareness of OPAL Program, goals and themes by contributing to the Pre School Newsletter available in hard copies and distributed to each family periodically. M-code(1): QA – 'Media campaign' *Coder 1 viewed 'Media campaign' as applicable Means but added coding note 'Newsletter (written)'.*	25. Contribute to preschool newsletter and website to increase awareness about OPAL and activities available in the community. M-code(1): C – Coverage issue *Coder 1 did not identify an applicable ICHI Means and recorded coding note 'Newsletter articles'.*
T16.06 Tobacco Control	16.06. Prohibit sale of tobacco products from vending machines. M-code(1): QE – 'Enforcement' *Coder 1 viewed 'Enforcement' as a good fit for describing prohibiting sale.*	16.06. Ban on sale of tobacco products from vending machines. M-code(1): QD – 'Enactment' *Coder 2 viewed 'Enactment' as a good fit for describing banning sale.*
T14.31 Tobacco Control	14.31. Facilitate the access and affordability of pharmaceutical products (which support cessation of tobacco use). M-code(1): QE – 'Economic instruments' *Coder 1 viewed 'Economic instruments' as a good fit to describe facilitating access and affordability.*	14.31. Facilitating accessibility and affordability of pharmaceutical products for tobacco cessation. M-code(1): D – Definability issue *Coder 1 recorded coding note 'Not described'.*
T13.01 Tobacco Control	13.01. Enforce ban on all tobacco advertising, promotion and sponsorship. M-code(1): QE – 'Enforcement' *IU framed as an enforcement intervention.*	13.01. Instituting ban on all tobacco advertising, promotion and sponsorship. M-code(1): QD – 'Enactment' *Wording suggests that Coder 2 has framed this as about putting a ban in place.*

Table 5.9 (continued): Examples – comparison of Means assignment

T15.07 Tobacco Control	15.07. Implement monitoring of cross-border trade. A-code(1): WC – 'Restrictions on the sale or distribution of products' M-code(1): QE – 'Enforcement' *Coder 1 viewed monitoring as enforcing restrictions – the Action and Means together describe intended effect of the IU.*	15.07. Monitoring of cross-border trade in tobacco products. A-code(1): AI – 'Monitoring' M-code(1): D – Definability issue *Coder 2 captured monitoring as the Action; there was no description of how the monitoring was done (i.e., Means not described).*
T12.01 Tobacco Control	12.01. Provide public educational and awareness programmes focusing on individuals. M-code(1): QC – Instructional materials M-code(2): QA – 'Media campaign' *Coder 1 has inferred that this education will be delivered by way of instructional materials and media campaigns.*	12.01. Implementation of educational and public awareness programs about health risks of tobacco consumption and exposure to tobacco smoke, and adverse consequences of tobacco production. M-code(1): D – Definability issue *Coder 2 recorded coding note 'Not described'.*

5.2.5 Intervention code assignment

> 'Each intervention is represented by a title and a unique seven-character code denoting the axis categories for that intervention' (ICHI 2016).

Inter-coder agreement on intervention code assignment was highest for the Netherlands data set at 32% of equivalent IUs, with an additional 13% for which the codes assigned had the same Target and Action but differed on Means (Table 5.10). The Tobacco Control data set had the lowest rate of agreement, with the same ICHI code assigned by the two coders for only 6% of records.

Table 5.10: Assignment of ICHI intervention codes by the two coders, equivalent IUs, by data set

	OPAL	Netherlands	Tobacco ctrl
IUs for which matching ICHI intervention code assigned (%)	26	32	6
IUs for which non-matching ICHI intervention code assigned [1] (%)	74	68	94[1]
IUs for which T & A match, but different M (%)	*0*	*13*	*2*
Equivalent IUs (N)	**50**	**60**	**50**

1. For the Tobacco Control data set, this includes 52% of IUs for which Coder 1 recorded intervention code as missing, while Coder 2 assigned an ICHI intervention code.

For all three data sets, the pattern of intervention code assignment differed between the two coders, resulting in different overall profiles of the data set. Tables 5.11 to 5.13 illustrate this by presenting the most frequently-assigned ICHI codes, by coder, for the three data sets. There was variation between the two coders not only in terms of which ICHI codes were most frequently assigned, but also in the percentage of IUs accounted for by the most commonly assigned codes, and in the number of codes represented in the coded data set, which could be taken as a measure of the diversity of types of interventions delivered. For example, in the OPAL data set for Coder 1, there were 18 ICHI codes represented; the two most common codes were 'Capacity building interventions targeting healthy eating behaviours' (15% of IUs) and 'Provision of products or services to support improved physical activity behaviours' (15%) (Table 5.11). For Coder 2, there were 15 ICHI codes represented; the residual code 'Other interventions targeting physical activity behaviours, not elsewhere classified' was assigned to nearly a quarter of all IUs, followed by 'Education about eating behaviours' (17% of IUs). For Coder 1, the two most commonly-assigned codes together accounted for 30% of all IUs, and for Coder 2, they accounted for 41% of all IUs; more 'Provision' and 'Capacity building' codes were assigned by Coder 1, and more 'Education' and 'Other interventions' codes by Coder 2. Appendix 5.1 shows all intervention codes represented for each data set and compares intervention code assignment between the two coders.

The reasons for inter-coder differences in the assignment of intervention codes flow from the differences in IU identification and framing and axis category assignment, reported above. For the Tobacco Control data set, the two coders had very different approaches to IU framing and choice of Targets. For 52% of IUs, Coder 1 did not assign an ICHI intervention, either because a code was not available that combined the Target, Action and Means categories assigned, and/or because applicable axis categories were not identified. In particular, for many IUs, Coder 1 assigned environmental factor Targets such as UE1 'Services, systems and policies', UAA 'Products and substances for personal consumption', and UA1 'Products and technology'; residual codes of the form 'Other interventions targeting …' ('ZY ZZ' codes) were not available for these Targets. In contrast, Coder 2 assigned Target VAB 'Tobacco use behaviours' for most IUs and thus was able to assign code VAB ZY ZZ 'Other interventions targeting tobacco use behaviours' when the required combination of Target, Action and Means was not available as an ICHI code.

Table 5.11: Most frequently-assigned ICHI intervention codes, Coder 1 and Coder 2, OPAL data set

ICHI code	ICHI intervention title	IUs (%) [1]
Coder 1 (18 ICHI codes represented in coded data; 82 IUs)		
VEA VA ZZ	Capacity building interventions targeting healthy eating behaviours	15
VEB RD ZZ	Provision of products or services to support improved physical activity behaviours	15
VEA RD ZZ	Provision of products or services to support improved eating behaviours	11
VEA ZY ZZ	Other interventions targeting eating behaviours, not elsewhere classified	11
VEB ZY ZZ	Other interventions targeting physical activity behaviours, not elsewhere classified	11
Missing		4
Other code		*32*
Total IUs		***100***
Coder 2 (15 ICHI codes represented in coded data; 58 IUs)		
VEB ZY ZZ	Other interventions targeting physical activity behaviours, not elsewhere classified	24
VEA PM ZZ	Education about eating behaviours	17
VEA PH ZZ	Training to influence eating behaviours	12
VEB PM ZZ	Education about physical activity behaviours	9
VEB RD ZZ	Provision of products or services to support improved physical activity behaviours	7
Other code		*31*
Total IUs		***100***

1. Percentages are calculated using the following denominators: Coder 1 N=82; Coder 2 N=58.

Table 5.12: Most frequently-assigned ICHI intervention codes, Coder 1 and Coder 2, Netherlands data set

ICHI code	ICHI intervention title	IUs (%) [1]
Coder 1 (35 ICHI codes represented in coded data; 71 IUs)		
VEB PH ZZ	Training to influence physical activity behaviours	18
VEA PM QB	Education about eating behaviours delivered through a curriculum	8
VEA PM QC	Education about eating behaviours by providing instructional materials	6
VEB ZY ZZ	Other interventions targeting physical activity behaviours, not elsewhere classified	6
VEB TK ZZ	Public facilities or infrastructure development to promote physical activity behaviours	4
Other code		*58*
Total IUs		***100***
Coder 2 (28 ICHI codes represented in coded data; 64 IUs)		
VEB ZY ZZ	Other interventions targeting physical activity behaviours, not elsewhere classified	16
VEB PH ZZ	Training to influence physical activity behaviours	9
UE1 VP ZZ	Improving access to services	8
VAA PM ZZ	Education about alcohol use behaviours	6
VEF PM ZZ	Education about sexual behaviours	6
Other code		*55*
Total IUs		***100***

1. Percentages are calculated using the following denominators: Coder 1 N=71; Coder 2 N=64

Table 5.13: Most frequently-assigned ICHI intervention codes, Coder 1 and Coder 2, Tobacco Control data set

ICHI code	ICHI intervention title	IUs (%) [1]
Coder 1 (13 ICHI codes represented in coded data; 50 IUs)		
UA1 WC QE	Restrictions or requirements concerning the sale or distribution of products or technologies — enforcement of legislation or regulations	8
UA1 WE QE	Restrictions or requirements concerning the production or importation of products or technologies —enforcement of legislation or regulations	6
UE1 VA ZZ	Building the capacity of services, systems and policies, in preparedness for disasters and emergencies that may impact on health	6
Missing		52
Other code		*28*
Total IUs		***100***
Coder 2 (17 ICHI codes represented in coded data; 50 IUs)		
VAB ZY ZZ	Other interventions targeting tobacco use behaviours, not elsewhere classified	24
VAB WC QD	Restrictions or requirements concerning the sale or distribution of tobacco products—enactment of legislation or regulations	20
VAB WE QD	Restrictions or requirements concerning the production or importation of tobacco products—enactment of legislation or regulations	10
Other code		*46*
Total IUs		***100***

1. Percentages are calculated using the following denominators: Coder 1 N=50; Coder 2 N=50

5.3 Discussion of findings from inter-coder comparison study

The results presented above reveal high rates of discrepancies between coders in applying ICHI to descriptions of public health interventions. Coders made different decisions at each step of the coding process, so that summary profiles of each data set, in terms of ICHI axis categories and intervention codes represented, differed between coders. The highest rates of agreement were for Target category assignment for the OPAL and Netherlands data sets, at 88% and 80% agreement, respectively. In all other comparisons, there was agreement between coders for a third or less of equivalent IUs. These results resonate with the findings from the first research component (Chapter 4), in that many of the issues identified through the thematic analysis of coding notes were found to be a source of discrepancies between coders. Thus, together, the detailed findings from these two research components indicate a range of specific issues and aspects of the classification that should be addressed in order to improve its utility.

Low rates of inter-coder agreement on the assignment of ICHI axis categories and intervention codes for equivalent IUs suggest low reliability of ICHI-coded data on public health interventions. The results presented here concern reproducibility, that is, the extent to which similar data will be

produced when different users apply the classification to a given set of intervention descriptions. Reliability studies sometimes measure coding accuracy in relation to a 'gold standard', representing what is considered to be the correct coding for the units coded (e.g., Michie et al. 2011; Johansson et al. 2013; Paoin et al. 2018). In the context of the current research, there is no basis for determining what is 'correct' ICHI coding for any given intervention description. Poor reproducibility has implications for the utility of ICHI-coded data. As illustrated by these results, a data set coded by one coder may produce a particular profile in terms of the nature and diversity of interventions delivered (e.g., under a given program or within a given jurisdiction), but a very different profile may be produced if the data are coded by another coder. This limits the confidence that can be placed in the data, and undermines their ability to support uses such as comparison between programs or jurisdictions and monitoring change over time in interventions delivered. This clearly indicates a shortcoming of the draft classification of public health interventions in ICHI.

The multi-step coding process offered multiple points for the two coders to diverge, often resulting in the final assignment of different ICHI intervention codes. For two of the data sets, the pairs of coders frequently identified different numbers of IUs per record, and for all three data sets, different framing of IUs was common. Differences between coders in the number and nature of IUs identified frequently led to different choices of axis categories for equivalent IUs. However, discrepancies in axis category assignment also occurred where there was no difference between coders in the number and nature of IUs identified for a record. Where the descriptive information suggested two or more Targets, coders sometimes differed in their choice of ICHI Target categories or the order in which they were recorded (i.e., which was recorded as T-code(1)). Discrepancies in Action category assignment were sometimes due to different ways of framing the Action concept for an IU, for instance focusing on just the deed done (e.g., providing something) versus the intended effect (e.g., enabling a desired behaviour), or reflecting different actor perspectives when two or more actors were involved in delivering the intervention described. Different choice of Action often led to different choice of Means, but some discrepancies in Means category assignment were due to different interpretation of the definition and scope of particular Means categories.

It should be noted that the low rates of agreement in intervention code assignment may, in part, be attributable to the specific coding process set out in the coding protocol, which instructs coders to first assign Target, Action and Means separately, then look for an intervention code. Inter-coder discrepancies in axis category assignment for any of the three axes will often result in coders assigning different intervention codes. If coders were instructed simply to find the best-fit intervention code (without first assigning axis categories), or to select a Target and then choose the most applicable code from those available for that Target, rates of agreement on intervention code assignment might be somewhat higher. However, coders would still need to approach the task of

finding an intervention code via either Target or Action, so disagreements could still occur because of different views on the most applicable axis categories for the IU in question.

The background and expertise of individual coders inevitably influences the coding produced (e.g., Stausberg et al. 2008). All three volunteer coders understood the principles of using classifications to capture health data and were familiar with the nature of non-clinical health interventions; these qualifications were considered highly relevant to the task they were assigned. However, within the constraints of this research, it was not possible to recruit coders who had in-depth knowledge of ICHI or were familiar with the source data sets. Coding discrepancies may have been reduced if the volunteer coders had a similar level of knowledge of ICHI to the researcher. Lower rates of discrepancy might also be expected where both coders are familiar with the source data. Thus, the results here may indicate higher rates of discrepancy than are likely to be found in real-world applications of ICHI.

The method used in this research component, comparing between coders at each step of the coding process, has enabled detailed exploration of the causes of the coding discrepancies observed (Keeley et al. 2016). Some of these causes lie within the classification itself, while others may be viewed as related to characteristics of public health interventions that pose particular classification challenges. Discrepancies often resulted when coders were unable to find an applicable axis category to capture a concept in an IU (e.g., 'raising awareness'), or when coders interpreted the scope of a given axis category differently (e.g., 'curriculum'). These issues should be fairly straightforward to address in the further development of ICHI: additional axis categories can be added to fill identified gaps, and the scope of categories can be clarified with tighter definitions, inclusions and exclusions. Simple solutions are less likely for causes of coding discrepancies that are related to the typically complex, multi-component and integrated nature of public health interventions. These issues – for example, how to standardise the identification and framing of IUs, whether and how to capture both proximate and ultimate Targets, and whether Action should describe intervention form and/or function – will require further exploration to develop approaches that can deliver improved data reliability without compromising the meaningfulness of the data.

The results suggest that the instructions in the coding protocol concerning the identification of IUs as 'distinct functional components' were not effective to ensure that coders made the same determinations as to number and nature of constituent IUs. As the 'hypothesised mechanism of action' was not normally articulated in intervention descriptions in the source data sets, coders were left to infer how the intervention was intended to effect change and, from this, decide how many separate functional components were present. However, it is not clear from the results that coders did in fact use the 'hypothesised mechanism of action' as the basis for identifying constituent IUs. Rather,

detailed comparison of IUs between pairs of coders suggests that they often took a more intuitive approach and distinguished IUs on the basis of other information in the intervention description, including different health-related behaviours, different activities undertaken, and different target audiences. Framing of IUs (as determined from the short, written description of each IU entered in the spreadsheet) also varied between coders, often reflecting different interpretations of the essential nature of the IU, emphasis on different aspects of the IU, or different actor perspectives when there were two or more actors involved in delivering the intervention.

It is interesting here to reflect on the socially constructed nature of understandings of public health interventions. As discussed in Section 2.4, there is no consensus in the field concerning what a public health intervention is, and there is a diversity of purpose-specific frameworks and classificatory schemes that describe and group public health interventions in different ways. Agreed 'types' of intervention do not appear to have crystallised. The inter-coder comparison results illustrate that different coders bring their own understandings to bear in their interpretation of the source material (intervention descriptions), in terms of how they frame the intervention described and how they translate this framing into the Target-Action-Means structure of ICHI. A question to be considered in the further development of ICHI will be the extent to which this diversity of understanding and interpretation should be controlled or standardised in the context of the classification. Kutschenko (2011b) makes the point that achievement of high inter-rater reliability may require trading-off 'explanatory pluralism', that is, the flexibility to use a classification in different ways to answer different questions or meet different types of information needs. It will be important to ensure that changes to improve reliability are not made at the expense of the perceived relevance and usefulness of ICHI to those working in the field of public health.

In relation to the classification of mental and behavioural disorders in the ICD, changes made during development of the eleventh revision were informed by research into the conceptualisations held by psychiatrists and psychologists concerning the relationships among mental disorders, and these changes appeared to improve both the rated clinical utility of the classification and reliability (Reed et al. 2013; Keeley et al. 2016; Reed et al. 2018). This suggests that, for the classification of public health interventions in ICHI, information on how interventions are conceptualised by those working in the field – both in terms of how individual 'units' are recognised and how these are grouped into 'types' – could usefully inform changes to improve reliability. However, there is a 'chicken-and-egg' relationship between how people conceptualise things in practice and how those things are represented in classifications that are in common use (described as 'convergence' by Bowker & Star (1999)). Shared conceptualisations of mental and behavioural disorders have no doubt been shaped by the history of formal classification in this field (Clegg 2012). Thus, it may be expected that, over time, use of ICHI in the field of public health may encourage commonly-held conceptualisations of

interventions and types of intervention to emerge more strongly, these in turn will inform refinement of the classification, and reliability will improve as a natural consequence.

Coding guidance and coder training may be expected to improve reliability by promoting a common approach to application of the classification. The volunteers who undertook the coding for this study had only the coding protocol to guide their work; the online version of ICHI Alpha 2016 includes an *Introduction*, which provides general background to the classification, and *Guidelines for Editors and Coders*, containing only two pages of coding guidelines. In contrast, the ICD-10 instruction manual occupies an entire 250 page volume and provides users with a general orientation to the classification and extensive instructions for use, including detailed coding rules (World Health Organization 2016b). Additional support for standardised use of the ICD is developed at country level in the form of education and training programs, and coding standards tailored to national information infrastructures (e.g., National Centre for Classification in Health 2010). It is anticipated that guidance and training materials of this sort will be developed during the beta phase of ICHI's development and beyond.

However, greater precision in the delineation of categories and more rigidly specified coding rules will not necessarily deliver improved reliability. The authors of a study that revealed relatively low levels of reliability for ICD-10 diagnosis coding in Germany concluded that 'the refinement of the ICD-10 accompanied by innumerous coding rules has established a complex environment that leads to significant uncertainties even for experts', and advocated for classifications and coding rules to be 'radically simplified' (Stausberg et al. 2008, pp.50, 56). Other researchers have also suggested that simpler classifications (fewer categories) and more flexible coding guidelines can promote classification utility and reliability (Keeley et al. 2016; Reed et al. 2018). Discussing classifications more broadly, Olson (2002) states that 'Specificity tends to exacerbate inconsistency as more finely constructed categories will be more difficult to differentiate from each other'. A related point is that unless a classification (and the data generated through its use) is seen as relevant and useful by those who use it, the data produced are unlikely to be of high quality (Dixon et al. 1998; Keeley et al. 2016). There may be important lessons here for ICHI: a simpler classification, that offers fewer possible alternatives for coding a given unit, accompanied by guidelines rather than tightly-specified coding rules, might be more user-friendly and thus deliver more reliable data. While coder guidance and training are no doubt needed to support consistency of application, attempting to control the use of a classification in a rigid and prescriptive way may in fact be counter-productive.

A key conclusion from this research component is that the low rates of inter-coder agreement suggest that ICHI-coded data on public health interventions would have poor reliability. However, this should not be viewed as a summative assessment of ICHI's reliability – the classification is still in

development and user guidance and training materials have not yet been developed. The more important contribution of this research component, in the context of the broader developmental appraisal of ICHI, is to provide a rich source of information about the causes of coding discrepancies, which can inform improvements to the classification and development of guidance. These results will be brought together with results from the other two research components in Chapter 7, within the analytical structure developed in Section 2.3. The following chapter presents results from the third research component, in-depth key-informant interviews, concerning how potential users respond to the classification and to summary characterisations of public health intervention data sets using ICHI-coded data.

6. Research Component 3: In-Depth Key-Informant Interviews

This chapter reports results of the third research component, in which in-depth, semi-structured interviews were conducted with key-informants associated with each of the three data sets used in the first research component (ICHI public health data coding study). The purpose of the interviews was to obtain feedback from potential users concerning the structure and content of the draft classification and its utility for representing and analysing data on public health interventions.

The method for this research component, described in Section 3.6, is summarised below; information about interview participants is provided, and the approach taken to analysing the interview data is explained in detail (Section 6.1). Section 6.2 presents results of the thematic analysis of interview data. The main findings of this research component are discussed in Section 6.3.

6.1 Methods

In-depth, semi-structured interviews were conducted to obtain feedback from key-informants associated with each of the three data sets used for the ICHI public health data coding study. Ten key-informants participated in the study. Prior to their interview, each participant was sent a document providing information about ICHI, a link to the online browser version of ICHI 2016, and summary results of the ICHI public health data coding study for their data set, as well as a list of interview questions, a Participant Information Statement and a Participant Consent Form. The participant was asked to read the background information about ICHI and the summary results of the data coding study in advance of the interview. Ethical approval to conduct the interviews was granted by the University of Sydney Human Research Ethics Committee (Project No. 2016/809) (see Appendix 3.4). For each data set, the summary results document included data tables and figures showing intervention units (IUs) grouped by ICHI Target, Action and Means, a full list of IUs with ICHI intervention code assigned, and selected issues identified from the thematic analysis of coding notes (Section 4.3). Interviews were conducted over the period from May to September 2017.

6.1.1 Conduct of the interviews

The method employed is described in Section 3.6.1, and was developed with reference to established techniques for conducting semi-structured interviews (Rice & Ezzy 1999; Ritchie & Lewis 2003). All interviews were conducted by the researcher, either face-to-face (8 interviewees) or via video conference (2 interviewees). Interview participants were asked to respond to the summary results presented in terms of how well ICHI was able to capture important information about the interventions, and whether ICHI axis categories provided a useful basis for grouping and summarising

the data; they were also asked for their views more broadly on ICHI (see interview schedule in Appendix 3.3). The questions listed in the interview schedule were used as a guide only; the interviews were semi-structured in format and conversational in nature. Additional prompts were used to elicit more detailed or focused responses, but participants were not pressed to provide specific responses to all questions in the schedule. Therefore, the feedback provided by each participant reflected the issues and aspects of the classification that were of particular interest or concern to them. Interviews varied in length from one hour to just over two hours. All interviews were recorded, with the consent of the participant, and were fully transcribed. A summary of the interview, based on the full transcript, was sent to the participant with an invitation that they could suggest any corrections needed.

6.1.2 Interview participants

For each data set, the aim was to identify two or more individuals who were very familiar with the data and could thus provide well-informed feedback on the extent to which ICHI captured important features of the data and could potentially meet the information needs of various data users. The number of participants varied from 2 to 4 per data set. Box 6.1 sets out the organisational affiliations and roles of participants, as well as the length of time each had been working with the data set in question, and in public health practice, research or policy more broadly. The participant codes in Box 6.1 (O-1, O-2, etc.) are used in Section 6.2 where it is necessary to note the identity of a participant in relation to a specific comment or quote. The participants represent a spread of different information needs in relation to each data set. The three data sets were the OPAL obesity prevention interventions data set, the Netherlands lifestyle interventions data set, and the Tobacco Control data set (see Section 3.3).

Two of the OPAL participants had been employed under the OPAL Program, one as Evaluation Manager for the program, and the other both as OPAL State Manager and previously as a Site Manager (i.e., working on the ground in an OPAL community and entering data on the OPAL database). The other two OPAL participants were using the OPAL data for academic research, including one participant who was also part of a team conducting an integrative evaluation of the program. All participants were very familiar with the OPAL data and had used it for different purposes.

Box 6.1: Organisational affiliations and roles of interview participants

OPAL data set:

O-1 Public health academic.
6 years working with OPAL data set; 20 years working in public health practice, research or policy.

O-2 State health department employee; previously OPAL Evaluation Manager.
8 years working with OPAL data set; 15-20 years working in public health practice, research or policy.

O-3 State health department employee; OPAL State Manager; previously OPAL Site Manager.
6 years working with OPAL data set; 20 years working in public health practice, research or policy.

O-4 PhD candidate with research project focused on OPAL.
6 years working with OPAL data set; 7 years working in public health practice, research or policy.

Netherlands data set:

N-1 RIVM (National Institute for Public Health and the Environment, Netherlands), quality of interventions programme manager.
10 years working with RIVM interventions database; 26 years working in public health practice, research or policy.

N-2 RIVM (National Institute for Public Health and the Environment, Netherlands), WHO Collaborating Centre for the Family of International Classifications in the Netherlands.
5 years working with RIVM interventions database (indirectly); 17 years working in public health practice, research or policy.

Tobacco Control data set:

T-1 Government health department employee, tobacco reform.
7 years working with Framework Convention on Tobacco Control (FCTC); 9 years working in public health practice, research or policy.*

T-2 Health non-government organisation employee, tobacco control policy.
14 years working with FCTC; 19 years working in public health practice, research or policy.

T-3 Government health department employee, tobacco control.
5 months working with FCTC; 5 months working in public health practice, research or policy. *

T-4 Convention Secretariat, WHO FCTC, reporting and knowledge management.
9 years working with FCTC; 18 years working in public health practice, research or policy.

* These two participants were interviewed together; all other participants were interviewed individually.

One of the Netherlands participants was working very closely with the lifestyle interventions database in a role that involved identifying interventions for inclusion in the database, managing the processes for assessing interventions, and promoting use of the database for informing health promotion practice. The other participant worked less closely with the database, but was in a role that included supporting municipalities with statistical data analysis and indicators in the context of their reporting on interventions implemented; this participant was also co-head of the WHO Collaborating Centre for the Family of International Classifications in the Netherlands and was familiar with ICHI.

The four participants for the Tobacco Control data set represented very different perspectives. One participant was based at the Framework Convention on Tobacco Control (FCTC) Secretariat in Geneva, was centrally involved in global reporting on implementation, and had worked closely on development of the reporting instrument, including the indicators. The roles of the two participants from the government health department involved engaging with States and Territories on implementation of the FCTC and providing collated Australian data to the Secretariat for FCTC implementation reporting. The fourth participant had a longstanding involvement with the FCTC as a non-government representative, including as a board member of the Framework Convention Alliance, and had used country-level data made available online by the Secretariat to track implementation.

6.1.3 Thematic analysis of key-informant interview data

The method used for analysing the interview data is described in Section 3.6.2. The thematic analysis process was adapted from those described in the literature (Ritchie & Lewis 2003; Braun & Clarke 2006; Gale et al. 2013; Brooks et al. 2015) and involved repeatedly reading over the interview transcripts and 'message units' extracted from them, and iteratively refining the grouping of message units and the articulation of themes. The method consisted of the following steps:

> Step 1. Identifying 'message units'. Each transcript was read carefully and 'message units' identified – these were discrete comments, views, points, or questions expressed by the participant. Message units were uniquely numbered and collated for each interview.
>
> Step 2. Grouping message units into topics and sub-topics. An a priori coding frame – consisting of the headings Intervention units, Targets, Actions, Means, Intervention codes, and Other – was used to group message units from all 9 interviews. Additional topic headings were generated inductively during the analysis process to accommodate material that did not fit comfortably under the initial set of headings (e.g., Structure of the classification, Level of detail, Utility of ICHI). The message units within each topic were further grouped into sub-topics, which were generated inductively based on the content of the message units (e.g., 'ICHI's utility in relation to different uses and user groups').

Step 3. Articulating themes within sub-topics. Within each sub-topic, themes were identified as separate points or views expressed on that sub-topic. Each theme was articulated as a sentence or a short paragraph. In some instances, two or three closely aligned points or views were combined in a single theme. For each sub-topic, the themes articulated were used to draw together the key messages, which were written up as a paragraph of text. Some topics originally identified were combined with other topics to improve coherence and reduce duplication of information. For example, the topic 'Level of detail' is covered under the broad topic heading 'Utility of ICHI'. This resulted in a final set of seven topic headings. In the presentation of interview results, below, sub-topic headings have not been used, as a continuous flow of text was judged to be a more effective way to communicate the key messages as expressed by participants on each topic and to convey the inter-connectedness of many of the issues covered.

The three data sets were not used as a structure for the analysis of interview data because the responses provided by each individual participant were judged to be strongly influenced by their own unique perspective, as shaped by their background, experience, professional role and information needs in relation to the data set in question and public health practice, research and/or policy more broadly. As a general observation, on many topics there was as much diversity among views expressed and issues emphasised by participants representing a single data set as there was for participants representing different data sets. However, the data set in question did influence the issues that received most emphasis in any given interview, as detailed discussion about ICHI content was largely limited to the range of axis categories represented in the summary results document for that data set. Therefore, in reporting the results of the thematic analysis, the particular data set is noted in connection with some comments, where this is relevant to understanding the perspective of the participant making the comment.

6.2 Results – thematic analysis of key-informant interviews

Results of the thematic analysis are presented below under seven topics (Box 6.2). The views expressed collectively by participants on each topic are represented comprehensively, indicating where there was commonality and where there was divergence. There has been no attempt to quantify the relative strength of the views expressed. This would have been difficult because often a given view was expressed with varying degrees of emphasis by different participants, so classifying a given participant as holding or not holding a particular view would not have resulted in a meaningful metric. Therefore, the approach taken has been to reflect as accurately as possible the range of views expressed, illustrating with direct quotes from participants where this helps to illuminate the nature of

what was expressed. The participant codes in Box 6.1 (O-1, O-2, etc.) are used where it is necessary to note the identity of a participant in relation to a specific comment or quote.

In the course of the interviews, participants reflected extensively on the data set with which they were familiar, covering topics such as level of detail, data quality (especially the difficulty of achieving consistent interpretation and use of categories), usefulness of data categories for meeting specific information needs, and data entry burden. These reflections are not reported as they do not relate directly to the research questions for this study, however this material was valuable in providing background and context to aid interpretation of participants' views concerning ICHI.

Box 6.2: Topic structure for the thematic analysis of interview data

1. Defining and operationalising 'intervention unit'
2. Target – concept and categories
3. Action – concept and categories
4. Means – concept and categories
5. Intervention codes
6. Structure of the classification
7. Utility of ICHI

6.2.1 Defining and operationalising 'intervention unit'

> Intervention unit – a key functional component of an intervention with a distinct Target, Action and Means, where 'functional' relates to the explicit or inferred mechanism of action (i.e., the hypothesised process by which the intervention will achieve the desired result).
> *(Definition from coding protocol developed for ICHI public health data coding study, Appendix 3.2)*

Participants were broadly comfortable with the concept and definition of intervention unit (IU) as a way of defining the unit of classification for public health interventions, and accepted the necessity of breaking complex interventions down into 'units' in order to record information about them in a manageable way. Public health programs and interventions typically involve multiple discrete components that are intended to work together to bring about desired change. As one participant put it: 'the definition [of IU] tried to formalise common sense, more or less – for the majority of the interventions, it's very clear that there are multiple layers in an intervention, and 'intervention unit' is, I think, fine as a term to discriminate between them' (N-2). One participant commented that the concept of IU is similar to the concept of 'core element' or 'active ingredient', i.e., the component of an intervention that brings about a change in the determinant that is the focus of the intervention.

OPAL participants felt the concept of IU related well to the concept of 'Project' in the OPAL Program. Concerning the wording of the definition of IU, one participant pointed out that 'distinct Target' is problematic because intervention components can have more than one Target, and that the term 'mechanism of action' could cause confusion with the concept of Action as one of the three ICHI axes.

Several comments were made about the difficulty of applying the operational definition of IU in practice. Participants for the OPAL data set said that defining a 'Project' had been difficult in the context of that data collection because OPAL communities varied in how they 'packaged' projects, and there was variation between communities in the number of projects per year entered into the database. It was generally acknowledged to be difficult to define the unit so as to ensure all users would make the same decisions about what constitutes a single unit.

The issue of IUs for which multiple Targets or Actions were applicable was seen as a particular concern. One participant suggested that an intervention unit could be defined as something that has a different code, that is, to determine the number of IUs for a given intervention according to the number of applicable ICHI codes identified. However, this participant went on to reflect:

> 'I guess it depends on what you want to use the coding for. If you're trying to use the coding for dose then, yes, you probably shouldn't be doing that [splitting it into multiple IUs], but if you're doing it for reach, or like for "what are the public health interventions happening here", then just having one of those [ICHI codes] is like "well we're doing nothing for tobacco", when in fact you are doing something for tobacco.' (O-4)

That is, the best approach for differentiating constituent IUs for a given intervention may depend on the purpose for which the data are to be used. In the words of one participant, 'I think it's hard; I think defining the intervention unit is a nebulous concept, and I think you just need to make it work' (O-1).

6.2.2 Target – concept and categories

> 'Target – the entity on which the Action is carried out' (ICHI 2016).

