Interventions for Children with Foetal Alcohol Syndrome within Early Childhood Development: A RE-AIM Framework Review

by

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ABSTRACT

Alcohol consumption during pregnancy is a widespread global issue, impacting the development of children both in utero and throughout early childhood, up to the age of eight. This leads to lifelong challenges associated with foetal alcohol syndrome for affected children and their families. This systematic review, using the RE-AIM framework, aimed to identify and describe interventions used for children with foetal alcohol syndrome within the context of early childhood development, employing Bronfenbrenner's ecological system's approach to understand the influence of prenatal alcohol exposure on child development.

The findings of this study highlight the importance of prevention interventions. For effective outcomes, interventions need to be multidisciplinary, potentially combining pharmacological treatments for comorbid symptoms with behavioural interventions. The study also emphasises the adaptability of interventions to meet the specific needs of individual foetal alcohol spectrum disorder cases.

Recommendations include developing appropriate services and support structures for parents, families, governments, and other stakeholders to improve awareness and outcomes in early childhood development. Governments should allocate appropriate funds within the Basic Education Department to support interventions, and an early intervention programme in schools for children with foetal alcohol spectrum disorder should be established. Additionally, sharing interventions from high-prevalence countries can inform South African-specific guidelines for screening, referral, and support. A focused alcohol consumption census-style study is advised to comprehensively capture the nation's alcohol consumption patterns, enabling researchers to prioritise areas for intervention.

KEYWORDS

Early childhood development

Foetal alcohol disorder

Foetal alcohol spectrum disorder

Intervention

Prenatal alcohol consumption

Prenatal alcohol exposure

Secondary disabilities

DECLARATION STATEMENT

I declare that the study entitled, 'Interventions for children with Foetal Alcohol syndrome within Early Childhood Development: A RE-AIM Framework Review', is a result of my own research. All the sources used in this study, have been indicated and fully acknowledged, by means of complete references.

Name: Lorenzo Blouw

Date: 2 July 2024

Signed: ……………………………………

DEDICATION

I would like to dedicate this thesis to my children.

I realise it has been a long and difficult journey. Time was short, and we faced many challenges, including financial difficulties. I know I have made many promises, but some things take longer than others. I can promise that this is not the end. We will achieve all that we have planned. I am doing all of this not only for myself but for all of you.

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Lastly, I thank God Almighty for giving me the strength, guidance, commitment, and perseverance to achieve my goal.

LIST OF ABBREVIATIONS & ACRONYMS

ABA	Applied Behavioural Analysis
ADHD	Attention Deficit Hyperactivity Disorder
AOD	Alcohol or Other Drug
APA	American Psychiatric Association
ARBD	Alcohol Related Birth Defects
ARND	Alcohol Related Neurodevelopmental Disorder
AUD	Alcohol Use Disorder
BEST	Bio-Ecological Systems Theory
BMA	British Medical Association
BST	Behavioural Skills Training
CBT	Cognitive Behavioural Therapy
CDC	Centers for Disease Control and Prevention
CFT	Children's Friendship Training
CNS	Central Nervous System
CPP	Child Parent Psychotherapy
DSM-5	Diagnostic and Statistical Manual of Mental Disorders
DTC	Delayed Treatment Control
ECD	Early Childhood Development
EMA	European Medicines Agency
EST	Ecological Systems Theory
FAS	Foetal Alcohol Syndrome
FASD	Foetal Alcohol Spectrum Disorder
FMF	Family Moving Forward
FOT	Families on Track
GBG	Good Behaviour Game
IQ	Intelligence Quotient

MPE	Mindful Parenting Education
ND-PAE	Neurobehavioral Disorder associated with Prenatal Alcohol Exposure
NDA	National Development Agency
NOFAS	National Organisation on Foetal Alcohol Syndrome
PAE	Prenatal Alcohol Exposure
PAHO	Pan American Health Organisation
PCAP	Parent-Child Assistance Programme
pFAS	Partial Foetal Alcohol Syndrome
PIO	Patient or Problem, Intervention and Outcome
PPCT	Person Process Context Time
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PuP	Parent under Pressure
RCT	Randomised Controlled Trial
RE-AIM	Reach, Effectiveness, Aims, Implementation, Maintenance
SES	Socioeconomic Status
T-ACE	Tolerance, Annoyed, Cut down and Eye-opener
UNICEF	United Nations Children's Fund
USPSTF	US Preventive Services Task Force
UWC	University of the Western Cape
VB	Verbal Behaviour
WHO	World Health Organisation

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CHAPTER 1

INTRODUCTION

1.1 Introduction and Background

The consumption of alcohol is a common phenomenon that affects many people worldwide. A study conducted by Popova et al. (2017) revealed that globally, approximately 1 in 10 women (9.8%) consume alcohol while pregnant. Alcohol consumption during pregnancy is a phenomenon that may result in children being born with foetal alcohol syndrome disorder (FASD) (Cloete & Ramugondo, 2015), an umbrella term used to describe individuals who experience disabilities related to prenatal alcohol exposure (PAE) (Popova et al., 2016). Foetal alcohol syndrome (FAS) is the most common and severe adverse outcome of FASD (British Medical Association [BMA], 2016; Popova et al., 2016; Popova et al., 2019), and is globally regarded as the leading cause of mental and physical handicaps in communities (Bailey & Sokol, 2008). Moreover, it has been recorded that not all pregnancies involving alcohol consumption leads to the delivery of children with FAS. However, no amount of alcohol consumption at any stage of pregnancy is safe (Cloete & Ramugondo, 2015).

Prenatal alcohol consumption interferes with the normal development progress of a foetus. It affects the development of both the central nervous system (CNS) and the physical development, resulting in lifelong health consequences (Lange et al., 2017; Popova et al., 2016). Furthermore, research suggests that the exposed foetus may also experience many somatic defects such as low birth weight, craniofacial abnormalities, and skeletal and organ defects (Feldman et al., 2012; Price et al., 2017).

FASD categorises a range of effects on a foetus that may result from maternal alcohol consumption during pregnancy (Price et al., 2017). These effects include but are not limited to behavioural, emotional, neurological, and structural problems in children (Jańczewska et al., 2019). While FAS is the most easily identifiable condition, the milder forms of FASD are likely to be more prevalent in the general population. However, many countries do not record prevalence estimates for FASD, which can affect the prioritisation of healthcare for individuals with FASD (Lange et al., 2017). The lack of prevalence estimates for FASD has hindered researchers from determining meaningful prevalence rates and evaluating the effects of interventions. However, more recently, some estimates have been published in certain settings (Lange et al., 2017). On average, 15 out of every 10 000 live births will result in FAS, meaning that globally there are 119 000 babies born with FAS each year. Recent studies suggest that this rate has increased, with an estimated 630 000 children born with FAS worldwide every year (Popova et al., 2017). Consequently, FASD is recognised as the leading preventable cause of learning disabilities, affecting an estimated 2% of all live births globally (Roozen et al., 2016; Westrup, 2013).

Furthermore, it is important to note that the severity and type of birth defects caused by alcohol exposure depend on various factors, such as dosage and the developmental stage of the foetus at the time of exposure (Flak et al., 2017; Lange et al., 2017; Subramoney et al., 2018). Price et al. (2017) emphasised that the frequency and timing of alcohol exposure, along with maternal nutrition, metabolism, genetics, and potential foetal vulnerabilities influence the nature and extent of foetal damage. Consequently, the risk of significant birth defects in infants increases with a combination of maternal risk factors and the amount and timing of alcohol consumption (Flak et al., 2014; Lange et al., 2017).

The presentation of FASD varies widely, and recent changes in diagnostic criteria have made it challenging to determine its prevalence (Signal et al., 2018; Vorgias & Bernstein, 2019). Typically, mothers are not routinely questioned about their alcohol intake during pregnancy, which frequently results in medical practitioners overlooking FAS symptoms and the necessity for FAS testing. This lack of awareness may result in undiagnosed cases of FAS. Additionally, FAS is not typically a visible birth defect, further contributing to delayed diagnosis. As a result, children are often only diagnosed at a later stage in their lives when secondary symptoms begin to appear (Signal et al., 2018). Therefore, the current study aims to review interventions for children with FAS within the context of early childhood development (ECD) globally, using a RE-AIM (Reach, Effectiveness, Aims, Implementation, Maintenance) framework.

1.2 Theoretical Framework

The *ecological systems theory* (later the *bio-ecological systems theory*) proposed by Uri Bronfenbrenner, which posits that the ecological environment is a series of nested structures, similar to a set of Russian nesting dolls (Berk, 2000), serves as the theoretical foundation of this study. According to this theory, Bronfenbrenner emphasises the significance of considering an individual's development within the societal and environmental context in which they live. The theory is comprised of five interconnected systems: the microsystem, mesosystem, exosystem, macrosystem, and the chronosystem (Berk, 2000).

In the context of FASD, the chronosystem explains the development of a drinking culture over time, while the microsystem elucidates the mother's interaction with alcohol and her interaction with the developing foetus. The mesosystem and exosystem contribute to a multidisciplinary approach to assessment and diagnosis, and the macrosystem has policy implications for children with FASD (Bronfenbrenner, 1979; Berk, 2000).

1.3 Problem Statement

South Africa has been ranked as one of the worst countries globally in terms of its level of alcohol consumption (Probst et al., 2017). Alcohol is a major contributor to disability and mortality (Lim et al., 2012), and a study by Abernethy et al. (2018) suggested that over 15% of women consume alcohol in excessive amounts. In South Africa specifically, previous research suggests that approximately 36.9% of pregnant women consume alcohol while pregnant (Petersen-Williams et al., 2014). More recent statistics show that globally, 1 in 10 women, or 9.8%, consume alcohol during pregnancy (Oh et al., 2020; Popova et al., 2017).

Furthermore, global statistics indicate that 1 in 13 women who consume alcohol during pregnancy are estimated to give birth to a baby with FASD (Popova et al., 2017; Lange et al., 2017). Popova et al. (2017) also report that an estimated 1 700 children are born with FASD every day, totalling around 630 000 annually. External factors such as exposure to violence (Skagerstróm et al., 2011), poor mental and physical health (Oh et al., 2017; Skagerstróm et al., 2014), smoking (Dumas et al., 2017), and lower educational attainment (Glass et al., 2017; May et al., 2008), among others, all contribute to prenatal alcohol consumption.

With all these potential factors, it is concerning that many cases of FASD are difficult to diagnose as the condition varies from case to case, and the diagnostic criteria and exact prevalence of FASD are difficult to determine (Signal et al., 2018; Vorgias & Bernstein, 2020). Consequently, interventions are often implemented at a later stage in a child's life. Children are typically only diagnosed with FASD when they reach school age and secondary symptoms become apparent (Signal et al., 2018). It is only then that interventions are initiated. As a result, approximately five crucial years (including the pregnancy period and up to age six) are lost during which interventions could have been implemented. Therefore, this study aims to explore interventions for children with FAS within the ECD period.

1.4 Research Question

The research *question* guiding this study was formulated as follows: "What interventions are available for children with FAS within ECD?"

1.5 Aim and Objectives

1.5.1 Aim of the study

The aim of this RE-AIM review was to identify interventions used for children with FAS within ECD.

1.5.2 Objectives of the study

The objectives of this study were to:

- Explore interventions used for children with FAS within ECD.
- Identify interventions and evaluate their effectiveness for children with FAS.
- Systematically appraise the methodological rigour of studies exploring interventions used for children with FAS within ECD.

1.6 Research Approach and Design

The current study conducted a systematic review employing a RE-AIM framework, recognised for evaluating public health interventions. This methodology is widely used to assess interventions and discern their strengths and limitations in terms of programme implementation (Lakerveld et al., 2012). The framework looks at the reach, efficiency/effectiveness, adoption, implementation, and maintenance of a study (Farris et al., 2007). Within the RE-AIM framework, an evaluation can be executed at an individual and organisational level, with each level providing valuable information on an intervention's impact (Boersma et al., 2015). The 'Reach' and 'Efficacy' elements of the RE-AIM framework evaluate the impact at an individual level, while 'Adoption' and 'Implementation' evaluate impact at an organisational level. 'Maintenance' can be used to determine the level of impact at both the individual and organisational levels (Lakerveld et al., 2012).

1.7 Definition of Key Terms/Concepts

Foetal alcohol spectrum disorder (FASD): an umbrella term used for a group of permanent, lifelong, and irreversible conditions in children caused by the effects of alcohol exposure during the mother's pregnancy (Popova et al., 2016).

Foetal alcohol syndrome (FAS): the most severe form of FASD with at least two characteristic facial fissures, growth retardation (height and weight), and smaller head circumference, as well as CNS damage with neurodevelopmental delays (Popova et al., 2016).

Prenatal alcohol consumption: the consumption of alcohol during pregnancy (Popova et al., 2016).

Prenatal alcohol exposure: the exposure of the developing foetus to alcohol in the womb (Popova et al., 2016).

Secondary disabilities: disabilities that are not present at birth but occur due to primary disabilities (Signal et al., 2018).

Early childhood development (ECD): the physical, cognitive, linguistic, and socio-emotional development of a child from the prenatal stage up to age eight (World Health Organization [WHO], 2016).

Intervention: a combination of programme elements or strategies designed to produce behaviour changes or improve health status among individuals or an entire population (Finfgeld, 2003).

1.8 Outline of Chapters

Chapter 1 – Introduction

Chapter 1 sets the stage for the study by providing context and background. It introduces the concepts of 'FAS' and 'maternal alcohol use', exploring their impact on ECD. Additionally, this chapter offers a brief overview of the theoretical framework underpinning the study, outlines the research methodology employed, and highlights the study's significance.

Chapter 2 – Theoretical Framework

Chapter 2 describes Bronfenbrenner's ecological systems theory, which forms the foundation of this study.

Chapter 3 – Literature Review

Chapter 3 presents the essential background information for investigating FAS interventions and their effectiveness on ECD. It discusses the existing literature and how the various concepts are interconnected.