Participants made the point that the concept of Target, as it is operationalised in ICHI, is different to how the term 'target' is generally used in public health. It was commented that 'the entity on which the Action is carried out' suggests the community, agency or individual to which an intervention is directed ('target audience'), or the social-ecological system level at which an intervention is carried out, rather than a health-related behaviour. As one of the OPAL participants commented, 'but this is saying "the entity *on* which" … the entity in our terms would be either an agency or an individual' (O-3). Similarly, one of the Netherlands participants said, 'in practice, when people hear the word

'target' they relate it to persons, not behaviours … [but] that is something that could be learned, that's something people can get used to' (N-2). One of the tobacco control participants said, 'we consider necessarily the objectives, which corresponds with what you've described as Target, and I think that does broadly align with the way that we understand interventions in practice' (T-1).

Concerning health-related behaviours as Targets for public health interventions in ICHI, several participants made the point that interventions often aim to change knowledge, skills, attitudes, self-efficacy, capacity, social norms, and aspects of the physical environment in order to bring about behaviour change; these things can be seen as enablers of, or precursors to, behaviour change. One participant said that the health-related behaviours listed in ICHI could be regarded as medium-term Targets, with interventions being focused more directly on influencing precursors to behaviour change and establishing a conducive environment for behaviour change. Some participants suggested that different levels of Targets could be articulated for an intervention. For example, the high-level or long-term Target may be to reduce overweight, but this is underpinned by specific health-related behaviour Targets (e.g., healthy eating and physical activity), and these in turn are underpinned by enablers (knowledge, skills, a conducive environment, etc.).

For some interventions, a 'proximate–ultimate' relationship may exist between two Targets. Several participants talked about interventions in which the ultimate Target is a health-related behaviour, but the proximate or antecedent Target is an environmental factor. One participant suggested that, in such cases, the environmental factor could be seen as the process Target, or the intermediate Target. Participants for the OPAL data set explained that some interventions address one behaviour (e.g., road safety) with the aim of changing another behaviour (e.g., physical activity) – as expressed by one participant, 'It's really about the physical activity it's going to promote … their aim is to get people to ride to work and ride to school more, and walk to school more, whereas [road safety] is very much a secondary type outcome' (O-4). For many tobacco control interventions, the proximate Target is tobacco products, but the ultimate aim is to reduce tobacco use. Participants for the Tobacco Control data set were ambivalent as to whether the ICHI Target for such interventions should be 'Products or substances for personal consumption' or 'Tobacco use behaviours', although the point was made that assigning 'Tobacco use behaviours' as the Target for all tobacco control interventions would help identify them as such.

The ICHI requirement to choose one Target category per IU was seen as a limitation, as public health interventions commonly aim to bring about change in more than one health-related behaviour or environmental factor. In the words of one participant, 'There's so much integration of issues as part of the strategy – so that's a given, there's no opportunity to give more than one [Target] code?' (T-3). Another participant talked about the potential multiple benefits of an intervention – for example, a

community garden intervention can promote physical activity and healthy eating, as well as greening the environment and helping to build community; infrastructure changes can boost tourism and employment, as well as increasing physical activity. Capturing such co-benefits was seen as important for communicating to stakeholders about the gains public health interventions can offer communities. A related point made was that partners in the community, working in non-health sectors, may be primarily interested in the non-health outcomes of an intervention that also delivers health benefits.

Various views were expressed concerning the overall content of the Target axis. While one participant for the Netherlands data set felt that the Target axis does a good job of discriminating between interventions, the other participant commented that the Target categories represented for that data set were the 'traditional lifestyle' ones (N-1). Some participants noted the inability of existing ICHI Targets to capture factors such as knowledge, self-efficacy and attitudes as the direct Targets of interventions and enablers of behaviour change, and to capture the co-benefits delivered by interventions. Participants commented that ICHI Target is not useful for discriminating between interventions within specific areas of public health – for instance, ICHI codes for almost all tobacco control interventions have the Target 'Tobacco use behaviours', and the majority of IUs for the OPAL data set have the Target 'Eating behaviours' and/or 'Physical activity behaviours'. One participant noted that some ICHI Targets can be readily linked to major health indicators, like smoking or alcohol use, but for others it is more tricky, e.g., 'Services, systems and policies'; the ability to make clear links between ICHI data on interventions and health priority areas was seen as beneficial.

Although the ICHI Target axis is presented as a flat list, with no hierarchical relationships between categories, some participants viewed certain Targets as sub-categories of others. One participant expressed the view that, within the context of the OPAL Program, road safety is a sub-category of physical activity, and breastfeeding is a sub-category of eating behaviours. Another participant saw 'Products and substances for personal consumption' and 'Indoor air quality' as subcategories of 'Tobacco use behaviours' in the context of tobacco control. These comments were made in relation to the use of ICHI for coding interventions within these particular data sets, and did not necessarily suggest that these hierarchical relationships among Target categories should be seen as applying more universally.

6.2.3 Action – concept and categories

> 'Action – the deed done by an actor to a Target' (ICHI 2016).

In general, participants were comfortable with the concept of 'Action' as used in ICHI. ICHI Action was seen to correspond to 'Method' in the Netherlands interventions database and 'Strategy' in the OPAL database. However, several issues were identified concerning Action axis categories.

A range of views was expressed regarding the content of the Action axis overall. Some participants expressed the view that ICHI Action categories are relatively coarse and there are many 'gaps'. In contrast, one participant said that ICHI Actions provide good coverage and enable a finer-grained analysis than is possible through the OPAL database. Another OPAL participant thought that ICHI Action categories would be satisfactory as 'a higher-order list of components', but that some categories were 'nebulous' (e.g., Advocacy, Applying incentives), and that the seven 'Strategies' (a categorical data item in the OPAL database) work better: 'Based on our experience, the seven strategies are a distillation of anything that could be done by any agency at any scale' (O-3). This participant also commented that some ICHI Actions are not informative enough as to what is actually being done and why, for instance, saying 'if we talked about "provision" with our team they would immediately say "provision of what, and why?"' (O-3); in the OPAL database, information about how an intervention is intended to work is captured separately to 'Strategy', using the environmental and individual factors and cost-benefit data fields.

Several participants reflected at length on the delineation of particular ICHI Actions, and the issue of overlapping category boundaries. The overall impression was that there is not clear demarcation between concepts such as education, training, awareness-raising and capacity building as they are understood in the field, and it will therefore be difficult to define these as mutually-exclusive categories in ICHI. One participant made the point that 'Whatever categories you come up with, they [should] have the definition and the example and they're differentiated from the other categories … so that people in different countries are actually using the same definition to define what it is they're doing' (O-1).

Several participants queried whether defining education and training as separate actions was practical or necessary. It is difficult to draw a clear line between these two actions as they can look very similar, and interventions with an education component commonly also involve guided practice. One participant suggested that a distinction could be made based on whether or not there is a hands-on component to the intervention, or whether the emphasis is on building skills or knowledge, but queried whether such a distinction would be useful to make. Another participant made the point that education programs do much more than influence knowledge, and suggested that the definition of 'Education' in ICHI should convey the more holistic approach of education programs in modern health promotion practice (i.e., to include changing attitudes, building self-efficacy and influencing intentions regarding behaviour).

The distinction between education and awareness-raising was regarded as somewhat blurry in practice, but participants tended to think that awareness-raising should be available as an ICHI Action separate to education. This was of particular interest to the OPAL participants, because a social

marketing approach was central to the OPAL Program, with many OPAL projects focused on raising awareness. In identifying general awareness-raising as missing from the Action axis, one participant said that there is a lot that OPAL did 'that was not necessarily about education but it's about getting the message out there, in general, it's about the awareness of it … and that kind of feeds into the social norms' (O-4). Another OPAL participant expressed the view that education is about knowledge and active engagement, and there is more intent in education than in awareness raising. One participant talked about related actions lying along a continuum: 'It starts off with awareness, then goes into education, then it goes into training, then it goes into changing behaviours, then it goes into social norms … they're on the same continuum but where do you draw the line?' (O-4).

Making a clear distinction between training and capacity building was also seen as difficult; indeed, some suggested that training could be regarded as a *means* of building capacity. One participant said that, compared with training, capacity building interventions tend to be bigger picture, with broader community engagement and a more diverse spread of community members involved. Another said that capacity building is fundamental in health promotion practice but is often seen as a precondition for an intervention, i.e., capacity building describes what is done at community or organisation level in order to implement an intervention. Conversely, another participant thought that 'capacity building' is a term used by policy makers to describe what practitioners call 'skills training' (i.e., they are different terms for essentially the same thing). One of the OPAL participants expressed the view that:

> 'What we're focusing on is what's going to change as a result. So the output needs to be comfortably in that space, that you're doing something to build capacity, but what is being built [i.e., behavioural precursors] is more important to us than debating the classification of the output … all of the sectors have their own language and their own emphasis; we try not to enter into a debate.' (O-3)

This variety of views suggests a lack of consensus around the concept of 'capacity building' in the context of public health.

Another issue of potential category overlap related to Action WI 'Legislation or regulations, other'. Two of the tobacco control participants queried how 'Legislation or regulations, other' relates to the four ICHI Actions concerning restrictions on products (WC, WD, WE, WF), which are usually implemented by regulation or legislation in practice. These comments suggest that the residual nature of Action WI may not be clear to users.

Participants noted several gaps in the Action axis, including awareness-raising, social marketing, policy change measures, 'nudge' interventions, enablement and reducing barriers to participation, and changing social norms around behaviours. There was discussion about how interventions that provide

an opportunity for people to do or try something (e.g., healthy food-tasting sessions, fun runs) could be captured in ICHI, as interventions of this type were common in both the OPAL and Netherlands data sets. Often these interventions take the form of an event, but they can also be ongoing activities offered for people to join in (e.g., walking groups). It was agreed that such interventions are common but difficult to characterise. Event interventions often combine a number of objectives and different community actors, and may be implemented as the first step in starting a new collaboration or partnership. One participant thought that these would not normally be regarded as real public health interventions, but another argued that they can be important components of health promotion programs:

> 'Some might argue that's not a very strategic use of time, running these pop-up events, but sometimes they can be critical to building the trust, building the rapport, the credibility in our work, and that then can lead to more sustainable, significant pieces of work … so it's a legitimate component to the work, just running these pop-up opportunities, but sometimes it's a means to another end as opposed to being an end in itself.' (O-3)

6.2.4 Means – concept and categories

> 'Means – the processes and methods by which the Action is carried out' (ICHI 2016).

The Means axis was seen as more problematic than Target or Action. Several participants noted that articulating a clear conceptual distinction between Action and Means is difficult in public health, and this is not a distinction that is normally made. In the words of one participant, the distinction is 'much more grey' (T-1) in public health than in clinical interventions. To illustrate this, one participant commented 'for example, having a workshop, that's almost an Action and a Means in one' (N-2). It was suggested that the distinction between Action and Means might correspond to the distinction between 'output' and 'process'. One of the Netherlands participants said that ICHI Means might best correspond to 'the practical translation of the method in a program' (where 'method' would correspond to ICHI Action) (N-1), but noted that how this kind of practical translation is normally described by health promotion practitioners would be too detailed for ICHI. As interventions are typically adapted to local needs and context, how an intervention is delivered will vary depending on local factors and decisions made by health promotion practitioners on the ground. One participant said that, for this reason, it is not desirable to try to capture this information in ICHI. An alternative view was that information on how an intervention is delivered is nonetheless useful, to see 'what we are doing' at country level (N-1).

There was general agreement that the Means axis is not 'working' for public health interventions and is effectively a wasted dimension of the classification as it currently stands. Some participants

expressed the view that more and better Means categories should be developed so that Means can be more effectively used to describe how things are done at a finer-grained level than 'Action', and to better distinguish between different types of interventions. Others suggested that this third axis could be used instead to capture different dimensions of information about an intervention, such as the social-ecological system level to which an intervention is directed, enablers of or precursors to behaviour change (e.g., affordability, knowledge, skills), or what needed to be done to achieve a particular output (e.g., lobbying council, changing community attitudes).

In relation to how the content of the Means axis could be improved, the view was expressed that categories should reflect contemporary, evidence-based approaches. One participant made the point that it will be important to decide on the level of granularity required and ensure that categories are clearly defined so that they will be interpreted consistently by users. Some comments made suggested that existing Means categories such as 'Curriculum' and 'Interview' are not clearly enough defined. 'Group pressure' and 'tailored information delivered via apps or websites' were suggested as potential candidates for ICHI Means categories. For the Action 'Collaborating', possible Means categories suggested were structures through which collaboration is achieved (e.g., 'Coalitions', 'Steering committees') or models of decision-making (e.g., 'Shared decision-making').

In response to the presentation of data on Means in the summary results for each data set, some participants remarked on the high proportion of IUs for which a specific Means category was not assigned (i.e., where a coverage issue was noted). Participants for the tobacco control data set all agreed that the high frequency of IUs with Means 'Enactment' and low frequency of IUs with Means 'Enforcement' for that data set does reflect reality, suggesting that these two categories are useful – one participant said, of the low proportion of indicators for which ICHI Means was coded 'Enforcement', 'it's another indication for us of something that we need to further promote, and that's why I'm saying that this is a very useful exercise for us' (T-4).

6.2.5 Intervention codes

> 'Each intervention is represented by a title and a unique seven-character code denoting the axis categories for that intervention' (ICHI 2016).

Although the summary results document for each data set included a large appendix table grouping IUs according to the ICHI code assigned to each, participants did not provide much specific comment on ICHI intervention codes. This may have been because the appendix tables were large, dense, and difficult to engage with for someone new to ICHI. However, in response to the appendix table for the Tobacco Control data set, one participant did comment that ICHI groups together interventions that are very different from a policy viewpoint:

> 'It's categorising too many things that are very different from a policy and an intervention point of view into one category, so in order to understand progress or whatever, you would need to unpick that. … Some of the things that appear to be coded together, I would say are totally different types of interventions and have totally different outcomes and, it's like, that makes no sense that they would be sitting in the same category together. … This one, requirement to display health warnings on tobacco products … that is the same [ICHI code] as banning duty free, and to me they are just completely separate issues, like they are not related at all in tobacco control … health warnings are about educating the public, so I wouldn't see it as a restriction on sale, but this [banning duty free sales] is about how much can you buy, when can you buy it.' (T-2)

This comment may be taken to suggest that, for the data to be meaningful, interventions should be grouped on the basis of how they are intended to effect change.

Participants engaged much more with the smaller tables and figures that grouped IUs according to Target, Action and Means categories assigned. The comments and views reported above in relation to the three axes (e.g., gaps, difficulty distinguishing between categories), clearly have implications for ICHI intervention codes, which are comprised of axis categories.

An issue that several participants did comment on was the fact that an ICHI intervention code can convey only a single Target, Action and Means. This was seen as limiting. Two participants suggested that allowing more than one Target and Action to be recorded for a single IU would be desirable, and would enable interventions to be more fully and meaningfully characterised.

6.2.6 Structure of the classification

There were several comments regarding the overall structure of the classification. Broadly, participants thought that the Target-Action-Means structure was clear, but a number of issues were raised concerning conceptual cross-over between the three axes. Also, additional dimensions of information relevant for describing and grouping interventions were noted as not captured by ICHI.

Most participants were comfortable with the tri-axial structure for representing public health interventions. Comments included that the structure provides a 'good discipline' (T-3) and a useful way of thinking about and categorising interventions, although it does not reflect how public health interventions are currently conceptualised in practice; it was noted that there is benefit in adopting an established structure that has been used for representing interventions in other areas (such as medical and surgical interventions). One participant expressed the view that the Target-Action-Means structure represents a 'medical model' approach and is not adequate to capture the heterogeneity of public health interventions.

Several observations were made that suggested participants perceived a degree of conceptual cross-over between the three axes, or that it was not clear where some concepts of importance in public health should sit in relation to the three axes. For instance, one participant noted that the Action 'Capacity building' effectively identifies a Target ('capacity') in its name. Another observation was that 'social norms' is represented as an environmental factor Target category, but changing social norms could be seen as an Action carried out in relation to a particular health-related behaviour Target. Also, 'Health services, systems and policies' is a Target category, but policy development or change is more appropriately seen as an Action. As mentioned above, participants noted that articulating a clear conceptual distinction between Action and Means in relation to public health interventions is problematic. In discussing how to make decisions about which axis a given concept should be represented on, one participant said, 'There are different ways to cut the pie; it just needs to be coherent, it's not that one is right and another one is wrong … internally the system needs to be coherent and make sense for public health' (O-1).

Participants identified some additional dimensions of information important for describing public health interventions that are not captured by ICHI. The OPAL participants emphasised the importance of capturing information on the social-ecological system level at which an intervention is implemented (or 'ecological target'). Other participants agreed that this is valuable information. As a related issue, one of the Netherlands participants noted the importance of distinguishing between direct and indirect interventions, saying of ICHI, 'It's difficult to differentiate between direct interventions and indirect interventions, like 'train-the-trainer' versus training people' (N-2). Participants representing all three data sets made comments concerning the importance of capturing information on 'enablers' (such as affordability, knowledge, attitudes, capacity, and physical environmental factors) as the first link in the behaviour change pathway and the factors that many interventions aim to change. Capturing this information was viewed as important for describing what public health interventions aim to do, and understanding why and how particular interventions work or do not work. Other types of information identified as missing were intervention duration, setting, and target population group (e.g., as defined by age group). Setting, which was defined in OPAL as the setting through which people were reached (e.g., through a particular school or a suburb) was seen as relevant to describing the 'reach' of an intervention. For tobacco control interventions, target demographic was seen as important information (e.g., high-risk, high-prevalence groups), as was the type of product that is the focus of an intervention (particularly new nicotine products such as e-cigarettes versus more traditional tobacco products).

6.2.7 Utility of the International Classification of Health Interventions

Concerning the potential utility of ICHI, participants expressed a range of views, with strengths and limitations identified in relation to different uses and user groups. Comments were made in particular about how the level of detail and the tri-axial structure of the classification affected its likely usefulness for particular applications.

The value of having a common framework and language for collecting data on health interventions was generally acknowledged. As one participant said, 'If everybody is coding on the same level … and it means also the same (because that's difficult) then you know what's happening in the world; and then we can learn [from what other countries are doing]' (N-1). In the words of another participant, 'The most important thing is consistency – if we can get the whole of Australia doing it, then that's of much greater value than having a mismatch of activity; that was one of the things in developing the Single Platform was that there wasn't anything else around … so OPAL was starting from scratch' (O-2). Another participant said, 'How many ways can you slice something, or slice and dice … you've got to have some sort of framework to fit it in, but often it never works particularly neatly' (T-2). The challenge of getting meaningful and accurate data in practice was also noted, and variable interpretation of axis categories and codes was seen as a risk for ICHI.

Several participants thought that ICHI would be most useful for broad, high-level comparison of public health interventions, e.g., between countries. As expressed by one participant:

> 'I think it's most useful in not looking at individual interventions but … looking at the whole output of the system, if you're trying to make some sort of systems thinking about what is happening in this whole state, in this whole country, or even internationally; what are the sorts of things that are happening in public health specifically. Whereas if you're trying to evaluate a program I don't think it would be particularly useful … I don't think it's fine enough to be looking at a program-by-program, community-by-community level.' (O-4)

Only one participant (the WHO-based tobacco control participant) specifically mentioned ICHI's utility for statistical purposes; this participant also made the point that when ICHI is in place, it may be useful in assisting the FCTC Secretariat to promote FCTC indicators as an integrated part of a country's broader statistical system. These comments suggest that he viewed ICHI as a potentially valuable component of health information infrastructure at national and international levels.

The general view was that ICHI would be less useful for meeting local or detailed information needs. In particular, ICHI was seen as not detailed enough to meet the information needs of practitioners or to support practice improvement, to use in evaluating intervention or program effectiveness at community or municipality level, or to inform policy at national or subnational level (this last point

was made specifically in relation to tobacco control policy). However, one of the OPAL participants felt that the level of detail in ICHI's Target and Action axes would be adequate for program evaluation purposes, though ICHI data would need to be supplemented by other information, particularly relating to intervention rationale. One of the tobacco control participants suggested that ICHI could be useful as an advocacy tool in areas of public health that have not yet achieved traction with governments (e.g., alcohol use) to show what interventions are delivered and where there are gaps: 'Sometimes it's useful to say, "well, here we are in Australia, quite a rich country, and here's where we are in the whole league for interventions on one particular area, this is not very good, we should be doing better than that"' (T-2).

Concerning level of detail of the classification, the point was made that what is enough detail for some uses may be too much detail for other purposes. However, there was a general view that ICHI was not detailed enough to meet the information needs of the participants themselves in relation to the data sets included in this study. For example, to quote one of the tobacco control participants:

> 'Even within that [the FCTC reporting structure] there's some issues of "well that's not detailed enough to really know what's going on" … to collapse that even more it just starts to not be particularly useful because we've got something else existing that's already there; and that's not to say that for obesity or alcohol use or something this wouldn't be useful, but we've already got something that's more detailed.' (T-2)

One participant commented on the relatively coarse coding structure of ICHI, saying, '… and it would have to be, given the scope that it has, to be able to use the same set of rules for everything from having your gall bladder out, having surgery, to a social norms campaign, to cooking lessons' (O-4), thus articulating the inevitable trade-off between classification scope and level of detail.

The tables and graphs presenting data on IUs grouped by Target, Action and Means categories were generally seen as useful; some participants qualified this view stating that they would be useful if all the important axis categories were present. Some participants noted that these summary representations picked up patterns in the data that they recognised to be true, e.g., 'It's true what you have recognised, that we have a lot of education … we need more multi-component interventions; so in that way it's OK' (N-1), and 'It gives us insight in that we don't do anything about capacity building, or less about public facilities, and I recognise it' (N-1). One of the OPAL participants said that local governments would find this kind of data presentation useful, but added that they would want to see Target categories capturing the broader benefits of interventions (e.g., economic and tourism benefits for communities). One tobacco control participant said that the summary tables would be of limited usefulness for informing development and implementation of tobacco control initiatives, while another tobacco control participant commented that 'It is very useful to look at the

different indicators and requirements of the convention from this point of view [i.e., in terms of the ICHI Target-Action-Means structure]' (T-4).

Some comments related to ICHI's limitations in terms of capturing the complex and integrated nature of public health interventions. Several participants commented that ICHI is not capable of capturing the complexities or heterogeneity of public health interventions: 'For the scope that it has, I think it does a reasonable job of capturing some of it, but there's obviously going to be a lot of detail lost if you just use the ICHI codes to code it; you're not going to understand really what's going on, what the intervention did' (O-4). Two of the OPAL participants suggested that this was, in part, because the underpinning Target-Action-Means structure was developed for, and is more suited to, describing medical and individual-level interventions, and reflected a 'medical model' view of health interventions. One of the Netherlands participants made the point that complex, multi-component interventions are important in health promotion, and if ICHI is only suited to coding simple, less effective interventions this will be a major limitation. Making a similar point, one of the tobacco control participants expressed concern about '… blunt responses to things that are complex and integrated, that really are a significant component of our approach to tobacco control', going on to say of ICHI 'so it would have limitations, that's for sure' (T-3).

Some comments were made about the need for ICHI to capture what were seen as fundamental aspects of public health practice, and conversely the risks of failing to capture these things. Such comments allude to the role that a classification of health interventions can play in influencing 'the real world' of health practice, policy and resourcing. For example, in answering a question about whether a classification of public health interventions needs to have a way to capture interventions that are primarily about building relationships with partners in the community, one of the OPAL participants said:

> 'I think it does. Otherwise the work is invisible. That's what I heard from OPAL staff with their partnership work. … They said that "I spend most of my time talking to people, building partnerships with them, working on projects. You're not capturing that in the evaluation. It's invisible". And that's where we built in partnership components to the evaluation. … In any kind of system, such as these classification systems, that invisible work needs to be seen; it's the critical stuff that you need to count and actually make real; it's kind of like the lawyers billing their time.' (O-2)

This participant went on to emphasise this point, saying 'The ability to be able to account for public health work will actually help continue public health work because when work is difficult to see and to account for you can't get funding for it' (O-2). In a similar vein, one of the Netherlands participants expressed the view that ICHI reflects a 'traditional, simple' approach to health promotion, and if it is

not able to capture contemporary and future more effective approaches (e.g., integrated approaches and collaboration), this could have the effect of holding practice back: 'The danger is, the challenge maybe, the danger is that it's too classical, the coding is too classical' (N-1).

Participants made a number of suggestions as to how ICHI could be improved. Some suggestions related to including dimensions of information not currently captured by ICHI but seen as important: information about how the intervention is expected to work; the social-ecological system level to which the intervention is directed; and co-benefits delivered by public health interventions (e.g., economic benefits, tourism attraction). Three of the OPAL participants raised issues concerning the theoretical foundation of the classification and expressed the view that ICHI would be improved by having a logic model or overarching framework, and by being better aligned with relevant theoretical frameworks (e.g., Ottawa Charter, social-ecological model). Other suggestions for improving ICHI's utility were: 'cleaning up' and further developing the Means axis; providing a capacity to 'drill down' to more detailed and qualitative information; and having add-on data fields to capture information such as demographics and specific types of tobacco product. Some participants emphasised the importance of removing ambiguities, improving definitions, and providing examples and coding guidance: 'The data is only as good as the way that it's entered, so what's really important is that you need to have the data dictionary and people need to be abiding by the same definitions … if people don't have that data dictionary and those consistent definitions then there's always the chance that people are assigning different things to different codes'
(O-1).

6.3. Discussion of findings from in-depth key-informant interviews

The in-depth interviews provide a rich source of information on the views of potential classification users concerning the structure and content of the draft classification and its utility for representing and analysing data on public health interventions. This is an essential perspective to include in this developmental appraisal of ICHI: it is not enough for the classification to 'work' satisfactorily for coding public health interventions, it must also be viewed as useful and acceptable by potential users in the field. As some participants may not previously have given extensive thought to the classification of public health interventions, the interactive interview approach was a useful way of encouraging participants to reflect on a range of issues and further develop and articulate their views. The flexibility of the interview structure meant that it was possible to pursue in more depth those issues on which a given participant had most to contribute. The views expressed by the participants on various aspects of the classification were, on the whole, consistent. The nature and scope of participants' contributions varied according to the issues that were of greatest interest and concern to them, but few contradictory views were expressed.

Interview participants saw the purpose and relevance of ICHI for the field of public health; their responses were insightful as to the challenges posed by the development of such a classification, and the various trade-offs to be negotiated. The value of having a common framework was appreciated and the tri-axial structure of ICHI was regarded as broadly acceptable. Participants engaged with the summary representations of ICHI-coded data grouped by Target, Action and Means, and saw it as useful to be able to produce this kind of summary data on public health interventions. Some valuable comments were made concerning specific gaps on the three ICHI axes and the delineation of existing Action categories.

The ICHI concepts of Target and Action were generally seen as relevant for describing public health interventions, although limitations in terms of how they are operationalised in ICHI received considerable attention. In contrast, the utility of the Means axis was seen as more doubtful, with some participants expressing the view that the distinction between Action and Means is often not clear for public health interventions. There was general agreement that, in its current state, Means is of limited utility for describing or grouping interventions.

Many of the issues identified from the results of the first two research components were also picked up and often elaborated in the responses provided by interview participants. There was considerable feedback concerning important information about interventions that may not be captured in ICHI-coded data. Topics of this sort related particularly to Target (e.g., the inability to capture more than one Target in an intervention code, and the lack of ICHI Target categories to describe enabling factors when these are the immediate targets for change), and additional dimensions of information not captured (e.g., the system level to which an intervention is directed). Comments were also made regarding the importance of being able to capture the complex, integrated nature of public health interventions, and the need to render fundamental aspects of public health work, such as partnership-building, visible. It is inevitable that some of the information seen as important by those working in a field cannot feasibly be captured by a classification like ICHI: classifications, by their nature, simplify reality. The challenge for those designing the classification is to know which information must be captured and which can be left out. As one participant said, ‘As soon as we start listing, it takes on this linear personality that we know from experience diminishes and undervalues the dynamism of what we do’, also acknowledging that ‘That’s the nature of our work [i.e., working with data]: trying to minimise it, reductionist thinking, and not letting go of the big picture’ (O-3).

A key message that emerges from this research component is that ICHI, as it currently stands, is seen as best suited to high-level comparisons of public health outputs, particularly at the international level. Most participants did not think that ICHI-coded data would meet their own information needs. This is a concern. To perform the function of providing a common framework for information in a given

domain, a classification must be regarded as relevant and useful by a range of different actors in the field. If those actively working in public health do not see it as useful in meeting their information needs, they will not use it. This message should be taken on board, both in terms of considering whether and how the limitations identified by interview participants could be addressed in the further development of ICHI, and promoting use of the classification to potential users by illustrating how ICHI axis categories and intervention codes may be used with or alongside other information about public health interventions as required in a given application.

Results of the three research components have been presented in this and the preceding two chapters. In the following chapter, these results are brought together under the twelve headings of the framework of criteria, developed in Section 2.3 (Box 2.3), to examine the extent to which the draft classification of public health interventions in ICHI can be considered to possess the desired features of a statistical classification. Limitations identified in relation to the criteria are then discussed within the organising structure of the 4-tier model representing key elements of a statistical classification (Figure 2.1), in order to better understand how they relate to classification development choices made, and to propose options for addressing them in order to improve the utility of the classification.

7. Appraisal of the Draft Classification of Public Health Interventions Within ICHI

In this chapter, I draw together the results presented in the previous three chapters, in order to appraise the strengths and limitations of the draft classification of public health interventions in the International Classification of Health Interventions (ICHI). In Section 7.1, I use the framework of criteria, introduced in Chapter 2 (Box 2.3), to examine the extent to which the draft classification exhibits the desired features of a statistical classification, identifying specific strengths and limitations under each of the twelve headings. Then, in Section 7.2, I further consider the research findings using the structure of the 4-tier model (Figure 2.1). The model is intended as a tool to aid in investigating the origins and manifestations of, and the interactions among, the various issues and problems identified, as a basis for exploring how they could be addressed. In Section 7.3, I consider the utility of the framework of criteria and 4-tier model as analytical structures, how they could be improved, and whether they should be recommended for wider use. Lastly, in Section 7.4, I reflect more broadly on the research design and methods employed. Then, the final chapter of this thesis will place the research findings within the context of the literature reviewed in Chapter 2, and propose a path forward for the classification of public health interventions within the International Classification of Health Interventions.

7.1 Research findings analysed using the framework of criteria

In this study, I set out to conduct a developmental appraisal of the draft classification of public health interventions in ICHI, using three complementary research components to view the classification in terms of how it interacts with the domain classified, that is, how it is applied by users to produce data and how the data produced are used. The three research components were:

> **Component 1: ICHI public health data coding study.** The draft classification was applied to code descriptions of public health interventions in three existing data sets; descriptive analyses of ICHI-coded data and thematic analyses of coding notes were conducted.
>
> **Component 2: Inter-coder comparison study**. The draft classification was applied independently by two coders to a subset of records from each data set; rates of inter-coder agreement were calculated and reasons for coding discrepancies explored.
>
> **Component 3: In-depth key-informant interviews**. Semi-structured interviews were conducted to obtain feedback from key informants associated with each of the three data sets, concerning the structure and content of the draft classification, and its utility for representing and analysing data on public health interventions.

Three existing data sets (described in Section 3.3) were used as a basis for all three research components: the OPAL obesity prevention interventions data set, the Netherlands lifestyle interventions data set, and the Tobacco Control data set. These data sets were regarded as expressing both the information needs of the stakeholders by whom and for whom they have been developed, and how public health interventions are understood by those stakeholders.

The three research components proved to be complementary in that there were no contradictory findings, and often a finding from one component was confirmed or elaborated by a finding from another component. For example, coding notes in Component 1 highlighted the frequent difficulty in choosing between Action categories 'Education' and 'Training'; the responses of interview participants in Component 3 suggested that there is not a clear distinction between education and training in public health practice, with some participants questioning the value of making this distinction in ICHI. Difficulty concerning the identification of separate intervention units (IUs) within data records was noted in Component 1, and this was confirmed as a significant issue by results of the inter-coder comparison in Component 2: for the OPAL and Netherlands data sets, there were frequently discrepancies between the two coders in the number of IUs identified per record. Detailed results from the three research components are set out in Appendix 7.1, along with proposals for consideration; this is intended as a resource to inform further development of ICHI. Below, findings from the three components are used to appraise ICHI in terms of the extent to which the draft classification exhibits the desired features of a statistical classification, using the framework of criteria developed in Section 2.3 (Box 2.3).

7.1.1 Appraisal of ICHI in relation to the desired features of statistical classifications

1. Purpose and scope

a) The purpose of the classification should be clearly stated, including its intended statistical uses.

b) The scope of the classification should be clear.

The stated purposes of ICHI set out in the introduction to the classification are broad, encompassing a varied range of applications (ICHI 2016). The ability to support production of internationally comparable data is asserted as a key objective, with Eurostat and OECD efforts to report on hospital interventions in member countries cited as evidence of demand for an international standard. At national level, ICHI is proposed as a key element of 'the basic infrastructure to collect information on what is being done' within health systems, to support 'planning, quality and resource allocation' (ICHI 2016, Introduction). Data needs concerning health-care management, cost monitoring, patient safety, funding (including case-mix financing) and insurance are mentioned, but these relate more

obviously to interventions delivered to patients within healthcare facilities than to public health interventions.