Chapter 4 – Research Methodology

Chapter 4 delves into the methodology employed for this study, detailing the specific processes implemented to ensure its credibility and rigour. It encompasses the research design, inclusion and exclusion criteria, retrieval strategy, review methods, abstract assessments, full text assessment strategy, critical appraisal tools used, analysis methods, and ethical considerations.

Chapter 5 – Results

Chapter 5 presents the findings and discussion of the study in relation to the methodology used. It discusses the results of various interventions and their Reach, Effectiveness, Adoption, Implementation, and Maintenance.

Chapter 6 – Discussion

Chapter 6 expands upon the results of the preceding chapter by providing a thorough analysis. It delves deeper into the implications of the findings, examining them through multiple theoretical and methodological lenses to enhance understanding. This chapter contributes to the broader scholarly discourse by contextualizing the results and suggesting new directions for further research.

Chapter 7 – Conclusion

Finally, Chapter 7 offers an overall summary of the research, stating the significance and limitations of the study, as well as suggesting recommendations for future research.

1.9 Conclusion

In conclusion, Chapter 1 laid the groundwork for this study by providing the context and background information on FAS and maternal alcohol use, and their impact on ECD. It also introduced the theoretical framework, research methodology, and the significance of the study. The primary aim of this RE-AIM review was to identify interventions available for children with FAS within the context of ECD. Guided by the research question, "What interventions are available for children with FAS within ECD?", this study endeavoured to uncover and evaluate the existing strategies to support these children effectively.

The discussion now shifts to the theoretical framework underpinning this study.

CHAPTER 2

THEORETICAL FRAMEWORK

2.1 Introduction

This chapter provides the theoretical underpinnings for understanding FAS interventions within ECD. The study utilises Urie Bronfenbrenner's bio-ecological systems theory (BEST) as a framework to comprehend and evaluate interventions for children with FASD in the context of ECD.

2.2 Origins of BEST

The ecological systems theory, originally developed by psychologist Urie Bronfenbrenner in 1979, proposes that understanding human development requires understanding how it is influenced by environmental systems (Bronfenbrenner, 1979). Bronfenbrenner viewed development as the interaction between the individual and their context/environment. He formulated this theory after observing that previous research focused on development itself, rather than the role of context and its impact on development. He argued that the environment in which individuals exist and the interactions they have within these environments significantly influence their development (Paquette & Ryan, 2001).

Various scholars played a crucial role in Bronfenbrenner's thinking, which aided him in developing his theory. Theorists like Kurt Lewin, with his 1935 classical field theory (Britannica, 2024), argued that behaviour is the outcome of interaction between an individual and the environment. Bronfenbrenner incorporated this idea into his thinking and concluded that development is the result of the interaction between the individual and the environment (Paquette & Ryan, 2001).

Another significant influence on Bronfenbrenner's work is the contribution of Lev Vygotsky and his sociocultural theory. In the 1920s, Vygotsky focused his theory on the social and cultural forces in development and proposed that learned behaviour is influenced by an individual's social context (Mahn & John-Steiner, 2012). To understand how people learn, Vygotsky suggested that one must consider the social context in which a person exists and how these social contexts impact the learning process (Mahn & John-Steiner, 2012).

The earlier version of the ecological systems theory involved four ecological systems, which include the micro-, meso-, exo-, and macrosystems that an individual interacts with. Each of these systems is based within the other. The first layer, the *microsystem*, is the most immediate layer of the systems (Berk, 2000). Thus, within this level, the focus is on the individual's interpersonal interactions with their immediate environment. This includes the relationships an individual has with their parents, siblings, and peers22, among others.

The second level, known as the *mesosystem*, is the layer that surrounds the microsystem (Bronfenbrenner & Morris, 2006). This level promotes the idea that children not only develop based on the influence from their family members but also from the surrounding environments, which are equally influential.

The third layer, the *exosystem*, promotes the idea that environmental elements indirectly influence a child's development (Bronfenbrenner, 1992).

The fourth level in the ecological systems theory is the *macrosystem*. Bronfenbrenner proposed that cultural and societal beliefs, such as religion and gender norms, influence the child's development (Bronfenbrenner, 1992).

Critics of Bronfenbrenner’s ecological model argue that it fails to acknowledge individuals' inherent abilities and the fact that humans possess diverse characteristics, which can influence how they interact with the environment (Mönks & Mason, 1993). Similarly, Elder (1995) and Santrock (2008) have pointed out that Bronfenbrenner's ecological model does not account for the biological influences and cognitive processes that individuals bring into their interactions with others and their environments. Bronfenbrenner himself acknowledged this oversight in focusing primarily on the context, and he subsequently revised his theory by incorporating biological influences (Bronfenbrenner, 1989, 2005).

Bronfenbrenner revised the theory to include the active role of the individual in the development process and the biological disposition of the child, thus renaming it the 'bio-ecological systems theory' (Ettekal & Mahoney, 2017; Kaakinen et al., 2010). In addition to emphasising the role of the individual, in his new bio-ecological systems theory model, Bronfenbrenner also underscored the impact of time and processes (Rosa & Tudge, 2013). Moreover, Bronfenbrenner recognised that development is a process in which change occurs. Thus, in order for the process to occur, it takes time – hence time and process are important factors, which he included in his theory. With the help of a colleague, the *ecological theory* was reconstructed into the *bio-ecological systems theory*. With this, Bronfenbrenner added another layer to his model named the '*chronosystem'*, which refers to how an individual and their environments change over time. In this regard, a Person Process Context Time (PPCT) model was included in the theory (Bronfenbrenner, 1992).

2.3 The Bio-ecological Systems Theory

The BEST, conceptualised by Urie Bronfenbrenner, is a theory of development that suggests that human development is a transactional process. It posits that development is influenced by various aspects of the environment (Bronfenbrenner, 1992). Similarly, Ettekal and Mahoney (2017) explain that the BEST elucidates how human development is influenced by different types of environmental systems. Initially, Bronfenbrenner's ecological model consisted of the micro-, meso-, exo-, and macrosystems. However, with the revision of the theory, the chronosystem was added. The latter focuses on the interactions between a person and various systems over time, highlighting their mutual influence (Bronfenbrenner, 1992).

The BEST emphasises that an individual's development, specifically that of a child, is influenced by their environment. Children are typically exposed to various ecosystems or networks, ranging from their immediate home environment to the broader school system, and ultimately to societal and cultural environments (Paquette & Ryan, 2001). According to this theory, these environments interact with one another and impact a child's development. Moreover, the theory recognises that as children grow and mature physically and cognitively, the interactions within their environments become increasingly complex (Paquette & Ryan, 2001).

BEST is divided into five interconnected systems: the m*icrosystem, mesosystem, exosystem, macrosystem*, and the *chronosystem* (Berk, 2000; Rangmar et al., 2016). Each of these levels influences an individual's behaviour and adaptation (see Figure 1 below).

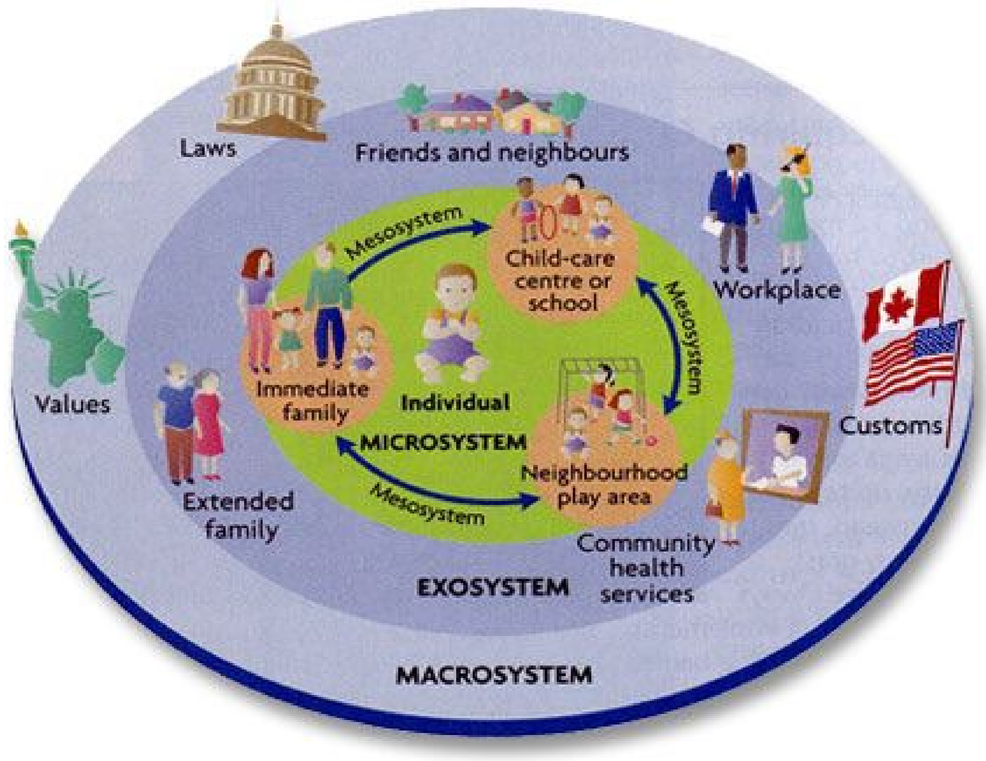

Figure 1: Bronfenbrenner's bio-ecological systems theory

(source: Berk & Roberts, 2009)

2.3.1 Microsystem

The *microsystem* refers to the immediate environment in which individuals engage daily, such as their home, school, or workplace. According to Bronfenbrenner (1992), growth is driven by ongoing processes and interactions between people and their environment. Thus, the most important relationships for an individual's survival and development are formed within this microsystem level. For example, children form these crucial relationships through continuous interactions with family, peers, and their neighbourhood. These interactions between microsystems involve patterns of daily activities, roles, and relationships. Therefore, the continuous relationships a child has with familiar people, like their parents and teachers, have the most immediate effect on the child (Boemmel & Briscoe, 2001). Especially during the early years, children are dependent and reliant on their parents/caregivers, and it is within this microsystem that they develop virtues such as trust in the people around them (Florence, 2014). Consequently, the parent-child relationship influences the quality of child development.

BEST consists of interconnected systems, with the developing child at the centre. Bronfenbrenner (1979) posits that these systems either directly or indirectly impact development. If the relationships the child has with their parents are inconsistent, insecure, or lacking in nurturing qualities, the child is less likely to successfully explore and navigate other environments.

Similarly, the types of relationships pregnant women have will influence their choices, which in turn impacts the developing foetus and/or child. For example, a familial pattern of excessive alcohol consumption can affect a child's development and later progress in school. If a mother comes from a family where alcohol is heavily consumed during pregnancy, it is likely she will also consume alcohol while pregnant (Crawford-Williams et al., 2015; Morojele et al., 2010). Additionally, if a pregnant woman is in an unhealthy relationship with the father of her child or another partner, it can also impact her decision-making. Pregnant women who use substances such as alcohol often do so due to past traumas, including emotional abuse from their partners (Covington, 2008; Esper & Furtado, 2014; Wodinski, 2014).

Additionally, a child's personality is formed and shaped within this level. A child's development is more likely to be positively impacted by supportive and nurturing parents (Berk, 2000). Furthermore, although an individual is central to the system, they are not merely passively experiencing their settings; they actively help to construct the social environment (Santrock, 2008). Therefore, at the microsystem level, bi-directional influences are essential, as this level has the most significant impact on children (Paquette & Ryan, 2001). The bio-ecological system is thus a dynamic process of interaction between the person and their environment in which a child develops (Bronfenbrenner, 1979).

In this regard, the BEST highlights that within an individual's daily life, multiple factors influence behaviour. These factors can include people, stressors, and other elements within an individual's environment. Thus, BEST provides a comprehensive understanding of both internal and external influences (Coady & Lehmann, 2016). The internal factors refer to those within the microsystem, such as family and immediate surroundings, where an individual spends most of their time.

2.3.2 *Mesosystem*

The *mesosystem* refers to the relationships between different microsystems or the connections between environments (Berk, 2000; Bronfenbrenner & Morris, 2006). It encompasses a network of interconnected microsystems. For instance, it involves linkages between home and school, peers, and family, and between the family and the community (Kaakinen et al., 2010). These interactions between various microsystems or environments are influenced by the relationships individuals have with others. In children, these interactions could involve parents, peers, teachers, and so forth, while in adults, they may include childcare providers, other parents, colleagues, among others. These relationships can significantly impact the microsystem – the individual – either positively or negatively depending on the circumstances. For example, the relationships a pregnant woman has with the father of her child, or with church members, neighbours, and friends within the community, can influence child development.

Moreover, research indicates that adolescents' drinking behaviour is often influenced by those with whom they spend most of their time, such as family and friends (Sudhinaraset et al., 2016). When parental and peer alcohol use is high, it often results in increased alcohol consumption among adolescents (Cruz et al., 2012; Mares et al., 2011).

2.3.3 Exosystem

The *exosystem* encompasses the larger social systems that influence a child's experiences indirectly, without direct involvement of the child (Bronfenbrenner, 1979; Vogler et al., 2008). This layer includes connections between individuals close to the child and their broader social environment (Rangmar et al., 2016).

Regarding alcohol consumption during pregnancy, the exosystem includes larger contexts that influence prenatal alcohol consumption, even though neither the mother nor the child may be directly involved. For example, the parents' workplace schedules and social drinking activities are part of this exosystem. Although the child is not directly engaged in the parents' work or social activities, they are impacted by them.

For instance, if the father spends long hours at work or goes out for drinks with friends after work, this can influence the father-child relationship negatively, as the father may be less involved or unavailable to care for the child (Berk, 2000). Consequently, this can lead to conflict between the parents, affecting their interactions with the child.

Another example is if the father goes out drinking with friends after work and becomes intoxicated. This could lead to conflicts with the mother, causing emotional, psychological, and even physical effects on the child. The father's drunken state may result in ongoing arguments with the mother, further impacting the child's well-being (Subotnik et al., 2003).