For public health, the purpose of ICHI is stated in general terms, 'to support accountability for use of public health resources, improve the quality and availability of information on public health interventions, and raise the profile of public health in the broader sphere of health policy'; intended statistical uses are not specifically addressed. Responses of interview participants suggest a broad understanding of the purpose of the classification as a tool for collecting and reporting summary information on interventions delivered. In general, ICHI was viewed as most suitable for broad, high-level applications, such as summarising outputs at whole system level or making comparisons between countries, rather than for meeting local or program-level information needs (e.g., for intervention evaluation or practice improvement). Such high-level, summary data were seen as potentially valuable for public health advocacy.

The research findings indicate the need for some clarification of the scope of ICHI in relation to public health interventions. The classification domain is, in effect, defined in the introduction to the classification by listing the areas of health care activity covered (such as diagnostic, medical, surgical, allied health, nursing, mental health, public health), and also by the definition of health intervention as '*an act performed for, with or on behalf of a person or a population whose purpose is to assess, improve, maintain, promote or modify health, functioning or health conditions*'. Screening of data records against the inclusion criteria (Section 4.2.1) raised questions as to whether interventions with a non-health purpose should be in scope. Some records were excluded because the main objective was to increase sports club membership or to promote the OPAL Program. These records were judged not to satisfy the definition of 'health intervention', but these decisions were not clear-cut and other similar records were included. Comments provided by interview participants suggest that, in the context of inter-sectoral and collaborative public health practice, interventions with a stated non-health purpose that are anticipated to have health effects, or interventions primarily aimed at building relationships with partners in other sectors, may legitimately be considered public health interventions. Also, as discussed in Section 2.4.2, a health-related purpose is not necessarily a pre-requisite for an intervention to be of research interest in the context of building the evidence base for public health (Hawe & Potvin 2009; Hawe et al. 2009).

Thus, the findings suggest that some further work is needed to clarify both the purpose and scope of the classification as it applies to public health interventions, including elaborating the statistical and non-statistical uses it is intended to be able to serve. A clearer statement of purpose would perform the function of keeping the developers of the classification 'honest' – only when purpose is clearly stated is it possible to determine whether the tool is 'fit for purpose'. Regarding scope, there may be an

argument for not restricting application of the classification to interventions delivered for a health-related purpose, that is, promoting a looser interpretation of the ICHI definition of 'health intervention' in relation to public health interventions.

2. Structure and organisational principles

a) The classification structure, its underlying concepts and organisational principles, should be clear and well-defined.

b) The structure should be hierarchical or multi-axial, and should reflect the descriptive and analytical needs the classification is intended to serve (including aggregation and retrieval of data).

The structure of ICHI is clear and the three axes are defined. Responses provided by interview participants indicate that the tri-axial structure made sense to them in principle, although it does not reflect how public health interventions are normally conceptualised. However, the research findings suggest that there are problems in terms of how the underlying concepts of Target, Action and Means are operationalised for public health interventions.

The ICHI concept of Target presents challenges because it is not always obvious what should be regarded as the 'the entity on which the Action is carried out'. For many IUs, it was possible to identify both a proximate Target (i.e., the factor towards which the Action is immediately directed) and an ultimate Target (i.e., the factor the intervention ultimately seeks to change). For example, the proximate Target may be tobacco products, and the ultimate Target tobacco use behaviours. Interview participants explained that many public health interventions aim to change factors such as knowledge, skills, attitudes, self-efficacy, capacity, social norms, and aspects of the environment in order to bring about behaviour change; these factors are enablers of or precursors to behaviour change, and can be viewed as the immediate Targets to which the Action is directed. Thus, different types or levels of Target can be articulated for an intervention, and these can be related to how the intervention is understood to work (i.e., steps in the hypothesised change pathway). Clarification is needed as to which of these types or levels of Target should be identified for the purpose of ICHI coding – an editorial principle addressing this issue is needed to guide a consistent approach to constructing ICHI intervention codes, as well as coding guidance to promote consistency in code assignment.

The process of selecting ICHI Action categories for assignment to IUs revealed that ICHI Actions vary in the degree to which they convey form (i.e., the deed done, e.g., RD 'Provision') and/or function (i.e., the intended effect, e.g., VA 'Capacity building'). For some IUs, one Action could be assigned to describe what was done, and another to describe the intended effect, e.g., delivering training (Action PH) in order to build capacity (Action VA). Thus, the Action axis appears to conflate two dimensions of information: form and function. Both the form and function of what is done can be described for an IU. Some Action categories convey information on form, some convey function, and

some convey a mix of form and function; this creates mutual-exclusivity problems and also raises questions about how data on public health interventions grouped by ICHI Action can meaningfully be interpreted. This is an issue that should be addressed in the further development of ICHI.

Another observation about categories on the Action axis is that some convey information about an environmental factor proximate Target (e.g., 'Public facilities or infrastructure development' (TK) or 'Restrictions on the sale or distribution of products' (WC)). When such Actions are used in construction of an ICHI intervention code, the code effectively conveys information about the environmental factor proximate Target (conveyed by the Action), as well as the ultimate Target conveyed by the Target category (e.g., 'Public facilities or infrastructure development to promote physical activity behaviours' (VEB TK ZZ)). Such codes are more informative because the Action conveys information about what is done in relation to the proximate Target, and the Target conveys information about what the intervention ultimately seeks to change. Intervention codes in which the Action does not provide any information about the proximate Target effectively convey less information about the intervention. For example, 'Assessment of physical activity behaviours' (VEB AA ZZ) was used to code IUs in which an environmental factor was assessed (e.g., neighbourhood walkability), but this information was not conveyed by the code assigned. The issue here is one of consistency concerning the type of information represented on the Action axis – currently, some Actions convey information about a proximate Target (and are thus more informative) while others do not.

The findings also suggest a need for clarification of the meaning of 'Means' in relation to public health interventions. It was often difficult to articulate the Means for an IU and, for many IUs, a clear conceptual distinction between Action and Means was not evident. Coding notes suggest that some ICHI Action categories might reasonably be viewed as 'Means' (e.g., 'Training' as a Means of 'Capacity building', or 'Collaborating' as a Means of delivering an intervention). Interview participants noted that distinguishing between Action and Means is difficult in public health, and this is not a distinction normally made. There are relatively few ICHI Means categories of relevance to public health interventions in ICHI Alpha 2016. Clearer articulation as to how 'Means' should be operationalised for public health interventions will be needed to inform further development of this axis.

These conceptual issues notwithstanding, the tri-axial structure of ICHI proved workable for aggregating data. This was demonstrated by the descriptive analysis of ICHI-coded data for the three data sets, grouping IUs by Target, Action and Means (Section 4.2). Interview participants responded well to the data summarised in this way, and recognised some of the patterns conveyed as consistent with their knowledge of the types of interventions represented in the data.

3. Unit of classification

a) The unit of classification should be clearly identified.

The unit of classification was operationalised for the current research by defining 'intervention unit' (IU) as 'a key functional component of an intervention with a distinct Target, Action and Means, where 'function' relates to an explicit or inferred mechanism of action (i.e., the hypothesised means by which the intervention will achieve the desired result)' (Section 3.4.1). The concept of 'intervention unit' resonated with interview participants, who recognised the need to break complex interventions into 'units' in order apply the classification, and saw IU as corresponding to other concepts they were familiar with (e.g., core element, active ingredient, project).

In practice, applying the operational definition of IU was problematic. Issues included: difficulty deciding whether an activity described should be regarded as a 'functional component' of an intervention (rather than an aspect of development or implementation); the effects of differing emphasis and amount of detail provided in the descriptive information on the number and nature of IUs identified; choices regarding the scale at which IUs should be identified (particularly for setting-wide interventions comprising multiple elements designed to work synergistically). In addition, it was often possible to frame an IU in different ways, depending on which mechanism of action or which step in the change pathway was emphasised, or which actor perspective was taken (where more than one actor was involved in delivery of the intervention) (Section 4.3.1). These issues, identified from coding notes, were found to cause discrepancies between coders – it was common for coders to identify different numbers of IUs per record, and to frame IUs differently (Section 5.2.1). It can be concluded that the operational definition of IU developed for this study does not provide adequate guidance on identifying units of classification.

4. Comprehensiveness

a) The classification should cover the full scope of the domain, with categories available to allow all units of classification within the domain to be classified (including by providing residual categories).

ICHI intervention codes were assigned to all IUs, suggesting that the classification does provide comprehensive coverage of public health interventions represented in the three data sets. However, residual codes (i.e., with a specific Target but other/unspecified Action and Means) were assigned to about a quarter of all IUs. Such a high frequency of residual codes is unsatisfactory in that they convey little information about the nature of the intervention delivered.

Coverage gaps were noted for each of the three axes, where Target, Action and Means concepts were identified in intervention descriptions but no applicable axis category could be found. This issue was

least serious for the Target axis, as few gaps were identified and there were no instances in which an applicable Target category was not assigned for an IU. Action and Means coverage issues were common and had flow-on effects in terms of the number of residual intervention codes assigned and coder disagreement. Interview participants noted that appropriate codes were not available to describe what they saw as distinct types of interventions (e.g., awareness raising and 'nudge' interventions). Specific Action and Means concepts not adequately captured by ICHI were identified (e.g., policy change, facilitating and conducting research, community event, group discussion, tailored information – see Appendix 7.1), which could provide a basis for improving the coverage of these two axes, and thus ICHI intervention codes.

5. Mutual exclusivity

a) Categories should not overlap and there should be only one code for each entity classified.

Mutual exclusivity problems were identified from coding notes, and were found to be a source of disagreement between coders. Mutual exclusivity is achieved when 'the allocation of an entity to a particular category precludes the allocation of that entity to another category of the same rank' (Jablensky & Kendell 2002). Lack of mutual exclusivity of categories within each of the ICHI axes flows through to lack of mutual exclusivity of intervention codes. Mutual exclusivity issues were of two broad types, as described below.

First, it was common for more than one applicable Target or Action category to be identified per IU – for example, for IUs seeking to change more than one health-related behaviour (e.g., smoking and alcohol use), with an environmental factor proximate Target and a health-related behaviour ultimate Target, or involving a mix of Actions (e.g., education and training). In such cases more than one applicable intervention code could be identified, with no single code able to fully capture the IU. This situation reflects the nature of IUs – in practice, a single intervention component may involve more than one Target or Action. As noted by interview participants, integrated intervention approaches are characteristic of contemporary public health practice; in many cases, it is reasonable to characterise an IU in terms of its 'main' Target, Action and Means, but in some instances this may not be possible without misrepresenting the nature of the IU.

Second, the boundaries between some axis categories were found to be unclear or overlapping. In some cases, this was a question of knowing what should be included in a given category, for instance, whether a ban on the display of tobacco products at point of sale should be classified as a restriction on sale or rather a restriction on promotion. The need for clarification of scope was noted for specific axis categories (see Appendix 7.1). The issue noted above concerning some Action categories conveying information on form (the deed done) and others on function (the intended effect) was also a

cause of mutual-exclusivity issues. That is, because the Action axis conflates two dimensions of information (form and function) some categories are not mutually exclusive (e.g., where an IU involves providing training in order to build capacity, both 'Training' (PH) and 'Capacity building' (VA) are applicable).

In addition to these general issues, a couple of instances of apparent overlap between ICHI intervention codes were noted, where two applicable codes were identified based on code title wording, definition and inclusions (e.g., Yoga classes offered in the workplace to reduce stress could be coded as 'Other relaxation exercises', with Target SDJ 'Handling stress and other psychological demands', or 'Holistic exercise involving physical, mental and spiritual elements *incl.* Pilates; Tai Chi', with Target PZA 'Whole body').

Thus, in its current state, and in the absence of coding rules concerning which of two or more potentially applicable codes should be assigned in a given instance, the classification of public health interventions within ICHI does not meet the criterion of mutual exclusivity.

6. Clearly defined categories

a) Category titles should be clear, meaningful and unambiguous.
b) Categories should have definitions and explanatory notes.
c) Category titles and definitions should use language that is accepted and in common usage in the domain.

In general, axis category titles were clear and meaningful, and the language used could readily be related to the textual descriptions in the source data sets. Findings from the in-depth interviews suggest that participants found category titles to be clear and meaningful on the whole. Issues were noted with some titles, for example 'Provision' (RD) was thought not to convey the content of this Action clearly enough, and 'Legislation or regulations, other' (WI) was found to be ambiguous. All axis categories represented in the coded data had definitions except for the Means 'Enactment' (QD) and 'Enforcement' (QE). As discussed above under 'Mutual exclusivity', it was noted that the boundaries between some categories were not delineated clearly enough, indicating a need for tighter definitions and inclusions/exclusions (see Appendix 7.1). Comments provided by interview participants suggest that some commonly-used terms such as 'capacity building' may be subject to a range of different interpretations, and that it is difficult to clearly delineate concepts such as 'education' and 'training' in terms of how they relate to public health practice.

It was noted that the wording of many intervention code titles specifies a particular relationship between Action and Target (e.g., 'Education *about* eating behaviours'), which may not match how a given intervention is intended to work. This was an issue particularly for IUs in which the Action was

directed to a proximate Target not represented in the intervention code (e.g., 'Assessment of eating behaviours' (VEA AA ZZ) assigned to an IU involving an environmental audit of take-away food outlets), and for IUs directed to actors at higher system levels (e.g., 'Education about physical activity behaviours' (VEB PM ZZ) assigned to an IU involving a workshop on designing natural playgrounds delivered to playground designers). This issue affects the apparent applicability of intervention codes, in that a given code may be composed of Target, Action and Means categories that are applicable to the IU being coded, but the wording of the title may misrepresent the nature of the IU.

7. Level of detail and specificity

a) Level of detail should be appropriate to the domain and the intended uses of the classification.

b) Concepts of particular importance should have their own unique category; there should not be unnecessary categories.

The ability of ICHI to describe interventions with sufficient specificity is inevitably impacted by coverage gaps. Thus, to the extent that coverage gaps have been identified for each of the three axes (as discussed above under 'Comprehensiveness'), ICHI can be regarded as having deficits in terms of level of detail. In addition to the issue of gaps, detail is also determined by the number of axes used to define categories of the classification, and the spacing of divisions along axes (i.e., whether axis categories are broad or narrow). Thus, for example, a particular use of the classification might require more detailed specification of intervention Targets (e.g., to distinguish between interventions that target sodium intake and those that target fruit and vegetable consumption, rather than grouping these all as interventions targeting 'eating behaviours'), or the inclusion of intervention setting as a separate dimension of information.

In assigning ICHI axis categories, the need for greater detail was rarely noted (an exception was in relation to the Target 'Other safety behaviours, NEC'), suggesting that the current level of detail is broadly appropriate to the source data. Interview participants saw ICHI as best suited to high-level uses, such as comparing information about public health interventions between countries. On the whole, participants did not think ICHI would be detailed enough to meet the needs of practitioners on the ground, to support practice improvement, to use in evaluating intervention or program effectiveness at local level, to inform (tobacco control) policy at national or subnational level, or indeed to meet their own information needs. However, only one participant suggested that more detail was needed along the three ICHI axes; the more general view was rather that richer qualitative information about interventions would be required to meet the needs of practitioners and policy-makers. Thus, these comments could be interpreted as suggesting not that ICHI has insufficient detail, but that participants did not see a classification of this sort as relevant to meeting information needs other than high-level comparisons of public health outputs. One participant did comment that, for the

Tobacco Control data set, very different types of intervention were grouped together into a single ICHI intervention code; this could indicate that the categories are not detailed enough (i.e., they should be split further) or that the categories group IUs inappropriately (i.e., the divisions between categories are not correctly placed).

There were no findings concerning concepts of particular importance that might require their own unique category, or unnecessary categories.

8. Relevance

a) The classification should be meaningful and relevant, and should address dimensions of importance to users.

The research findings suggest that Target and Action are relevant information dimensions for describing and distinguishing between public health interventions, but that Means, at least in its current form, is less useful. Target and Action concepts were able to be identified (or readily inferred) from the descriptive information provided in data records, and interview participants saw these concepts as relevant for describing interventions. It was not always possible to articulate the Means for an IU, and comments provided by interview participants indicated some doubt as to whether this is a relevant dimension of information for public health interventions in the context of ICHI. Whether the categories defined along an axis provide a meaningful basis for grouping and distinguishing between interventions is a related but separate question. As discussed above, the use of the Action axis as a meaningful basis for grouping IUs into different types may be compromised by the fact that some Action categories convey information on form, some convey function, and some convey a mix of form and function. The comment of one interview participant, related above, that ICHI groups together interventions that are very different from a policy viewpoint, suggests the need for further investigation as to whether particular axis categories produce useful groupings of interventions.

Additional dimensions of information relevant for describing and distinguishing between public health interventions were identified. IUs directed towards different system levels, or involving direct versus indirect change pathways, emerged from the analysis of coding notes as important distinctions not able to be captured by ICHI, and such distinctions were regarded as relevant by interview participants. Another dimension of information mentioned by several interview participants related to enabling factors, such as affordability, knowledge, self-efficacy, social norms, and features of the physical environment. Many interventions aim to change such enabling factors as the first link in the behaviour change pathway; this relates to how an intervention is intended to work, which was seen as important information to capture. Other comments made by interview participants included that ICHI does not capture the broader co-benefits of interventions that are important in advocating for the value of public health interventions (e.g., tourism, employment, economic benefits), and that the

classification is limited in its ability to represent the complexity of public health interventions and important aspects of public health practice such as partnership-building, collaboration, the evidence-based rationale for an intervention, and integrated approaches. These comments are important because they convey the overall impressions of potential users concerning the relevance of ICHI in the context of contemporary public health practice and policy. Clearly, many dimensions of information are potentially relevant for describing and grouping interventions, but it is not feasible for all of them to be captured in ICHI. It will be important for user guidance to explain the information dimensions that are represented by ICHI axes and extension codes, and encourage users to record other information alongside ICHI-coded data (i.e., in separate data fields), as appropriate in a given application.

The fact that each ICHI intervention code can capture only one Target, Action and Means emerged as a limitation; IUs for which more than one Target or Action was assigned were noted to be only partially captured (and possibly thus misrepresented) by the intervention code assigned. The ICHI Alpha 2016 coding guidelines do suggest that an additional Target category can be added as an extension code when the intervention involves more than one Target (e.g., a media campaign about both physical activity and healthy eating); this approach may provide a solution, though the representation of different relationships between Targets (e.g., Targets of equal status or proximate and ultimate Targets) would need to be considered.

9. Reliability

a) Different users, or users in different settings, should assign the same code for a given unit of classification.

Results from the inter-coder comparison showed high rates of discrepancies between coders in applying ICHI to code descriptions of public health interventions, suggesting that ICHI-coded data on public health interventions have low reliability. Discrepancies between coders were observed at each stage of the multi-step coding process, and consequently the summary profiles for each data set, in terms of ICHI axis categories and intervention codes represented, differed between coders. A conclusion that may be drawn is that, applying the draft classification as it currently stands, limited confidence can be placed in the data produced. This would undermine the ability of ICHI-coded data to support uses such as comparison between programs or jurisdictions, and monitoring change over time.

Many of the issues described under the headings above, such as coverage gaps and unclear boundaries between categories, were observed to be responsible for coding discrepancies. At all steps of the coding process, there is scope for different choices to be made – concerning the number of IUs identified, how they are framed, which axis categories are assigned and, where there are multiple applicable axis categories, which of these is used as the basis for selecting an intervention code.

Choices made at one step flow through to subsequent steps. As acknowledged in Section 5.3, the low rates of agreement in intervention code assignment may have been attributable, in part, to the specific coding process set out in the coding protocol, instructing coders to first assign Target, Action and Means separately. Changing the coding process (e.g., instructing coders to select a Target and then choose the most applicable intervention code from those available for that Target) might produce somewhat higher rates of agreement, though it is unlikely that a substantial improvement could be achieved simply by taking a different approach to the task of finding the most applicable intervention code.

It is emphasised that these findings do not represent a summative assessment of reliability. The inter-coder comparison research component has provided valuable information on the reasons for discrepancies between coders. This can guide refinement of ICHI to reduce the scope for different coding choices to be made, as well as the development of user guidance and training materials. However, as discussed in Section 5.3, an important consideration will be the extent to which the use of ICHI should be controlled and standardised (Kutschenko 2011b). Efforts to more precisely delineate categories or put rigid coding rules in place may not deliver improved reliability if they do not also promote the perceived relevance and usefulness of ICHI to those working in the field of public health (Stausberg et al. 2008). Simplifying the classification, for instance by removing distinctions that are difficult to make in practice (e.g., between education and training), could lead to improved reliability.

10. International applicability

a) The classification should be internationally applicable, across different cultures and systems.

The three data sets used in this research were an Australian program-level data set, a national data set from the Netherlands, and an international indicator set against which 133 countries reported in 2016 (World Health Organization 2016a). It was possible to apply ICHI to code interventions described in these three data sets, and this can be taken to indicate a level of international applicability. However, the spread of data sets used in this research is not sufficient to allow a thorough assessment of applicability across different cultures and systems. This would require testing use of ICHI to code interventions delivered in a range of different country contexts, including in low resource settings. There would need to be investigation of whether interventions can adequately be described using ICHI, and whether ICHI-coded data can be used to group and distinguish between different types of interventions in a way that is meaningful to stakeholders in different countries.

11. Ease of use

a) The classification should be relatively easy to use and compatible with users' work processes and information flows.

Findings from this research provide limited insights into ease of use and compatibility with users' work processes and information flows. Interview participants were not specifically asked to comment on this, although one of the OPAL participants expressed the view that information held in the various categorical data fields of the OPAL database could be readily translated into the structure of ICHI. While ease of use and compatibility with users' work processes is an important consideration that may be expected to influence uptake of a classification and its correct use (and thus the quality of data produced), this is more obviously relevant for classifications used in high-volume coding situations. In the context of public health there are not the same kind of routinised processes for recording data on outputs as typically exist in clinical settings.

All the factors discussed above that affect how easy it is to identify units of classification and assign an appropriate code, inevitably impact on ease of use. User guidance and the form of the classification as it is presented to users, including availability of a classification index and/or electronic search function, will also affect ease of use. Given that there is still much to be done in terms of improving the content of the draft classification of public health interventions in ICHI, and support materials and user interfaces are at very early stages of development, it may be considered too early to conduct a meaningful appraisal of the classification against this requirement.

12. Compatibility with other classifications

a) The classification should be compatible or comparable with other classifications in use in the domain.

Two classification schemes could be judged incompatible if they shared a common information dimension but grouped entities differently along that dimension (i.e., with a different structure of categories so that only a many-to-many map was possible between the two classifications). This incompatibility would mean that data collected using one classification could not be translated into the structure of the other. Existing classification schemes relevant to public health interventions are reviewed in Section 2.4.3., but as none of these is widely accepted and used for data collection, they do not raise issues for ICHI concerning compatibility. In the WHO-FIC context, compatibility with the ICF has been a design consideration for ICHI, thus ICF Body Functions, Activity and Participation and Environmental Factor categories have been adopted as Target categories in ICHI. This is of greatest significance for interventions in the areas of allied health, rehabilitation, and support with functioning, where it is anticipated that ICF and ICHI will be used together (Fortune et al. 2018).

Other than the structural features of the three data sets themselves – the data items of the OPAL Single Platform, the information fields of the Netherlands interventions database, and the Articles of the Framework Convention on Tobacco Control – interview participants did not identify other classifications or formal data collection structures relevant to public health interventions. Several high-level data reporting systems (e.g., the WHO's non-communicable diseases targets and related monitoring systems) and policy instruments (e.g., the *Regional Action Plan for the Tobacco Free Initiative in the Western Pacific (2015–2019)* and *Australia's National Drug Strategy*) were mentioned, but no views were expressed concerning the extent to which ICHI may be capable of providing data compatible with these structures. One participant noted that some ICHI Targets can be readily linked to major health indicators, such as smoking or alcohol use, and are thus compatible with high-level reporting structures; this was seen to be a strength. Overall, the research findings did not suggest any concerns regarding lack of compatibility or comparability between ICHI and other classifications in use in the domain.

7.1.2 Overall appraisal of the draft classification of public health interventions in ICHI

In the discussion above, I have analysed the research findings against criteria relating to the desired features of a statistical classification. Shortcomings of the draft classification include problems with the conceptual clarity and operationalisation of the three axes in relation to public health interventions, difficulty identifying IUs in a consistent way, and low data reliability. These are issues that will need to be addressed if the classification is to have utility for collecting reliable and comparable data on public health interventions. A number of strengths were identified: the tri-axial classification structure is clear and workable for aggregating data, Target and Action appear to be relevant information dimensions for describing and distinguishing between public health interventions, the concept of IU as the unit of classification makes sense to people working in the field of public health, category titles are generally clear and categories are defined, and the level of detail is appropriate to the source data used in this study. In the following section, the 4-tier model is used to consider how the particular problems and shortcomings identified might be addressed in the next phases of developing the classification.

7.2 Discussion of findings in relation to the 4-tier model for representing key elements of a statistical classification

The 4-tier model, developed for the purposes of this study and described in Section 2.3 (Figure 2.1), is used here as a heuristic structure within which to locate the various issues identified from the research findings described above. This will assist in exploring how these issues might be addressed. Use of the 4-tier model fosters an appreciation of the inter-relationships between issues, particularly

highlighting where an issue at a higher level of the model (e.g., concerning apparent overlap between axis categories – Tier 3) has its origins in, or is affected by, issues at a lower level (e.g., concerning how the classification axes are operationalised – Tier 1).

Tier 1 – Information dimensions and structure

This tier represents the conceptual structure that is the foundation for the classification. Tier 1 issues are concerned with the definition and differentiation of classification axes and how the axes are put together to create the overall structure of the classification.

The research findings suggest that, while ICHI's tri-axial structure is workable for the aggregation of data on public health interventions, there are some problems with how it is realised in the draft classification. Although the axis concepts Target, Action and Means are defined, their meaning as they apply to public health interventions is not sufficiently clear. The effect of this is an uncertain conceptual foundation for development of axis categories and construction of public health intervention codes. In this section, I propose that the Tier 1 issues identified should be addressed by articulating editorial principles concerning how the axes are operationalised for public health interventions. These editorial principles would serve to guide development decisions at Tiers 2 and 3 of the model, and should be reflected in supporting materials (user guidance, etc.) developed at Tier 4.

Target, 'the entity on which the Action is carried out', is realised for public health interventions as health-related behaviour and environmental factor categories. These are factors that public health interventions aim to change in order to produce population-level effects on health. However, the change pathway hypothesised for a public health intervention often involves a series of factors which might all be regarded as Targets for the purposes of ICHI coding. As described above, an intervention might seek to have a direct effect on an enabling factor (e.g., self-efficacy or motivation) in order to achieve change in a health-related behaviour (e.g., alcohol use). The terms 'proximate' and 'ultimate' Target have been used in the discussion of these results, but in some instances more than two Targets may be identified in a change pathway. The research findings do not suggest a basis for choosing one of multiple Targets identified for an IU as the single Target to represent that IU for the purpose for assigning an ICHI intervention code. Rather, to represent the IU in a meaningful way, it may be relevant to capture both/all factors in the hypothesised change pathway. Thus, 'Target' for public health interventions could be operationalised as the factor/s an IU seeks to change; for any given IU this might include enabling factors (i.e., precursors to behaviour change), health-related behaviours, and environmental factors, and also other ICHI Target types such as body functions and activity and participation domains.

For the purpose of ensuring a consistent approach to constructing intervention codes, however, an editorial principle will also be needed concerning which type of Target should be the subject of ICHI intervention codes (e.g., proximate or ultimate Target). There should be a mechanism for capturing additional Target information (e.g., by use of extension codes), and information on the nature of the relationship between multiple Targets (e.g., equal, proximate–ultimate). These developments should be informed by input from the field regarding what is a meaningful basis for distinguishing between different types of interventions and grouping interventions.

Currently, ICHI Action categories relevant to public health interventions relate to two distinct underlying concepts: form (i.e., the deed done) and function (i.e., the intended effect). Some categories convey information on form, some convey function, and some convey a mix of form and function. As discussed above, the study findings identified this as a cause of mutual exclusivity and data reliability issues, and as a problem in terms of how data grouped by Action can meaningfully be interpreted. It may not be possible or desirable to operationalise Action as either purely form (i.e., categories that describe the deed done without any information about intended effect, e.g., 'Provision') or purely function (i.e., categories that describe the intended effect without any information on how it is achieved, e.g., 'Capacity building'). Contemporary literature concerning building the evidence base for public health interventions emphasises the importance of theorising intervention components in terms of their function (Hawe et al. 2004; McKleroy et al. 2006; Armstrong et al. 2008; Durlak & DuPre 2008; Brownson et al. 2009; Hawe & Potvin 2009; Wight et al. 2016). Also, interview participants expressed the view that it is important to know how an intervention is intended to work. However, if Action was operationalised purely as function, Action categories would convey no information about what was actually done. Ideally, ICHI Actions should capture meaningful information on different approaches to intervening, so that ICHI-coded data can be used to look at, for instance, whether there is an appropriate mix of interventions being funded or delivered, or whether effective types of interventions are in place.

A pragmatic approach could be to articulate an editorial principle stating that 'Action' for public health interventions should be operationalised as categories that correspond to broad approaches used in public health and that convey information about both what is done and how it is expected to work. Such Action categories should be readily recognisable as 'types' by those working in public health. Many existing ICHI Actions such as 'Education' (PM) and 'Applying incentives' (WG) would be consistent with this principle. Again, this development should be informed by input from the field regarding which of the existing Action categories provide a basis for identifying meaningful 'types' of intervention, which should be amended, and what new categories are needed (Tier 2). Actions would need to be defined so that they are mutually exclusive (Tier 3), or can be made operationally mutually

exclusive with the help of coding rules, for example stating which categories should have priority where more than one applicable category is identified (Tier 4).

Means, 'the processes and methods by which the Action is carried out', is incompletely realised in that there are only a few Means categories relevant to public health interventions, and nearly three-quarters of public health intervention codes in ICHI Alpha 2016 utilise the residual Means category 'ZZ – Intervention using other method, without approach or not otherwise specified'. The Means categories 'Enactment' and 'Enforcement' arguably do not fit the ICHI definition of Means, but are useful in distinguishing different types of interventions with Actions involving legislation or regulations. The study findings indicate that, for public health interventions, a clear conceptual distinction between Action and Means is not easily made. A pragmatic approach may be to articulate an editorial principle stating that Means categories for public health interventions enable further distinctions to be made in relation to particular Actions or groups of Actions, where this is necessary. Thus, in further developing the classification, Means would effectively be treated as an optional third axis, an adjunct to the Action axis.

Another important Tier 1 issue concerns the way axis categories are used to construct ICHI intervention codes. As discussed above, it is common for IUs to involve more than one Target or Action; in such cases more than one applicable intervention code can be identified, with no single code able to adequately capture the IU. In its current form, ICHI is presented as a pre-coordinated classification, with the expectation that a single code will be assigned to each unit of classification. The research findings suggest that this does not work satisfactorily in practice for some IUs, raising the question of whether separate use of the three axes should be proposed for coding public health interventions. That is, for public health applications, ICHI could be available as a tri-axial, faceted classification, as well as a pre-coordinated, enumerative classification. Used as a faceted classification, sets of interventions (e.g., the interventions delivered by separate programs over the course of a year) could be characterised and compared in terms of the relative representation of different axis categories, as was done for the three data sets used in this study (see data tables and figures in Chapters 4 and 5).

A final topic to be addressed at Tier 1 concerns dimensions of information not currently captured by ICHI. Following clarification of how Target, Action and Means axes are operationalised for public health interventions, there should be consideration of whether and how any additional dimensions of information should be captured in ICHI. There is scope to do this formally within ICHI by means of extension codes, which can be optionally post-coordinated with ICHI intervention codes. This approach provides a way of standardising how additional dimensions of information are captured. Alternatively, this can be left to users, who are free to record other information in separate data fields

alongside ICHI codes. From these research findings, the system level to which an IU is directed emerged as an important distinction not captured by ICHI. This information could potentially be captured as an extension code, with categories based on the ecological coding system developed by Richard and colleagues (1996; 2015). If it is decided that enabling factors should not be represented as Targets in ICHI, another option would be to develop an extension code to capture enabling factors.

Tier 2 – Content: coded categories

This tier represents the population of the classification structure with coded categories. Tier 2 issues are concerned with the specification of categories and their location within the overall structure.

The research identified specific coverage gaps, that is, Target, Action and Means concepts not captured by ICHI axis categories. These are listed in Appendix 7.1 and corresponding suggestions for new categories are given. New axis categories should be created to fill the gaps identified, in accordance with the editorial principles concerning how Target, Action and Means are operationalised for public health interventions (Tier 1). As missing axis categories were noted to be a cause of discrepancies between coders, addressing coverage gaps can be expected to improve overall data reliability.