Furthermore, external factors such as community, partner influence, and neighbours can contribute to substance abuse. A study by Watt et al. (2016) revealed that many women reported witnessing pregnant women in the community consuming alcohol. Similarly, research on alcohol consumption in the Western Cape showed that alcohol is the most commonly used substance, with high prevalence rates for lifetime alcohol use and risky drinking behaviour (Puljević & Learmonth, 2014). This highlights how contextual factors such as community norms, peer influences, and partner behaviours shape pregnant women's perceptions and behaviours related to alcohol abuse. Moreover, additional contextual factors such as family conflicts and unemployment can also influence attitudes and behaviours regarding alcohol use during pregnancy (Havens et al., 2009).

2.3.4 Macrosystem

The *macrosystem* differs from the previously mentioned systems as it encompasses institutional systems, including cultural values, laws, and customs that influence society as a whole, thereby shaping the individual's reality (Berk, 2000; Bronfenbrenner, 1994; Rosa & Tudge, 2013). Cultural norms, societal groups, and legal frameworks profoundly impact child development (Bronfenbrenner, 1992; National Development Agency [NDA], 2016).

The influences of principles established at the macrosystem level affect interactions across all other layers. For instance, cultural or religious beliefs that oppose childhood immunisations or advocate for non-traditional treatments can significantly impact child development. This can leave children vulnerable to common childhood illnesses such as measles and chickenpox, among others (NDA, 2016).

The macrosystem also encompasses larger-scale factors that impact people, including governmental policies (Duncan et al., 2007). For example, while some health specialists suggest moderate alcohol consumption can be beneficial, heavy alcohol drinking and drinking during pregnancy are widely recognised as unsafe and detrimental (Centers for Disease Control and Prevention [CDC], 2018; National Organisation on Foetal Alcohol Syndrome [NOFAS], 2018). Consequently, to regulate alcohol consumption, the South African government has implemented policies specifying where and when alcohol can be consumed, as well as age restrictions – set at 18 years of age – for alcohol consumption (Republic of South Africa, 2016).

Moreover, culture and society also influence alcohol consumption patterns. In some communities, alcohol consumption is considered a social or cultural norm (Sudhinaraset et al., 2016). For example, in Latino culture, drinking alcohol is seen as a cultural norm and heavy alcohol consumption is associated with masculinity (Sudhinaraset et al., 2016). Mager (2010) opines that alcohol consumption can serve as a way to form connections and relationships with others. She contends that alcohol is used as a means to bring people from different racial groups together, such as at sports events where individuals of different races sit together and support the same teams (Mager, 2010).

2.3.5 *Chronosystem*

The final layer is the *chronosystem*, which refers to the developmental timeframes and progressive stages of a child's development. The NDA (2016) describes the chronosystem as the way each level influences the other and vice versa. Brakenhoff and Slesnick (2015) explain that the chronosystem of the ecological systems theory focuses on the individual aspects of a person and their environment, as well as the aspects that remain constant or change over time. Boemmel and Briscoe (2001) further explain that the elements within this system can be either external (such as the death of parents) or internal (such as physiological changes that occur with the aging of a child). This level explains how the child changes and matures over time and includes the time period in which the child is being raised (NDA, 2016).

Another example of the chronosystem is the changes that occur in pregnant women during the stages of pregnancy and childbirth. During this time, there are various changes happening within a woman's body, including physical and emotional changes. Additionally, there are changes in her identity as she transitions into motherhood, as well as changes in her relationship with her partner (Kathree et al., 2014). It is common for women to experience postnatal depression, which can affect the relationship with their partner, and they may also face rejection or a lack of support from their partner and their partner's family (Kathree et al., 2014). Consequently, the mother-father relationship, which is part of the microsystem, can be impacted, leading to effects on the pregnancy and influencing the choices and behaviours of the mother, such as alcohol consumption.

2.4 Conclusion

The BEST, which comprises five interconnected systems – the micro-, meso-, exo-, macro-, and chronosystems – explains the interaction and development of children with their environment. This concept helps us understand how various relationships and environmental factors influence alcohol use during pregnancy, which subsequently leads to FASD in children. This theoretical framework elucidates the complexities associated with pregnant women and how their environment can influence their behaviour. Moreover, the BEST can be used to gain a multifaceted perspective on the use of alcohol during pregnancy.

The following chapter reviews existing literature to delve deeper into the research topic, aiming to address the research questions comprehensively.

CHAPTER 3

LITERATURE REVIEW

3.1 Introduction

This chapter explores literature on FAS, focusing on the harmful effects of prenatal alcohol exposure (PAE), maternal risk factors associated with alcohol consumption during pregnancy, and the consequences of PAE on ECD. It aims to provide insights into the characteristics of FASDs, global prevalence rates, and examines interventions aimed at preventing and managing FASD for both mothers and children.

3.2 Prenatal Alcohol Exposure

PAE occurs when a woman who is pregnant consumes alcohol (CDC, 2018), and the developing foetus is thus exposed to alcohol in utero, which affects the development of the foetus at any stage of development. Women who consume numerous amounts of alcohol (i.e., four or more per occasion) can cause detrimental damage to the developing foetus. However, harm can be caused in instances where women consume even lesser amounts of alcohol during pregnancy (Addila et al., 2021; Gosdin et al., 2022; Pielage et al., 2023). Thus, no amount of alcohol is safe during pregnancy (CDC, 2018; Skagerstróm et al., 2013).

There are several reasons why women consume alcohol during pregnancy. In some cases, alcohol consumption happens unintentionally because women are not aware that they are pregnant. Once they find out about their pregnancy, most women stop consuming alcohol (Vorgias & Bernstein, 2019). However, there are still significant instances where alcohol continues to be consumed during pregnancy. This is often due to certain risk factors that a woman may have. Some maternal risk factors include a history of alcohol consumption, previous pregnancies, and genetic susceptibility to metabolize alcohol slowly (Vorgias & Bernstein, 2019).

In conclusion, the combination of maternal risk factors, the amount of alcohol consumed, and the timing of consumption all contribute to the increased risk of significant birth defects in the baby (Lange et al., 2017; Popova et al., 2023). Other risk factors include maternal smoking and a family history of alcohol abuse (Wubetu et al., 2019).

Unemployment and partial post-traumatic stress disorder in women are associated with alcohol consumption during pregnancy (Peltzer & Pengpid, 2019). Additionally, unplanned pregnancies often occur among women who are more likely to engage in risky behaviours, such as excessive drinking and having multiple sexual partners (Eaton et al., 2012; McQuire et al., 2020). Moreover, these women are often in unhealthy relationships characterised by physical and emotional abuse (Oh et al., 2017). Furthermore, external factors like exposure to violence (Skagerstróm et al., 2011), poor mental and physical health (Oh et al., 2017; Skagerstróm et al., 2013), and smoking (Dumas et al., 2017) are contributing factors to prenatal alcohol consumption. Therefore, it can be said that alcohol is often used as a coping mechanism for various underlying issues (Cloete & Ramugondo, 2015; Cornah, 2006).

PAE is the leading preventable cause of birth defects, disabilities, and other neurodevelopmental abnormalities (Lim et al., 2012; May et al., 2017). When alcohol is consumed during pregnancy, it easily passes through the placenta and reaches the developing foetus, where it disrupts the healthy development of the body and brain (Price et al., 2017). Exposure to the chemicals in alcohol can cause permanent and multi-system damage, both before and after birth. Prenatal alcohol consumption interferes with the normal development progress of the foetus, affecting the development of both the CNS and physical growth, leading to lifelong health consequences (Lange et al., 2017; Popova et al., 2016). The developing foetus will experience a wide range of adverse health consequences, which will be discussed in more detail later. These consequences include, but are not limited to, cognitive, behavioural, emotional, and adaptive functioning. In some cases, there may also be congenital anomalies (Lange et al., 2017), mental retardation, characteristic facial features, and CNS deficits. The majority of these effects primarily affect the central nervous tissue and brain (Feldman et al., 2012; Popova et al., 2021; Price et al., 2017; Subramoney et al., 2018).

The severity and type of birth defects caused by alcohol exposure depend on various factors, such as dosage and the developmental stage of the foetus at the time of exposure (Lange et al., 2017; Popova et al., 2023; Sulik, 2014). The more alcohol a mother consumes, the greater the potential impact. Price et al. (2017) also agree that the type and extent of foetal damage depend not only on the frequency and timing of alcohol exposure, but also on factors such as maternal nutrition and metabolism, genetics, and unknown foetal vulnerability. Furthermore, consuming alcohol during pregnancy is associated with other health consequences, including miscarriages, stillbirths, premature births, low birth weight (WHO, 2014), and an increased risk of spontaneous abortions (Wubetu et al., 2019). Infants exposed to alcohol in the womb also face an elevated risk of neurocognitive deficits, which can affect cognitive, language, and motor functions (Mattson et al., 2019; Wubetu et al., 2019).

3.3 Foetal Alcohol Spectrum Disorder

FASD encompass a range of effects resulting from maternal alcohol consumption during pregnancy (Price et al., 2017). According to the Fifth Edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (American Psychiatric Association [APA], 2013), FASD serves as a diagnostic term that specifies the presence or absence of sentinel facial features (Cook et al., 2016). Disorders categorised under FASD include Foetal Alcohol Syndrome (FAS), partial Foetal Alcohol Syndrome (pFAS), Alcohol-Related Neurodevelopmental Disorder (ARND), Alcohol-Related Birth Defects (ARBD), and

Neurobehavioural Disorder Associated with Prenatal Alcohol Exposure (ND-PAE) (Lange et al., 2017; Mattson et al., 2019; NOFAS, 2018; Popova et al., 2016; Stanley, 2021; Vorgias & Bernstein, 2019).

The aforementioned disorders describe the diverse physical and neurological effects that occur as a result of PAE (Adebiyi et al., 2019a). The most severe diagnostic category of FASD is FAS (BMA, 2016; Heimdahl Vepsä, 2021; Popova et al., 2019). While FAS is the most physically recognisable of the conditions, the milder conditions are likely to be more prevalent in the general population. The effects of FAS may vary but often include physical, mental, behavioural, and/or learning disabilities with lifelong implications (Mattson et al., 2019; Price et al., 2017; Popova et al., 2007; Rendall-Mkosi et al., 2008).

FASD affects individuals and their families of all races, socioeconomic backgrounds, and ethnic backgrounds (Popova et al., 2016). In many cases, individuals with FASD often require lifelong assistance from various services, including health, community, and remedial education, among others (Popova et al., 2016). Therefore, FASD is considered to have a significant economic impact on any society (Jordan et al., 2023; Lange et al., 2016; Mattson et al., 2019; Popova et al., 2023).

3.4 Foetal Alcohol Syndrome

FAS is the most recognisable form of FASD. Despite extensive research on PAE and its effects, challenges remain in identifying all affected individuals and their alcohol-induced deficits (Popova et al., 2023; Warren et al., 2011). FAS results in irreversible mental and physical birth deficiencies (Safe et al., 2018) and is associated with a range of impairments in motor functioning, reading comprehension, and executive functioning, particularly in the early years of schooling (Comasco et al., 2017).

The severity of FAS varies, with children exhibiting a range of physical deficits, intellectual or cognitive disabilities, and social problems, all of which can affect their daily functioning and coping mechanisms (Comasco et al., 2017; Kingdon et al., 2016; McDougall et al., 2020; Sayal et al., 2009). These disabilities have lifelong consequences that extend beyond childhood into adulthood (Moore & Riley, 2015). For a diagnosis of FAS, specific criteria must be met, including characteristic facial features, growth retardation, and evidence of nervous system dysfunction (Astley, 2013; Government of Canada, 2022).

3.4.1 Characteristics of FAS

3.4.1.1 Facial abnormalities and other dysmorphologies

FAS can be diagnosed shortly after birth when characteristic facial features and growth retardation are present, in conjunction with known prenatal exposure (Price et al., 2017; Wozniak et al., 2019). Babies born with FAS may exhibit skeletal and/or organ defects or impairments (Calleja & Calleja-Agius, 2022; Feldman et al., 2012; Price et al., 2017). One of the most common characteristics associated with FAS is facial abnormalities. These include a thin upper lip, a flat midface, a low or flat nasal bridge, small eye openings, small head circumference and brain size, and a smooth or indistinct surface between the nose and upper lip (the philtrum) (Figure 2) (Calleja & Calleja-Agius, 2022; Popova et al., 2023; Wozniak et al., 2019).

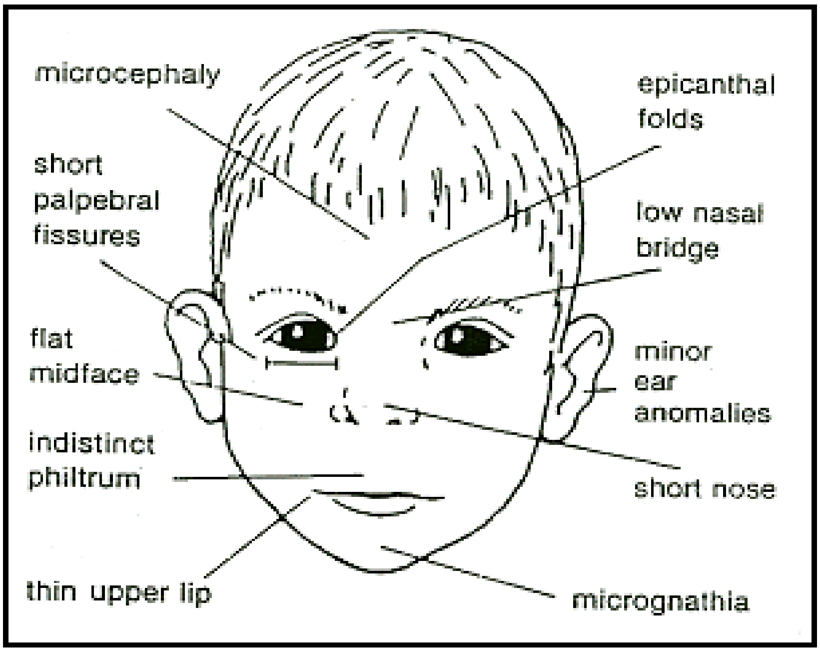

Figure 2: Characteristic facial features of foetal alcohol syndrome

(source: Kenner & D'Apolito, 1997)

Although these facial abnormalities are characteristic of FAS, it is important to note that not all children who have been exposed to alcohol prenatally will exhibit these features (Warren et al., 2011). The facial features associated with FASD may be more easily recognisable in children, which is why FASDs are typically diagnosed during childhood as the effects of alcohol are often evident from birth (Moore & Riley, 2015; Mpelo et al., 2018). However, these features often become less prominent as the child goes through puberty, making it more challenging to detect and diagnose FASDs at later stages of development (Moore & Riley, 2015). Other characteristics commonly associated with FASDs include a curved finger and a hockey stick-shaped crease on the hand that widens between the second and third finger (Figure 3), as well as an underdeveloped ear (Figure 4) (Fadeeva et al., 2021; Sujay et al., 2012; Wattendorf & Muenke, 2005).

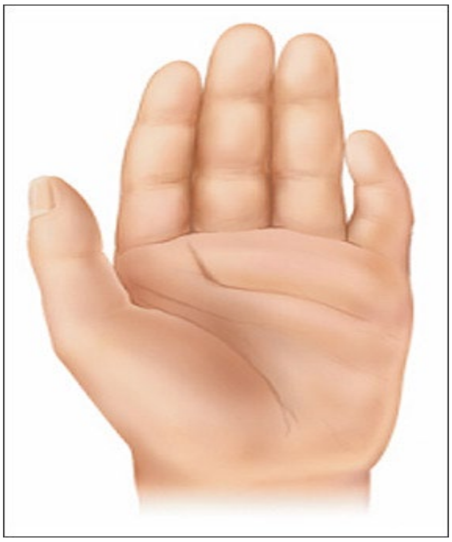

Figure 3: Curved finger present in FAS

(source: Wattendorf & Muenke, 2005)

Figure 4: Underdeveloped ear

(source: Wattendorf & Muenke, 2005)

Moreover, FAS patients often experience pre- and postnatal growth retardation, which can result in their height, weight, and head size being below what is typical for a developing child (FASD Rendall-Mkosi et al., 2008; Popova et al., 2016). These growth limitations often persist into adulthood, with individuals with FAS typically having a shorter physical stature and a thin upper lip (Moore & Riley, 2015). In addition, children with FAS may also have heart defects or abnormal features in their ears, eyes, liver, or joints (Fadeeva et al., 2021; Popova et al., 2023; Warren et al., 2011).

3.4.1.2 CNS abnormalities: Intellectual and behavioural impairments

Damage to the brain, spinal cord, or CNS due to prenatal alcohol use is another important factor, although it may not be immediately obvious at birth (Denny et al., 2017; Warren et al., 2011). CNS abnormalities can manifest as structural, neurological, or behavioural deficits, either individually or in combination.

To classify impairments as FASD dysfunctions, the individual must exhibit deficient brain growth, abnormal brain structure, or abnormal neurophysiology (Denny et al., 2017). A child with FAS who also has CNS abnormalities may experience a range of challenges, including learning disabilities, intellectual disabilities, and delayed development. They may also struggle with coordination, balance, and memory (Langwith, 2011; Mattson et al., 2019; McCoy et al., 2015; Warren et al., 2011). Additionally, they may face difficulties with attention, information processing, and exhibit poor judgement skills, often having trouble understanding the consequences of their actions (Signal et al., 2018). PAE can also lead to other underlying brain changes, such as sleep abnormalities and seizures (Bell et al., 2010; Boronat et al., 2017; Inkelis & Thomas, 2018; Jan et al., 2010; Wengel et al., 2011). Consequently, the cognitive issues mentioned above can contribute to social and behavioural problems in affected children.

Children with FAS often exhibit a range of social and behavioural problems, making it difficult for them to adapt to and participate in everyday activities like their typically developing peers. They may experience difficulties in functioning, interacting, and coping with others. School presents particular challenges, as they often struggle to meet specific developmental milestones, which can reduce their chances of becoming productive members of society (Lubbe et al., 2017).

In school, children with FASD often face trouble paying attention, hyperactive behaviour, and difficulty with math, among other issues (CDC, 2020). Additionally, poor social judgement and emotional problems can make it hard for them to get along with others (Signal et al., 2018). These children are also frequently oversensitive to touch and other forms of stimulation, which can further complicate their social interactions and learning experiences (Lubbe et al., 2017).

Individuals with FAS are often diagnosed with other disorders such as attention deficit hyperactivity disorder (ADHD). They typically have difficulty maintaining attention for long periods, may struggle with attachment disorders, and often find it hard to adapt to change (Kingdon et al., 2016; Lemola et al., 2009; Mattson et al., 2019). Additionally, they may experience issues with impulse control (Kingdon et al., 2016; Mattson et al., 2019). Despite extensive research on PAE and its effects, challenges remain in identifying all affected individuals and their alcohol-induced deficits (Mattson et al., 2019; Warren et al., 2011).

3.5 Prevalence of FAS and FASD

For many years, the exact number of FASD cases globally was not published. This is due to several factors, including difficulties in diagnosing FASDs as diagnostic criteria have evolved over the years (Vorgias & Bernstein, 2019), challenges in passive versus active monitoring, and the difficulty in identifying milder cases of FAS when FAE deficits are not present (Pan American Health Organisation [PAHO], 2020). These issues have hindered researchers' ability to estimate a meaningful prevalence of FASD and evaluate the effects of interventions. Additionally, the lack of prevalence data can impact the prioritisation of healthcare for individuals with FASD (Lange et al., 2017). However, recent statistics on FASD prevalence are available, providing more insight into the global scope of the condition.

Globally, approximately 10% of women consume alcohol during pregnancy. The European Region has the highest prevalence at 25.2%, followed by the Americas at 11.2%, Africa at 10%, the Western Pacific at 8.6%, and South-East Asia at 1.8%. The Eastern Mediterranean Region has the lowest prevalence at 0.2%, primarily due to its predominantly Muslim population (Popova et al., 2023). In Southern Africa, the figures stand at 6.6% (Popova et al., 2016). However, more recent data suggest that 7.6% of women have reported consuming alcohol during pregnancy (Vorgias & Bernstein, 2019). Alcohol consumption during pregnancy is also higher among certain Indigenous populations in South Africa, reaching 37%, often in the context of disadvantage, violence, and the ongoing traumatic effects of colonisation (Popova et al., 2023). The global prevalence of FASD is estimated at 7.7 cases per 1 000, with the highest rates found in the European region at 19.8 cases per 1 000 (Okulicz-Korazyn et al., 2021).

A recent study in South Africa examined alcohol consumption during pregnancy and found that 3.7% of pregnant women reported drinking alcohol while pregnant (Peltzer & Pengpid, 2019). Among participants of mixed race, the study revealed that the Free State (8.7%), the Northern Cape (7.2%), and the Western Cape (6.1%) had the highest rates of alcohol consumption during pregnancy (Peltzer & Pengpid, 2019). In certain parts of Africa, such as Sub-Saharan Africa, where binge drinking is common, the prevalence of FAS is believed to be high, although the exact prevalence is unknown (Adnams, 2017). South Africa has the highest reported cases of FASD globally, ranging from 29 to 290 per 1 000 live births (Olivier et al., 2016). Additionally, the Western Cape Province has an estimated FASD prevalence of 196 to 276 children per 1 000, making it the province with the highest prevalence (Adebiyi et al., 2019a).

It is further estimated that 630 000 children are born with FASD globally annually. However, this estimation is only based on published studies. The global average may be significantly higher (Brown et al., 2019). On average, 15 babies out of every 10 000 live births will have FAS, which means that there are 119 000 babies born with FAS per year. The highest rate of FASD is found in South Africa, Croatia, Ireland, Italy, and Belarus (Table 1) (Popova et al., 2023). A study by Lange et al. (2017) further indicated that 76 countries globally showed a prevalence of FASD of more than 1%.

Table 1: Prevalence of FASD among children and youth in the general population

Country	Rate per 1 000 population
South Africa	111.1
Croatia	53.3
Ireland	47.5
Italy	45.0

Belarus	36.6

(Source: Popova et al., 2023)

3.6 Prenatal Alcohol Exposure on ECD

ECD spans from the prenatal period to eight years of age and encompasses the social, cognitive, physical, linguistic, motor, and emotional development that children experience (WHO, 2018; WHO & United Nations Children's Fund [UNICEF], 2012). ECD plays a fundamental role in determining how a child transitions throughout their life and whether they reach their developmental potential (Heckman et al., 2013). The early years, particularly the first two, are especially crucial, as this period sets the foundation for health, well-being, productivity, and learning (Western Cape Department of Health, 2017; WHO, 2018).

During the first few years of a child's life, the brain forms over 1 million connections every second, making early childhood a period of immense opportunity. However, it is also a vulnerable phase where negative influences can significantly impact child development (Moore et al., 2017). Brain development is particularly rapid during these early years, with 80% of a child's brain already developed by the age of two (WHO et al., 2018), crucially influencing cognitive development and behaviours (Gilmore et al., 2018).

However, young children cannot achieve optimal development on their own. To support child development during these critical first two years, the National Department of Health outlines five essential responsibilities: healthcare programmes (including doctor's visits and immunisation), nutrition programmes (such as growth monitoring and supplementation), social welfare services (including birth registration and access to social grants), early detection and referral (through routine screenings and service referrals), and parenting and caregiver support (including education for parents and caregivers) (Camden-Smith, 2022).

Parents' actions significantly impact their child(ren)'s development and progression through various developmental stages. Numerous factors can negatively affect ECD, with major threats including extreme poverty, poor mental health, insecurity, gender inequalities, and exposure to environmental toxins (Black et al., 2017). Similarly, parental behaviours and actions can also either positively or negatively influence child development (WHO, 2018). Therefore, prenatal alcohol consumption can profoundly impact ECD.

3.6.1 Effects on newborn and infant development

Being exposed to alcohol in the womb can affect the child's development both during pregnancy and after birth. Research has shown that during the neonatal period, PAE can cause increased irritability (Vorgias & Bernstein, 2020), abnormal reflexes, decreased orientation, and decreased muscle tone (del Campo et al., 2024). Furthermore, children who are exposed to alcohol prenatally may be born with facial deformities, such as small eye openings, a smooth and wide philtrum, and a thin upper lip, among other features (del Campo et al., 2024; Popova et al., 2023). Infants with PAE, and even those with FASD, often have reduced suckling abilities, leading to a delay in transitioning to solid foods. Similarly, older children frequently exhibit dysfunctional eating habits and abnormal feeding behaviours (Amos-Kroohs et al., 2016).

Research suggests that children exposed to prenatal alcohol have been found to experience delays in motor development, including delays in sitting, standing, and walking during infancy (Fjørtoft et al., 2020). They may also experience delays in fine motor skills (Breit et al., 2022; Doney et al., 2017). A systematic review conducted in 2011 on PAE and its effects on child motor function revealed that when pregnant women consumed 10 to 20 alcoholic drinks per week, it resulted in impaired motor function (Bay & Kesmodel, 2011). Mild (three drinks or less per week) and moderate (six drinks or less per week) prenatal alcohol consumption were associated with motor impairments in children aged five years and younger (Flak et al., 2014).

Research on children with FAS has indicated that they are three times more likely to have gross motor impairments. However, heavy PAE is not significantly associated with gross motor impairments (Hutchinson et al., 2019). Despite this, there is a lack of updated information on this topic. Bandoli et al. (2023) conducted a narrative review of 2 422 papers, which included samples ranging from approximately 500 to 40 000 participants aged 0 to 19. The study found no clear patterns between low to moderate PAE and offspring outcomes, and attributed the heterogeneity of results to differences in methodologies. Nevertheless, there are numerous studies that indicate heavy PAE does result in infant motor function defects (Hendricks et al., 2020; Hutcherson et al., 2019; Popova et al., 2023; Subramoney et al., 2018).

Furthermore, research has shown that sleep problems are often associated with FAS (Boronat et al., 2017; Chen et al., 2012; McDougall et al., 2020). Sleep problems include insomnia, breathing disorders during sleep, and even daytime sleepiness (hypersomnia) (Cortese et al., 2009; Dylag et al., 2021). In child development, sleep is essential and if disrupted, it can often result in a wide range of health and behavioural problems such as poor school performance, neurocognitive deficits, hyperactivity during the day, inability to pay attention, and unstable mood (Halstead et al., 2021; Kapsi et al., 2020; Sayal et al., 2009).

3.6.2 Effects on development: Preschool age

Research has shown that preschool-aged children undergo difficulties or challenges in their development as a result of PAE (Hendricks et al., 2020). Studies have found that children who were exposed to alcohol during pregnancy sometimes show lower IQ scores than children without exposure (Roetner et al., 2024; Waite & Burd, 2023). On the contrary, it was also found that these children's IQ scores were not necessarily lower, but their poor performance was dependent on the amount of alcohol consumed during pregnancy. This means that mothers who consumed more than nine alcoholic beverages per week had children who had poor performance (Falgreen Eriksen et al., 2012; Flak et al., 2014).

Furthermore, prenatal alcohol consumption has been linked to difficulties in attention, social interaction, and behaviour (Kingdon et al., 2016). PAE children often exhibit behavioural problems like hyperactivity and tantrums, making it challenging for them to manage their behaviour effectively and impairing their daily functioning (Halstead et al., 2021; Kapsi et al., 2020; Sayal et al., 2009).

In addition, children with FAS more frequently exhibit insecure attachments with others. This can lead to difficulties in forming connections with others (Kingdon et al., 2016; Lemola et al., 2009). Furthermore, children with FAS often struggle with adaptive functioning, such as sustaining attention and responding to multiple stimuli (Kilburn et al., 2015). As a result, these cognitive and behavioural challenges limit their ability to keep up with the learning demands of preschool, compared to their typically developing peers. Consequently, this negatively impacts their ability to cope in a school environment and affects their executive functioning in the classroom. For example, they may be labelled as disruptive and potentially removed (Koren, 2015).