Another Tier 2 issue is review of existing axis categories where the research findings raised questions about their scope and applicability for public health interventions. Examples include the Actions 'Provision' (RD), 'Capacity building' (VA) and 'Preparation' (SI). Once again, such review should be informed by the editorial principles (e.g., that Action categories should convey information both on what is done and how it is expected to work). Axis categories should support meaningful groupings of interventions; that is, all interventions to which a given axis category is applicable should share a commonality that users of the resulting data will be interested in. The objective should be to ensure that each axis comprises a set of conceptually consistent categories that divide up and comprehensively cover that dimension of information as it is operationally defined for public health interventions.

New intervention codes would be created following addition of new axis categories, as well as some new codes combining existing categories where research findings indicated gaps (Appendix 7.1). Some review of existing intervention codes may also be needed to check that they are consistent with relevant editorial principles. For instance, some changes may be needed to ensure a consistent approach to the construction of intervention codes for describing IUs that involve an environmental factor proximate Target and a health-related behaviour ultimate Target; as discussed above, this is currently achieved for some codes by combining a health-related behaviour Target and an Action that conveys information about the environmental factor proximate Target, but this is not the case for all

such codes. Key considerations should be maximising the information content conveyed by intervention codes (e.g., not 'doubling up' information by having both an environmental factor Target and an Action concerning change to environmental factors), and ensuring that intervention codes can be grouped in meaningful ways using their constituent axis categories.

Development of new extension codes is also a Tier 2 activity, for instance to capture the system level to which an IU is directed.

Tier 3 – Category titles and definitions

This tier represents the way the content of and delineation between categories is communicated within the classification itself. Tier 3 issues are concerned with category titles, definitions, descriptions, inclusions and exclusions.

Boundaries between some axis categories were found to be unclear. Detailed results indicate particular categories for which improved definition and expanded use of inclusion and exclusion terms would help to ensure mutual exclusivity in practice (Appendix 7.1). In addition, some modifications to axis category definitions may be suggested to clarify the scope and applicability of particular categories with respect to public health interventions (e.g., modifying the definition for Target 'Sexual behaviours' (VEF) to encompass patterns of sexual activity and sexual relationships). For some categories, the lack of inclusions of relevance to public health interventions was noted (e.g., 'Training' (PH)). Research findings indicating that some commonly-used terms are subject to different understandings and interpretations underline the importance of ensuring that category definitions, together with inclusions and exclusions, convey their intended meanings within the context of ICHI. This would improve reliability by reducing scope for coders to interpret categories differently according to their own understandings of terms.

The form of wording of some intervention code titles was identified as problematic, in particular those that imply a specific type of relationship between Action and Target (e.g., 'Education *about* [Target]'). Such titles should be re-worded so that they are general enough to encompass all interventions for which the code is intended to apply, including those interventions with indirect change pathways where there is not a direct relationship between Action and Target. For example, the current title 'Education *about* eating behaviours' (VEA PM ZZ) could be modified to 'Education *to influence* eating behaviours' to be more obviously applicable to education interventions for which the goal is to influence eating behaviours but the education is not 'about' eating behaviours (e.g., education about how to display foods in a school canteen in a way that encourages healthier choices). Some other changes to intervention code definitions and inclusions/exclusions may also be needed to ensure mutual exclusivity (see Appendix 7.1).

Tier 4 – Supporting materials

This tier represents the infrastructure of materials developed to support consistent use of the classification, and thus to promote stability of the data produced through its application. Tier 4 issues are concerned with user guidance, coding rules, reporting standards and education/training materials.

In the field of public health, there is no established practice of using standard classifications to collect or analyse data on outputs, as there is in some other sectors of health systems, so a key role for ICHI user guidance in the context of public health should be to promote use of the classification. Interview participants indicated that the Target-Action-Means structure is not how public health interventions are usually conceptualised, and that 'Target' as used in ICHI does not reflect how this term is normally understood. Participants also did not see a classification of this sort as relevant to meeting information needs other than high-level comparisons of public health outputs. The editorial principles articulated at Tier 1 would provide a basis for developing user guidance designed to clearly convey how the structure of the classification, its underlying concepts and organisational principles are operationalised for public health interventions. In addition, the envisaged uses of ICHI public health content should be elaborated to encourage potential users to consider its applicability to their own information needs. The ICHI definition of 'health intervention' implies that the intervention must have a health purpose to be in scope for ICHI but, as discussed above, this may be an unnecessary restriction in the context of public health; potential users may want to collect data on interventions that have a health effect, regardless of stated purpose. An expanded interpretation of the ICHI definition of 'health intervention' could therefore be suggested for public health. Thus, user guidance should, in effect, provide a cultural orientation to the classification, building a bridge between ICHI and contemporary public health thinking and practice.

At a more detailed level, guidance and coding rules should be developed to ensure, as far as possible, a standard approach to the application of ICHI for coding public health interventions. Once mutual exclusivity and reliability issues have been addressed to the extent possible at Tiers 1, 2, and 3, as discussed above, user guidance and training materials (including detailed public health examples) should be developed to address any outstanding issues (e.g., establishing priority rules in cases where two or more axis categories or intervention codes are found to be applicable) to support coding consistency.

Identifying IUs as the individual units of classification has emerged from this research as a particularly challenging issue with important implications for data reliability and comparability. There is no 'correct' way to split a complex, multi-component intervention into units of classification for coding. The operational definition of 'intervention unit' developed for this research was not effective in standardising this step of the coding process, and research findings do not indicate how

standardisation could be more effectively achieved. Indeed, it may not be desirable to be more prescriptive about this – different approaches to identifying IUs for coding will be suited to different information needs (e.g., depending on the actor perspective that is of interest, or the level of granularity at which the user seeks to describe interventions). A pragmatic way forward on this issue could be to provide a definition of 'intervention unit' that relates it to concepts found in the public health literature (e.g., theoretically important components, active ingredients, and core elements), to provide some general principles concerning the identification of IUs (e.g., stating that activities considered part of the implementation of an intervention should not be identified as IUs for coding), and to encourage users to specify the approach they have chosen to use and record this as metadata. Such metadata would inform subsequent analyses, for example, providing a basis for determining whether two separate collections of ICHI-coded data on public health interventions may be meaningfully compared.

7.3 Utility of the analytical structure: framework of criteria and 4-tier model

The framework of criteria and the 4-tier model were developed within this study, as described in Chapter 2, as two complementary components of a novel analytical structure for use in bringing the research findings to bear on my two research questions:

1. ***Does the draft classification of public health interventions in ICHI possess the desired features of a statistical classification?***
2. ***What problems or shortcomings can be identified and how could these be addressed to improve the utility of the classification?***

The previous two sections of this Chapter demonstrate the application of this analytical structure. Both the framework and the model have proved to be serviceable in providing a structured approach for first teasing out and articulating specific strengths and limitations of ICHI (Section 7.1), then examining where the various problems and issues identified are located in relation to the main elements of the classification and considering how they might be addressed (Section 7.2).

In applying the framework of criteria to the research findings, it became clear that some issues could appropriately be discussed under more than one heading, and some issues were causally related to issues discussed elsewhere in the framework. For example, the finding that some axis categories were not sufficiently clearly delineated was picked up under no. 5 'Mutual exclusivity' and no. 6 'Clearly defined categories'. Issues concerning how Target and Action are operationalised for public health interventions were discussed under no. 2 'Structure and organisational principles', and identified as a cause of mutual exclusivity issues (no. 5); similarly, problems with identifying units of classification (no. 3) and coverage gaps (no. 4) were identified as contributing to poor reliability (no. 9). These

inter-relationships are to be expected, and the fact that the twelve headings do not provide a mutually exclusive classification of issues does not detract from the utility of the framework. Rather than resulting in duplication or redundancy, the inter-relatedness of different components of the framework enables a given issue to be viewed from different perspectives, fostering a greater depth of understanding.

The research findings served to highlight the multi-faceted nature of some of the criteria. For example, discussion of findings in relation to no. 2, 'Structure and organisational principles', revealed this to be a multi-faceted topic, concerning not only the identity and definition of classification axes but also how they are realised as axis categories, what underlying concepts are present and where these are represented (e.g., the observation that some Action categories convey information about proximate Target), and how axis categories are used in the construction of intervention codes. In relation to mutual exclusivity (no. 5), issues of two broad types were identified: applicability of more than one axis category (and thus intervention code) per IU (i.e., issues concerning the unit of classification), and unclear or overlapping axis categories (i.e., issues concerning classification content). Further elaboration of the framework could be considered to encourage a more in-depth exploration of issues that might arise under each heading. However, as the nature of issues to be explored might vary depending on the characteristics of each particular classification and classification domain, and the level of detail in the current version of the framework was adequate for this study, no elaboration is proposed here.

There was variation in the extent to which research findings provided material for discussion under the various framework headings. The final three headings – 'International applicability', 'Ease of use' and 'Compatibility with other classifications' – were criteria that could not be explored in great depth because of the nature of the data sources used (in relation to international applicability) and the lack of established data collection processes and use of standard classifications in relation to public health interventions. However, there is no reason why these topics could not be explored in the context of the developmental appraisal of a classification. For example, field tests were conducted to assess cross-cultural applicability during development of the ICF (Ustun et al. 2003), and time taken to code has been the subject of tests conducted during the development of the ICD-11 (Donada et al. 2017). Therefore, it is proposed that all twelve headings should remain in the framework of criteria.

The framework does not provide guidance on how the classification should be judged as meeting or not meeting particular criteria, for example, judging whether purpose is stated clearly enough (criterion 1a). Also, it is agnostic as to the relative importance of the various criteria listed. Thus, the framework is not to be viewed as an assessment instrument that can be used to produce a definitive

measure of the extent of conformity to the requirements of a statistical classification. Rather, its value is in providing a checklist of issues to be considered or tested as part of a developmental appraisal.

The 4-tier model was developed and utilised to consider how the problems identified might be addressed in the next phases of developing ICHI. Ideally, development would address issues at Tier 1 first, to strengthen the conceptual structure that is the foundation for the classification, then progress upwards to address issues at subsequent tiers. This implicit logic is reflected in the way the discussion has been presented in Section 7.2 – that is, issues to be addressed at a particular tier are acknowledged as needing to be considered in light of decisions made at lower tiers (e.g., editorial principles concerning how the axes should be operationalised for public health interventions (Tier 1) will inform review of axis categories (Tier 2)). In some cases, a decision taken at a lower tier may obviate the need to address an issue identified at a higher tier – for instance, if it was decided to present ICHI solely as a tri-axial, faceted classification with no pre-coordinated intervention codes, it would not be necessary to address any of the higher-tier issues concerning intervention codes (e.g., wording of code titles). Conversely, development at a higher tier (e.g., work on category definitions) may suggest the need for changes at a lower tier (e.g., adding or removing categories).

In practice, it may not always be possible to resolve issues at lower tiers before tackling higher-tier issues, for instance because of time or resource constraints, or features of the classification that are 'non-negotiable'. Therefore, solutions at higher tiers may be sought to improve the practical utility of the classification with an acknowledgement that the problem has its origin in lower tier issues that cannot fully be resolved (e.g., tightening up definitions and adding exclusion terms to solve mutual exclusivity problems that are due to underlying conceptual issues with classification axes). Whichever pathway is taken, understanding the nature and source of problems is valuable for considering options during development. Viewing the issues as located at different levels of the 4-tier model is helpful for understanding the relationships and dependencies that exist between issues, and provides a basis for making pragmatic decisions about how to move forward, while being aware of what issues remain so that these can be considered in future revisions of the classification, and can inform interpretation of data produced using the classification.

Thus, it is concluded that, together, the framework of criteria and 4-tier model have provided a helpful structure within which to analyse and discuss the research findings. They have assisted with separating out the issues while also capturing inter-relationships among them, serving to provide a clear basis for identifying options for the further development of ICHI. As observed in Section 2.3, there is currently no established, publicly-documented body of practice concerning the developmental appraisal of statistical classifications. It is therefore proposed that the analytical structure developed

and demonstrated in the context of this research may be applicable to the development of other statistical classifications.

7.4 Reflections on research design and methodology

This research project was described, in Chapter 3, as a developmental appraisal of the draft classification of public health interventions in ICHI, with the results intended to contribute to the ongoing development and improvement of the classification. The mixed, qualitative research design comprised three components (Section 3.2), which provide three different approaches for exploring the classification in the context of its interactions with socially constructed understandings of public health interventions – how it relates to descriptions of interventions in existing data collections, how different coders interpret and apply classification categories, and how potential users respond to the classification and to the coded data produced through its use. The three data sets used for this research were regarded as expressing both information needs of stakeholders and how interventions are understood by stakeholders. They were treated as 'naturally occurring data' (Ritchie & Lewis 2003), and were used across the three research components to produce 'generated data' for analysis.

Overall, this research design worked well. The different approaches taken in the three components provided complementary views on the classification. Using existing data sets and interviewing stakeholders connected with those data sets means that, in effect, all the data that contribute to the overall appraisal of the classification reflect how the classification works in real-world contexts, to the extent that is practically possible at this stage of its development.

Data sets for this research were selected to represent a variety of public health practice areas and types of intervention, different information needs, and different scales (program-, national-, and international-level data sets). The three data sets did in fact raise different issues and challenges in the process of applying the classification to code data records. However, the data sets were not sufficiently diverse to assess whether ICHI can be regarded as internationally applicable. Also, they did not, collectively, cover the full scope of public health interventions. Types of public health interventions not covered include infectious disease control measures, environmental and infrastructure interventions (e.g., to improve housing conditions or water quality), and interventions focused on influencing the social determinants of health. Combining the three data sets, there were 82 ICHI intervention codes represented in the coded data, accounting for around 16% of the about 500 codes in ICHI 2016 relevant to public health interventions; thus, this research has not tested the full range of public health content in ICHI. It is reasonable to expect that most of the issues highlighted by the research findings would apply more broadly; however, some additional issues would no doubt be identified if the draft classification was tested using data sets covering a wider range of public health interventions. Some difficulties encountered in applying ICHI were due to the characteristics of the

source data, such as insufficient information about what some interventions entailed. Rather than being a limitation, these difficulties serve to highlight the kinds of challenges that will inevitably be encountered in using the classification – the source data will rarely be perfectly suited to ICHI coding.

In the data coding and inter-coder comparison research components, the capture of data for each step of the coding process allowed detailed investigation of the issues arising at each step and in relation to particular aspects of the classification, and how these issues impacted on the ultimate assignment of intervention codes. However, the coding process employed (set out in the coding protocol, Appendix 3.2) meant that later steps were contingent on choices made at earlier steps, particularly the identification and framing of IUs. In the inter-coder comparison, this limited the ability to compare axis category and intervention code assignment, as coders were often assigning categories to differently framed IUs. Higher rates of agreement would very likely have resulted if coders were presented with pre-specified IUs for coding. Nonetheless, the inter-coder comparison provided an effective way of exploring in detail the various issues responsible for coding discrepancies in the context of a multi-axial classification.

The key-informant interviews provided an essential perspective in the context of the overall appraisal of ICHI – that of potential classification users. Interview participants represented a range of different user types and information needs, and provided feedback on the classification from various vantage points afforded by their in-depth knowledge of three quite different data sets. The views of participants were influenced not only by which data set they were associated with, but also by their professional backgrounds, roles, and particular interests and information needs in relation to public health interventions. Participants also varied in their levels of experience with the use of statistical classifications or similar data collection structures. As the sample size was small (10 participants), it was not possible to explore patterns of response in relation to these variables. While this sample is not representative of the full spectrum of potential users, there is value in the range of different perspectives represented. It must be acknowledged that participants' responses were limited to their impressions of the classification based on the summary data presented to them; they were not responding based on their own use of the classification, or based on the use of ICHI-coded data to meet a concrete and specific information need. Thus the views expressed must be taken as initial reactions to a new classification. It may be expected that views of potential users would change with experience using the classification to collect, analyse or interpret data on public health interventions – additional strengths and limitations may be identified.

In explaining the theoretical position from which I have approached this research (Section 3.1), I emphasised a view of classifications as not only technical information *tools* but also social information *artefacts* that embody cultural and political values and agendas, that can help to reveal

but also to conceal characteristics of, and differences and relationships among, entities classified, and that facilitate but also constrain knowledge and communication. The conduct of this research has been in keeping with a social constructionist epistemology – I have approached the task from the perspective that the draft classification represents one way, among many possible ways, of constructing understandings of public health interventions. The discussion of the research findings presented in this Chapter is consistent with recognition of the importance of critically examining the decisions that are made in the process of constructing classifications, and of being 'conscious' in how they are used, including being aware of the potential limitations of information produced through their use.

This study has not specifically examined how the manner in which public health interventions are represented in ICHI might be favourable to certain interests and agendas at play in the domain of public health and unfavourable to others, which perspectives are given voice and which are silenced, or what is revealed and what is concealed. Some views expressed by interview participants indicated that there are issues to be explored in this regard – for example, comments that the Target-Action-Means structure reflects a 'medical model' view of public health, and that the classification is best suited to representing more traditional, simple interventions and less able to capture contemporary more effective, complex and integrated intervention approaches. Being conscious of how the classification may reflect and/or reinforce various cultural and political values and agendas will be important for understanding the potential consequences of its use in real-world applications. This is among the topics that will be taken up in the final Chapter of this thesis, in which I propose a path forward for the classification of public health interventions in the International Classification of Health Interventions and reflect on the broader implications of this study.

8. Conclusions: A Path Forward for the Classification of Public Health Interventions Within ICHI

"The human understanding is of its own nature prone to suppose the existence of more order and regularity in the world than it finds. And though there be many things in nature which are singular and unmatched, yet it devises for them parallels and conjugates and relatives which do not exist."
Francis Bacon, 1620.

"Above all, one should not wish to divest existence of its rich ambiguity."
Friedrich Nietzsche, 1882.

"Distinctions are easy enough to draw. Useful ones are another matter."
John Dupré, 1993.

In undertaking this study, I set out to conduct a comprehensive developmental appraisal of the draft classification of public health interventions in ICHI, in order to gain an understanding of its strengths and limitations and to identify problems and issues that should be addressed to improve its utility. In addition, I aimed to develop and test an analytical structure within which to conduct the developmental appraisal, and to make recommendations concerning the future use of this structure, both in the further development of ICHI and more widely for other statistical classifications.

Statistical classifications can be understood as technical tools, but also as information artefacts that shape and are shaped by the social worlds in which they exist; they embody a particular social construction of the domain they classify and may be seen as key players in the social process of constructing meaning (Bowker & Star 1999). The methodology and research design I employed in this study reflect a social constructionist perspective: viewing the draft classification as one way of constructing meaning concerning public health interventions, I explored how ICHI relates to public health interventions as they are understood by those working in the field. To do this, I used three existing data sets containing descriptions of public health interventions as a basis for testing ICHI, taking these data sets to represent interventions as they are understood by stakeholders in real-world contexts, and to express the information needs of stakeholders.

Three complementary research components were developed to test how well the draft classification functions when it is used to transmit and receive information about public health interventions. First, ICHI was used to code descriptions of public health interventions in the three data sets, with issues encountered during this process recorded as coding notes. Secondly, ICHI was applied independently by two coders to a subset of records from each data set, to measure inter-coder agreement and explore

reasons for coding discrepancies. Thirdly, key-informants associated with each of the data sets were interviewed to gather stakeholder feedback on the draft classification and the utility of ICHI-coded data.

Results from the three research components were presented in Chapters 4 to 6. In Chapter 7, these results were drawn together under the twelve headings of the framework of criteria developed in Chapter 2 (Box 2.3), to examine the extent to which the draft classification exhibits the desired features of a statistical classification, and to identify its specific strengths and limitations. The 4-tier model (Figure 2.1), developed to represent the main elements or layers that make up a statistical classification, was used to consider the origins and manifestations of, and the interactions among, the particular issues identified, and how they might be addressed in the further development of ICHI. In this final Chapter, I present answers to the two research questions posed at the beginning of this study, and propose a path forward for the further development and use of the classification of public health interventions in ICHI, based on a consideration of the findings of this research within the context of the literature reviewed in Chapter 2. I also reflect on the implications and significance of this study for the field of public health and for future work in statistical classification development.

8.1 Answering the research questions

Drawing on the analysis and discussion of the study findings presented in Chapter 7, this section presents specific answers to the two research questions posed in Chapter 1 of this thesis.

1. ***Does the draft classification of public health interventions in ICHI possess the desired features of a statistical classification?***

The framework of criteria was developed in Section 2.3, drawing on relevant literature, to provide a basis for examining the extent to which the draft classification exhibits the desired features of a statistical classification. As detailed in Section 7.1.1, analysis of the research findings revealed both strengths and limitations of the draft classification in relation to the criteria set out under the twelve headings of the framework. Some of the shortcomings identified can be expected to seriously compromise its ability to function as a robust statistical classification, and thus indicate issues that should be addressed. These include a lack of clarity concerning how the underlying concepts of Target, Action and Means are operationalised for public health interventions, issues with mutual exclusivity of axis categories and intervention codes, coverage gaps, low reliability, and practical difficulties in defining the unit of classification. Strengths of the draft classification included that the tri-axial classification structure is clear and workable for aggregating data, and that Target and Action appear to be relevant information dimensions for describing and distinguishing between public health interventions. These strengths suggest that ICHI has potential utility. Overall, however, the study

findings indicate that, in its current state, the draft classification of public health interventions in ICHI would not be suitable for use as a statistical classification.

2. What problems or shortcomings can be identified and how could these be addressed to improve the utility of the classification?

The study has identified numerous issues that should be addressed to improve the utility of the classification. These are set out in Appendix 7.1, along with proposals concerning how they could be addressed. In some cases, specific suggestions are made. For example, several new Action categories are proposed for consideration: 'Raising awareness', 'Environment modification', 'Policy change', 'Development of legal or administrative infrastructure in relation to health', 'Development and implementation of guidelines in relation to health', and 'Facilitating or conducting research in relation to health'. For some issues, further thought is required to develop workable solutions. For example, interventions that provide an opportunity for people to do or try something (e.g., healthy food tasting sessions, fun runs) are common but difficult to characterise – some are one-off events, some are activity programs, some involve putting an arrangement in place which can then be sustained by participants (e.g., a walking group). Input from the field will be important to assist with determining how such interventions are best represented in ICHI, so that interventions can be grouped and distinguished in ways that are meaningful to potential users.

The 4-tier model, developed in Section 2.3, was used to locate the various issues identified from the research findings and explore how they might be addressed in the next stages of ICHI's development. The discussion presented in Section 7.2 illustrates the relationships and dependencies that exist between issues at different tiers of the model. This highlights the importance of an integrated approach to the further development of ICHI, rather than seeking to 'fix' specific issues in a piecemeal fashion. Ideally, such an approach would focus first on Tier 1 issues, which relate to the conceptual foundation of the classification. Thus, it is proposed that editorial principles should be articulated concerning how Target, Action and Means are operationalised for public health interventions; these principles would guide decisions concerning changes needed to axis categories and category titles and definitions, and should be reflected in user guidance. For example, it is suggested that 'Action' for public health interventions should be operationalised as categories that correspond to broad approaches used in public health and that convey some information about both what is done and how it is expected to work (as some existing Actions, such as 'Education' and 'Training', do). Action categories that have been noted as problematic (e.g., 'Provision' and 'Capacity building') could be reformulated to be consistent with this principle, and new categories (to fill identified gaps) should also be formulated accordingly. Thus, while proposals have been made concerning how specific problems could be addressed, each should be considered in the broader context of an integrated effort to produce an improved version of the draft classification. Continued

use of the 4-tier model would be valuable throughout this process, to assist developers in maintaining an awareness of how issues addressed at one tier affect or are affected by aspects of the classification at other tiers.

8.2 Implications for the classification of public health interventions in ICHI: a path forward

In this Section, I take a forward-looking view and consider the implications of the study findings for the future development and use of ICHI. It is tempting to feel pessimistic about the prospects of satisfactorily addressing all the problems and limitations that have been identified, in order to achieve a statistical classification that can be used to produce reliable data on public health interventions capable of meeting a range of information needs. However, it is my view that this should not be the main goal for the developers of ICHI, at least in the short or medium term. Rather than striving to develop ICHI so that it is capable of meeting the stringent requirements of statistical applications, a more pragmatic and constructive path forward may be pursued, as explained below.

There is little evidence of demand for comparable data on public health interventions akin to those produced by the routine administrative data collections that exist in the hospital sector. In many countries, diagnosis and intervention data are recorded at patient level for individual hospital episodes; these data are used in a range of applications, such as monitoring the safety and quality of care and determining the distribution of resources (e.g., Australian Institute of Health and Welfare 2018). Data on selected hospital interventions are reported at international level to allow comparison between countries (OECD 2014), but the collection of data is driven by their need for domestic uses rather than international comparison. There is not, currently, an expressed need for data of this kind on public health interventions. The Australian experience concerning data on public health expenditure illustrates this point. The National Public Health Expenditure Project was established in 1998 to develop a consistent set of annual estimates of expenditure on public health activities (Australian Institute of Health and Welfare 2001b). Annual data were reported against nine nationally agreed 'core public health expenditure categories' from 1998-99 to 2008-09 (Australian Institute of Health and Welfare 2011). It was intended that these data on the cost of inputs would be related to public health outputs and outcomes as a basis for measuring cost-effectiveness of public health interventions (Australian Institute of Health and Welfare 2001b; Australian Institute of Health and Welfare 2001a); however, this was not done and, in 2012, the public health expenditure series was put on hold indefinitely. The difficulty identifying public health intervention data sets for this research is another indication of the lack of expressed demand for data on public health interventions.

As discussed in Section 2.4.3, there exist numerous frameworks and classification schemes for organising and analysing information on public health interventions, most of which have been

developed for quite narrowly-specified uses. There is no consensus in the field on any standard approach for grouping public health interventions by type. Indeed, there is a trend towards understanding interventions through a 'complexity lens', with some authors advocating the use of methods developed for analysing complex systems to assist in the design and evaluation of interventions (Shiell et al. 2008; Hawe et al. 2009; Finegood 2011; Rohwer et al. 2017; Valente & Pitts 2017; Minary et al. 2018). This 'state of play' in the field would seem to be at odds with the reductionist, simplifying approach that a classification projects onto the domain classified. The developers of ICHI may need to find a way to reconcile this apparent clash of cultures, or epistemological mismatch, if the classification is to be seen as relevant.

Nonetheless, a case can clearly be made for greater standardisation and the use of common frameworks for describing and communicating about public health interventions, and the need for this has been articulated. As discussed in Section 2.4, the lack of a common language and common structures is seen as an impediment to the advancement of knowledge and to knowledge translation in public health and related fields (Jorm et al. 2009; Michie et al. 2009; Lamb et al. 2011; Colquhoun et al. 2014; Dijkers 2014; Lokker et al. 2015; Guegan et al. 2016). The many classification schemes that have been developed indicate that there is a need for such structures. In this study, interview participants saw the purpose and relevance of ICHI for the field of public health, acknowledged the value of having a common framework, and thought it was useful to be able to produce summary data on public health interventions. One participant commented that, when the OPAL Program database was being designed, there was an attempt to identify existing frameworks that could be used as a basis for collecting data on OPAL projects, but none were found. If ICHI can be developed in a way that is responsive to such real-world information needs, it has potential to make a contribution to building knowledge in the field of public health.

A constructive path forward, I propose, is to position ICHI as an 'epistemic hub', able to serve as a basis for connection and information exchange between diverse public health actors with different 'epistemic interests'. Kutschenko (2011a) sees classifications that are heterogeneous and imprecise, but widely used in a range of different settings (such as the ICD), as positioned at one end of a spectrum; at the other end are very specific, narrowly-applied classification schemes that are developed to meet local needs. Negotiations and decisions concerning classificatory principles and the representation of units of classification are typically easier for more narrowly-applied classifications. Precision in the definition of categories is often required of such classifications, but precision restricts the range of applications for which a classification is suitable.

When broadly-applied classifications are viewed as performing an 'epistemic hub' function, a degree of imprecision can be a virtue, because this allows a variety of actors with different epistemic interests

to connect their more specific and precise classification systems to the common hub. In this way, the hub can act as a node, connecting diverse actors and applications across various settings and contexts, fostering communication and innovation. This approach emphasises the function of classifications as boundary objects (Star & Griesemer 1989; Bowker & Star 1999). 'Taxonomic pluralism' is the term used by Kutschenko to describe this coexistence of multiple schemes within a classification domain, 'recognising the necessity of a common classification system that can be applied in addition to more precise, thus more restricted, systems, protocols, and guidelines' (Kutschenko 2011a, p.597); the hub classification becomes integrated as part of a complex information infrastructure.

The International Classification of Health Interventions is intended to be a broadly-applied classification capable of meeting the information needs of diverse actors across many settings and contexts. In seeking to introduce a new information standard, there is an inevitable tension between the flexibility required to accommodate heterogeneity in local practices and information needs and the rigidity required to achieve consistency and alignment (Ciborra & Hanseth 1998). Findings from this study indicate that, in relation to public health interventions, ICHI exhibits a degree of imprecision that is problematic for its use as a statistical classification, but perhaps less problematic if it is viewed as an epistemic hub. ICHI may be received more favourably if it is presented to potential users as an epistemic hub, available for researchers and practitioners to use and connect with flexibly, in a range of different ways according to their own information needs, rather than as a stand-alone data collection tool to be used only on its own terms. Taking this approach to the further development of ICHI would mean a change of emphasis, rather than a radical change of direction, and a broadening of view to embrace a wider spectrum of possibilities concerning its use.

This path forward is illustrated in Box 8.1. Revision of the current draft version would be undertaken, implementing the changes suggested by the results of this research to address identified shortcomings to the extent possible. A user guidance document would be prepared explaining the purpose and anticipated uses of the classification, describing how the ICHI axes are operationalised for public health interventions, and illustrating use of ICHI for coding interventions, but not setting out rigid or prescriptive rules about how the classification should be used. Widespread use would be encouraged. A benefit of the proposed approach is that some of the more challenging issues identified in this study (e.g., how to ensure a consistent approach to identifying IUs, or how to capture information on the nature of the relationship between multiple Targets identified for an IU) could be left open and unresolved for the time being. As noted by Bowker & Star (1999), 'Any classificatory decision made now might by its nature block off valuable future developments'. Further development and revision of ICHI would be anticipated in future, informed by experience of use. Study of how ICHI is used in practice may, over time, suggest changes that could and should be made to the classification and/or user guidance to promote more standardised use.

Box 8.1: A path forward for ICHI public health

It is proposed here that the further development and use of the classification of public health interventions in ICHI should be approached in the spirit of a collaborative, evolutionary process. The proposed path forward comprises the following elements:

1. Approaching ICHI as an 'epistemic hub' that can function to facilitate exchange of information and integration of knowledge.
2. Undertaking an initial process of revision, based on the detailed findings of this research (see Appendix 7.1). The aim would be to improve the utility of the classification by making changes that are clearly indicated as needed, such as adding new axis categories where specific gaps have been identified. Editorial principles would be drafted, articulating how Target, Action and Means are operationalised for public health interventions. This work could be accomplished relatively quickly by a small group involving participants who, collectively, have both classification and public health expertise.
3. Drafting a user guidance document, focused specifically on the use of ICHI for coding public health interventions. An important role of this document would be to provide a cultural orientation for potential users not familiar with the use of statistical classifications. It would clearly convey the structure of the classification, how its underlying concepts (including Target, Action and Means) and organisational principles are operationalised for public health interventions. It would also provide coding guidance to ensure, as far as possible, a standard approach to coding, illustrated with diverse examples.
4. Presenting ICHI to potential public health users in a way that is minimally prescriptive and encourages its use in flexible ways to meet a broad range of information needs. Where this research has identified issues that pose particular challenges in terms of achieving consistency – such as the identification and framing of IUs, and the coding of IUs for which multiple Targets are identified – scope would be left open for users to apply ICHI in a way that meets local information needs. This could include offering use of the ICHI axes independently. Users would be encouraged to record metadata on how ICHI has been used and any application-specific rules developed (e.g., how IU is defined in the context of a particular data collection, whether proximate and/or ultimate Targets are recorded, etc.).
5. Ongoing development of ICHI that is responsive to the experience of users, and is overseen by a group involving participants who, collectively, have both classification and public health expertise. Ideally, there would be a mechanism for capturing user feedback, such as an online platform where users can directly enter comments.
6. Use of the 4-tier model to assist in considering options for modifications to the classification and user guidance, as it fosters an awareness of the relationships and dependencies that exist between issues at different tiers.
7. Approaching future development of ICHI with a consciousness of how use of the classification may impact on the field of public health, including how the manner in which public health interventions are represented in ICHI might be favourable to certain interests and agendas and unfavourable to others. This awareness should inform development decisions (with corresponding documentation) and user guidance.