Moreover, research suggests that children with FASD often face greater challenges in areas with limited resources. These conditions place a heavy burden on them, as limited resources can delay diagnosis and restrict access to available services (Davies et al., 2011; Petrenko et al., 2014). Therefore, early interventions that aim to mitigate the effects of PAE are essential in low-resource areas, particularly those with high FASD prevalence. Such interventions will greatly benefit the child's overall development.

3.7 Interventions and Treatment for FASD

Due to the complex nature of the health effects and disabilities related to prenatal alcohol exposure, FASD is a difficult condition to diagnose (Signal et al., 2018), and despite its high prevalence, it is often misdiagnosed or underdiagnosed (PAHO, 2020). Often, children are not diagnosed in infancy and are only diagnosed later when they reach school-going age (6+ years), when symptoms begin to appear (Signal et al., 2018). FASD cannot be cured; however, it can be treated if early interventions are implemented. Currently, there is no specific treatment method for FASD, as treatment is multifaceted and multidisciplinary (Signal et al., 2018). The goal of treating symptoms of FASD is based on a case-by-case basis, as each case presents differently. Thus, intervention can be in the form of prevention and/or treatment.

3.7.1 Prevention interventions

Several interventions aim to prevent PAE and FAS. These interventions are categorised into three main approaches: universal, selective, and indicated.

The universal approach focuses on educating the general public about the risks associated with alcohol consumption during pregnancy (Schölin et al., 2019). The objective of this intervention is to enhance awareness of the dangers of alcohol use during pregnancy at a population level and to change current drinking norms (Schölin et al., 2016). Various forms of this intervention include campaigns, warning labels on products, health initiatives, and other educational strategies (SAMHSA, 2014).

The selective approach targets women and their partners of childbearing age who are at risk of having children with FAS due to their risky alcohol consumption levels (Symons et al., 2018). An example of this approach is the intervention programme recommended by the US Preventive Services Task Force (USPSTF), which advocates for clinic-based services to screen for unhealthy alcohol consumption patterns among this population (O'Connor et al., 2018).

This includes screening for unhealthy alcohol use in primary care settings, including pregnant women, and providing counselling interventions for them and other adults with risky alcohol behaviour. These counselling sessions consist of sharing basic education on alcohol consumption and suggestions to reduce alcohol limits (CDC, 2014). Individuals who exceed drinking limits and show indications of severe alcohol use disorder (AUD) will be referred for treatment (CDC, 2018).

Another example is the PROTEGO programme for the prevention of tobacco, alcohol, and other drug use in the family. It consists of multiple two-hour sessions for groups of 12 to 15 parents of children and adolescents aged 9 to 13 years. The programme focuses on educational activities aimed at developing parenting skills, addressing risk factors, and family protection (European Monitoring Centre for Drugs and Drug Addiction, 2019).

The *indicated approach* aims to specifically target women who have a child with FASD (because they consumed alcohol at risky levels during pregnancy), or women who have an alcohol use problem, and those who are not using efficient and effective contraceptives (Substance Abuse and Mental Health Services Administration [SAMHSA], 2014; Symons et al., 2018). An example of this approach is the Case Management method, which aims to empower heavy drinking pregnant women to reduce their alcohol consumption. This method utilises activities such as life management, motivational interviewing techniques, and the community reinforcement approach (de Vries et al., 2016). Home and work visits were scheduled once a month, lasting for 30 minutes. Additionally, the case manager would also make telephonic contact. The women in the programme were given a cell phone number to send a "please call me" message if they needed support from the case manager. These visits included various activities mentioned above to encourage positive lifestyle changes (de Vries et al., 2016).

3.7.2 *Treatment as an intervention method for FAS*

3.7.2.1 Non-pharmacological and pharmacological interventions

Treatment for FASDs is typically classified into two main categories: pharmacological and non-pharmacological interventions. Pharmacological interventions are primarily used for individuals with comorbid conditions such as ADHD and depression, which often necessitate medications (Paley & O'Connor, 2009; Signal et al., 2018). While there are no medications specifically approved to treat FASD itself, certain medications can be employed to help manage these associated comorbidities (CDC, 2018; Hanlon-Dearman & Narvey, 2022).

Furthermore, while FASDs cannot be cured, the symptoms can be managed (Breuer et al., 2024). Medications such as stimulants are utilised to address symptoms like hyperactivity, inability to focus, and poor impulse control. Antidepressants are also employed to manage symptoms such as irritability, aggression, and anxiety, among others (CDC, 2018; Mela et al., 2020).

Non-pharmacological treatments for FAS include educational and learning strategies, cognitive-behavioural therapy (CBT), speech therapy, psychosocial interventions, occupational therapy, and physiotherapy. There are various intervention programmes that are considered effective for FAS. Some interventions are suggested practices that can be carried out by parents or teachers, while others are specific programmes that are best implemented by therapists, psychologists, or other skilled practitioners.

Behavioural and effective learning interventions have been developed and implemented to assist individuals with FASD (Peadon et al., 2009; Signal et al., 2018). School-based interventions are examples of these interventions, which aim to make learning easier for children with FASD. It is essential to provide educational support and information on ideal methodologies for school-aged children with FASD to educators (PAHO, 2020). These education-based interventions help children establish consistent routines and create opportunities for them to practice new skills repeatedly (PAHO, 2020; Paley & O'Connor, 2011). Some of these programmes focus on improving children's competency and execution of skills such as mathematics, literacy, social skills, and problem-solving through direct skills-based training approaches (Hilley et al., 2023). Parents can also benefit from these services as they provide behavioural regulation techniques that enhance the child's readiness to learn (CDC, 2018).

3.7.2.2 Early intervention

Interventions implemented early, from birth to age three, have proven to improve the development of children with FASD (de Jong et al., 2019). These early interventions have the potential to understand the plasticity of the developing brain, which has been exposed to alcohol prenatally. Early intervention can possibly help improve some neurological impairments that result from alcohol exposure (Olson & Montague, 2011).

Early diagnosis and intervention play a crucial role not only in preventing future FASD births but also in benefiting children already diagnosed with FASD by reducing secondary disabilities (PAHO, 2020). Addressing cognitive and learning disabilities early can mitigate academic challenges and improve overall life outcomes for these children (PAHO, 2020). Additionally, early interventions are vital for enhancing speech development, improving gross motor skills like walking, and teaching essential social skills. For children with FASD, early intervention treatment programmes aimed at their mothers have been established. These programmes can help connect mothers with substance abuse problems to available services in their communities, such as counselling and prenatal support (Palmer & Paley, 2024; Popova et al., 2023). Additionally, these early intervention programmes provide peer support, counselling, and enrichment programmes for children.

Moreover, personalised interventions are most effective when implemented in environments with high levels of education and awareness about FASD. These interventions can be delivered through innovative approaches such as interviewing and case management (de Vries, et al., 2016; Hanson et al., 2013), and are particularly beneficial for targeting pregnant women or women of childbearing age who are planning to have children (Adebiyi et al., 2019a; de Vries, et al., 2016; SAMHSA, 2014). Brief interventions, for example, are ideal for women who consume alcohol at higher levels and can serve as a preventive measure (Schölin, 2016).

3.7.2.3 Preventative interventions

Although there is no cure for FASD, it is possible to manage the disabilities and improve the quality of life for individuals affected by this condition. Research suggests that screening babies for FASD early on can help confirm exposure to alcohol during pregnancy (Adebiyi & Mukumbang, 2021; Popova et al., 2023). By routinely screening babies, it becomes possible to diagnose and intervene at an early stage, which can help prevent and reduce the occurrence of secondary disabilities (Adebiyi & Mukumbang, 2021; Popova et al., 2023).

Screening babies for FASD involves a multidisciplinary approach that relies on the expertise of various trained professionals to assist in diagnosis. Therefore, a critical component of managing FASD involves training healthcare professionals and educators in classroom settings. Additionally, preventive interventions may include promoting contraceptive use and providing skill development for parents, families, and support networks of individuals affected by FASD (Adebiyi et al., 2019b).

3.7.2.4 Parent-focused interventions

Parent-focused interventions implement tools and skills for parents and family member as a means for them to better help their children diagnosed with FASD. The Family Moving Forward (FMF) approach aims to provide parents with support to promote parental self-efficacy and also to reduce child behavioural problems for families who are raising children between the ages of 12 and 13 years (Petrenko et al., 2020). FMF is typically implemented in clinic settings with varying session frequencies and durations, or delivered biweekly at home across 14 to 17 sessions (Petrenko et al., 2020).

According to Petrenko et al. (2021), the Parent-Child Assistance Programme (PCAP) supports women who are pregnant or have young children and have problematic alcohol or other drug (AOD) use. These women are not effectively engaging with services. PCAP has been shown to reduce alcohol-exposed pregnancies, promote AOD abstinence, increase employment and family planning, and improve child outcomes. Trained and experienced case managers provide home visitation case management. They assist clients in effectively engaging with existing services to meet their own goals using a combination of relational theory, motivational interviewing, and harm reduction concepts (Petrenko et al., 2021).

The PCAP Modified Addiction Severity Index 5th Edition was tailored for Australian use to assess addiction severity-related issues as the primary outcome. Secondary outcomes included client satisfaction and program fidelity. Significant improvements were noted in composite addiction severity scores from baseline to one year, with 80% of participants achieving periods of abstinence lasting longer than four months. All clients reported improved access to services, no subsequent AOD-exposed pregnancies, and high satisfaction with the programme. These findings will guide future programme delivery and methodologies for a larger longitudinal study evaluating outcomes upon programme exit (Petrenko et al., 2021; Symons et al., 2022).

Recently, FMF Connect, a mobile health (mHealth) application, was developed based on the FMF programme, specifically tailored for FASD (Petrenko et al., 2021). Mobile health (mHealth) interventions are well-suited for delivering peer-to-peer and self-help support strategies for families raising children with FASD. Typical methods for parent-focused interventions for FASD include:

3.7.2.4.1 Parent-Child Assistance Programme

The PCAP – an intensive and evidence-based programme – is aimed at mothers (including pregnant mothers) who have alcohol and drug-related substance use disorders and who are at risk of having children with FASD. The PCAP intends to help these parents overcome AOD abuse and create a healthier environment for themselves and their children (Greenmyer et al., 2019; Popova et al., 2017; Symons et al., 2022). This intervention utilises a home-visitation case management model which is provided to mothers with AOD use (Symons et al., 2022). Through this home-based intervention, sustained involvement, advocate support, a holistic approach, FASD prevention, and the PCAP deliver individualised, long-term care. According to Symmons et al. (2022), the PCAP intervention has been proven to reduce alcohol-exposed pregnancies as this intervention helps to promote AOD abstinence as well as increase employment, family planning, and improve child outcomes.

3.7.2.4.2 Parent training workshops

Various parent training programmes have been developed for parents of children with FASD. These programmes primarily focus on psychoeducation for families raising children with FASD, providing information on effective behaviour management strategies and advocacy tools. The training can be delivered through in-person workshops or online materials, both of which have been proven beneficial to families (Petrenko et al., 2016).

3.7.2.4.3 Parent-Child Interaction Therapy (PCIT)

PCIT is an evidence-based treatment that has been applied to various populations. It involves in vivo parent coaching to enhance the parent-child relationship, improve the child's social skills, reduce problem behaviour, and assist parents in developing a positive discipline programme (Lieneman et al., 2017). The case management approach for preventing FASD was also found to be effective in reducing alcohol consumption during pregnancy (May et al., 2017). The case management activities included life management, motivational interviewing techniques, and the Community Reinforcement Approach.

These findings support the need for integrated care in preventing and managing chronic conditions (Popova et al., 2019). Additionally, training and education of relevant service providers and individuals with FASD were found to be effective in preventing FASD (Peltzer & Pengpid, 2019; Popova et al., 2019). Furthermore, the findings support previous studies that have shown the effectiveness of training and education in promoting health and achieving behavioural changes.

3.8 Conclusion

Literature highlights that FAS remains highly prevalent in communities worldwide. Many cases of FASD go untreated and undiagnosed due to factors such as changing diagnostic criteria and the wide range of characteristics associated with FASDs. Despite numerous global interventions, the rate of FAS has not decreased. Several systematic review studies have examined FASD and related interventions across the human lifespan, including early childhood. The methodology for conducting this study is discussed in greater detail in the next chapter.

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CHAPTER 4

METHODOLOGY

4.1 Introduction

Chapter 4 begins with an overview of the methodology and research design employed to address the research question. It then details the inclusion and exclusion criteria, providing an in-depth exploration of the data collection methods utilised. This chapter also encompasses the data analysis process, considerations related to the RE-AIM framework, and ethical considerations implemented throughout the study.

4.2 Aim

The aim of this RE-AIM review was to identify interventions used for children with FAS within ECD.

4.3 Objectives

The objectives of this study were to:

- Explore interventions used for children with FAS within ECD.
- Identify interventions and evaluate their effectiveness for children with FAS.
- Systematically appraise the methodological rigour of studies exploring interventions used for children with FAS within ECD.

4.4 Research Question

The review was guided by the following research question:

> "What interventions are available for children with FAS within ECD?"

To address the research question, the PIO – Patient or Problem, Intervention, and Outcome – framework was utilised (Akobeng, 2005). In this study, the 'Patient' component referred to children with FASD in early childhood. The 'Intervention' component included the various interventions designed for these children. The 'Outcome' component focused on the effectiveness of these interventions in reducing the impact of FAS in children. Therefore, using the PIO framework can improve literature screening efficacy (Rathbone et al., 2017).