This study has shown that a major challenge in applying ICHI to produce comparable data on public health interventions lies in defining the unit of classification. As described in Section 3.4.1, a key message from the literature concerning building the evidence base for public health is that, to properly characterise an intervention, it is important to identify its constituent components, and that the identity of these components relates to their function or hypothesised mechanism of action in achieving change, rather than their form (Hawe et al. 2004; McKleroy et al. 2006; Armstrong et al. 2008; Durlak & DuPre 2008; Brownson et al. 2009; Hawe & Potvin 2009; Moore et al. 2014; Hawe 2015; Mohler et al. 2015; Moore et al. 2015). The concept of 'intervention unit' was found to be workable as a basis for applying ICHI to code multi-component public health interventions, but the operational definition of IU did not ensure a consistent approach to splitting interventions into their constituent parts for coding. Indeed, there is no 'correct' way to decompose an intervention into its constituent parts, and an intervention may legitimately be viewed (and coded) at different scales or levels of detail, or from different actor perspectives, to meet different information needs. Therefore, I propose that ICHI user guidance should provide a definition of 'intervention unit' that relates it to concepts found in the public health literature (e.g., theoretically important components, active ingredients, and core elements), but that leaves scope for users to identify constituent IUs in the way that best meets their information needs. It will be important for users to record metadata specifying how IU has been operationally defined in a given application, and for mechanisms to be in place to capture experience of use to inform ongoing development of ICHI.

The potential value of taking an 'epistemic hub' approach to the further development of ICHI has emerged through considering the results of this research in light of insights concerning the sociology of classification provided by science and technology studies and related areas of social science research. Public health is an interdisciplinary field, in which different knowledge traditions intersect and bring different epistemic perspectives to bear in relation to how interventions are understood and conceptualised. This is a challenge for classification (Kwasnik 1999). In contrast, widely shared conceptions of medical and surgical interventions, shaped by the dominant epistemological perspective of the medical profession, make for a relatively more tractable classification domain. In the area of disability, there is recognition of the value of the ICF as a common structure to facilitate integration of knowledge from different sources, and to mediate communication between different social worlds with different epistemic perspectives on a shared issue (e.g., finding effective ways of determining need for disability support in educational settings) (Hollenweger 2013). The potential for ICHI to function in this way should be further explored, drawing on theoretical approaches and methods employed in the social sciences, concerning the creation, transformation and use of 'knowledge objects' (Swan et al. 2007; McGivern & Dopson 2010). This would include examining how ICHI relates to understandings of public health interventions in the field, how it is used by

different players, in different settings and within different institutional structures, and how its use may operate to shape real-world processes and structures. Such research could contribute to future improvement of the classification and development of user guidance.

In addition, analytical approaches developed in the social sciences, such as Activity Theory (Kuutti 1995; Engeström et al. 1999), could be used to gain more detailed insights into how public health interventions are understood in real-world contexts, to assist in refining ICHI axis categories and intervention codes. Methods of formal ontology development used in health informatics (e.g., Kumar & Smith 2005), may provide a basis for interrogating the conceptual composition of the three ICHI axes and indicating where refinement may be needed, for instance to support the development of mutually exclusive categories. Thus, the classification of public health interventions in ICHI is a 'work in progress', and its ongoing development and future use will provide much scope for further research.

What are the implications of this proposed path forward for the broader ICHI development process? ICHI content covering diagnostic, medical and surgical interventions is at a more advanced stage of development than the public health content, has been extensively informed by existing classifications, and is intended to be fit for use in statistical applications (e.g., collecting data to inform healthcare funding and reimbursement) (ICHI 2016a). The development of ICHI to date has benefitted from both input and activity focused on specific content areas and an overall integrated process to progress development of the classification as a whole. WHO-FIC Network members who are part of the core ICHI development team contribute their respective expertise relating to different content areas, and participate in making decisions that have implications across content areas. In this way, development has been responsive to the different requirements of different content areas. As ICHI development moves through beta testing and towards completion, developers must continue to be mindful of the different circumstances, needs and applications that apply to different content areas. To produce a single classification that encompasses the full diversity of health interventions is an ambitious goal. It seems likely that, rather than being monolithic and homogeneous, the final product may, in effect, function as an articulated set of classifications, united into a coherent whole by the common tri-axial structure.

The proposal made here, to present ICHI to public health users as a tool that can be applied flexibly to meet local information needs, is not inherently inconsistent with the use of ICHI as a standard tool for collecting comparable data on interventions. ICHI may be used for statistical applications, but the findings of this research suggest that application-specific rules may be needed (e.g., concerning the operational definition of IU), and that testing should be conducted to determine whether coding reliability is sufficient to serve the particular purposes for which data are being collected. As

discussed above, there is little evidence of demand for a classification of public health interventions for use in statistical applications. Pursuing fitness for statistical use as the primary goal in the upcoming phases of ICHI development would risk producing a product that is not seen as relevant by potential users. It is argued here that a more pragmatic, longer-term view should be taken in relation to the use of ICHI for statistical applications in the area of public health, allowing time for the needs and experiences of users to inform development.

In this section, I have presented a novel proposal concerning how the results of this research may be used to inform the further development of the classification of public health interventions in ICHI, adopting an epistemic hub approach. I now turn to consider the broader implications of this research for the fields of public health and statistical classification development.

8.3 The broader implications of this research

8.3.1 A common framework for communicating about public health interventions

The classification of public health interventions in ICHI is well-positioned to fill an existing gap: there is currently no common framework or classificatory structure for public health interventions that can provide a basis for collecting data on public health outputs. Statistical classifications have been developed for many fields of human endeavour because there is a need to know what is going on at a broad level, and to make comparisons over space and time (Desrosieres 1998). This research makes a significant contribution by ensuring that further development of ICHI progresses with a focus on enhancing its utility for the field of public health and its relevance as perceived by potential users.

The findings of this study show that classifying public health interventions is not straightforward. It is likely that the heterogeneity of public health interventions, and their typically complex and context-specific nature in part explain why there has apparently been little impetus coming from those working in the field to develop a comprehensive, classificatory scheme. However, there is no reason to consider public health interventions any less amenable to classification than other domains within which it is difficult to define units of classification and to achieve agreement on principles of classification. For example, although modern, scientific approaches to biological taxonomy date back to the 18th Century, debate continues concerning how to define ‘species’ as an identifiable entity, and how to understand its nature as a unit of classification (Dupré 2001). Different classification methods produce different results and, with continual technological advances and the ongoing discovery of new species, taxonomies are never stable. In 2017, the authors of an article published in the journal *Nature* claimed that ‘the scientific community’s failure to govern taxonomy threatens the effectiveness of global efforts to halt biodiversity loss, damages the credibility of science and is

expensive to society', and called for a global governance mechanism to create boundaries for species that can be applied consistently across multiple life forms, and to ensure a stable and agreed taxonomy better able to support international conservation efforts (Garnett & Christidis 2017). This article provoked energetic reaction from taxonomists, asserting the fundamental importance of taxonomic freedom (Raposo et al. 2017; Thomson et al. 2018). The point I wish to emphasise here is that the value of classifying organisms is not questioned by those on either side of this debate, despite the challenges of finding a way of doing it that is acceptable to all players; biological classification is part of a shared culture. In contrast, among those with an interest in public health interventions there is no established culture of classification.

Reasons why a culture of classification has not developed to any significant extent within the field of public health could include the diverse nature of the public health workforce, and changes over time in the dominant philosophical and theoretical approaches that have influenced practice, policy and research (Lewis 2003; Palmer & Short 2014; Baum 2016). Also, public health functions are typically dispersed across different sectors and levels of government (OECD et al. 2011; Jackson & Shiell 2017; Leider et al. 2018). The proposal described above, to develop ICHI as an epistemic hub for use in addition to, or in combination with, existing tools and information structures, would allow a diverse range of potential uses in public health to be explored. Over time, as awareness and acceptance of the classification grow, and as ICHI is moulded to better meet information needs, higher-level statistical applications may develop, for instance using ICHI-based data to monitor trends in the delivery of different types of interventions at national level, or making inter-country comparisons concerning the mix of interventions delivered in response to particular public health issues (e.g., obesity). In this way, the availability of an international classification may, in effect, give rise to demand for it; with no such classification in place it is difficult to envisage the potential benefits that comparable data could bring.

The heterogeneous and dispersed nature of public health as a field of practice arguably makes it particularly vulnerable to funding cuts – it is less visible than other sectors of health systems, and it lacks a clear, unified voice, so it is an easy target when governments are looking for ways to reduce spending. ICHI could provide a common basis for communicating about what is done in public health, both within the field but also, importantly, to funders and the wider community. Summary data on public health outputs would help to make public health visible; such data could be used to show where there are gaps in the system, and to illustrate the impact prospective funding cuts could have. The inclusion of public health interventions as part of a broader international classification of health interventions effectively 'mainstreams' public health interventions and should assist in lifting the profile of public health in the context of the broader health system.

While it is usual for classifications to be initiated (formally or informally) by those working within a field, or at least to be developed from the outset with major input from content experts (Hancock 2013), there are perhaps benefits in the initial phases of development being undertaken by people from outside the field. The structure and conceptual foundation of ICHI were developed mainly with medical and surgical interventions in mind, although it was always intended to cover interventions across the full scope of the health system. The public health content has not been developed by people with experience in the field. However, the result of the process so far is that a draft classification of public health interventions exists – there is something, where before there was nothing. Also, the content in place was not developed from the perspective of a particular interest group within the field, which may encourage potential users to judge it on its merits, rather than to pre-judge it as promoting a particular interest or perspective. The findings of this research, and the proposed path forward, provide a foundation from which the next phase of developing the classification can proceed, consciously and in a way that will allow it to be shaped to meet real-world information needs in the field of public health.

This study was approached with a social constructionist perspective, seeing the draft classification as one way of constructing meaning concerning public health interventions, which inevitably must interact with other socially-constructed understandings of public health interventions held by various players in the field. However, the study has not specifically investigated whether the way public health interventions are grouped and distinguished in ICHI is *meaningful* to potential users of the classification. Some comments made by interview participants bear on this issue: comments that some patterns in the data are familiar or suggest a need for more attention to under-represented intervention types (e.g., enforcement of tobacco control measures, or less 'classical' lifestyle interventions) are positive indications; comments that ICHI groups together interventions that are very different from a policy viewpoint, or that distinctions between some ICHI Actions may not be useful (e.g., 'Education' and 'Training') are negative indications. Also, this research has not explored whether the manner in which interventions are represented and grouped in ICHI might be more favourable to some interests and agendas at play in the domain of public health and less favourable to others. These are issues that should be explored in the context of real-world applications of ICHI.

Viewing ICHI as both a technical tool and a social information artefact, as it has been viewed in this study, provides a strong foundation for a conscious and critical approach to its further development and use. Here, it is useful to recall Messick's (1995) conception of validity, as entailing the value implications and social consequences of the application of an instrument (or a classification), and his advice on the importance of examining the effects of instrument use in real-world contexts. The social consequences of classification are well-established. As described by Bowker and Star (1999) and others (Section 2.1.4), through mechanisms such as convergence and reification, classifications shape

and are shaped by the social worlds in which they exist. Classifications can be used in ways that reflect and/or reinforce particular cultural and political values and agendas, for good or ill. In relation to public health interventions, there is potential for a classification to exert influence in the areas of practice, policy, workforce and resourcing. It will be of value to the field to approach the classification of interventions with eyes open, and thus be better placed to reap the benefits of classification while being alive to and ready to counter the potential risks of adverse consequences.

8.3.2 An approach for the developmental appraisal of statistical classifications

This study makes valuable conceptual and methodological contributions to a currently under-developed body of knowledge concerning the developmental appraisal of statistical classifications. The study employed a combination of methods to interrogate the draft classification, and has identified, described and explored the implications of issues to be addressed in the next stages of its development. This developmental appraisal may be regarded as a case study and, as such, the context-situated knowledge produced can contribute to a deepening of knowledge and understanding in the broader area of learning in which it is situated (Flyvbjerg 2006). Thus, both the overall methodological approach employed and the analytical structure developed for and demonstrated in this research will be of value to future research in classification development.

This study viewed the draft classification both as a technical tool and a social artefact, developed and (ultimately) used within a social context encompassing a variety of players with varied information needs and diverse ways of understanding public health interventions. It adopted a social constructionist theoretical perspective, operationalised by using existing data sets as the basis for testing the draft classification, and by reflecting ICHI-coded data back to key-informants familiar with each of the data sets. This social constructionist perspective provided a sensitising lens, encouraging a more critical analysis of the data to explore how the classification interacts with the classification domain, for instance, noting the different perspectives from which interventions can be viewed, the different scales at which they can be described, and the different dimensions of information embedded in textual descriptions of interventions and in definitions of ICHI axis categories. The intention in approaching the research in this way has been to apply the insights provided by Bowker and Star (1999) and other scholars in science and technology studies and within the philosophy of science who adopt a sociological frame of reference in their investigation of classifications. Whereas these scholars have most often been positioned as outside observers, providing commentaries on classifications, this thesis has demonstrated how the sociological viewpoint they offer can be applied in an active way, during the process of developing a new classification. This perspective has facilitated a richer exploration of the strengths and limitations of the draft classification, and can thus be recommended

for others engaged in the development or revision of statistical classifications to inform the methods employed.

The framework of criteria was developed to examine the extent to which the draft classification exhibits the desired features of a statistical classification. A tool was needed for this purpose, and the framework was constructed by drawing together principles that had been articulated in a small number of key documents specifically addressing the requirements of statistical classifications (Section 2.3). The twelve headings of the framework are broad topics to which attention should be directed, and one or more criteria are listed under each heading. As discussed in Section 7.3, the framework is not an assessment instrument, in that it does not dictate how the classification should be judged as meeting or not meeting particular criteria or how an overall assessment of the classification should be produced. Rather, it prompts the user as to the issues that should be investigated or tested as part of a developmental appraisal. While the framework is based on existing, authoritative sources, it adds significant value by extracting those requirements that are relevant to a classification in the developmental phase (thus leaving out considerations such as indexes, training materials, update procedures, and other matters relevant to the later stages of development and ongoing maintenance), and formalising them as a concise and comprehensive list. Use of the framework proved valuable in this research for identifying specific strengths and limitations, and it provided a basis for reaching the conclusion that, in its current state, the draft classification of public health interventions in ICHI would not be suitable for use as a statistical classification. This new tool thus constitutes a useful analytical structuring device for the future conduct of developmental appraisals of other statistical classifications.

The 4-tier model, which provides a simple representation of the main elements or layers that make up a statistical classification, functioned well as a heuristic structure within which to locate the particular issues identified as needing to be addressed to improve the classification. Continued use of this model is proposed as part of an integrated approach to the further development of ICHI, to help maintain an awareness of how issues addressed at one tier affect, or are affected by, aspects of the classification at other tiers. Although it is a simple model, it can function as a powerful tool to support the process of identifying and comparing options for making changes to the classification to improve its utility, and thinking clearly about the implications of choices made. As discussed in Section 7.3, ideally, developers would address Tier 1 issues first, to ensure a sound conceptual foundation for the classification, then progress upwards through the subsequent tiers, implementing solutions that are consistent with decisions made at lower tiers. However, this ideal will not always be possible. As Lambe (2007) cautions those engaged in the development of knowledge-organising structures, ‘rigour and purity are two of the most intense seductions of taxonomic work’ (p.1) – often perfect solutions are elusive and pragmatic choices must be made to produce a classification that is good enough. The

model encourages and assists developers to be more explicit about these choices and their implications. Thus, use of the 4-tier model may be recommended, alone or in combination with the framework of criteria, to aid thinking and decision-making in the development and revision of statistical classifications in the future.

8.4 In conclusion

The classification of public health interventions currently being developed as part of the World Health Organization's International Classification of Health Interventions is a pioneering development. No such classification has previously existed. This thesis has reported on a comprehensive developmental appraisal of the draft classification, conducted to gain an understanding of its strengths and limitations, and to identify what could be done to improve its utility. The social constructionist theoretical perspective adopted, and the mixed qualitative research methods employed, enabled a detailed and critical exploration of the draft classification to be undertaken. The research findings indicated that, while ICHI does have some utility for representing data on public health interventions, it does not, in its current state, function as a robust statistical classification. The description of numerous specific problems and limitations, and the detailed proposals made concerning how these could be addressed, constitute substantial and valuable input to inform further development work to improve the utility of the classification.

The overarching thesis advanced on the basis of this study is that viewing ICHI as an epistemic hub can productively inform the approach taken to its further development and use. As an epistemic hub, ICHI would be available for public health actors to use in different ways, in accordance with their own information needs, and it would serve as a basis for connection and information exchange among the diverse epistemic interests of different actors. In this final Chapter, I have proposed a path forward for the further development of the draft classification. It is likely that this will be implemented in the context of the upcoming beta phase of development and testing of ICHI, planned to commence in October 2018. Thus, this study makes a significant and timely contribution to the development of the classification.

In addition, the analytical structure developed and demonstrated in the conduct of this research represents an original conceptual and methodological contribution to the field of classification development. There is currently no well-developed body of knowledge concerning the practical business of developing statistical classifications, including developmental appraisal as part of this process. The framework of criteria relating to the desired features of a statistical classification, and the 4-tier model representing the main elements or layers of a statistical classification, are offered as new tools for use in the development and developmental appraisal of statistical classifications.

The classification of public health interventions in the International Classification of Health Interventions constitutes a valuable foundation for the collection, analysis and communication of data about public health interventions. Inclusion of public health in a standard international classification that is a member of the WHO Family of International Classifications is an important opportunity for the field of public health: ICHI has the potential to raise the visibility of public health within health systems, and within the broader public policy arena. In conclusion, this study has significant implications for the advancement and development of the classification of public health interventions in the International Classification of Health Interventions, and for the appraisal and development of statistical classifications more broadly.

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Appendix 2.1: Comparison of WHO-FIC classifications

Table A2.1 presents a comparison of the three reference classifications of the WHO Family of International Classifications – ICD, ICF and ICHI – according to the attributes on which classification schemes differ (as described in Section 2.1.2). The differences between the three classifications reflect their different histories and purposes. Such a comparative analysis highlights the design parameters about which choices are made by those who develop classifications.

Table A2.1: Comparing reference classifications of the WHO-FIC

Attribute	ICD-10	ICF	ICHI alpha 2016
Classification domain	Diseases ('the entire range of morbid conditions')	Health and health-related domains relevant to human functioning and disability described from the perspective of the body, the individual, and society	Health interventions (defined as 'an act performed for, with or on behalf of a person or a population whose purpose is to improve, assess or modify health, functioning or health conditions', across all sectors of the health system)
Unit of classification	Morbid entity	Health or health-related state	Health intervention
Property space – dimensions or axes along which distinctions between categories are made	Main dimensions: Body system; Etiology. Other dimensions: Anatomical site; Mode of transmission; Type of infecting organism; Behaviour of the neoplasm. (Extension codes capture other dimensions.)	Body functions – Body systems; Type of body function. Body structures – Body systems; Structures within body systems. Activities and participation – Types of activity; Areas of life. Environmental factors – Aspects of the physical and social environment. (Qualifiers capture other dimensions.)	Target (the entity on which the Action is carried out). Action (the deed done by an actor to the Target). Means (the processes and methods by which the Action is carried out). (Extension codes capture other dimensions.)
Overall structure (including hierarchical arrangement of categories)	Mono-hierarchy; two levels of categories within chapters. Coding structure reflects hierarchy.	Mono-hierarchy; up to three levels of categories within chapters. Coding structure reflects hierarchy.	Tri-axial structure. Some hierarchy in Target axis, no hierarchy in Action or Means axis. Intervention codes are presented as a non-hierarchical list. Codes reflect axial composition of interventions; codes weakly reflect hierarchy in Target axis.

A2.1: Comparison of WHO-FIC classifications

Attribute	ICD-10	ICF	ICHI alpha 2016
Enumerative versus faceted Pre-coordination versus post-coordination	Enumerative, pre-coordinated. (Post-coordination also possible in ICD-11, by combining stem codes or stem and extension codes, to describe health conditions in more detail.)	Enumerative, pre-coordinated.	Enumerative, pre-coordinated (because of its tri-axial structure ICHI may be regarded as effectively a pre-coordinated, faceted classification). (Post-coordination also possible using extension codes to record extra information about an intervention.)
Mutual exclusivity of classes	Categories are polythetic/prototypical (i.e., necessary and sufficient criteria for category membership are not specified); inclusions/exclusions and coding rules used to achieve mutual exclusivity in practice.	Categories are polythetic/prototypical; inclusions/exclusions and coding rules used to achieve mutual exclusivity in practice.	Categories are polythetic/prototypical; inclusions/exclusions and coding rules used to achieve mutual exclusivity in practice.
Coverage of domain	Comprehensive coverage, including by use of residual codes.	Comprehensive coverage, including by use of residual codes.	Comprehensive coverage, including by use of residual codes.
Level of detail or specificity	Can be used at 3- or 4-character level; data recorded at more detailed level can be aggregated up. Some categories represent diseases of particular importance, other categories represent groups of separate but related conditions.	Can be used to code at any level of the hierarchy; data recorded at more detailed level can be aggregated up.	Codes with Targets at different hierarchical levels are available in some Target groups (e.g., Body Functions); coding structure does not readily facilitate aggregation of interventions with more detailed Targets to higher hierarchical levels.
Method of content development	Largely bottom-up, i.e., grouping diseases that are recognised as such in clinical practice.	Largely top-down, i.e., starting with the overall conceptual structure and creating categories to divide up the main axis of each of the constituent classifications.	Combination of top-down and bottom-up. Medical and surgical content was largely derived from existing classifications and categories represent interventions recognised in clinical practice. In other content areas (e.g., functioning and public health interventions) much of the content has been developed top-down, by combining axis categories to describe interventions.

A2.1: Comparison of WHO-FIC classifications

Attribute	ICD-10	ICF	ICHI alpha 2016
Definition of categories	Titles, inclusions, exclusions, synonyms and explanatory phrases. Most categories do not have textual definitions/descriptions (ICD-11 will have).	Titles, textual definitions (except in Body Structure classification), inclusions, exclusions.	Titles, inclusions, exclusions. Textual definitions provided for about one-third of interventions.
Supporting materials (indexes, coding rules, etc.)	Index with cross-referencing, extensive coding rules, coding conventions, standards, reporting requirements, reporting forms.	Index (no cross-referencing), guidelines for coding and coded case examples. Ethical guidelines. ICF Practical Manual published separately.	Brief coding guidelines; no index.

References

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Appendix 2.2: Development of framework of criteria

As described in Section 2.3, a list of criteria was developed relating to the desired attributes of statistical classifications, against which to appraise the draft classification (Box 2.1). Table A2.2 shows how principles articulated in several key source documents were used as a basis for developing the list of criteria.

Table A2.2. Development of list of criteria for conducting a developmental appraisal of a statistical classification

Criteria for appraisal	**Desired attributes of statistical classifications** (reference number in square brackets – see end of Table)
1. Purpose and scope a. The purpose of the classification should be clearly stated, including its intended statistical uses b. The scope of the classification should be clear	'The objectives and statistical priorities to be served must be clearly stated'. [1] (p.3) What is the scope of the classification? What are the primary uses of the classification? [2] The classification should include a clear statement about scope. [3] (p.13) Objectives, purpose and scope (or coverage) should be clearly stated so that domain-relevance can be measured. [4] (p.73) 'A classification should be clear about what it classifies: its universe, its scope, its units of classification, its organization, and how these elements are structured in terms of their relation to each other. [6] (p.7)
2. Structure and organisational principles a. The classification structure, its underlying concepts and organisational principles should be clear and well-defined b. The structure should be hierarchical or multi-axial and reflect the descriptive and analytical needs the classification is intended to serve (including aggregation and retrieval of data)	'A well-defined classification structure must be prepared. Depending on descriptive and analytical needs, aggregated categories of statistical classifications may be organized in a hierarchy representing different levels of detail for measurement of the variable'. [1] (p.3) A statistical classification must be based upon sound and agreed concepts and principles; the conceptual basis should be well defined and documented. A statistical classification should have a flat structure (when there is no requirement to aggregate or group categories) or hierarchic structure with an appropriate number of levels. [2] The classification should include a clear statement about the organization of the classification; it should have a hierarchical and/or multi-axial structure to facilitate aggregation of data. [3] (p.13) Logical, hierarchical organisation built upon a theoretical framework; 'The hierarchical organisation should facilitate data retrieval at different levels of specificity'. [4] (p.74) A classification should be clear about its organisation. [6] (p.7)

A2.2: Development of framework criteria

Criteria for appraisal	**Desired attributes of statistical classifications** (reference number in square brackets – see end of Table)
3. Unit of classification a. The unit of classification should be clearly identified	Identify the main statistical units of the classification (i.e., observable units which can be assigned to one unique category). [1] (p.16) What are the statistical units being classified? The classification unit is the basic unit to be classified in the classification. [2] The classification should include a clear statement about the units of classification. [3] (p.13) A classification should be clear about its units of classification. [6] (p.7)
4. Comprehensiveness a. The classification should cover the full scope of the domain, with categories available to allow all units of classification within the domain to be classified (including by providing residual categories)	'The preparation of a classification means the creation of an exhaustive and structured set of mutually exclusive and well-described categories'. [1] (p.2) Categories must be exhaustive at each hierarchic level of the classification. Are residual categories specified and used appropriately? [2] Classification categories should be exhaustive. [3] (p.13) The classification must be comprehensive (i.e., exhaustive), 'Other' or 'unspecified' categories (residual categories) must be provided so that all possible concepts within a domain can be classified somewhere'. [4] (p.75)
5. Mutual exclusivity a. Categories should not overlap and there should be only one code for each entity classified	'The preparation of a classification means the creation of an exhaustive and structured set of mutually exclusive and well-described categories'. [1] (p.2) Categories must be mutually exclusive at each hierarchic level of the classification (taking into account descriptive definitions, explanatory notes, and the coding instructions). [2] Classification categories should be mutually exclusive. [3] (p.13) Categories must be mutually exclusive; there must be only one code for any given concept. [4] (p.75) 'There must be only one rubric for a given condition'. [5] (p.78)

A2.2: Development of framework criteria

Criteria for appraisal	**Desired attributes of statistical classifications** (reference number in square brackets – see end of Table)
6. Clearly defined categories a. Category titles should be clear, meaningful and unambiguous b. Categories should have definitions and explanatory notes c. Category titles and definitions should use language that is accepted and in common usage in the domain	'The preparation of a classification means the creation of an exhaustive and structured set of mutually exclusive and well-described categories'; 'Descriptive definitions or exhaustive listings of the contents of the defined categories are needed'. [1] (pp.2, 3) Definitions must be clear and unambiguous to define the content of each category. Are the category names precise and appropriate? Each descriptor should be unique within the classification and meaningful on its own. [2] 'Categories within a classification should facilitate the description of phenomena in a way that allows unambiguous understanding by others, including statistical users'; 'each code should have a unique definition'; 'terms should not be ambiguous and the relationship between terms should be consistent'; 'category names should be short, clear, and free from embedded examples or other additional phrases'. [3] (pp.13, 17) Each category descriptor should be unique (have one only meaning), unambiguous and clearly expressed; categories should be described using language that is accepted, in common use, and relevant to the domain; categories must be well defined and supported by definitions and explanatory notes. [4] (pp.76, 78) Inclusion of lay terms for describing categories. [5] (p.79)
7. Level of detail and specificity a. Level of detail should be appropriate to the domain and the intended uses of the classification b. Concepts of particular importance should have their own unique category; there should not be unnecessary categories	'Depending on descriptive and analytical needs, aggregated categories of statistical classifications may be organized in a hierarchy representing different levels of detail for measurement of the variable'. [1] (p.3) There should be sufficient broad levels in a classification to facilitate a wide range of statistical needs. Statistical balance – there should not be categories at the same hierarchical level that are too disparate in population size. Surplus or unnecessary categories can hamper the usefulness of a classification. [2] 'An entity within a classification that is of particular importance should have its own category'. [3] (p.13) 'The hierarchical organisation should facilitate data retrieval at different levels of specificity'. [4] (p.74) 'Concepts that have particular importance within a domain should have their own unique category'; 'The level of detail should match that of the domain it serves'. [4] (pp.77, 78) 'Rubrics should be specific enough so that the desired information may be recalled with the minimum amount of irrelevant data included'. [5] (p.78)

A2.2: Development of framework criteria

Criteria for appraisal	**Desired attributes of statistical classifications** (reference number in square brackets – see end of Table)
8. Relevance a. The classification should be meaningful and relevant, and should address dimensions of importance to users	'Classifications group and organize information meaningfully…' [1] (p.2); 'determining users' requirements with respect to both the detailed and the broad distinctions which needs to be made among the categories' [1] (p.15); within a classification, aggregations of the most detailed categories should be 'based upon similarity criteria that are meaningful for statistical and analytic comparisons'. [1] (p.17). The classification must meet user needs. [2] It should be simple enough to be seen by practitioners as meaningful; it should be useful for practice. [6] (p.246) Applicability or relevance: the measure should address dimensions of importance to users, and allow for the meaningful aggregation of data. [7] (p.40)
9. Reliability a. Different users, or users in different settings, should assign the same code for a given unit of classification	Statistical feasibility – it should be possible to accurately and consistently distinguish between categories on the basis of the information available in the contexts in which the classification is used. [2] The classification can be used reliably, 'there is inter-rater reliability and test-retest reliability in coding using the classification'. [3] (p.14) Reliability (external reliability): Reproducibility of the test's results in different situations; stability of measure despite changes to external parameters. [7] (p.42)
10. International applicability a. The classification should be internationally applicable, across different cultures and systems	The classification should be acceptable internationally. [3] (p.14) 'It should be sensitive to cultural variations (be translatable, and be applicable in different cultures and health care systems)'. [6] (p.247)
11. Ease of use a. The classification should be relatively easy to use and compatible with users' work processes and information flows	The classification should be 'relatively easy to use, unambiguous and well presented'. [3] (p.14) 'Classifications should be well matched to the users' work processes and information flow to enable integration'. [4] (p.78) 'Compatible with the users' work and information flow'; usable by both medical and nonmedical personnel. [5] (pp.78, 79) Feasibility (acceptability): Ease of use (user-friendliness). [7] (p.40)

Criteria for appraisal	**Desired attributes of statistical classifications** (reference number in square brackets – see end of Table)
12. Compatibility with other classifications a. The classification should be compatible or comparable with other classifications in use in the domain	'Harmonization of statistical classifications will require a process of reconciliation of the different classifications and statistical standards into a common framework, maximising the correspondence between them. This includes the use of common concepts and terminology, as well as the establishment of coordinated and agreed tables of correspondence between the categories of the different classifications, or through the identification of common detailed building blocks for these categories.' [1] (p.4) What is the compatibility with other statistical concepts and classifications, and the comparability with international standards? [2] The place of a classification in relation to other areas of health or related information should be clearly expressed. [3] (p.13) The classification should be compatible or comparable with other similar classifications in use, nationally and internationally. [4] (p.79) 'Compatibility with other health care classification systems in use'. [5] (p.79) 'It should be usable in a complementary way with the WHO family of classifications'. [6] (p.247)

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Appendix 2.3: Information dimensions for public health interventions

A review of reporting guidelines and classificatory schemes relevant to public health interventions was conducted to identify dimensions of information used to group and distinguish different types of intervention (Section 2.4.3). The results of this review are summarised in Box 2.2, with the types of information identified regarded as representing expressed information needs concerning public health interventions. Table A2.3 provides further information about each of the sources cited in Box 2.2.

Table A2.3: Reporting guidelines, frameworks and classification schemes relevant to public health interventions

Source	Purpose/background	Information specified (with item numbers where applicable)
TREND (Transparent Reporting of Evaluations with Non-randomized Designs) checklist (Des Jarlais *et al.* 2004).	Developed to be consistent with the Consolidated Standards of Reporting Trials (CONSORT) Statement, but applicable to the reporting of behavioural and public health intervention evaluation studies using non-randomised designs. Intended to improve the quality of data reporting in peer-reviewed publications and to support research synthesis. 'Assessing individual studies and using studies in quantitative research syntheses require transparent reporting of the study, with sufficient detail and clarity to readily see differences and similarities among studies in the same area.' (p.361)	17 items in the checklist, but 2 relating particularly to describing the intervention delivered: Item 2 'Theories used in designing behavioural interventions' is included to permit the identification of theories potentially useful in developing interventions in different fields. No categories. Item 4 'Interventions' – Details of the interventions intended for each study condition and how and when they were actually administered, specifically including: • Content: what was given? • Delivery method: how was the content given? • Unit of delivery: how were subjects grouped during delivery? • Deliverer: who delivered the intervention? • Setting: where was the intervention delivered? • Exposure quantity and duration: how many sessions or episodes or events were intended to be delivered? How long were they intended to last? • Time span: how long was it intended to take to deliver the intervention to each unit? • Activities to increase compliance or adherence (e.g., incentives)

A2.3: Information dimensions for public health interventions

Source	Purpose/background	Information specified (with item numbers where applicable)
Extension of CONSORT Statement for trials assessing nonpharmacologic treatments (Boutron *et al.* 2008)	A checklist designed to extend the CONSORT Statement to improve the reporting of randomised control trials for assessing nonpharmacologic treatments (e.g., surgery, technical interventions, devices, rehabilitation, psychotherapy, and behavioral intervention).	4. Precise details of both the experimental treatment and comparator 4A. Description of the different components of the interventions and, when applicable, descriptions of the procedure for tailoring the interventions to individual participants 4B. Details of how the interventions were standardized 4C. Details of how adherence of care providers with the protocol was assessed or enhanced Accompanying explanatory document states that, for rehabilitation, behavioral treatment, education, and psychotherapy interventions, authors should report 'the content of each session, how it is delivered (individual or group), whether the treatment is supervised, the content of the information exchanged with participants, and the instruments used to give information', and also the number, timing and duration of sessions, and of the overall intervention.
TIDieR (Template for Intervention Description and Replication) checklist and guide (Hoffmann *et al.* 2014)	An extension of item 5 of the CONSORT 2010 Statement and item 11 of the SPIRIT 2013 statement. Intended to improve the reporting of interventions and make it easier for authors to structure accounts of their interventions, reviewers and editors to assess the descriptions, and readers to use the information. Intended to apply across all evaluative study designs.	1. Brief name 2. Why (rationale, theory, goals) 3. What (materials) 4. What (procedures) 5. Who provided 6. How 7. Where 8. When and how much 9. Tailoring 10. Modification (during course of study) 11. How well (planned) – strategies for implementation fidelity 12. How well (actual) – measured implementation fidelity

A2.3: Information dimensions for public health interventions

Source	Purpose/background	Information specified (with item numbers where applicable)
Intervention Taxonomy (ITAX) (Schulz et al. 2010)	'To expand existing taxonomies for characterizing interventions by identifying elements that might be related to outcomes and thus are crucial for replication and extension of intervention science'; use of the taxonomy should support improved intervention design and execution as well as cross-study comparison. Designed to be relevant to studies ranging from clinical medical trials to psychosocial/ behavioral interventions.	11 items (each elaborated with an 'options checklist') in two broad groups: • Delivery characteristics—mode; materials; location; schedule; scripting; sensitivity to participant characteristics; interventionist characteristics; adaptability; treatment implementation • Intervention content—treatment content strategies; mechanisms of action
Criteria for Reporting the Development and Evaluation of Complex Interventions in healthcare: revised guideline (CReDECI 2) (Mohler et al. 2015)	A set of 13 items for the reporting and evaluation of complex interventions, covering the first three stages of the Medical Research Council framework: (1) development; (2) feasibility and piloting; and (3) introduction of the intervention and evaluation. Designed for applicability irrespective of study design employed.	Intervention: 1. Description of the intervention's underlying theoretical basis. 2. Description of all intervention components, including the reasons for their selection as well as their aims / essential functions; 'the aim or essential function rather than the content in detail is needed'. 3. Illustration of any intended interactions between different components. 7. Description of the strategy for delivering the intervention within the study context. 8. Description of all materials or tools used delivery the intervention; 'Materials or tools can be components of the intervention by themselves (for example, patient's diaries or short versions of guidelines) or a method to ensure the delivery or increase awareness towards the intervention (for example, posters or information sheets).' 9. Description of fidelity of the delivery process compared the study protocol. Context: 4. Description and consideration of the context's characteristics in intervention modelling; 'the macro level (for example, aspects of financing services, legal and political aspects, education of professionals), the meso level (for example, institutional or community-specific conditions) and the micro level (for example, teams, individuals, or local structures). The description of all aspects judged as relevant for modelling the intervention is of interest.'

A2.3: Information dimensions for public health interventions

Source	Purpose/background	Information specified (with item numbers where applicable)
Guidelines for naming, defining, and operationalizing implementation strategies (Proctor et al. 2013)	Guidelines for naming, defining, and operationalizing implementation strategies in terms of seven dimensions: actor, the action, action targets, temporality, dose, implementation outcomes addressed, and theoretical justification. 'Adopting these guidelines would address many of the current problems that make it difficult to interpret and use findings from implementation research, such as inconsistent labelling, poor descriptions, and unclear justification for specific implementation strategies' and 'would facilitate meta-analysis and replication'	Specifying implementation strategies (from Table 1): • The actor (identify who enacts the strategy), • The action (specify the specific actions, steps, or processes that need to be enacted), • Action targets (specify targets according to conceptual models of implementation, and unit of analysis for outcome measurement – often targets will be actors and/or aspects of the system), • Temporality (when the strategy is used; sequence of components), • Dose (dosage of implementation strategy – e.g., intensity or frequency of particular activities), • Implementation outcomes addressed (identify the implementation outcome(s) likely to be affected), and • Theoretical justification (empirical, theoretical, or pragmatic justification for the choice of implementation strategies).
AIMD - framework of interventions to promote and integrate evidence into health practices, systems, and policies (Bragge et al. 2017)	Framework for describing and communicating about knowledge translation interventions (interventions to promote and integrate evidence into health practices, systems, and policies); to help establish common and commonly-understood terms for describing interventions	Aims: What do you want your intervention to achieve and for whom? This component relates to the objective and outcome of the intervention (can include proximal and intermediate outcomes, and process outcomes related to implementation). Ingredients: What comprises the intervention? These are the observable, replicable, and irreducible aspects of the intervention. Mechanism: How do you propose the intervention will work? The pathways or processes by which it is proposed that an intervention effects change or which change comes into effect. Delivery: How will you deliver the intervention? Including mode (e.g. video, brochure); level (e.g. individual, team, population); dose, frequency, intensity; who's delivering; and size of target group.

A2.3: Information dimensions for public health interventions

Source	Purpose/background	Information specified (with item numbers where applicable)
Checklist for reporting group-based behaviour-change interventions (Borek et al. 2015)	A checklist of elements that should be described to ensure adequate reporting of group-based behaviour-change interventions (GB-BCIs), to facilitate comparison of behaviour-change interventions, synthesis of evidence on their effectiveness, and replication of effective interventions.	Reporting elements – 26 items grouped under 4 headings (Table 1): • Intervention design (e.g., General setting, Frequency of group sessions, Duration of the intervention) • Intervention content (e.g., Change mechanisms or theories of change, Change techniques, Participants' materials, Activities during the sessions) • Participants (e.g., Group composition, Group size) • Facilitators (e.g., Facilitators' professional background, Facilitators' training in intervention delivery, Intended facilitation style)
Reporting guidelines for implementation and operational research (Hales et al. 2016)	Reporting guidelines developed to facilitate the funding, conduct, review and publishing of implementation and operational research.	From Table 2: Introduction: Background: 'Explain the scientific background relating to both the intervention and the implementation. … Describe the policy or programme context. Describe relevant elements of setting or settings'. Introduction: Implementation strategy: 'Describe mechanisms or strategies by which components were expected to cause changes'. Introduction: Intervention: 'What evidence-based intervention or innovation is proposed?' Methods: Implementation: 'description of the implementation strategy: frequency, duration, intensity, including how and when interventions were actually implemented, additional resources required to support implementation, mode of delivery, ... Describe the intervention, (if relevant)'. Discussion: Generalizability: 'Discuss the generalizability (external validity) of the study results'.

A2.3: Information dimensions for public health interventions

Source	Purpose/background	Information specified (with item numbers where applicable)
Elaboration of the CONSORT checklist for evidence-based behavioral medicine. (Davidson et al. 2003)	'To explain and demonstrate how the revised Consolidated Standards for Reporting Trials (CONSORT) Statement criteria can be applied to the design, reporting, and review of research testing behavioral medicine interventions'. (p.161) Includes guidance on 'minimal intervention detail to be described in research reports' for Item 4 of the checklist, 'Interventions'. 'Key elements of the intervention must be provided in sufficient detail to allow it to be clearly understood and replicated by other researchers and considered for inclusion in systematic reviews'. (p.164)	From Table 1, 'Minimal intervention detail to be described in research reports': 'Content/elements – What was the content of the intervention and how was it delivered (e.g., oral communication, written material, videos, interactive computer programs, other)? Provider – Who delivered it? Format – What were the method(s) of intervention administration? (e.g., self-help, individual, group, telephone, other)? Setting – Where and when was the intervention delivered? Recipient – To whom was the intervention delivered? Was the recipient also the target of the intervention? Intensity – How many different patient contacts & how much total contact time was involved? Duration – Over what time period were intervention contacts conducted and how were they spaced? Fidelity – Was the intervention delivered as intended? How was this monitored and measured?'
The Behaviour Change Wheel (Michie et al. 2011)	Developed to provide 'an appropriate method for characterising interventions and linking them to an analysis of the targeted behaviour'; intended for use by policy makers and intervention designers as a tool to support evidence-based practice. Particular intervention functions can be theorized to affect particular components of the behaviour system; particular policy categories can support or enable particular intervention functions. The categories in the framework were derived from existing frameworks for behaviour change interventions, identified through a systematic review, and thus reflect concepts recognised as important by others working in the field.	The framework has three dimensions or 'layers': • Intervention functions (9 categories): Education, Persuasion, Incentivisation, Coercion, Training, Restriction, Environmental restructuring, Modelling, Enablement • Policy categories (7 categories): Fiscal measures, Guidelines, Environmental/Social planning, Communication/Marketing, Legislation, Service provision Regulation • Behaviour system: Capability (physical, psychological), Motivation (automatic, reflective), Opportunity (social, physical).

A2.3: Information dimensions for public health interventions

Source	Purpose/background	Information specified (with item numbers where applicable)
Ecological coding procedure (Richard et al. 1996, Richard et al. 2015)	A model and analytical procedure developed to describe and categorise intervention strategies in order to evaluate the extent to which an ecological approach is integrated in health promotion programs.	The analytical procedure is based on a model with two dimensions: • Setting, defined as the social system in which clients are reached: organisation, community, society, or supranational system. • Target: individual clients, interpersonal environment, organisations, the community, political players. Intervention strategy (or 'change pathway') can be described using target categories as 'building blocks'.
The intervention ladder (Nuffield Council on Bioethics 2007)	A model for comparing different types of intervention, in the context of developing ethical public health policy that balances potentially conflicting goals, such as 'individual choice, preservation of autonomy, reduction of inequalities, protection of vulnerable groups and targeting of at-risk groups'. Intended as an analytical tool to aid decisions about which of the potentially available public health interventions to implement in a given circumstance.	The ladder has eight 'rungs', from 'Do nothing or simply monitor the current situation' at the bottom, through progressively more coercive categories of intervention, to 'Eliminate choice' at the top (compulsory isolation of people with infectious diseases is given as an example of a top rung intervention).
Balanced intervention ladder (Griffiths & West 2015)	An extension of the 'Intervention ladder' (Nuffield Council on Bioethics)—addition of a 'positive' side to capture interventions that enhance autonomy. More positive conceptions of freedom require not just absence of constraint or interference, but that people have sufficient power and access to resources—'social goods'—to enable them to formulate authentic goals and pursue their own ends effectively.	The ladder has rungs from -4 to +5: • interventions that substantially restrict autonomy are at the bottom (-4), • interventions that substantially enhance autonomy are at the top (+4 or +5)
Health Impact Pyramid (Frieden 2010)	A scheme for characterising interventions to assist in designing public health programs—'comprehensive public health programs should generally attempt to implement measures at each level of intervention to maximise synergy and the likelihood of long-term success.' (p.594)	Five-tier 'pyramid': interventions that require minimal engagement on the part of individuals but substantial political commitment and support from civil society sit at the base (e.g., provision of clean water infrastructure), while those that require most effort on the part of individuals but little political commitment sit at the apex (e.g., education interventions).

A2.3: Information dimensions for public health interventions

Source	Purpose/background	Information specified (with item numbers where applicable)
Public Health Classifications Project (National Public Health Partnership 2006; Jorm et al. 2009)	Classification developed to describe the 'dimensions of public health', to promote consistency in collecting and reporting information about public health programs, expenditure, workforce and performance.	The six 'top level classes' in the classification: • Functions—'the purpose of public health interventions, actions, activities and programs' • Health issues—Health and wellbeing, Diseases and conditions, Injury, Disability and functioning • Determinants of health—Environmental, Person-level, Socioeconomic, External causes of injury, Health system • Methods—'the methods used by organised public health interventions (actions, activities, programs, services)' • Settings—'settings in which public health activities and interventions take place' • Resources and infrastructure—incl. Administrative infrastructure, Funds, Information systems, Workforce
Typology of policies to tackle health inequalities (Benach et al. 2013)	A typology of policies to tackle health inequalities to 'help policymakers and policy evaluation researchers to reflect on the characteristics of the policy they are concerned with, and then know how to adequately design or reorient it and which measures to use to evaluate it.' (p.290)	Three policy approaches (from Table 1): 1 Targeted interventions (focused on the worst-off) 2 Universal policy with additional focus on gap 3 Redistributive policy 4 Proportionate universalism
Conceptual framework for action on the social determinants of health (Solar & Irwin 2010)	Typology of approaches for policies that aim to 'alleviate the unfair burden of illness borne by the socially disadvantaged'. All three approaches may be effective, but they differ 'in their underlying values and implications for programming'. (p.50)	Broad policy approaches for reducing health inequities: '(1) improving the health of low SEP groups through targeted programmes; (2) closing the health gaps between those in the poorest social circumstances and better off groups; and (3) addressing the entire health gradient, that is, the association between socioeconomic position and health across the whole population.' (p.50)
Policy approaches for reducing health inequalities (Nuffield Council on Bioethics 2007)	The reduction of health inequalities is a crucial element of public health policy. The authors discuss advantages and disadvantages of three different policy approaches for reducing health inequalities (p.39-41).	Three policy approaches for reducing health inequalities: • Targeting disadvantaged groups • Targeting at-risk groups • Universal provision

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A3.1 - Ethical approval to use the OPAL Single Platform data

Government of South Australia
SA Health

SA Department for Health and Ageing
Human Research Ethics Committee

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Professor Stephanie Short
Head, Discipline of Behavioural & Social Sciences in Health
Faculty of Health Sciences
University of Sydney
PO Box 170
LIDCOMBE NSW 1825

Dear Prof Short

HREC reference number: HREC/16/SAH/38

Project title: Using OPAL Single Platform data to pilot test the draft World Health Organisation International Classification of Health Interventions

RE: HREC Application – Approval

Thank you for responding to the issues raised by the SA Department for Health and Ageing Human Research Ethics Committee (DHA HREC) in relation to the above project. Your response was reviewed by a sub group of the HREC out-of-session.

I am pleased to advise that your application has been granted full ethics approval and appears to meet the requirements of the *National Statement on Ethical Conduct in Human Research.*

The documents reviewed and approved include:

Document	*Version*	*Date*
LNR Application, AU/15/6195213	1.0	20/4/2016
LNR Checklist	1.0	20/4/2016
Data custodian approval	1.0	14/4/2016
Response to request for further information	1.0	12/5/2016
Research protocol	3.0	12/5/2016
Data security arrangement	2.0	12/5/2016
Approval from data custodian re data security arrangement	1.0	10/5/2016

Sites covered by this approval:

- SA Department for Health and Ageing

Please note the following conditions of approval:

- The research must be conducted in accordance with the 'National Statement on Ethical Conduct in Human Research.'
- A progress report, at least annually, must be provided to the HREC.
- When the project is completed, a final report must be provided to the HREC.

- The HREC must be notified of any complaints by participants or of adverse events involving participants.
- The HREC must be notified immediately of any unforeseen events that might affect ethical acceptability of the project.
- Any proposed changes to the original proposal must be submitted to and approved by the HREC before they are implemented.
- If the project is discontinued before its completion, the HREC must be advised immediately and provided with reasons for discontinuing the project.

HREC approval is valid for 3 years from the date of this letter.

Should you have any queries about the HREC's consideration of your project please contact the Executive Officer of the HREC, on (08) 8226 6278 or Health.HumanResearchEthicsCommittee@sa.gov.au

You are reminded that this letter constitutes ethical approval only. You must not commence this research project at a SA Health site until separate authorisation from the Chief Executive or delegate of that site has been obtained via the completion of a Site Specific Assessment form. Please contact David van der Hoek via email at ResearchGovernance@health.sa.gov.au to discuss this process further.

If University personnel are involved in this project, the Principal Investigator should notify the University before commencing their research to ensure compliance with University requirements including any insurance and indemnification requirements.

The HREC wishes you every success in your research.

Yours sincerely

Andrew Alston
A/CHAIRPERSON
HUMAN RESEARCH ETHICS COMMITTEE

23/6/2016

Appendix 3.2: Coding protocol for applying ICHI to source data sets

Instructions for the coding process

Coders are provided with a customised Excel template spread sheet with columns for each of the information fields to be recorded. The initial columns contain intervention description information from the source data set.

Each row in the template spread sheet corresponds to one record in the source data set; additional rows are to be inserted by the coder where more than one Intervention Unit is identified for a record, as described below. Please see examples of coded records given on separate tabs in the template spread sheet.

The aim is to code all source data records. Coders should work through the spread sheet record-by-record, according to the following instructions:

1. ***Identify Intervention Units (IUs).*** Based on the descriptive information in the record, identify one or more 'Intervention Units' to be coded. The definition of an IU is:

   > 'a key functional component of an intervention with a distinct Target, Action and Means', where 'function' relates to an explicit or inferred mechanism of action (i.e., the hypothesised means by which the intervention will achieve the desired result).

   If more than one IU is identified, add extra rows to record information separately for each IU. In the column headed 'Intervention Unit', give a short one sentence description of the IU. Please assign a number to each added IU row: e.g., for record number 14 an added row should be assigned the number 14.2, denoting the second IU for that record. (See examples in template spread sheet.)

   Note: each IU identified must be a functional component of the intervention as it would be implemented, and not just an element of the intervention resource package. For example, for an intervention involving the delivery of curriculum content on nutrition to primary school students, provision of information and resources to teachers to enable them to deliver the intervention would not constitute an IU; delivery of the curriculum content to the students would be identified as an IU. However, for an intervention involving educating community health workers about nutrition so that they are better able to give nutrition advice to their clients, educating community health workers would be identified as an IU as this is a key functional component of the intervention.

2. ***Assign ICHI axis categories.*** Identify target, action and means concepts for each IU, based on the descriptive information in the record and guided by the ICHI definitions:

   - Target — the entity on which the Action is carried out (a health-related behaviour or environmental factor)
   - Action — the deed done by an actor to the Target
   - Means — the processes and methods by which the Action is carried out

   Find ICHI axis categories that best fit the target, action and means for the IU and record the corresponding codes in the relevant columns. Up to three Target and Action categories and up to two Means categories may be recorded. If it is possible to determine the primary or main target/action/means, record this one in the first position (i.e., T-code(1), A-code(1), M-code(1)).

Choice of ICHI axis categories should be based on information actually provided in the record; no inferences or assumptions should be made. Refer to definitions and any inclusions or exclusions for ICHI Target, Action and Means categories to verify that the choice is appropriate.

a) Where a matching ICHI axis category cannot be found for the target, action or means concept identified for the IU '**C**' should be entered in the appropriate column (T-code, A-code, or M-code) to denote a 'coverage issue'.

b) Where the information in the record is not sufficient to determine a target, action or means for the IU, and/or to decide which ICHI Target, Action or Means category provides the best match, '**D**' should be entered in the appropriate column ('T-code', 'A-code', or 'M-code') to denote a 'definability issue'.

Note: the residual Action categories ZY ('Other action, not elsewhere classified') and ZZ ('Unspecified action, not elsewhere classified'), and the residual Means category ZZ ('Intervention using other method, without approach or not otherwise specified') should not be used at this step of the coding process. If no matching specific Action or Means category can be found 'C' or 'D' should be recorded, as appropriate.

3. ***Record notes on fit of ICHI axis categories.*** In the columns 'T-notes', 'A-notes', and 'M-notes' make brief notes on how well the ICHI axis categories fit the corresponding concepts in the IU.

- Record 'GF' where the ICHI axis category is a good fit, i.e., the definition of the ICHI axis category is a good description of the corresponding IU concept. 'GF' should be recorded even where the concept in the IU is more specific than the corresponding ICHI category, for example ICHI Target VEA 'Eating behaviours' is a good fit for an IU about encouraging children to eat more fruit and vegetables.
- Note whether or not the language used in ICHI axis category titles and/or definitions matches or resonates with the language used in describing the IU. For example, where ICHI Action categories 'Education' or 'Training' are assigned, are these words used in the description provided in the record? If not, what words are used (e.g., 'teaching', 'participate in and learn…', 'skill development')?
- Note when the ICHI axis category only partially captures the corresponding IU concept, and describe aspects of the concept not captured. For example, ICHI Target 'Sexual behaviours' only partially captures the target concept of an IU focused on sexuality and intimate relationships.
- Describe any target, action or means concepts in the IU for which a matching ICHI axis category is not available.

Where more than one ICHI axis category has been assigned (e.g., multiple Targets), please be specific as to which category the notes relate to.

4. ***Assign an ICHI intervention code.*** Where an appropriate ICHI intervention code is available, record the code in column 'ICHI-Code' and the descriptor in column 'ICHI-descriptor' (these can be copied from the ICHI Excel file and pasted into the coding template). Where an appropriate specific code cannot be found for a given Target, a residual code of the form 'Other interventions…' (Action code 'ZY') may be recorded (e.g., VEA ZY ZZ 'Other interventions targeting eating behaviours, not elsewhere classified'); this may be necessary where there is not an ICHI code that combines the Target, Action and Means categories assigned at step 2, above.

5. ***Record notes on fit of ICHI intervention code.*** In the column 'Code-notes' note any issues concerning how well the ICHI intervention code selected captures the IU (e.g., where it does not capture all aspects of the IU, or where it is a very broad or general code that does not reflect the specific nature of the IU). 'GF' should be recorded when the code is judged to be a good fit for the IU.

6. ***Additional notes.*** In the column 'Additional notes' record any additional comments or observations made during the coding process, in particular relating to the following questions:

    - How easy was it to identify 'intervention units'? Was it difficult to decide whether the intervention constituted a single IU or multiple IUs? Was there sufficient information to identify and distinguish all the IUs making up this intervention?
    - How easy was it to find and select appropriate ICHI axis categories?
    - Was there ambiguity in the record or in ICHI intervention code titles, axis category titles, or textual definitions?
    - Was there other important information in the description not captured by ICHI (e.g., setting, nature of intervention provider or recipient).

Appendix 3.3: Example of interview schedule

Below is the interview schedule provided to key informants for the Tobacco Control data set. The same set of questions was used to structure key-informant interviews for all three data sets, with minor modification to tailor wording to the data set in question.

Uses and limitations of the classification of public health interventions in the World Health Organization's draft International Classification of Health Interventions (ICHI)
Questions for semi-structured interview

You will be participating in a semi-structured interview based around the questions below.
In preparation, please read the background document '**ICHI coding of FCTC implementation indicators – summary results**'. You can access the draft classification online: http://mitel.dimi.uniud.it/ichi/

The Framework Convention on Tobacco Control (FCTC)

1. What is the nature of your relationship to the FCTC and indicators or other data concerning FCTC implementation?

Use of ICHI to code FCTC implementation indicators

ICHI axis categories and intervention codes were assigned to FCTC implementation indicators, and summary analyses were conducted on the resulting ICHI-coded data. In your view:

2. How well does ICHI capture important information about interventions to which FCTC indicators relate?
3. To what extent do ICHI Target, Action and Means categories provide a useful basis for grouping and summarising interventions to which FCTC indicators relate?
4. Are the summary representations of the FCTC implementation indicators, based on ICHI-coded data, meaningful and easy to interpret? Would these summary representations be useful to stakeholders?
5. Are there important distinctions between different types of interventions that are not captured by ICHI?

Content and structure of ICHI

6. How do the three axes – Target, Action and Means – relate to the way public health interventions are described and understood in practice?
7. Do the Target, Action and Means categories in ICHI provide a good basis for distinguishing between different types of public health interventions?
8. 'Intervention unit' is defined as 'a key functional component of an intervention with a distinct Target, Action and Means', where 'functional' relates to an explicit or inferred mechanism of action. Does this concept make sense as the unit of classification for public health interventions?

Information on public health interventions more broadly

9. Are you aware of other frameworks and classifications relevant to tobacco control interventions or public health interventions more broadly (including funding and reporting frameworks)?
10. To what extent do you think ICHI will be useful for collecting, analysing and reporting data on public health interventions? How could it be improved?

Thank you for sharing your time and expertise,
and for your valuable contribution to this research

Appendix 3.4 - Ethical approval to conduct in-depth key informant interviews

Research Integrity & Ethics Administration
Human Research Ethics Committee

Friday, 18 November 2016

Prof Stephanie Short
Health Systems and Global Populations; Faculty of Health Sciences
Email: stephanie.short@sydney.edu.au

Dear Stephanie

The University of Sydney Human Research Ethics Committee (HREC) has considered your application.

After consideration of your response to the comments raised your project has been approved.

Approval is granted for a period of four years from **18 November 2016** to **18 November 2020**

Project title: **Evaluating the utility of the classification of public health interventions in the World Health Organization's draft International Classification of Health Interventions (ICHI)**

Project no.: **2016/809**

First Annual Report due: **18 November 2017**

Authorised Personnel: **Short Stephanie; Madden Richard; Riley Therese; Fortune Elizabeth Nicola;**

Documents Approved:

Date Uploaded	Version number	Document Name
19/10/2016	Version 2	Participant Consent Form - clean
19/10/2016	Version 2	Interview schedule - clean
19/10/2016	Version 2	Participant Information Statement - clean
22/08/2016	Version 1	Attachment 1 - Analytical Framework
22/08/2016	Version 1	Expert Interview Invitation Email

Condition/s of Approval

- Research must be conducted according to the approved proposal.
- An annual progress report must be submitted to the Ethics Office on or before the anniversary of approval and on completion of the project.
- You must report as soon as practicable anything that might warrant review of ethical approval of the project including:
  - Serious or unexpected adverse events (which should be reported within 72 hours).
  - Unforeseen events that might affect continued ethical acceptability of the project.
- Any changes to the proposal must be approved prior to their implementation (except where an amendment is undertaken to eliminate *immediate* risk to participants).

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- Personnel working on this project must be sufficiently qualified by education, training and experience for their role, or adequately supervised. Changes to personnel must be reported and approved.
- Personnel must disclose any actual or potential conflicts of interest, including any financial or other interest or affiliation, as relevant to this project.
- Data and primary materials must be retained and stored in accordance with the relevant legislation and University guidelines.
- Ethics approval is dependent upon ongoing compliance of the research with the *National Statement on Ethical Conduct in Human Research*, the *Australian Code for the Responsible Conduct of Research*, applicable legal requirements, and with University policies, procedures and governance requirements.
- The Ethics Office may conduct audits on approved projects.
- The Chief Investigator has ultimate responsibility for the conduct of the research and is responsible for ensuring all others involved will conduct the research in accordance with the above.

This letter constitutes ethical approval only.

Please contact the Ethics Office should you require further information or clarification.

Sincerely

R. L. Shackel

Associate Professor Rita Shackel
Chair
Human Research Ethics Committee

The University of Sydney HRECs are constituted and operate in accordance with the National Health and Medical Research Council's (NHMRC) National Statement on Ethical Conduct in Human Research (2007) and the NHMRC's Australian Code for the Responsible Conduct of Research (2007).

Appendix 5.1: Intervention codes assigned for each data set in the inter-coder comparison study

Table A5.1.1: Frequency of ICHI intervention codes assigned, Coder 1 and Coder 2, OPAL data set

ICHI code	ICHI intervention title	Coder1(%)	Coder2(%)
SX1 ZY ZZ	Other interventions on engagement in community, social and civic life, not elsewhere classified	-	2
VCA PM ZZ	Education about road safety behaviours	-	5
VCA ZY ZZ	Other interventions targeting road safety behaviours, not elsewhere classified	1	-
VEA AA ZZ	Assessment of eating behaviours	1	2
VEA PH ZZ	Training to influence eating behaviours	5	12
VEA PM QB	Education about eating behaviours delivered through a curriculum	4	-
VEA PM ZZ	Education about eating behaviours	2	17
VEA RD ZZ	Provision of products or services to support improved eating behaviours	11	2
VEA TD ZZ	Stakeholder partnership interventions targeting healthy eating behaviours	2	3
VEA TK ZZ	Public facilities or infrastructure development to support healthy eating behaviours	1	5
VEA VA ZZ	Capacity building interventions targeting healthy eating behaviours	15	-
VEA WC ZZ	Restrictions or requirements concerning the sale or distribution of certain foods or beverages	-	2
VEA ZY ZZ	Other interventions targeting eating behaviours, not elsewhere classified	11	7
VEB AA ZZ	Assessment of physical activity behaviours	2	2
VEB PH ZZ	Traning to influence physical activity behaviours	1	-
VEB PM ZZ	Education about physical activity behaviours	-	9
VEB PN ZZ	Advising about physical activity behaviours	1	-
VEB RD ZZ	Provision of products or services to support improved physical activity behaviours	15	7
VEB TD ZZ	Stakeholder partnership interventions targeting physical activity behaviours	5	-
VEB VA ZZ	Capacity building interventions targeting physical activity behaviours	5	-
VEB WG QF	Economic incentives to promote physical activity behaviours	-	2
VEB ZY ZZ	Other interventions targeting physical activity behaviours, not elsewhere classified	11	24
VEK VA ZZ	Capacity building interventions targeting social behaviours	2	-
Missing		4	-
Total		*100*	*100*

Note: Percentages are calculated using the following denominators: Coder 1 N=82; Coder 2 N=58

Table A5.1.2: Frequency of ICHI intervention codes assigned, Coder 1 and Coder 2, Netherlands data set

ICHI code	ICHI intervention title	Coder1(%)	Coder2(%)
PZA AB ZZ	Body measurement of whole body	-	2
UE1 VP ZZ	Improving access to services	-	8
VAA PM QB	Education about alcohol use behaviours delivered through a curriculum	3	-
VAA PM QC	Education about alcohol use behaviours by providing instructional materials	3	-
VAA PM ZZ	Education about alcohol use behaviours	-	6
VAA TD ZZ	Stakeholder partnership interventions targeting alcohol use behaviours	3	-
VAB PM QC	Education about tobacco use behaviours by providing instructional materials	1	-
VAB WF ZZ	Restrictions or requirements concerning the consumption or use of tobacco products	-	2
VBB PM ZZ	Education about family and partner violence behaviours	-	3
VBB VA ZZ	Capacity building interventions targeting family and partner violence behaviours	1	-
VBB ZY ZZ	Other intervention targeting family and partner violence behaviours, not elsewhere classified	1	-
VCD PM ZZ	Education about other safety behaviours	-	2
VEA PH ZZ	Training to influence eating behaviours	-	2
VEA PM QB	Education about eating behaviours delivered through a curriculum	8	5
VEA PM QC	Education about eating behaviours by providing instructional materials	6	2
VEA PM ZZ	Education about eating behaviours	3	5
VEA RD ZZ	Provision of products or services to support improved eating behaviours	1	3
VEA TD ZZ	Stakeholder partnership interventions targeting healthy eating behaviours	3	-
VEA TK ZZ	Public facilities or infrastructure development to support healthy eating behaviours	1	2
VEA WF ZZ	Restrictions or requirements concerning the consumption of certain foods or beverages	1	-
VEA ZY ZZ	Other interventions targeting eating behaviours, not elsewhere classified	3	2
VEB AI ZZ	Monitoring physical activity behaviours	4	-
VEB PH ZZ	Training to influence physical activity behaviours	18	9
VEB PM QB	Education about physical activity behaviours delivered through a curriculum	1	3
VEB PM ZZ	Education about physical activity behaviours	3	5
VEB PN ZZ	Advising about physical activity behaviours	-	2
VEB RD ZZ	Provision of products or services to support improved physical activity behaviours	-	2
VEB TD ZZ	Stakeholder partnership interventions targeting physical activity behaviours	3	-
VEB TK ZZ	Public facilities or infrastructure development to promote physical activity behaviours	4	5
VEB VA ZZ	Capacity building interventions targeting physical activity behaviours	1	-
VEB ZY ZZ	Other interventions targeting physical activity behaviours, not elsewhere classified	6	16
VEE PM QC	Education about oral hygiene behaviours by providing instructional materials	1	-

Table A5.1.2 (continued): Frequency of ICHI intervention codes assigned, Coder 1 and Coder 2, Netherlands data set

ICHI code	ICHI intervention title	Coder1(%)	Coder2(%)
VEF PM QB	Education about sexual behaviours delivered through a curriculum	1	-
VEE PM ZZ	Education about oral hygiene behaviours	-	2
VEF PM QB	Education about sexual behaviours delivered through a curriculum	-	2
VEF PM QC	Education about sexual behaviours by providing instructional materials	3	-
VEF PM ZZ	Education about sexual behaviours	-	6
VEF TD ZZ	Stakeholder partnership interventions targeting sexual behaviours	3	-
VEH PN ZZ	Advising about breastfeeding	1	-
VEH WI QD	Enactment of legislation or regulations concerning breast feeding	1	-
VEH ZY ZZ	Other interventions targeting breastfeeding, not elsewhere classified	-	2
VEJ AI ZZ	Monitoring of parenting behaviours	1	-
VEJ PM QC	Education about parenting behaviours by providing instructional materials	1	-
VEK PM QB	Education about social behaviours delivered through a curriculum	1	2
VEK ZY ZZ	Other interventions to targeting social behaviours, not elsewhere classified	-	3
VEL PM ZZ	Education about behaviours related to psychological health and wellbeing	-	2
VEL ZY ZZ	Other interventions targeting behaviours related to psychological health and wellbeing, not elsewhere classified	1	2
VEX TD ZZ	Stakeholder partnership interventions targeting other health-related behaviours	1	-
VEX ZZ ZZ	Unspecified intervention targeting health-related behaviours	1	-
Total		*100*	*100*

Note: Percentages are calculated using the following denominators: Coder 1 N=71; Coder 2 N=64

Table A5.1.3: Frequency of ICHI intervention codes assigned, Coder 1 and Coder 2, Tobacco Control data set

ICHI code	ICHI intervention title	Coder 1 (%)	Coder 2 (%)
UA1 WC QD	Restrictions or requirements concerning the sale or distribution of products or technologies —enactment of legislation or regulations	4	-
UA1 WC QE	Restrictions or requirements concerning the sale or distribution of products or technologies — enforcement of legislation or regulations	8	-
UA1 WD QE	Restrictions or requirements concerning the advertising, promotion or sponsorship of products or technologies—enforcement of legislation or regulations	4	-
UA1 WE QE	Restrictions or requirements concerning the production or importation of products or technologies —enforcement of legislation or regulations	6	-
UA1 ZY ZZ	Other interventions targeting products and technology, not elsewhere classified	-	4
UE1 PM ZZ	Education about services, systems and policies	2	-
UE1 VA ZZ	Building the capacity of services, systems and policies, in preparedness for disasters and emergencies that may impact on health	6	-
UE1 VN ZZ	Establishing services	-	2
UE1 VO ZZ	Marshalling services	-	2
UE1 VP ZZ	Improving access to services	2	2
VAB PH ZZ	Training to influence tobacco use behaviours	-	4
VAB PM QA	Media campaign about tobacco use behaviours	2	2
VAB PM QB	Education about tobacco use behaviours delivered through a curriculum	-	2
VAB PM QC	Education about tobacco use behaviours by providing instructional materials	4	-
VAB PM ZZ	Education about tobacco use behaviours	-	4
VAB PP ZZ	Counselling about tobacco use behaviours	-	2
VAB TD ZZ	Stakeholder partnership interventions targeting tobacco use behaviours	2	8
VAB VA ZZ	Capacity building interventions targeting tobacco use behaviours	4	-
VAB WC QD	Restrictions or requirements concerning the sale or distribution of tobacco products—enactment of legislation or regulations	-	20
VAB WD QD	Restrictions or requirements concerning the advertising, promotion or sponsorship of tobacco products—enactment of legislation or regulations	-	8
VAB WE QD	Restrictions or requirements concerning the production or importation of tobacco products—enactment of legislation or regulations	2	10
VAB WF QE	Restrictions or requirements concerning the consumption or use of tobacco products—enforcement of legislation or regulations	2	2
VAB WF ZZ	Restrictions or requirements concerning the consumption or use of tobacco products	-	2
VAB WG QF	Economic incentives to encourage improved health behaviours relating to tobacco use	-	2
VAB ZY ZZ	Other interventions targeting tobacco use behaviours, not elsewhere classified	-	24
Missing		52	-
Total		*100*	*100*

Note: Percentages are calculated using the following denominators: Coder 1 N=50; Coder 2 N=50

Appendix 7.1: Detailed findings to inform further development of ICHI

Numbers in square brackets indicate research component from which findings are derived: [1] ICHI public health data coding study (Chapter 4); [2] Inter-coder comparison study (Chapter 5); [3] In-depth key-informant interviews (Chapter 6).