4.5 Research Design

This study utilised a RE-AIM review methodology, which is commonly used for evaluating public health interventions and addressing the research-practice gap. The methodology aims to assess the translatability of interventions (Glasgow et al., 2019) and identify their strengths and limitations (Lakerveld et al., 2012). The RE-AIM framework consists of five components: *Reach, Effectiveness, Adoption, Implementation*, and *Maintenance* (Farris et al., 2007; Holtrop et al., 2018). These components are used to measure the importance of both traditional clinical outcomes (effectiveness) and the implementation of outcomes, which are often overlooked but crucial for broad impact (Holtrop et al., 2018). The RE-AIM design follows a logical sequence, starting with adoption, followed by reach, implementation, efficacy, and concluding with maintenance (Gaglio et al., 2013).

The **Reach** component refers to the number of people who were intended to benefit from or were aware of the intervention (Compernolle et al., 2014). It assesses the number, characteristics, and proportions of participants compared to the target audience (Harden et al., 2015). The **Effectiveness** component refers to the impact of the intervention, the intervention's aim, as well as the potential negative outcomes (Compernolle et al., 2014). Harden et al. (2015) further explain that the effectiveness of the RE-AIM framework assesses whether the intervention achieved the desired outcomes. The **Adoption** component describes the staff delivering the intervention and their representativeness. It also details the settings where the intervention is delivered and not delivered, along with their representativeness (Compernolle et al., 2014). Compernolle et al. (2014) explain that the **Implementation** component denotes how consistently the intervention is delivered and how it will be or was adapted, the finances associated with the intervention, time needed, and the expertise of the staff. The final component of the RE-AIM framework is **Maintenance**, which Compernolle et al. (2014) refer to as intervention sustainability and adaptions, the long-term effects, and the representativeness of the organisation delivering the intervention.

Moreover, the components of the RE-AIM framework are evaluated at both an individual and organisational level of impact. ‘Reach' and 'Efficacy' can be evaluated at an individual level of impact, whereas 'Adoption' and 'Implementation' can be evaluated at an organisational level of impact (Lakerveld et al., 2012). Unlike the other components, the 'Maintenance' component can be evaluated at both an individual and organisational level of impact (Lakerveld et al., 2012).

Thus, the RE-AIM review framework was found to be a suitable method for the study as it aligned with and sought to answer the study’s aims and objectives at an individual and organisational level of impact.

4.6 Inclusion Criteria

The criteria for inclusion in the review were:

4.6.1 Time Frame

The study focused on articles published between 1 January 2010 – 31 December 2020 to include the most recent literature and developments regarding interventions for FAS and ECD at the time the current study was conducted. Numerous researchers have concentrated on FAS interventions within ECD during this period, leading to new developments and diagnostic criteria as the field has evolved. Limiting the study to this time frame allowed for a systematic appraisal of the latest advancements in FAS interventions and ECD.

4.6.2 Participants

The review considered studies focusing on FAS research involving children from birth to eight years old. The first eight years of life are considered early childhood a critical period for comprehensive and healthy cognitive, emotional, and physical development (WHO, 2020). Therefore, the participant criteria were set within this age range to capture the most relevant and impactful findings (WHO, 2016).

4.6.3 Types of studies

To ensure comprehensive coverage of all relevant studies and recent developments related to interventions for FAS within ECD, a range of study types, including qualitative, quantitative, and mixed methods studies, were considered. Only peer-reviewed, full-text articles published in English between 2010 and 2020 were included in this analysis. Additionally, these studies needed to be accessible through the University of the Western Cape (UWC) Library databases. To meet the eligibility criteria, the studies had to report on or present interventions used for children with FAS during ECD.

4.7 Exclusion Criteria

Studies were excluded if they did not meet the following criteria: published between 2010 and 2020, available in the UWC's Library databases, published in English, full text, and peer-reviewed. Additionally, studies requiring payment for access were excluded. Research not reporting on interventions related to FAS and ECD, focusing on developmental stages other than early childhood, or employing designs such as literature reviews, scoping reviews, and systematic reviews that did not fit the current review's design were also excluded.

4.8 Method of Review

For this study, the primary researcher (LB) and the supervisor (CE) acted as reviewers throughout the search strategy. At the identification level, the primary researcher (LB) screened each potential title for relevance to the respective review, actively looking for pertinent keywords and search terms within the titles. Additionally, the primary researcher screened and assessed the article titles and abstracts. Duplicates across different databases were identified and removed. Titles that fit the inclusion criteria were then identified and considered relevant to the study, recorded, and tabulated.

The primary researcher conducted a thorough full-text review. Throughout all levels of the review, the researcher worked in collaboration with the supervisor (second reviewer) to ensure that two independent reviewers were responsible for the evaluation process, with each documenting their findings independently (Khan et al., 2003). To preserve validity and reliability (Wager & Wiffen, 2011), the second reviewer (CE) then repeated the same processes independently, as mentioned above.

After the review process, both the primary researcher (LB) and supervisor (CE) discussed any disputes and disagreements. If disputes arose between them, LB would reconsider CE's comments and reassess the titles and abstracts of the articles to decide whether to include or exclude the study. This decision was then presented to CE, where consensus was reached.

Potential titles deemed relevant to the current review progressed to the next level of review, namely, screening (Liberati et al., 2009). During the screening level, the abstract of each potential title was independently screened by LB and the reviewers for relevance to the review, assessed against the inclusion and exclusion criteria (Nama et al., 2021).

4.9 Search Strategy

The search strategy employed in this study followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Moher et al., 2009; Rehman et al., 2020). This approach includes four levels of review: *Identification, Screening, Eligibility*, and *Inclusion*. The first two levels of searching for data – Identification and Screening – was mostly carried out by LB. The Identification level involved LB identifying suitable keywords, search terms, and Boolean strings.

Subsequently, LB conducted searches across the UWC Library databases and identified pertinent article titles. At the Screening level, all abstracts retrieved from the identified articles were independently reviewed by LB to determine suitability and eligibility (Moher et al., 2009; Rehman et al., 2020).

The third stage, Eligibility, involved a thorough independent review of the full texts of articles identified during Screening. Articles meeting the eligibility criteria in this final stage were included in the data collection process.

4.10 Levels of Review

The literature on FAS interventions is extensive and continues to expand annually. Accessing relevant information is crucial as it informs the quality of reviews, facilitates summarisation and comparison of findings, and identifies strengths and weaknesses, ultimately aiding in formulating recommendations (Smith et al., 2011). Therefore, establishing a systematic strategy prior to literature sourcing is essential to ensure the collection of pertinent and sufficient information. Such a strategy helps researchers gather data that addresses their inquiries and fulfils the requirements of a systematic review (Smith et al., 2011). In this study, the PRISMA strategy was employed, and detailed descriptions of its stages and methodologies are provided in the subsequent sections.

4.10.1 *Identification of potential titles*

During the Identification level, potential studies were selected based on the relevance of their titles to the current review. The first step in the review process was to identify appropriate search terms. These search terms, or keywords, were selected using the PIO method. In this study, the researcher identified the key components to consider, namely the *patient or problem* (e.g., children in early childhood, FAS, FASD), the *intervention* (e.g., FASD interventions), and the *outcome(s)* of the intervention (e.g., development).

The primary terms used and identified in the literature were 'foetal alcohol syndrome', 'intervention', and 'early childhood development'. LB then conducted an initial search to identify suitable articles. CE reviewed the work identified by LB. These terms were inputted into electronic databases accessible through the UWC online library. Initially, their effectiveness was evaluated upon entry into the databases. However, it was found that these key terms were too restrictive and yielded few results.

LB decided to include synonyms of the primary terms to generate more data sources in the databases. Therefore, in addition to the primary terms mentioned earlier, the terms 'FAS', 'Foetal alcohol syndrome', and 'development' were added to the list of search terms.

To ensure that the search terms and results were comprehensive, LB used the "AND" Boolean operator in the search strings. This ensured that the results were reliable and efficient. Boolean strings were created to refine the searches and identify relevant data. By using Boolean strings, the searches were focused, eliminating unnecessary data that did not meet the inclusion criteria and increasing the chances of finding data that addressed the aims and objectives of the study.

The search terms formed four sets of Boolean strings, as follows:

1. “Foetal Alcohol Syndrome” AND “Intervention” AND “Early Childhood Development”
2. “Foetal Alcohol Syndrome” AND “Intervention” AND “Development”
3. “FAS” AND “Intervention” AND “ECD”
4. “FAS” AND “Intervention” AND “Development”

Furthermore, the selected databases were chosen based on their categorisation within relevant disciplines available at the UWC Library (see Table 2). These disciplines include Natural Sciences, Social Sciences, Education, and Health (Table 2). The decision to choose these specific databases was guided by their academic relevance to the aims and objectives of the current study. In addition to searching within the UWC Library databases, the primary researcher also utilised article reference lists to supplement the search for relevant titles.

Table 2: Table of disciplines and associated databases

Education	Social & Natural Sciences	Health
Education	Sociology	Medicine
	Anthropology	Occupational Therapy
	Psychology	School of Pharmacy
	Women & Gender studies	School of Public Health
	Sport Sciences	Nursing
	Human Ecology	Dietetics
		Dentistry
	Databases	
PsycArticles	JSTOR	Medline (EBSCOhost)
SAGE Journals	Academic Search Complete	
ERIC	African Journals Online	

The selected databases were searched using the specified Boolean strings, employing the "AND" Boolean operator. The search parameters included limits for date (2010–2020), full text availability, peer-reviewed status, and language set to English. Upon retrieval of search results, databases were screened to eliminate duplicates and titles deemed irrelevant. Titles meeting the inclusion criteria, which focused on key terms such as 'FAS', 'early childhood development', and 'intervention', were extracted, recorded, and saved on Google Drive.

A Title Summary Sheet (Appendix B) was compiled to organise and manage the extracted titles. This sheet recorded details such as author, date, title, database, location stored, and outcome (inclusion/exclusion). Titles that did not meet the inclusion criteria were excluded and not recorded. After manually counting all database hits and excluding duplicates and irrelevant titles, the total number of included studies was tallied for entry into a PRISMA chart (see Figure 5).

CE, the second reviewer, conducted a review of the titles presented by the primary researcher, LB, and screened them accordingly. CE followed the same process as LB, either agreeing or identifying titles deemed irrelevant. Subsequently, the findings were returned to LB for further review, repeating this process until a consensus was achieved.

4.10.2 Screening of abstracts

Furthermore, at the Screening level, abstracts retrieved from the eligible titles identified at the identification level were independently reviewed. These abstracts were assessed based on the predetermined inclusion and exclusion criteria outlined earlier. Specific details such as study designs, sample group characteristics, accessibility to full-text articles, publication period, and language were carefully evaluated (Moher et al., 2009). Articles whose aims and objectives aligned with those of the current study were considered suitable and recorded on the Abstract Summary Sheet (Appendix C).

The Extraction Sheet contained details such as authorship, study design, study population, instruments utilised, outcomes, and analysis results. Abstracts that did not meet the inclusion criteria outlined in Appendix C were excluded from further consideration. Reasons for exclusion included abstracts that did not address early childhood development, lacked information on interventions, did not specify inclusion criteria adequately, or were inaccessible. The total number of excluded abstracts was saved on Google Drive, and the total hits removed were recorded for the PRISMA chart.

CE, the second reviewer, reviewed the Extraction Sheet compiled by the primary researcher, LB, and conducted a similar screening process. CE then returned the Data Sheet to LB with comments and identified any discrepancies, such as abstracts that were either incorrectly included or excluded. LB revisited these abstracts for further screening and made final decisions based on CE’s feedback.

4.10.3 Eligibility

The third level of review, Eligibility, involved conducting a full-text review of all articles that were deemed eligible during the screening process (Moher et al., 2009; Rehman et al., 2020). These eligible articles were selected based on meeting the inclusion criteria, which included relevance to the topic, addressing FAS and interventions in ECD, being written in English, and having full-text availability for review.

The articles that met these criteria and were included in the final dataset were then subjected to a data collection process conducted by the primary researcher. The primary researcher independently screened the titles and abstracts using the critical appraisal tool (Appendix D & Appendix E). All abstracts of the articles were reviewed by LB, with a second reviewer (the supervisor – CE) also reviewing the abstracts. Any disagreements were discussed until a consensus was reached.

This research utilised methodological appraisal to ensure that research is efficient and reliable for decision-making. Critical appraisal is important as it enhances the skills of healthcare professionals and determines whether research evidence is unbiased, true, and relevant for the intended population (Mhaskar et al., 2009; Rehman et al., 2020). By critically appraising the methodology of interventions and studies, various aspects such as costs, methods, instruments, and outcomes are examined. This critical appraisal is crucial in weighing the pros and cons of an intervention and aids in selecting the best practice.

The interventions' domains were further scrutinised, checking for similarities and best practices. Best practices can be defined as initiatives and practices that have been proven by research and experience to produce reliable results. These practices can be proposed as a standard suitable for widespread adoption (World Health Organisation, 2008). Best practices represent the most efficient or prudent course of action by following guidelines, ethics, or ideas set by governing bodies, authorities, or institutions (UNESCO, 2018). Best practices continue to evolve as new and better solutions are found or as awareness improves, new technology emerges, or different perspectives are considered.

For this study, the primary (LB) and secondary (CE) researchers worked independently to verify information separately. They then reviewed their findings together to reach a consensus. For example, during the title Screening stage, if LB found an article suitable for further evaluation, but CE deemed it unsuitable, LB re-examined the inclusion criteria and made a final decision. Both researchers agreed upon this decision to remove the article.

4.10.3.1 Critical appraisal tool

It is important to evaluate your studies because this helps eliminate the burden of unnecessary work and allows you to focus solely on data that is relevant and aligns with your research questions and aims. Critically evaluating data also enables you to support or refute claims with reliable and solid evidence (Morrison, 2017). Consequently, this helps differentiate between evidence and assumptions and aids in recognizing any potential bias (Morrison, 2017).

Frantz and Chandeu (2011) indicated that to critically assess the effectiveness of interventions on the intended beneficiaries at the individual and community levels, the RE-AIM appraisal tool (Appendix D) must be applied. Boersma et al. (2015) reiterated that the RE-AIM appraisal tool is ideal for all types of studies – qualitative, quantitative, and mixed methods.