1. Intervention Units (IU) – identifying and framing

Issue raised by research findings	Comments and proposals for consideration
Determining interventions as 'in-scope' or 'out-of-scope' for ICHI Some records were excluded because the primary purpose of the intervention described was not health-related (e.g., to increase sports club membership), but similar records were included where a health purpose was expressed as well as a non-health purpose. [1] Interview participants noted that, when collaborating on health promotion with actors in other sectors, it is important to work with the interests and motivators of partner organisations (health goals may not be their top priority). [3]	The ICHI definition of 'health intervention' implies that health purpose is necessary to bring an intervention in scope for ICHI. Findings suggest this should not be emphasised in ICHI user guidance for public health, as it may result in excluding interventions of public health interest. Propose that user guidance should: (i) encourage use of ICHI wherever it is found to be useful, including to capture or analyse data on interventions that have the potential to affect health, whether or not the purpose of the intervention is to influence health; (ii) urge users to record metadata concerning inclusion criteria applied. *(Tier 4)*
Determining what qualifies as an IU rather than an aspect of implementation Difficulty deciding whether activities such as training staff or providing intervention resources should be regarded as a 'functional component' to be identified as a separate IU for coding, or merely an aspect of implementation. Similar issues arise with activities involving assessment, advocacy, collaboration, etc., as part of an intervention. [1]	ICHI user guidance could provide some direction on this issue (e.g., to treat staff training as separate IU if aim is to up-skill staff beyond the delivery of the activities that are the immediate focus of the intervention). However, as a general principle, how interventions are split into components for coding should be determined in relation to the information needs associated with a given application. Propose that user guidance should: (i) provide general guidance on how to determine what activities should be regarded as separate IUs for ICHI coding, rather than aspects of implementation; (ii) urge users to record metadata concerning the principles applied in the context of a given application. *(Tier 4)*

A7.1: Detailed findings to inform further development of ICHI

Issue raised by research findings	Comments and proposals for consideration
Splitting versus lumping (level of granularity at which an intervention is coded) Difficulty deciding whether and how interventions involving several elements (e.g., multiple linked activities as part of a setting-wide intervention) should be split into separate IUs. Such decisions can be affected by the level of detail provided. Variation results in some intervention records being coded at a coarser level and others at a more granular level. [1] Discrepancies between coders were evident, e.g., instances in which one coder bundled together two or three different 'things done' while the other split them into separate IUs; one coder identified as a separate IU an element in the intervention description not mentioned by the other coder; the coders viewed the intervention at different scales or levels of detail, so that one coder identified a single IU for the overall intervention while the other identified multiple IUs for its component parts. [2] Interview participants acknowledged the difficulty of defining IU so as to ensure all users will make the same decisions about what constitutes a single unit. It was also noted that the best approach for differentiating constituent IUs for a given intervention may depend on the purpose for which the data are to be used (e.g., measuring dose vs reach). [3]	Findings indicate that the concept of 'intervention unit' is workable as a basis for applying ICHI to code multi-component public health interventions, but that the operational definition of IU developed for this research did not provide sufficient guidance or ensure consistency between coders concerning how to split a given intervention into its constituent parts for coding. The findings did not suggest a clearer or more reliable basis for specifying how to identify separate IUs for ICHI coding. There is no 'correct' way to decompose an intervention into its constituent parts, and an intervention may legitimately be viewed (and coded) at different scales or levels of detail to meet different information needs. Propose that user guidance should: (i) provide a definition of 'intervention unit' that relates it to concepts found in the public health literature (e.g., theoretically important components, active ingredients, and core elements), but that leaves scope for users to identify constituent IUs in a way that best meets their information needs; (ii) urge users to record metadata concerning the principles applied for splitting interventions into constituent IUs in the context of a given application. *(Tier 4)*
Wording of operational definition of IU Often more than one mechanism of action could be inferred for a given IU, that is, the deed done could be understood to bring about change via more than one pathway. [1] In some cases the presence of more than one Target or Action appeared to be the basis for a coder identifying separate IUs; this was a cause of discrepancies between coders in IU identification. [2] Commenting on the definition of IU, interview participants noted that 'distinct Target' is problematic because intervention components can have more than one Target, and the term 'mechanism of action' could cause confusion with the concept of Action as one of the three ICHI axes. [3]	The definition of IU refers to 'a distinct Target, Action and Means' and 'the explicit or inferred mechanism of action'; this wording creates ambiguity concerning whether an IU may have more than one Target, Action or Means, and more than one mechanism of action. Propose that user guidance should provide a definition of 'intervention unit' that does not make reference to Target, Action, Means, or mechanism of action. *(Tier 4)*

A7.1: Detailed findings to inform further development of ICHI

Issue raised by research findings	Comments and proposals for consideration
Framing an IU for ICHI coding A given IU may be framed differently depending on which mechanism of action or which step in the change pathway is emphasised, or which actor perspective is taken. The operational definition of IU gives no guidance on this, or even whether mechanism of action (rather than simply the deed done) should be the focus in how the IU is framed for coding. [1] In framing IUs, coders frequently emphasised different aspects of the intervention, conveyed different views of the essential nature of the intervention, or represented different actor perspectives. [2]	It will often be possible to frame a given IU in different ways (e.g., when there is more than one actor involved, or more than one hypothesised mechanism of action), leading to different coding choices. Propose that user guidance should: (i) raise this issue and encourage users to be explicit about how framing choices are made; (ii) suggest that the framing of an IU for coding should include information on both what was done and the main mechanism via which it is intended to work; (iii) urge users to record metadata on principles applied for framing IUs in the context of a given application. *(Tier 4)*

2. Target – concepts and categories

Issue raised by research findings	Comments and proposals for consideration
Meaning of 'Target' in relation to public health interventions Different types or levels of Targets may be identified for a given IU, e.g., proximate Targets, intermediate Targets, ultimate Targets, enabling factors. For public health interventions, there may not be a direct relationship between Action and Target, so often the ICHI definition of Target as 'the entity on which the Action is carried out' does not provide useful guidance for articulating the Target of an IU. [1] Different approaches to determining the Target concept for an IU, and to coding proximate and ultimate Targets, resulted in discrepancies between coders. For example, in the Tobacco Control data set there were many IUs for which Coder 1 assigned UE1 'Services, systems and policies' as T-code(1) (because the intervention involved making a system change of some sort), while Coder 2 assigned VEB 'Tobacco use behaviours' (because the ultimate aim was to reduce tobacco use). [2] Interview participants noted that the ICHI concept of Target is different to how the term 'target' is generally used in public health. Participants also stated that many public health interventions aim to change factors such as knowledge, skills, attitudes, self-efficacy, capacity, social norms, and aspects of the environment in order to bring about behaviour change; these things can be seen as enablers of or precursors to behaviour change. Different types or levels of Target can be articulated for an intervention – e.g., enablers, intermediate Targets, medium-term, or long-term Targets. The ultimate Target may be a health-related behaviour, but the proximate or antecedent Target an environmental factor. [3]	Propose articulation of an editorial principle concerning how the ICHI concept of Target is operationalised for public health interventions, addressing the different types or levels of Target that may be identified for an intervention (e.g., proximate, intermediate and ultimate Targets and enabling factors). This should be informed by input from the field regarding what is a meaningful basis for distinguishing between different types of interventions and grouping interventions. *(Tier 1)* Construction of ICHI intervention codes and decisions about Target categories needed (e.g., enabling factor Targets) should be consistent with this editorial principal. *(Tier 2)* User guidance should explain how the ICHI definition of Target is operationalised for public health interventions, including in relation to proximate and ultimate Targets, with illustrative examples. *(Tier 4)*

A7.1: Detailed findings to inform further development of ICHI

Issue raised by research findings	Comments and proposals for consideration
More than one Target category applicable for single IU It is common for more than one ICHI Target to be applicable for a given IU. In some cases multiple Targets are of equal status; in other cases they represent the proximate Target to which the Action is directed and the ultimate Target that the intervention seeks to change. Usually it is not possible to identify a 'main' Target. The nature of the relationship between multiple Targets (e.g., proximate-ultimate) cannot be captured in ICHI. [1] In some cases discrepancies between coders were due to different approaches to coding proximate and ultimate Targets for an IU, different views on what environmental factor or health-related behaviour the intervention was primarily directed towards, or different weight ascribed to multiple envisaged benefits of the intervention. [2] Interview participants made the point that public health interventions commonly aim to bring about change in more than one health-related behaviour or environmental factor; they are designed as integrated strategies. [3]	In the context of a pre-coordinated classification where a single intervention code is to be assigned per IU, the identification of multiple applicable Targets has implications for choice of ICHI intervention codes. Propose articulation of an editorial principle addressing which type of Target should be the subject of ICHI intervention codes (e.g., proximate or ultimate Target), and how additional Target information may be captured (e.g., by use of extension code), including how to capture information on the nature of the relationship between multiple Targets (e.g., equal, proximate-ultimate). *(Tier 1)* Propose allowing use of ICHI axes separately, as an alternative to use of pre-coordinated ICHI intervention codes, so that users may record multiple Targets per IU. *(Tier 1)* User guidance should explain which Target type is to be used as a basis for selecting pre-coordinated ICHI codes, and how additional Target information may be captured. If use of ICHI axes separately is allowed, users should be urged to record metadata on the nature of Targets recorded (e.g., 'proximate' or 'ultimate'); definitions for 'proximate' and 'ultimate' Target should be provided to help standardise use. *(Tier 4)*
Target concepts not adequately captured by ICHI – characteristics of an individual, a family, or a community Some Target concepts are not captured by ICHI and do not readily fit into any of the existing ICHI Target types, e.g., self-efficacy, resilience, self-esteem, problem solving, coping skills, social-emotional skills, personal development, social connectedness/isolation, social cohesion, family functioning, risk for anxiety or depression, and motor skills. These can be described as characteristics or properties of an individual, a family, or a community. In many cases these factors may be viewed as proximate Targets or enabling factors, theorised as preconditions for change in specified health-related behaviour/s. Sometimes they are the only articulated Target for an intervention (e.g., a program of classes aimed at building resilience of children through Aikido). [1] Interview participants noted that ICHI Targets do not currently capture enablers and behavioural preconditions that are the direct focus of many interventions in contemporary health promotion practice. [3]	Some interventions seek to change characteristics or properties of an individual, a family, or a community (e.g., resilience, social cohesion, family functioning). Consideration is needed concerning whether and how such Target concepts should be captured in ICHI. Options: (1) include as Targets in a new Target type group; (2) capture with an extension code for describing 'enabling factors' or 'behavioural preconditions' (this would not solve the problem when there is no other Target concept mentioned in an IU). *(Tier 1)* In accordance with the decision reached (as necessary), Target categories or Extension codes should be developed to capture the characteristics or properties of an individual, a family, or a community that interventions seek to change. *(Tier 2)*

A7.1: Detailed findings to inform further development of ICHI

Issue raised by research findings	Comments and proposals for consideration
Target concepts not adequately captured by ICHI – safety behaviours Sports injury prevention, falls prevention, and child safety are Target concepts of significant public health relevance, but are covered only by residual ICHI Target VCD 'Other safety behaviours, NEC'. [1]	Current safety behaviour Targets in ICHI are distinguished on the basis of the setting in which the behaviour occurs (work, home, road). Consider adding Target categories 'Sports safety behaviours', 'Falls prevention behaviours', and 'Child safety behaviours', i.e., safety behaviours not described on the basis of setting. (Refer also to ICD-11 Ch 23 – 'External causes of morbidity or mortality'.) (*Tier 2)*
Target concepts not adequately captured by ICHI – sexual behaviours ICHI Target VEF 'Sexual behaviours' does not adequately capture the Target concept for interventions that address broader topics related to sexuality and relationships, e.g., with the aim of preventing unequal or exploitative sexual relationships. [1]	Propose modifying definition for VEF to read 'Behaviour concerning patterns of sexual activity and sexual relationships'. *(Tier 3)*
Target concepts not explicitly expressed It was sometimes necessary to infer the Target of an intervention when this was implied rather than explicitly expressed in the description. This was contrary to the coding protocol which stated: 'Choice of ICHI axis categories should be based on information actually provided in the record; no inferences or assumptions should be made'. [1]	This may often be an issue for uses that involve applying ICHI for secondary coding of data already collected. Propose that user guidance should state that choice of ICHI axis categories is to be based on information provided or that can reasonably be inferred. *(Tier 4)*
Definition and scope of ICHI Target categories – code VEL VEL 'Behaviours related to psychological health and wellbeing': the exclusion for this code, 'handling stress and other psychological demands (SDJ)', was noted to create confusion, suggesting that behaviours to do with handling stress are not included under VEL. [1] In the Netherlands data set, one coder chose not to assign Target VEL because of the exclusion listed, assigning instead VEX 'Other health-related behaviours, NEC'; this caused a coding discrepancy. [2]	For Target VEL, 'Behaviours related to psychological health and wellbeing', exclusion of SDJ was intended to flag that users should decide whether the Target is a behaviour (VEL) or an A&P domain (SDJ); in practice it creates confusion. The distinction between behavioural and A&P Targets is explained in the ICHI coding guidelines. Propose to remove exclusion of SDJ for Target VEL. *(Tier 3)*

A7.1: Detailed findings to inform further development of ICHI

Issue raised by research findings	Comments and proposals for consideration
Definition and scope of ICHI Target categories – code VEA VEA 'Eating behaviours': clarification of scope needed to indicate that 'drinking behaviours' are included, e.g., interventions that aim to increase consumption of water or decrease consumption of sugary drinks should use Target VEA. [1] The exclusion for this code, 'eating (SMF)', was noted to create confusion, suggesting that 'eating' is not an 'eating behaviour'. [1] One interview participant noted the exclusion of 'eating' for Target VEA as an anomaly. [3]	For Target VEA, 'Eating behaviours', exclusion of SMF was intended to flag that users should decide whether the Target is a behaviour (VEA) or an A&P domain (SMF); in practice it creates confusion. The distinction between behavioural and A&P Targets is explained in the ICHI coding guidelines. Propose to remove exclusion of SMF for Target VEA; add inclusion 'drinking behaviours'; add exclusion: VAA 'Alcohol use behaviours'. *(Tier 3)*
Use of Body Function and Activities and Participation domain Targets In some instances Body Function or Activities and Participation Targets may better capture the Target concept of an IU than Health-related Behaviour or Environmental Factor Targets – e.g., Target SDJ 'Handling stress and other psychological demands' (A&P domain) for yoga classes offered in the workplace to reduce stress, or Target CTB 'Hearing function' (body function) for an online hearing test. [1]	The Introduction to ICHI alpha 2016 states that 'Public health interventions in ICHI are interventions delivered to populations; they target health-related behaviours or environmental factors'. Propose that user guidance should say that ICHI Targets in all Target groups may be used for coding public health interventions. *(Tier 4)*

3. Action – concepts and categories

Findings	Comments and proposals for consideration
'Form' versus 'function' approach when assigning Action categories ICHI Actions were noted to vary in the degree to which they convey form (i.e., the deed done, e.g., RD 'Provision') and/or function (i.e., intended effect, e.g., VA 'Capacity building'). For some IUs, one ICHI Action could be assigned to describe what was done and another to describe the intended effect, e.g., delivering training (Action PH) in order to build capacity (Action VA). [1] In some instances discrepancies between coders were due to choice of an Action describing what was done versus an Action describing the intended effect of what was done (e.g., 'Training' vs 'Capacity building', 'Provision' vs 'Applying incentives', 'Monitoring' vs 'Restrictions on the sale or distribution of tobacco products', 'Assay' vs 'Restrictions on production or importation of products', 'Public facilities or infrastructure development' vs 'Capacity building', 'Provision' vs 'Education', 'Provision' vs 'Collaborating'). [2] Interview participants noted the importance of knowing how an intervention is intended to work. [3]	The Action axis conflates two dimensions of information: form and function. Both the form and function of what is done can be described for an IU. As some Action categories convey information on form, some convey function, and some convey a mix of form and function, this raises questions about how data on public health interventions grouped by ICHI Action can meaningfully be interpreted. Propose articulation of an editorial principle stating that 'Action' for public health interventions should be operationalised as categories that correspond to broad approaches used in public health and that convey information about both what is done and how it is expected to work. Such Action categories should be readily recognisable as meaningful 'types' by those working in public health. *(Tier 1)* The specification and definition of ICHI Action categories should be consistent with this editorial principal. *(Tiers 2 and 3)* User guidance should explain how the ICHI definition of Action is operationalised for public health interventions, consistent with the editorial principle. *(Tier 4)*

A7.1: Detailed findings to inform further development of ICHI

Findings	Comments and proposals for consideration
More than one Action category applicable There were instances in which more than one Action category was potentially applicable because: • elements from the definitions of two ICHI Actions were present in the description of an IU and it was not possible to identify a main or primary Action (e.g., 'Education' and 'Training', 'Education' and 'Advising', or 'Provision' and 'Public facilities or infrastructure development'). • an activity that could be described by one ICHI Action was undertaken in order to achieve a result that could be captured by another ICHI Action (e.g., stakeholder collaboration to achieve restrictions on advertising); or • different ICHI Actions might be applicable because of alternative ways in which the central Action of an IU could be framed. [1] In some cases, discrepancies between coders reflected different choices of Action assignment where more than one category was applicable because the intervention included elements of two or more ICHI Actions (e.g., advising and education). [2]	The findings illustrate that there are various reasons why more than one ICHI Action may be applicable for a given IU. In the context of a pre-coordinated classification where a single intervention code is to be assigned per IU, the identification of multiple applicable Actions has implications for choice of ICHI intervention codes. Propose allowing use of ICHI axes separately, as an alternative to use of pre-coordinated ICHI intervention codes, so that users may record multiple Actions per IU where this would better meet their information needs. *(Tier 1)* User guidance should provide general principles to assist in the assignment of intervention codes to IUs for which multiple applicable Actions are identified, with illustrative examples. Users should be urged to record metadata on the principles applied in a given application (e.g., priority given to particular Action categories when multiple applicable Actions identified). *(Tier 4)*
Inter-coder discrepancies in Action assignment due to unclear scope of ICHI Actions In some instances discrepancies between coders were due to different interpretation of the scope of particular ICHI Action categories (e.g., 'Education', 'Training', 'Capacity building', 'Restrictions on the sale or distribution of products', 'Restrictions on advertising, promotion or sponsorship of products', 'Restrictions on production or importation of products', 'Applying incentives', 'Legislation or regulations, other'). [2]	This finding indicates the need for clearer definition of some Actions to clarify scope – see proposals for specific Action categories, below.

A7.1: Detailed findings to inform further development of ICHI

Findings	Comments and proposals for consideration
Definition and scope of ICHI Action – AI 'Monitoring' The inclusion 'Population heath monitoring' suggests that this category is applicable to surveillance interventions (e.g., surveillance of patterns of tobacco consumption). However, code UBC AA ZZ 'Assessment of the population to identify and develop responses to population health issues' includes 'Establishing and maintaining disease registers'. [1]	The findings suggest lack of clarity concerning the respective applicability of Actions AA 'Assessment' and AI 'Monitoring' for describing public health interventions involving surveillance of population health issues. Propose new Action 'Public health surveillance', defined as 'Ongoing, systematic collection, analysis and interpretation of health-related data to support the planning, implementation, and evaluation of public health practice'; add 'Public health surveillance' as an exclusion for AI 'Monitoring'; use this new Action for a code to capture establishing/maintaining disease registers; delete UBC AA ZZ. *(Tiers 2 and 3)*
Definition and scope of ICHI Action – RC 'Emotional support' For several IUs the intended effect of the intervention was to motivate people in order to bring about a change in behaviour, e.g., trained coach to help employees meet physical activity goals. It was noted that Action RC 'Emotional support' includes 'motivational support', though the title 'Emotional support' generally was not an appropriate description. [1]	The findings suggest need for clarification of the applicability of the Action RC 'Emotional support' for interventions involving motivational support, e.g., as provided by a coach. Propose review of title and definition of RC 'Emotional support' to clarify its applicability to public health interventions that involve motivational support provided by a coach. *(Tier 3)*
Definition and scope of ICHI Action – PM 'Education' 'Education' was often assigned to IUs characterised by less traditional approaches to increasing knowledge and understanding about an issue, such as experiential learning, educational entertainment, community events, interactive group learning, or online discussion forums. In such cases the ICHI definition of 'Education' was noted to be a poor fit. [1] For the OPAL data set, Coder 2 appeared to interpret 'Education' more broadly than Coder 1 and assigned it for IUs involving awareness raising, for which Coder 1 often recorded 'C'. There were also several instances in which one coder assigned 'Education' while the other assigned 'Capacity building'. [2] One participant made the point that education programs do more than influence knowledge, and suggested that the definition of 'Education' should convey the more holistic approach of education programs in modern health promotion practice (i.e., to include changing attitudes, building self-efficacy and influencing intentions regarding behaviour). [3]	The findings suggest that ICHI definition of 'Education' as 'Providing structured information in a manner conducive to improving knowledge about matters relevant to health and/or functioning' is not a good fit for educational public health interventions that employ less traditional approaches and aim to change attitudes as well as improving knowledge. Propose review of the definition of PM 'Education' to encompass less traditional and more holistic approaches to education used in contemporary public health practice. *(Tier 3)*

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Findings	Comments and proposals for consideration
Definition and scope of ICHI Action – PH 'Training' Coding notes queried the applicability of 'Training' where skill development was implicit rather than explicit (e.g., skateboarding workshop provided to encouraging active travel, or game to learn task-oriented behaviour). Inclusions for this code are relevant to allied health interventions and do not help clarify scope in the context of public health interventions. [1] For the Netherlands data the two coders appeared to interpret the scope of 'Training' differently – there were several IUs for which one coder assigned Training while the other assigned a different Action or recorded 'C' (sometimes noting that Training had been considered but was determined not to be a good fit). [2]	The findings suggest that it is not clear whether 'Training', defined as 'Teaching, enhancing or developing skills through context-specific practice', is applicable to public health interventions that involve less formal or structured approaches to fostering skill development. Propose review of the definition of PH 'Training' to clarify scope, and add inclusion terms relevant to public health interventions. *(Tier 3)*
Distinction between ICHI Actions Education (PM) and Training (PH) There were many instances in which it was difficult to decide between 'Education' and 'Training' as the best description of a given IU, as IUs often involved both developing skills and providing information to build knowledge. [1] Several participants queried whether defining education and training as separate Actions was practical or necessary. It is difficult to draw a clear line between these two Actions as they can look very similar and interventions with an education component commonly also involve guided practice. [3]	Findings suggest that guidance is needed concerning when to assign 'Education' and when to assign 'Training'. Propose user guidance to support a consistent approach to choosing between Education and Training codes when IU involves both providing information to improve knowledge and fostering skill development. *(Tier 4)*
Definition and scope of ICHI Action – PP 'Counselling' It was queried whether 'Counselling' should be used for IUs involving coaching or counselling to help people to set and work towards goals (e.g., physical activity goals, personal development goals); often it is not clear from the description whether the methods used are 'theory-based'. [1]	Action PP 'Counselling' is defined as 'Providing therapeutic and/or supportive communication (involving conversation, understanding of information and other knowledge exchange) using theory-based methods to encourage a change of functioning, attitude or behaviour in relation to health, or to support problem-solving', *Incl*: Health coaching; Problem solving. Propose review of the definition of PP 'Counselling' to clarify scope with respect to interventions involving coaching and counselling that may not be described as 'theory-based'. *(Tier 3)*

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Findings	Comments and proposals for consideration
Definition and scope of ICHI Action – Capacity building (VA) For several IUs it was difficult to choose between 'Training' and 'Capacity building' when an IU involved training provided in order to build capacity at individual, organisational or community level. It was noted that 'Capacity building' describes the intended effect of the intervention, while 'Training' describes what is done. [1] Systematic differences were noted between coders in the use of 'Capacity building' – in several instances one coder assigned 'Capacity building' while the other assigned 'Education', 'Training', or recorded 'C' (coverage issue). [2] Interview participants expressed a variety of views concerning the meaning of 'capacity building', suggesting lack of consensus around this concept. Comments included: making a clear distinction between training and capacity building is difficult; training could be regarded as a Means of building capacity; capacity building can be seen as a precondition for an intervention; compared with training, capacity building interventions are typically bigger picture, with broader community engagement and a more diverse spread of community members involved; 'capacity building' does not tell you what is being built (i.e., what behaviour precursors the intervention aims to change). [3]	Findings suggest this Action should be reviewed, and its scope in relation to other Actions (e.g., Education, Training, Provision) clarified. 'Capacity building' describes the intended function of an IU, not what is done in order to build capacity. Improving knowledge ('Education'), building skills ('Training'), providing resources ('Provision'), and creating partnerships ('Collaborating') may be ways of building capacity. Propose review of the definition of VA 'Capacity building' to clarify its scope and include information on what is done to build capacity. *(Tier 3)* User guidance should help users decide when to assign an ICHI intervention code with Action 'Capacity building' rather than a code with another potentially applicable Action (e.g., Education, Training, Provision or Collaborating). *(Tier 4)*
Definition and scope of ICHI Action – SI 'Preparation' The scope of this Action in relation to public health interventions was queried, e.g., should 'Preparation' be assigned for a community consultation to inform a planned park redevelopment? [1]	'Preparation' describes the intended function of an IU, not what is done. It is unclear whether this Action is intended for use in relation to public health interventions and, if so, what types of preparatory activities would be covered. Propose consideration of whether SI 'Preparation' should be used as basis for describing and grouping public health interventions; review definition and inclusions/exclusions accordingly. *(Tiers 2 and 3)*
Definition and scope of ICHI Action – TK 'Public facilities or infrastructure development' The need for clarification as to what counts as 'public' was noted, e.g., is developing a school vegetable garden or installing a drinking fountain in a kindergarten covered? There were also queries regarding whether this Action includes small-scale or temporary changes to physical spaces, e.g., stencil art in school playground to encourage walking or display of foods in a canteen. [1]	Findings suggest clarification is needed concerning the scope of TK 'Public facilities or infrastructure development', in particular what is meant by 'public' and whether it is applicable for small-scale or temporary changes to physical spaces. Propose review of TK 'Public facilities or infrastructure development' to clarify its scope of application with respect to other Action categories that can be used to describe changes to the physical environment; revise definition, inclusions and exclusions accordingly. *(Tiers 2 and 3)*

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Findings	Comments and proposals for consideration
Definition and scope of ICHI Action – RD 'Provision' The definition of RD is 'providing products or services'. While this Action was applied fairly narrowly to IUs involving provision of something tangible (e.g., fruit, game materials), it was noted that it could be used much more broadly depending on how 'providing services' is interpreted, e.g., providing a sports or physical activity program. It was also noted that IUs that involve providing something can work in various different ways, e.g., enabling a behaviour, providing a motivational stimulus, raising awareness, or providing an opportunity to try something. [1] For the OPAL data set Coder 1 appeared to interpret 'Provision' more broadly than Coder 2 and assigned it for a wide range of IUs to convey that a program or activity was provided. [2]	'Provision' describes just the deed done (i.e., something is provided), not how this is intended to bring about change. Inclusion of 'services' raises the prospect of overlap with Actions VN, VO and VP, which concern, respectively, establishing, marshalling and improving access to health services or health-related services. Consideration is needed concerning the use of RD 'Provision' for describing public health interventions, particularly what types of interventions it should be applicable to, such that it can be used to group interventions in a meaningful way. Propose consideration of how RD 'Provision' should be used for describing and grouping public health interventions; revise definition, inclusions and exclusions accordingly, including to clarify its scope of application with respect to other Action categories. *(Tiers 2 and 3)*
Definition and scope of ICHI Action – Collaborating (TD) Coding notes queried whether TD should only be assigned when building/maintaining a partnership is the main focus of the IU. For the Netherlands data set TD was often assigned as A-code(2) when collaboration or partnership was a central feature of the intervention, but not the focus of what the intervention was doing. For some records with multiple IUs collaboration was noted to be a characteristic of the overall intervention, rather than specific IUs. It was noted that 'collaborating' could be viewed as a Means rather than an Action for some IUs. [1] For the Netherlands data set Coder 1 commonly assigned 'Collaborating' as main Action if the IU involved cooperation or a partnership relationship between different actors (e.g., school and local sports clubs), or active involvement of intervention recipients (e.g., group discussion), while Coder 2 assigned 'Collaborating' only as secondary Action and only for IUs that particularly emphasised community-level stakeholder partnerships. This pattern was also noted in the other two data sets, suggesting coders had different interpretations of this Action. [2]	The definition of TD 'Collaborating' is 'Working together and cooperating with the person/client, health providers, and other relevant stakeholders'; this describes a way of working that is likely to be applicable to many public health interventions. Collaboration or partnership as central to how an intervention is delivered can be distinguished from the main focus of an intervention being to build or maintain a collaboration or partnership. Propose revising the definition, inclusions and exclusions for TD 'Collaborating' to clarify that it should be assigned only when the main focus of an IU is developing or maintaining a partnership or a collaborative arrangement between two or more actors. *(Tier 3)*