When conducting a critical appraisal assessment, the appraisal tool is structured into sections to evaluate various dimensions: Reach, Effectiveness, Adoption, Implementation, and Maintenance, encompassing a total of 15 questions (see Appendix D). These dimensions were assessed by considering the who, what, where, when, and how of the interventions (Glasgow & Estabrooks, 2018).

The 'Reach' component contains questions based on participation and representativeness, whereas the 'Effectiveness' component reviews intervention objectives, limitations, outcomes, and attrition (Balis et al., 2019). The Reach dimension has three questions, namely: "Does the article indicate who the programme is intended for (inclusion and exclusion criteria)? Does the article report on the representativeness of the target population? And does the article report on the participation rate?" Whereas the Effectiveness dimension consists of four elements, which include whether or not the programme achieves the intended objective, reports on limitations, reports at least one outcome, and reports on attrition (Balis et al., 2019).

Moreover, questions related to the setting, adoption, and the individuals responsible for delivering the interventions were included in the 'Adoption' component. The final two components, 'Implementation' and 'Maintenance', evaluated aspects such as the duration, frequency, cost implications, intent, and long-term effects and indicators of the interventions, respectively (Balis et al., 2019). By using this appraisal tool, researchers are able to assess the usefulness of the study and/or intervention. In this section of the tool, the primary author was required to score the interventions as either 'Yes' (1 mark) if the item was present or 'No' (0 marks) if it was absent. The scores on this appraisal tool range from poor (0–33%), satisfactory (33–66%), to very good (66%–100%).

Interventions were recorded on the Critical Appraisal Tool Scoring Sheet (Appendix E). Each intervention was scored individually as either 1 (yes) or 0 (no), based on the questions that made up the sections of the RE-AIM components in the appraisal tool, as mentioned above. The scores for each intervention were then added together to obtain a total number. This number was divided by 15 (the overall total number of questions in the appraisal tool) and multiplied by 100 to calculate a percentage. Interventions with a high percentage (66%–100%) were included for the next level of the appraisal. After this, the studies considered eligible for review had to meet all the inclusion criteria and achieve a specific threshold score. To ensure consistency, reliability, and validity, the same critical appraisal tool was used for all the articles (Lakerveld et al., 2012).

4.10.3.2 Threshold score

The studies that met all the inclusion criteria were evaluated for their methodological rigour. According to O'Neill & Chorcora (2021), the threshold score is the minimum score required to be considered at the performance level. For the RE-AIM framework, the threshold scores are categorised as poor (0–33%), satisfactory (33%–66%), and very good (66%–100%) (Meline, 2006). For this study, the threshold was set at 'very good', with scores ranging from 66% to 100%. This level was chosen to ensure high-quality data, as studies within this range provide the best evidence for making informed decisions (Hemingway & Brereton, 2009). Consequently, studies with lower scores and inadequate methodologies were excluded, enhancing the validity and reliability of the current study by improving the likelihood of reporting robust findings from which decisions, conclusions, and recommendations can be made (Hemingway & Brereton, 2009).

4.10.3.3 Inclusion

The full-text studies that met the threshold score were prepared for data extraction. These studies, which are included in the final analysis for the current research, met the inclusion criteria: full-text availability, English language, and publication dates between 2010–2020. They also scored high on the RE-AIM dimensions. The data extraction process for this study is outlined below and discussed in more detail in Chapter 5, the Results chapter.

4.11 Data Extraction, Quality Assessment and Data Management

The main aim of the data extraction process is to use a data extraction tool to accurately record the findings of previous research in the same field and extract the findings of each study consistently for later interpretation (Peadon et al., 2009). The required data to be extracted included relevant information such as the author(s), date of publication, country, population, sample size, age, gender, methodology, and the RE-AIM components – reach, effectiveness, adoption, implementation, and maintenance (Appendix F). This process enabled the researcher to accurately record the findings from the primary studies (Peadon et al., 2009).

A self-constructed Data Extraction Sheet (Appendix F), consisting of three sections: General Description, Methodology, and Findings & Analysis, was used by the primary researcher to extract the data. Before the main data extraction process, the primary researcher conducted a pilot study by testing the Data Extraction Sheet on a random sample to reduce bias and identify any necessary changes (Thurman et al., 2016). An in-depth version of the data extracted will be presented in Chapter 5, using the Data Extraction Sheet.

In addition, a quality assessment was undertaken to ensure the data's quality. In this respect, the primary researcher reviewed all the studies once more. The researcher rechecked the appropriateness of each study, its limitations and biases, and the levels of review. Once satisfied, the primary researcher proceeded to the next phase. The relevant data from the studies were systematically recorded and organised in MS Excel tables. The data were then summarised using a qualitative narrative approach (Chalmers & Altman, 1995).

4.12 Meta-synthesis

A meta-synthesis research design was used to gain an account of the interventions available in the ECD setting for children with FASD. This means that a systematic review of findings from qualitative studies was undertaken and integrated into this study. The objective is to describe the steps of a meta-synthesis method adapted from thematic synthesis and phenomenology to fit the particularities of psychiatric research. The method is described in six steps, namely, define the research question and the inclusion criteria, select the studies, assess their quality, extract and present the formal data, analyse the data, and express the synthesis (Koorts & Gillison, 2015).

Meta-syntheses provide a suitable balance between an objective framework, a rigorously scientific approach to data analysis, and the necessary inclusion of the researcher's subjectivity in constructing the final work. They propose a third level of understanding and interpretation that offers original insights, enhances global understanding in psychiatry, and suggests immediate therapeutic implications (Turner et al., 2017).

4.13 Ethics Considerations

Permission to conduct this research was obtained from the Human and Social Sciences Research Ethics Committee at UWC (Appendix G). To ensure transparency, all studies included in this review were publicly available published articles. The primary researcher of this study is a full-time registered student at UWC with unrestricted access to UWC's library databases. Additionally, the study remained sensitive to the ethical shortfalls associated with systematic reviews identified by Vergnes et al. (2010), aiming to increase the trustworthiness and reliability of the findings and data analysis.

Moreover, by conducting a systematic review, the research was based on an unbiased assessment (Wager & Wiffen, 2011). To further avoid bias, two individuals reviewed the current study: the primary researcher (LB) and his supervisor (CE). This ensured that the information in the review was accurate and not opinion-based. To avoid plagiarism, the researcher reported findings in his own words and not that of anyone else. When exact words from another author were used, quotation marks and proper referencing were employed to give credit to the original author (Wager & Wiffen, 2011). The researcher adhered to ethical practices by objectively reporting the study's findings extracted from the included articles.

4.14 Conclusion

This chapter outlined the research methodology. Included in the chapter was the research design, which was the RE-AIM review methodology. The chapter also detailed the inclusion and exclusion criteria. The inclusion criteria specified that articles published within the past 10 years (2010–2020) were researched to incorporate the most recent literature and developments regarding interventions for FAS and ECD. The review considered studies that focused on FAS research for children from birth to eight years old. Studies with qualitative, quantitative, and mixed method methodologies were included to ensure comprehensive coverage of recent developments in interventions for FAS within ECD.

Articles were excluded if they did not report on the interventions related to FAS and ECD. Studies that focused on developmental stages other than early childhood were disregarded. Additionally, study designs related to literature reviews, scoping reviews, and systematic reviews that did not align with the current review's design were excluded. The search strategy employed in this study followed the PRISMA guidelines.

The results are discussed next in Chapter 5.

CHAPTER 5

RESULTS

5.1 Introduction

This chapter presents a description of the findings from all the studies included in the current RE-AIM review, using descriptive meta-synthesis. It details the process of results and data extraction. The review of the articles and interventions was conducted with data extracted at four levels: identification, screening, eligibility, and inclusion. This extracted data then underwent a RE-AIM review. The information was categorised based on general details, including description, methodology, findings, and a RE-AIM appraisal tool.

5.2 Process of Results

The process of results and the findings of this study are presented along the four levels of PRISMA (Moher et al., 2009; Rehman et al., 2020). Data were reviewed through four stages: identification, screening, eligibility, and inclusion. The PRISMA flow chart in Figure 5 below illustrates this process.

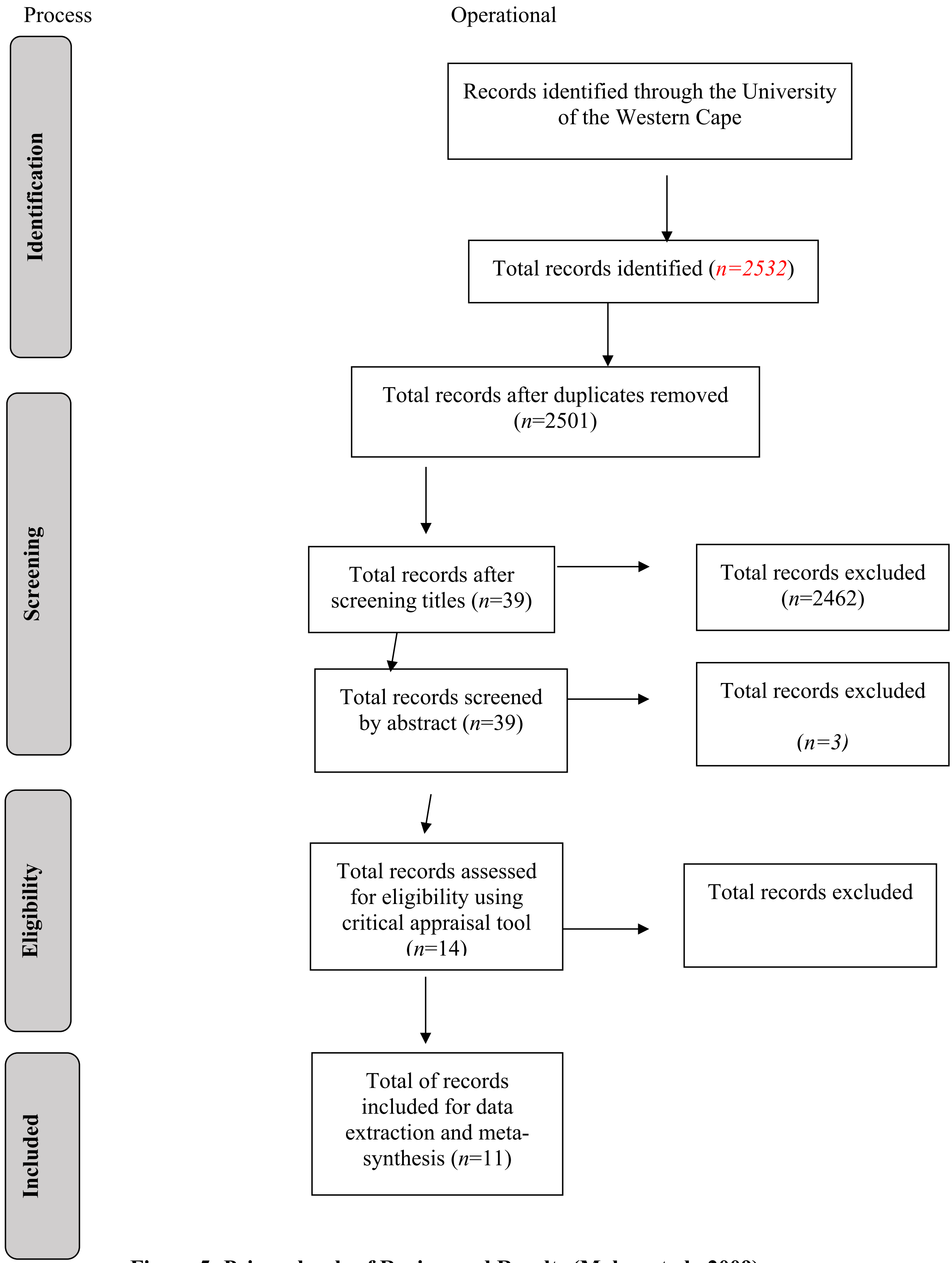

Figure 5: Prisma levels of Review and Results (Moher et al., 2009)

5.2.1 Identification

The data collection process began with a title search across the databases available on the UWC library website. This initial search yielded a total of 2 532 hits. Upon review, 31 duplicates were identified and removed, resulting in 2 501 unique records. These records were then included in the next level of appraisal: title screening.

5.2.2 Screening

Upon title screening, 2 462 titles were excluded because they did not meet the criteria, leaving 39 titles for the next level of appraisal. The articles were excluded for several reasons: they were not full text, did not mention or address the correct interventions, or the target population (children aged 0–9 years) was incorrect. Also excluded were studies that did not address the research question and purpose; abstracts were inadequate and poorly written, failing to report on significant elements of the study's design or methodological process; the sample group or target population was inappropriate; the study's design was inappropriate, being either a literature or systematic review; and the full texts of the articles were inaccessible via open access and were required to be purchased.

5.2.3 Eligibility

Of the 39 titles identified at the identification level, the abstracts were screened, resulting in 14 abstracts being identified for possible inclusion, as they were deemed appropriate for the current study and its aims and objectives. Consequently, 25 abstracts were deemed inappropriate and were excluded from the next level of review for several reasons: 21 did not include the target population of children aged 0–9 years, and 4 failed to report significant details regarding study design and results. Additionally, some studies were excluded because they did not focus on interventions for FASD; instead, they addressed other disorders, such as nutritional deficits, among others.

5.2.4 Inclusion

After the critical appraisal process that determined eligibility for inclusion, a total of 14 studies were included in the final stage of data collection, as their interventions scored a threshold of 66%–100%, which is regarded as very good. A total of three (3) titles were excluded from this level of review because they did not meet the desired threshold, with scores ranging between 0–55%. These excluded titles scored low on the effectiveness, adoption, implementation, and maintenance aspects of the RE-AIM framework, thus lowering their overall scores. Additionally, some articles were excluded because they did not include interventions for children with FAS. Therefore, a total of 11 studies were identified for the final level of review for the current study.

5.3 Findings & Analysis

5.3.1 General description of the studies

The general information of the included studies, such as the population and sample size, geographical locations, aim, and problem statement, is presented in Table 3 below.