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Findings	Comments and proposals for consideration
Definition and scope of ICHI Action – WC 'Restrictions on the sale or distribution of products' Coding notes queried whether this Action is applicable to interventions involving organisations voluntarily limiting sale/distribution, e.g., changing a school canteen menu to reduce unhealthy options. [1]	Findings suggest that clarification is needed concerning whether WC 'Restrictions on the sale or distribution of products' applies to voluntarily restricting sale or distribution of products through self-regulation. Propose review of WC 'Restrictions on the sale or distribution of products' to clarify its applicability in relation to voluntary restrictions and self-regulation. (Similar review should apply to Actions WD, WE and WF.) *(Tier 3)*
Definition and scope of ICHI Action – WC 'Restrictions on the sale or distribution of products' and WD 'Restrictions on advertising, promotion or sponsorship of products' For some IUs in the Tobacco Control data set it was difficult to decide whether they should be regarded as restrictions on sale or on advertising, e.g., a ban on display of tobacco products at points of sales or a ban on the sale of objects in the form of tobacco products. [1] In the Tobacco Control data set, for an IU that concerned prohibiting distribution of free tobacco products, one coder assigned WC while the other assigned WD. [2]	Findings suggest that the boundary between Actions WC and WD should be more clearly delineated in relation to restrictions that could be viewed as either restrictions on sale/distribution or restrictions on advertising (e.g., display and promotion of products closely associated with product sales, or sale of what could be regarded as promotional products). Propose review of inclusions and exclusions for Actions WC and WD to clarify their respective applicability in relation to restrictions that could be viewed as either restrictions on sale/distribution or restrictions on advertising (implementation guidelines developed for the Framework Convention on Tobacco Control indicators are a useful reference for this). *(Tier 3)*
***Definition and scope of ICHI Action* – WE 'Restrictions on production or importation of products'** Coding notes queried whether this Action is applicable to: trade of products (not just importation), e.g., legislation against illicit trade in tobacco products; requirements concerning the contents and other characteristics of products, e.g., regulations concerning emissions of tobacco products, requirement to mark packaging to indicate the origin of the product. [1] For two IUs in the Tobacco Control data set one coder assigned WE (Restrictions on production or importation of products) while the other assigned WC (Restrictions on the sale or distribution of products); these IUs concerned requirements to mark tobacco product packaging to indicate place of origin, and enactment of legislation against illicit trade in tobacco products. [2]	Findings suggest that clarification is needed re WE 'Restrictions on production or importation of products', in particular whether it applies to trade of products and whether it covers regulations concerning the contents, packaging and other characteristics of products. Propose review of inclusions and exclusions for Action WE to clarify its applicability in relation to trade of products and regulations concerning the contents, packaging and other characteristics of products. *(Tier 3)*

Findings	Comments and proposals for consideration
Definition and scope of ICHI Action – WI 'Legislation and regulations, other' Noted that, while the title indicates that this Action is intended for interventions involving formal and legally enforceable rules, the definition suggests that it could have wider applicability, including rules put in place within an organisation (e.g., rules within a school concerning when different groups of children can access different parts of the playground). [1] For the tobacco control data set, Coder 1 assigned WI 'Legislation and regulations, other' in instances where putting legislation in place was required to implement the IU. Coder 2 used WI as a residual category where the IU involved making or enforcing rules and no other Action category was applicable. For one IU in each of the other data sets, one coder assigned WI to indicate a policy-related Action, while the other coder assigned a different Action category. These results suggest coders differed in their interpretation of this Action. [2] Interview participants queried how Action WI relates to Actions WC, WD, WE, and WF, which address restrictions on products that would often involve putting legislation or regulations in place. [3]	Action WI 'Legislation or regulations, other' is defined as 'Making or enforcing rules concerning behaviour of individuals or organisations'. Findings suggest that clarification is needed concerning the scope of WI, including whether it should be assigned for IUs involving rules that are not legally enforceable (such as rules put in place within a school), and its applicability with respect to other ICHI Actions that would often involve putting legislation or regulations in place, such as Actions WC to WF ('Restrictions on…') and WG ('Applying incentives'). Propose revising the title, definition, inclusions and exclusions for WI 'Legislation or regulations, other' to clarify its scope and applicability. *(Tier 3)*
Definition and scope of ICHI Action – WG 'Applying incentives' Coding notes queried the scope of application of this Action, e.g., would it include funding programs aimed at encouraging organisations to implement certain activities/programs, or competitions aimed at motivating people to do certain activities? It was also suggested that this Action should more clearly apply both to incentives and disincentives. [1] In the Netherlands data set, one coder assigned WG to several IUs that involved using a motivational approach to achieving behaviour change (e.g., a competition, a motivational sticker system, and coaching and role modelling), while the other coder applied RD 'Provision' or recorded 'C' to indicate no appropriate Action category could be found. In the Tobacco Control data set, one coder assigned WG to IUs involving legislated financial penalties, while the other coder assigned different Actions for these IUs (e.g., 'Restrictions on the sale or distribution of products'). These results suggest that coders had different interpretations of Action WG. [2]	Action WG 'Applying incentives' is defined broadly as 'Putting in place an inducement for the purpose of encouraging a particular action or behaviour, by means of a reward or penalty of some kind', but is used in ICHI alpha 2016 only together with Means QF 'Economic instruments', defined as 'Economic policy measures that encourage improvements in behaviours concerning patterns of physical activity via their impact on market signals'. Findings suggest that clarification is needed concerning the scope of WG in terms of the range of incentivising mechanisms covered, and whether it should be applied to legislated penalties. Propose revising the definition, inclusions and exclusions for WG 'Applying incentives' to clarify its scope, and adding 'Applying disincentives' as an inclusion. *(Tier 3)*

A7.1: Detailed findings to inform further development of ICHI

Findings	Comments and proposals for consideration
Definition and scope of ICHI Action – VN 'Establishing health services or health-related services', VO 'Marshalling health services or health-related services', and VP 'Improving access to health services or health-related services' In the Netherlands data set, VN was assigned to an IU that involved establishing a special 'sports club' within a neighbourhood to facilitate young people to participate in organised physical activity, and VP was assigned for several IUs aimed at creating a pathway for people to establish ongoing involvement in organised sport. It was queried whether sports clubs/associations could be regarded as 'health-related services'. In the Tobacco Control data set it was noted that as VN includes providing medicines and training health personnel there is an overlap with Actions RD 'Provision' and PH 'Training'. [1] In the Netherlands data set, one coder assigned VP for several IUs involving facilitating access to opportunities to be physically active (e.g., sporting clubs), while the other coder assigned different Actions for these IUs (e.g., 'Training', 'Collaborating'). In the Tobacco Control data set different patterns of use of Actions VN, VO and VP between the two coders suggested different interpretations of these Actions. [2]	ICHI includes only one intervention code for each of the Actions VN, VO and VP: UE1 VN ZZ 'Establishing services', UE1 VO ZZ 'Marshalling services', and UE1 VP ZZ 'Improving access to services'. Findings suggest clarification is needed regarding the scope of these three Actions and their use in relation to other Actions. Propose review of Actions VN, VO and VP to clarify what is meant by 'health services or health-related services, and their applicability relative to other ICHI Actions (e.g., RD 'Provision' and PH 'Training'). *(Tier 3)*

A7.1: Detailed findings to inform further development of ICHI

Findings	Comments and proposals for consideration
Action concepts not adequately captured by ICHI – Running an event or activity in which people could participate No applicable Action category was found for IUs that involved running an event or activity in which people could participate (e.g., organising a walking group or holding a food-tasting session). Such interventions are intended to work in various ways, e.g., to motivate people to engage in healthy behaviours, to provide opportunities for people to engage in healthy behaviours, to change social norms concerning healthy behaviours, and to raise awareness (e.g., about relevant services or amenities). [1] In the OPAL data set there were several IUs that involved running an event or activity in which people could participate; in some cases both coders recorded 'C' while in others one coder recorded 'C' and the other assigned an Action category (e.g., 'Provision', 'Capacity building', 'Collaborating'). [2] Interview participants noted that interventions that provide an opportunity for people to do or try something (e.g., healthy food tasting sessions, fun runs) are common but difficult to characterise. Event interventions often combine a number of objectives and different community actors, and may be implemented as the first step in starting a new collaboration or partnership. One participant noted 'Reducing barriers to participation' as a gap in the Action axis. [3]	While findings suggest that there is a gap, careful consideration will be needed as to how these types of interventions should be characterised, i.e., what might be a meaningful basis for describing and grouping such interventions given that they are diverse in terms of their hypothesised mechanism of action. Propose addition of new Action category or categories to capture IUs that involve events or activities in which people can participate; the new Action/s should correspond to recognised approaches used in public health and should convey information about both what is done and how it is expected to work. *(Tier 2)*
Action concepts not adequately captured by ICHI – Raising awareness No applicable Action category was found for IUs that were primarily aimed at raising awareness or promoting a particular behaviour (e.g., drinking water), e.g., distribution of promotional products, display of public signage or running a special event to raise awareness about a health issue, health-related behaviour or health-related service or resource. [1] In the OPAL data set, IUs that involved raising awareness were frequently subject to coding discrepancies in Action category assignment, with Actions assigned including 'Education', 'Capacity building' and 'Provision', or 'C' recorded. [2] Interview participants noted 'Awareness raising' as a gap in the Action axis; awareness raising was regarded as different to education. [3]	Findings suggest that interventions involving raising awareness cannot be adequately captured with existing ICHI Actions; this is a gap in the Action axis. Propose addition of new Action category or categories to capture IUs that involve raising awareness; the new Action/s should correspond to recognised approaches used in public health and should convey information about both what is done and how it is expected to work. *(Tier 2)*

A7.1: Detailed findings to inform further development of ICHI

Findings	Comments and proposals for consideration
Action concepts not adequately captured by ICHI – Environmental change intended to influence people's behavioural choices Some IUs involved local, small-scale or temporary environmental change intended to influence people's behavioural choices (e.g., changes to a school playground to encourage physical play, changes to the display of food in a cafeteria). Action TK 'Public facilities or infrastructure development' was judged not to be applicable and no other appropriate Action was available. [1] Interview participants noted 'nudge' interventions as a gap in the Action axis [3]	Findings suggest that interventions involving small-scale or temporary environmental change intended to influence people's behavioural choices (i.e., 'nudge' or 'choice architecture' interventions) cannot be captured with existing ICHI Actions; this is a gap in the Action axis. Propose addition of new Action 'Environment modification', to cover IUs involving local, small-scale or temporary physical environmental change intended to influence people's behavioural choices. *(Tier 2)*
Action concepts not adequately captured by ICHI – Motivational stimulus Several IUs involved providing a motivational stimulus intended to bring about a change in behaviour, e.g., by providing products (pedometers for measuring physical activity), monitoring achievement against goals, running a competition, providing role models, and giving out prizes. For some IUs an appropriate ICHI Action was found to describe what was done (e.g., AI 'Monitoring'), and for others WG 'Applying incentives' seemed applicable, but no ICHI Action was available to directly capture the concept of providing a motivational stimulus. [1]	Providing a motivational stimulus describes the intended effect of an IU, not the deed done. Consideration is needed concerning whether ICHI should provide a way of identifying and grouping IUs that provide a motivational stimulus in order to influence behaviour and how this could be done (e.g., a new Action category or Extension code). Propose consideration of whether and how providing a motivational stimulus could be captured in ICHI, e.g., by adding a new ICHI Action or an Extension code; this should be considered in light of existing Actions RC 'Emotional support' (which includes providing motivational support), and WG 'Applying incentives'. (*Tier 2)*
Action concepts not adequately captured by ICHI – Coaching and mentoring Individual coaching and mentoring featured in several IUs. Where the IU was intended to be motivational in effect, ICHI Action 'Emotional support' was assigned because the definition for this Action includes 'motivational support'. It was sometimes difficult to decide whether coaching/mentoring should be regarded as an Action or Means in the context of the intervention description. [1]	Coaching and mentoring are well-recognised approaches that aim to assist a person to achieve a desired behaviour. Coaches can provide training, motivation, advice, support, etc., which can be captured by specific ICHI Actions (e.g., 'Training', 'Advising'). Findings suggest that consideration is needed concerning whether and how coaching and mentoring IUs should be captured in ICHI. Propose consideration of whether and how coaching and mentoring should be captured in ICHI e.g., by adding a new ICHI Action or Means, or as inclusions for an existing Action. *(Tier 2)*

A7.1: Detailed findings to inform further development of ICHI

Findings	Comments and proposals for consideration
Action concepts not adequately captured by ICHI – Policy change No ICHI Action was available to capture IUs involving developing, changing, or maintaining policy on a particular topic within an organisation or a jurisdiction (e.g., adoption of a breastfeeding-friendly policy by a local Council or a 'no junk food' policy by a school). [1] Interview participants noted policy change measures as a gap in the Action axis. [3]	Findings suggest that interventions involving policy change cannot be captured with existing ICHI Actions; this is a gap in the Action axis. Propose addition of new Action category 'Policy change'. *(Tier 2)*
Action concepts not adequately captured by ICHI – Development of legal or administrative infrastructure No ICHI Action was available to capture development of legal or administrative infrastructure (e.g., Establishment of national coordinating mechanism for tobacco control). [1]	Findings suggest that interventions involving development of legal or administrative infrastructure cannot be captured with existing ICHI Actions; this is a gap in the Action axis. Propose addition of new Action category 'Development of legal or administrative infrastructure in relation to health'. *(Tier 2)*
Action concepts not adequately captured by ICHI – Development of guidelines No ICHI Action was available to capture development of guidelines (e.g., development of evidence-based tobacco cessation guidelines). [1]	Findings suggest that interventions involving development of guidelines cannot be captured with existing ICHI Actions; this is a gap in the Action axis. Propose addition of new Action category 'Development and implementation of guidelines in relation to health'. *(Tier 2)*
Action concepts not adequately captured by ICHI – Facilitating and conducting research No ICHI Action was found for the Tobacco Control IU concerning the promotion of research on topics relevant to tobacco control. [1]	Findings suggest that interventions involving facilitating and conducting research cannot be captured with existing ICHI Actions; this is a gap in the Action axis. Propose addition of new Action category 'Facilitating or conducting research in relation to health'. *(Tier 2)*
Action concepts not adequately captured by ICHI – Social marketing Interview participants noted 'Social marketing' as a gap in the Action axis. [3]	Social marketing is a recognised approach in contemporary public health practice. Findings suggest the need for consideration concerning whether and how social marketing IUs should be captured in ICHI. Propose consideration of whether and how social marketing should be captured in ICHI, e.g., by adding a new ICHI Action or Means, or as an inclusion for an existing Action. *(Tier 2)*

A7.1: Detailed findings to inform further development of ICHI

Findings	Comments and proposals for consideration
Action concepts not adequately captured by ICHI – Enablement It was noted, for an IU that aimed to facilitate parents at a school to collectively influence the drinking culture of their children, that there was no Action that could capture the concept of empowerment. [1] Interview participants noted 'Enablement' as a gap in the Action axis. [3]	'Enablement' describes the intended function of an IU, not the deed done. Enablement could involve changing any of a range of individual factors (e.g., knowledge, motivation) or environmental factors (e.g., social norms or aspects of the physical environment) to facilitate a desired behaviour (e.g., increased physical activity). Consideration is needed concerning whether ICHI should provide a way of identifying and grouping IUs for which enablement is the hypothesised mechanism of action, and how this could be done (e.g., a new Action category or Extension code). This should be considered in conjunction with a consideration of whether and how particular 'enabling factors' or 'behavioural preconditions' might be captured in ICHI (see above). Propose consideration of whether and how enablement could be captured in ICHI, e.g., as an Action or Extension code. *(Tier 2)*
Action concepts not adequately captured by ICHI – Changing social norms 'Changing social norms around behaviours' noted as a gap in the Action axis. [3]	'Changing social norms' describes the intended function of an IU, not the deed done. Consideration is needed concerning whether ICHI should provide a way of identifying and grouping IUs that aim to change social norms as a mechanism for influencing behaviour, and how this could be done (e.g., a new Action category or Extension code, or proximate Target). Propose consideration of whether and how changing social norms could be captured in ICHI, e.g., as an Action category or Extension code, or proximate Target. *(Tier 2)*

4. Means – concepts and categories

Findings	Comments and proposals for consideration
Need for clarification concerning the ICHI concept of 'Means' in relation to public health interventions Often it was difficult to articulate the Means for an IU. Coding notes queried what information could usefully be captured by ICHI Means categories that would provide a basis for grouping interventions in a meaningful way (e.g., possible Means categories for IUs involving Actions such as 'Collaborating', 'Provision', 'Public facilities and infrastructure development'). Further, for many IUs it was difficult to identify Action and Means as distinct concepts, e.g., 'coaching' and 'policy change' could arguably be viewed as either Action or Means. For some IUs, the ICHI Action 'Training' could be viewed as a Means of building capacity. [1] Interview participants noted that articulating a clear conceptual distinction between Action and Means is difficult in public health, and that this is not a distinction normally made. The ICHI Means axis was not seen as very useful in its current form. Different views were expressed re use of the Means axis in ICHI: • Intervention delivery varies in response to local factors and it is not desirable to try to capture this information in ICHI; • Information on how an intervention is delivered is useful; Means categories should enable a finer-grained description of how things are done and should reflect contemporary, evidence-based approaches. • This axis could be used instead to capture different dimensions of information about an intervention, such as ecological system level or enablers of behaviour change (e.g., affordability, knowledge, skills). [3]	Findings suggest that, in its current form, the Means axis does not function well for describing and grouping public health interventions. Propose articulation of an editorial principle addressing how the ICHI concept of Means is operationalised for public health interventions, informed by input from the field concerning what is a meaningful basis for distinguishing between different types of interventions and grouping interventions. A pragmatic approach may be to state that Means categories for public health interventions enable further distinctions to be made in relation to particular Actions or groups of Actions, where this is necessary. The editorial principle should clarify the conceptual distinction between Action and Means, and should state that Means categories are to relate to contemporary, evidence-based approaches in public health practice. *(Tier 1)* Review of existing ICHI Means categories and consideration of new Means categories should be consistent with this editorial principle. *(Tier 2)* User guidance should explain how the ICHI definition of Means is operationalised for public health interventions. *(Tier 4)*
Mix of Means in a single IU There were many IUs involving the delivery of education, training or advice using a combination of tools and methods, e.g., website, information and communications technologies, information-sharing, discussion forum, promotional products, theatre performances. No ICHI Means categories were available to capture these tools and methods, individually or in combination. [1]	Findings suggest the need to consider whether Means categories should be available in ICHI for distinguishing between different approaches for delivering education, training or advice, in light of the fact that it is common for such interventions to use a combination of different approaches. Propose consideration of the need to develop Means categories to distinguish between different approaches for delivering education, training or advice. *(Tier 2)*

A7.1: Detailed findings to inform further development of ICHI

Findings	Comments and proposals for consideration
Definition and scope of ICHI Means – QA 'Media campaign', QB 'Curriculum' and QC 'Instructional materials' For Means QB, coding notes queried what counts as a 'course of study', e.g., should 'Curriculum' be used to describe one or more workshops or group learning sessions, or a course of judo lessons? For Means QC, it was noted that 'Instructional materials' was often not a good description of written materials that are not 'instructional' in nature (e.g., web page used for communicating with parents, grandparents and people working with children), and the title of this Means suggests a narrower meaning that the definition implies. [1] Systematic differences between coders were apparent in the use of QA, QB and QC, suggesting that coders differ in their interpretation of these categories (i.e., interpreting them more broadly or more narrowly); e.g., for an IU involving group discussion with supporting materials (DVD and guide), Coder 1 assigned Means QC, while coder 2 recorded 'C' to indicate that no applicable Means could be found. [2] Some comments made by interview participants suggested that 'Curriculum' may not be interpreted consistently. [3]	Findings suggest clarification is needed regarding the scope of Means categories QA, QB and QC. Propose review of definitions and inclusions/exclusions for Means categories QA, QB and QC to clarify their scope of application. *(Tier 3)*

A7.1: Detailed findings to inform further development of ICHI

Findings	Comments and proposals for consideration
Definition and scope of ICHI Means – QD 'Enactment' and QE 'Enforcement' It was noted that Means QD and QE do not have definitions, but their use in ICHI intervention codes suggests that they are only applicable to restrictions or requirements imposed with a degree of legal force. Coding notes queried whether 'Enforcement' is only applicable for IUs involving legally enforceable rules, and also whether 'Enforcement' should be applied for an IU that puts enforcement mechanisms in place or allocates resources for enforcement (e.g., providing mechanisms or infrastructure for enforcing a ban on tobacco smoking in public places). [1] Systematic differences between coders were apparent in the use of Enactment (QD) and Enforcement (QE), suggesting that coders interpreted these categories differently; e.g., for an IU involving legislation for the regulation of the contents of tobacco products, Coder 1 assigned QE while Coder 2 assigned QD. In the OPAL data set, Coder 1 assigned 'Enactment' for 62% of IUs, while coder 2 did not assign this Means at all, suggesting that Coder 1 used QD as a residual category to indicate that something was done, where no other applicable Means was available. [2]	Findings suggest that clarification is needed regarding the scope of Means categories QD 'Enactment' and QE 'Enforcement', which do not have definitions. Propose adding the following definitions: QD 'Enactment': Passing laws or putting enforceable rules or obligations in place. QE 'Enforcement': Compelling observance of or compliance with a law, rule, or obligation, *incl*. Providing mechanisms or resources for enforcement. *(Tier 3)*
Definition and scope of ICHI Means – QF 'Economic instruments' For the tobacco control data set, differences between coders in the use of this Means suggested coders interpreted it differently; e.g., Coder 1 assigned Means QF for an IU involving facilitating affordability of pharmaceutical products and an IU involving enforcing penalties for cross-border advertising, while Coder 2 assigned it for an IU involving implementing tax policies to reduce tobacco consumption. [2]	Means QF 'Economic instruments' is defined as 'Economic policy measures that influence behaviour via their impact on market signals', incl. 'taxes, marketable permits, deposit-refund systems, performance bonds'. Findings suggest that clarification is needed regarding the applicability of Means QF. Propose review of definition and inclusions/exclusions for Means categories QF to clarify its scope of application. *(Tier 3)*

A7.1: Detailed findings to inform further development of ICHI

Findings	Comments and proposals for consideration
Means concepts not adequately captured by ICHI There were several Means concepts identified in IU descriptions for which an ICHI Means could not be found. These included: participatory learning, group discussion, workshop, games, presentation, meetings, interactive website, app, home visit, survey, community consultation, community event, and theatre performance. Many IUs involved group delivery of education or training and in some cases group interaction was central to how the learning process was intended to work. [1] Interview participants suggested the following as possible new Means categories: 'Group pressure', 'Tailored information delivered via apps or websites'. For the Action 'Collaborating' it was suggested that Means could be used to describe the structures through which collaboration is achieved (e.g., 'Coalitions', 'Steering committees') or models of decision-making (e.g., 'Shared decision-making'). [3]	Means concepts identified as not adequately captured in ICHI could be used as a basis for developing new Means categories. However, such development should be consistent with the editorial principle concerning how the ICHI concept of Means is operationalised for public health interventions (see above). Means categories should provide a meaningful basis for distinguishing between different types of interventions and grouping interventions. Propose review of existing Means categories and addition of new Means categories, where appropriate, in accordance with editorial principle concerning how the ICHI concept of Means is operationalised for public health interventions. *(Tier 2)*

5. Intervention code

Findings	Comments and proposals for consideration
Limitation: each ICHI code conveys only one Target, Action and Means Where two or more applicable Target or Action categories had been identified for the IU, the assigned intervention code could capture only one category for each axis, thus the code was judged to not fully capture the nature of the IU. [1] Several participants commented on the fact that an ICHI intervention code can convey only a single Target, Action and Means; this was seen to be a limitation. Two participants suggested that allowing more than one Target and Action to be recorded for a single IU would enable interventions to be more fully and meaningfully characterised. [3]	Findings suggest that pre-coordinated ICHI intervention codes that capture a single Target, Action and Means per IU may have limitations in relation to some information needs. Propose allowing use of ICHI axes separately, as an alternative to use of pre-coordinated ICHI intervention codes, so that users may record multiple axis categories per IU where this would better meet their information needs. *(Tier 1)* User guidance should explain how additional axis categories may be captured, where necessary, alongside ICHI intervention codes. *(Tier 4)*

A7.1: Detailed findings to inform further development of ICHI

Findings	Comments and proposals for consideration
Wording of ICHI intervention code titles – implied relationship between Action and Target Many ICHI code titles and/or definitions suggest a direct relationship between the Action and the Target (e.g., 'Education *about*…[Target]'), or specify the effect that the Action is expected to have on the Target (e.g., 'Provision of products and services *to support* [Target]'); sometimes this does not match how a given intervention is intended to work, e.g., for the IU 'Workshop on designing natural playgrounds', the education is not 'about' physical activity behaviours, but the intervention is intended ultimately to influence physical activity behaviours. This is particularly an issue for IUs designed to operate through an indirect change pathway. In some cases the indirect relationship between Action and Target is due to the ecological nature of the IU (e.g., the IU is directed at a higher system level but aims to achieve behaviour change at individual level), in other cases it is due to the IU being directed at a proximate Target (e.g., an aspect of the environment) with the aim of affecting an ultimate Target (e.g., a health behaviour). [1]	The findings suggest that intervention code titles and definitions should be reviewed and modified as necessary to ensure that they do not imply a particular relationship between Action and Target, where other types of relationship between Action and Target are also possible, i.e., titles should accommodate all types of IU to which the intervention code, with its particular combination of Target, Action and Means, can legitimately be assigned. Propose review of the wording of intervention code titles and definitions, and modification as necessary to ensure that the wording accommodates all IUs to which that code could be assigned; e.g., titles of codes with Action PM 'Education' could be of the form 'Education *to influence* [behaviour]'. *(Tier 3)*
Wording of ICHI intervention code titles – 'Collaborating' codes Titles of ICHI intervention codes using the Action 'Collaborating' are of the form 'Stakeholder partnership interventions targeting …'; it was noted that the term 'stakeholder partnership' does not provide a good fit for interventions involving exchange of information or other less invested modes of cooperation. [1]	Findings suggest that the title wording for codes with Action TD and a health-related behaviour Target should be modified to better accommodate interventions involving less invested modes of cooperation. Propose modifying title wording for codes with Action TD and a health-related behaviour Target to the form: 'Collaborating or building partnerships in relation to [behaviour]*'. (Tier 3)*

A7.1: Detailed findings to inform further development of ICHI

Findings	Comments and proposals for consideration
Missing ICHI intervention codes For some IUs there was no ICHI intervention code available combining the axis categories selected, suggesting gaps that could be filled by adding new intervention codes combing existing axis categories. For example, a code combining Target 'Breastfeeding' and Action 'Advocacy' was not available to capture an IU involving advocacy to encourage local council to put breastfeeding-friendly policies in place and make council venues breastfeeding-friendly. [1] It was noted that residual codes of the form 'Other interventions targeting …' ('ZY ZZ' codes) were not available for some Targets (e.g., UE1 and UAA). [2]	Propose adding new intervention codes combining health-behaviour Targets with: • Action AC 'Test' and Means ZZ 'Other…' • Action WG 'Applying incentives' and Means QF 'Economic instruments' • Action WG 'Applying incentives' and Means ZZ 'Other…' • Action TA 'Advocacy' and Means ZZ 'Other…' Also new codes: • UAA AC ZZ 'Laboratory testing of products or substances for personal consumption' • UAA TD ZZ 'Collaborating or building partnerships in relation to products or substances for personal consumption' • VEF PH ZZ, VEK PH ZZ, VEL PH ZZ ('Training' codes) • VEJ PN ZZ ('Advising' code) • VAB WI QD, VAB WI QE ('Legislation or regulation, other' codes) Also add residual codes of the form 'Other interventions targeting …' ('ZY ZZ' codes) for environmental factor Targets where these codes are not available. *(Tier 2)*
Overlap between ICHI intervention codes Some instances of apparent overlap between ICHI codes were noted, where two applicable codes were identified, based on wording of the code title, definition and inclusions. [1]	Propose review the following pairs of codes and necessary changes to definitions, inclusions and exclusions to ensure mutual exclusivity: • PZA PG EE and SDJ PG EF • VEB PN ZZ and VEB TI ZZ • VAB WC QD and VAB WD QD • UBC AA ZZ and AI codes with health-related behaviour Targets *(Tier 3)*

A7.1: Detailed findings to inform further development of ICHI

Findings	Comments and proposals for consideration
Use of codes with Actions VN, VO and VP In the Netherlands data set, code UE1 VP ZZ 'Improving access to services' was assigned for 22 IUs and code UE1 VN ZZ 'Establishing services' was assigned for 1 IU. There is a 'code also' rule for these codes, instructing the user to record an 'additional code describing the individual intervention delivered via this public health intervention'. In all instances the additional code recorded was VEB ZY ZZ 'Other interventions targeting physical activity behaviours, not elsewhere classified', as these IUs all involved establishing or improving access to organised physical activity (e.g., sports clubs) and no more specific ICHI code was available to capture this; it was noted that the codes assigned did not capture the creation of links between organisations, which was a key characteristic of these interventions, or the nature of the services to which access was improved. [1]	ICHI includes only one intervention code for each of the Actions VN, VO and VP: UE1 VN ZZ 'Establishing services', UE1 VO ZZ 'Marshalling services', and UE1 VP ZZ 'Improving access to services'. Each of these codes has a 'code also' note, instructing users to also record an 'additional code describing the individual intervention delivered via this public health intervention'. Findings suggest that this coding arrangement may not work efficiently to capture the nature of IUs in some instances. Propose review of use of Actions VN, VO and VP in constructing intervention codes, including possibility of adding codes using these Actions together with health-related behaviour Targets to more directly capture establishing, marshalling or improving access to services in relation to a particular health-related behaviour, without need for a 'code also' rule (e.g., VEB VP ZZ 'Improving access to services in relation to physical activity behaviours; VAB VN ZZ 'Establishing services in relation to tobacco use behaviours'). *(Tier 2)*
Use of environmental factor or health-related behaviour as Target in construction of ICHI intervention codes It was noted that, for intervention codes concerning restrictions and requirements in relation to products (i.e., Actions WC to WF), the product as the proximate Target is, in effect, conveyed by the Action category, while the behaviour as the ultimate Target is conveyed by the Target category. Other product-directed intervention codes are constructed using an environmental factor Target category (e.g., UA1 AA ZZ 'Assessment of products and technology', where UA1 is 'Products and technology'). Some IUs with an environmental factor proximate Target and health-related behaviour ultimate Target were assigned codes that did not capture the environmental factor focus of the IU at all (e.g., audit of walkability of local shopping centres was assigned VEB AA ZZ 'Assessment of physical activity behaviours'). [1]	This finding concerns the nature of information represented on each classification axis. Because some Action categories convey information about a proximate Target some intervention codes convey information about both proximate and ultimate Target, while others only convey information about the ultimate Target. This is an inconsistency. Propose articulation of an editorial principle concerning how IUs involving a proximate environmental factor Target and an ultimate health-related behaviour Target should be represented in ICHI. *(Tier 1)* Axis categories and intervention codes should be reviewed for consistency with this principle. *(Tier 2)*

6. Other issues

Findings	Comments and proposals for consideration
System level at which intervention directed not captured in ICHI In some cases the content of an intervention is delivered directly to those people whose behaviour it is ultimately intended to influence (e.g., teaching children about healthy eating), while in other cases it is directed towards elements in the broader environment or system (e.g., teaching childcare workers how to encourage kids to eat healthy foods). ICHI does not capture this distinction. The OPAL data set included a data item to record the hypothesised 'change pathway' for OPAL Projects in terms of the system level to which the intervention was immediately directed and the consequent changes at other system levels expected. This data item was based on the ecological coding scheme developed by Richard et al. (1996), and could potentially be considered as a basis for developing an ICHI extension code to capture information on system level. [1] Interview participants noted the social-ecological system level at which an intervention is implemented (or 'ecological target') as important information not captured by ICHI. ICHI does not distinguish between direct and indirect interventions (e.g., 'train-the-trainer' interventions). [3]	Findings suggest that the social-ecological system level to which an IU is addressed is important information for characterising and distinguishing between IUs, and is not able to be captured by ICHI. Propose adding an extension code to record the system level at which the IU is directed, based on the ecological coding scheme developed by Richard et al. (1996). *(Tier 2)*
Other distinctions not captured by ICHI codes – Enabling factors Interview participants noted that ICHI does not capture information on 'enablers' (such as affordability, knowledge, attitudes, capacity, and reducing barriers to participation) as factors an intervention seeks to influence and the first link in the behaviour-change pathway; they emphasised the importance of information on enablers for describing the mechanism through which an intervention operates. [3]	Information on the enabling factor/s that an intervention seeks to change (e.g., affordability, attitudes) is relevant for describing the mechanism by which the intervention is intended to work. Propose consideration of whether and how enabling factors should be captured in ICHI, e.g., as Target categories or Extension codes. *(Tier 2)*

A7.1: Detailed findings to inform further development of ICHI

Findings	Comments and proposals for consideration
Other dimensions of information not captured by ICHI Additional dimensions of information used to describe interventions (e.g., setting and demographic characteristics of the population to which the intervention was directed) were identified within textual intervention descriptions and other data items contained in the three data sets (Table 4.3). [1] Interview participants identified a number of other types of information about interventions not captured in ICHI: intervention duration; setting; target population group (e.g., as defined by age group or risk level); type of nicotine product; why the intervention was performed; and co-benefits delivered by public health interventions (e.g., economic benefits, tourism attraction). [3]	Many additional dimensions of information are potentially relevant for describing and grouping interventions in relation to particular information needs, however it is not feasible for all these dimensions of information to be captured in ICHI. Propose that user guidance should clearly explain the information dimensions that are captured by ICHI axes and extension codes and encourage users to capture other information about interventions alongside ICHI-coded data (i.e., in separate data fields), as appropriate in a given application. *(Tier 4)*

Reference

Richard L, Potvin L, Kishchuk N, Prlic H & Green LW 1996. Assessment of the integration of the ecological approach in health promotion programs. *American Journal of Health Promotion*, 10(4), 318-328.