Table 3: General description of the articles

Author/s	General description			
	Population and Sample size	Geographical Location/ Country	Aim	Problem Statement
Connolly et al. (2016)	A young child diagnosed with partial pFAS and pervasive developmental disorder.	Not included	To determine whether she had truly acquired and maintained the skill, and to ensure that successful responding was not the result of repeated practice immediately prior to data collection.	• Currently, most empirical literature supporting the Verbal Behaviour (VB) approach consists of single-subject experimental designs that have demonstrated the impact of treatment on specific language skills. • A recent survey of behavioural practitioners found that 23% described their programming using the term *Verbal Behaviour* and almost 50% indicated that their programming was based on Sundberg and Partington's manual (1998), which is widely known as a VB manual. • Given the ubiquity of the use of the VB approach, more research is needed to show outcomes associated with the approach.
Keil et al. (2010)	A hundred (100) children with PAE aged 6–12.	Los Angeles	To determine if a social skills intervention would be effective in improving the social information processing patterns of children with PAE.	• Despite promising intervention studies on children without PAE, the impact of a social skills intervention on the tendency to attribute hostile intent to others among children with PAE remains untested.
Pei et al. (2016)	A total of 279 children were included (174	Not included	To examine intervention recommendations for children	• Although it is widely recognised that intervention research can provide answers for treating specific cognitive disturbances and ameliorating

	children in the FASD group, and 105 in the PAE group) between the ages of 1 and 17.		with FASD/PAE and their subsequent access to these recommended interventions.	adverse outcomes, the literature examining the effectiveness of interventions with the FASD population is limited. • This is particularly troubling as individuals with FASD often have a history of difficulties in their lives and may have unmet basic service needs.
Petrenko et al. (2019)	Twenty-four (24) foster and adoptive parents of children and adults (aged 3–33 years) with FASD.	New York	To fully understand the experiences of foster and adoptive parents raising a child with FASD.	• Family environment plays a critical role in determining the developmental outcomes of children with FASD, making the family level of the ecology important to understand. • Families need to balance the needs of the individual child and the primary disabilities associated with FASD with demands and interactions with systems of care. • Unfortunately, families encounter numerous systems-level barriers, including others' misinterpretations of FASD-related behaviour, lack of knowledge about FASD among providers and community members, delayed diagnosis, and poor availability and implementation of FASD-informed services. • About two-thirds of children with FASD in the United States are raised in out-of-home care and rates of FASD are 17 to 19 times higher in child welfare systems than in the general population.
Petrenko Demeusy, & Alto (2019)	Thirty (30) children with prenatal alcohol exposure and their caregivers.	New York State	To examine the sustainability of the effects of the multicomponent FOT intervention on child and	• FASD incurs a high monetary cost for individuals, their families, and society, as individuals with FASD often utilise services across multiple systems (e.g., healthcare, foster care, and criminal justice systems) and can sometimes require long-term care.

			caregiver functioning six months post-intervention.	• This financial burden underlines the importance of prevention and early intervention for FASD. • Early diagnosis and the provision of appropriate services can significantly improve child and family functioning, in both the short and long term, creating an economic return on investment for prevention efforts.
Reid et al. (2015)	Three families recruited from an FASD diagnostic service. Three female children and six parents.	Not included	To evaluate the feasibility of an adapted version of the Parents under Pressure (PuP) programme that addresses self-regulatory processes, through improving the parent-child relationship and the use of mindfulness-based strategies for both children and parents.	• Many parents, including those who are parenting children with FASD, experience multiple difficulties that extend beyond parenting knowledge and skills. This, in turn, affects their capacity to manage the child's emotions, especially when the child also has self-regulatory difficulties.
Tzilos et al. (2011)	Fifty (50) pregnant women.	USA	To conduct preliminary effect size estimation of intervention related changes in (1) alcohol consumption (frequency, quantity, and binge use) 30 days after the single-session intervention, and (2) birth outcome variables (i.e.,	• Drinking alcohol during pregnancy has a range of negative consequences for the developing foetus. • Screening and brief intervention approaches have significant promise, but their population impact may be limited by a range of challenges to implementation.

			gestational age, birth weight, and head circumference).	
Wagner et al. (2018)	Twenty-six (26) children, three teachers, Community members, stakeholders, occupational therapists.	Australia	To describe a three-phase formative process to develop and pilot a curriculum version of the Alert Programme, a promising intervention for improving self-regulation that could be used in remote community schools.	• Although previous research has demonstrated the benefits of targeting self-regulation in non-Aboriginal children, it is unclear whether such programmes would be effective for Aboriginal children attending school in remote communities. • Some of these children have been diagnosed with a FASD, which impairs their ability to self-regulate.
Wiskow et al. (2018)	One (1) boy with FAS and three peers.	Not included	To evaluate the effectiveness of the Good Behaviour Game (GBG) in reducing levels of disruptive behaviour d by a 4-year-old boy with FAS in a small group setting.	• The sum of recent meta-analyses indicates that despite the popularity of the GBG in general education classrooms with typically developing students, it continues to be understudied with students with disabilities. • Previous research has shown that students who play the GBG in first and second grade are (a) less likely to be diagnosed with drug and alcohol disorders or antisocial personality disorder, and (b) less likely to engage in a range of detrimental behaviours (e.g., regular smoking, delinquency, or incarceration for violent crimes and suicide ideation) later in life. • Given the potential benefits of implementing the GBG, additional research on the GBG with students with varying disabilities is warranted.

				• Furthermore, few studies have implemented an interdependent group contingency like the GBG with students as young as prekindergarten, but none of them included students with disabilities.
Zarnegar et al. (2016)	Thirty-eight (38) young children and their adoptive families. Only 15 met inclusionary criteria.	Southern California	To present outcomes from an early psychosocial intervention with 10 adopted, maltreated young children diagnosed with FASD, aged 10–53 months and their adoptive parents.	• Research on early intervention for young children with FASD, particularly children with comorbid maltreatment experiences, is limited. • Existing research has mainly focused on structuring environments to be responsive to the needs experienced by children with FASD rather than improving their functioning.
Zelner et al. (2012)	Forty-seven (47) pregnant women.	Grey-Bruce, Ontario	To assess whether women would willingly partake in a screening programme of this nature.	• It has been recognised that meconium analysis for fatty acid ethyl esters may serve as a neonatal screening tool for the identification of alcohol exposed new-borns, which could potentially be implemented as a universal screen or targeted to high-risk populations. • Such screening would not only provide accurate exposure history required for diagnosis but, if implemented along with a comprehensive follow-up programme and interventions, could facilitate early recognition and treatment of FASD. • As an added value, it may identify and allow for intervention in problem-drinking mothers, which, in turn, may prevent future alcohol-exposed pregnancies. • Since informed consent from a competent patient or appointed guardian prior to treatment or testing is an ethical and legal component of medical

				practice, a screening programme of this nature may require consent of the child's legal guardian (typically the parent).

Table 3 presents the findings of the 11 studies that met the inclusion criteria. These studies, conducted between 2010 and 2020, included interventions for children, families, and stakeholders of children aged 0–8 diagnosed with FAS or exposed to alcohol in utero. Overall, the findings in Table 3 indicate that the studies aimed to determine, explore, and understand the effects of alcohol exposure during pregnancy, the phenomenon of FAS, and the direct and indirect effects on children during ECD. Although there is a significant amount of research on FASD interventions during early childhood, the studies included in this review highlight that research on the effectiveness of interventions for individuals with FASD is still limited. Therefore, these studies aimed to explore the effectiveness of the interventions used for children with FASD.

This review examined global studies of interventions for FASD during early childhood. Of the included studies, three interventions were conducted in developed regions of the United States of America, New York (Petrenko et al., 2019) and California (Keil et al., 2010; Zarnegar et al., 2016), and one in Ontario, Canada (Zelner et al., 2012). Additionally, one study was conducted in the rural regions of Australia (Wagner et al., 2018). Six of the included studies did not report the geographical location of the intervention.

The studies included children who were exposed to alcohol prenatally (Petrenko et al., 2019; Wiskow et al., 2018; Connolly et al., 2016; Pei et al., 2016; Zarnegar et al., 2016; Keil et al., 2010). The sample sizes varied, with smaller groups consisting of 1 to 3 individuals with FAS or pFAS (Wiskow et al., 2018; Connolly et al., 2016), and larger groups ranging from 100 to 279 participants (Keil et al., 2010; Pei et al., 2016). The age of the children in these larger groups ranged from 1 to 17 years old (however for the purpose of the current study, we only focused on children until 8yrs of age). Studies involving interventions with parents (including pregnant women), families, and stakeholders had sample sizes ranging from 3 to 50 participants (Reid et al., 2017; Zelner et al., 2012).

Overall, several studies aimed to examine and determine the effectiveness of interventions on parents, children, and families of children with FAS. The study by Wiskow et al. (2018) evaluated the effectiveness of the Good Behaviour Game (GBG) intervention in reducing the levels of disruptive behaviour displayed by a 4-year-old boy with FAS. Similarly, the study by Reid et al. (2017) assessed the feasibility of an adapted version of the PuP programme, while another study evaluated pregnant women's willingness to participate in a screening programme (Zelner et al., 2012).

Additionally, other studies examined the experiences of foster and adoptive parents (Petrenko et al., 2019) and the long-term effects of interventions on child and caregiver functioning (Petrenko et al., 2019). Furthermore, Tzilos et al. (2011) conducted a preliminary estimation of the effect size of intervention-related changes in alcohol consumption and birth outcome variables. These studies contributed to the existing body of literature exploring the outcomes and effectiveness of interventions.

5.3.2 Methodological aspects

The methodological aspects of included studies that focus on study's design, sampling method and size, as well as the data collection instruments are captured in Table 4 below.

Table 4: Methodological aspects of studies

Authors	Methodological appraisal				
	Study Design	**Participants/Population**	**Sampling method**	**Sample size**	**Data collection/instrument(s)**
Connolly et al. (2016)	Case study, quasi-experimental single-subject design	Child diagnosed with pFAS and pervasive developmental disorder.	Purposive sampling	One (1) child diagnosed with pFAS and pervasive developmental disorder.	• Applied behaviour analysis based on verbal behaviour treatment • 15-hour intensive one-on-one therapy for 23 months • Behavioural skills assessment • Behavioural skills training (BST) used to train staff
Keil et al. (2010)	A two-group CFT or delayed treatment intervention	Children with PAE aged 6–12.	Random sampling	A hundred (100) children with PAE aged 6–12.	• Children's friendship training • Physical examination
Pei et al. (2016)	Patient file review	Children with FASD and PAE aged 1–17.	Not specified	A total of 279 children (174 children with FASD, and 105 with PAE).	• File review • Clinical assessment • Parents completed the Services for Children and adolescents – Parent interview
Petrenko et al. (2019)	Qualitative	Twenty-four (24) foster and adoptive parents and adults aged 3–33 with FASD.	Not specified	Twenty-four (24) foster and adoptive parents who are raising a child or adult with FASD aged from birth to 35.	• Individual interviews • Focus groups • Referrals • FASD parent support groups • Posted flyers and brochures

					• Pre-presentation at family-oriented conferences
Petrenko Demeusy, & Alto (2019)	Intervention (neuropsychological evaluation and customised community referrals)	Children aged (4–8) with PAE and their caregivers.	Random sampling	Thirty (30) children with PAE.	• Participants were recruited by practitioner referrals, brochures and flyers, and presentations at local parent support groups • Children in the comparison group received comprehensive assessment
Reid et al. (2017)	Mixed methods – qualitative and quantitative – and a single-case experimental design.	Families recruited from FASD diagnostic service, children and adults.	Not specified	Three families, three female children and six parents.	• A survey to assess programme feasibility for researchers • Semi-structured parent interviews
Tzilos et al. (2011)	Intervention	Pregnant women who screened positive for risky drinking during a routine prenatal clinic visit.	Random sampling	Fifty (50) pregnant women who screened positive for risky drinking during a routine prenatal clinic visit	• Computer-delivered brief interventions or assessment only conditions • Clinical trial • 40 min. assessment on tablet/PC • T-ACE (screening tool for problem alcohol use) • Readiness to change questionnaire
Wagner et al. (2018)	Mixed method research design	Community members, stakeholders, and occupational therapists.	Not specified	Twenty-six (26) children and three teachers	• School and home visits • Unstructured phone interviews

					• One-hour face-to-face focus group with teachers • Teachers completed lesson reflections and questionnaire • Standardised questionnaires were completed by teachers and caregivers before and after programme
Wiskow et al. (2018)	Mixed methods – observation	A boy with FAS	Purposive sampling	One (1) boy with FAS and three peers	• Playing structured games • Unstructured play or art time • Structured group time • Reading short stories • Evaluated the effectiveness of the GBG • Carpet squares forming a semi-circle • Sit crisscross on their bottoms and keeping a bubble in their mouth without talking • Keeping hands on their laps
Zarnegar et al. (2016)	Quantitative research design	Young children and their adoptive families	Convenience sampling	Fifteen (15) young children and their adoptive families, of which 10 completed the intervention.	• Children and caregivers received Child-Parent Psychotherapy (CPP) • Caregivers (adoptive parents) received Mindful Parenting Education (MPE)

Zelner et al. (2012)	Screening	Mothers and neonates	Purposive sampling	Forty-seven (47) mothers and 39 neonates	• Women tested positive for meconium were identified by nurses • Pamphlets and posters in the maternity ward

Various research approaches were adopted in the studies. Zarnegar et al. (2016) used a quantitative approach to explore interventions for young children and their adoptive families, specifically child-parent psychotherapy and mindful parenting education. Convenience sampling was used in this study. On the other hand, Petrenko et al. (2019) used a qualitative research design but did not specify the sampling method.

Additionally, three studies (Reid et al., 2017; Wagner et al., 2017; Wiskow et al., 2018) used a mixed method research approach. Wagner et al. (2017) and Reid et al. (2017) did not specify their sampling methods, while Wiskow et al. (2018) used purposive sampling. Connolly et al. (2016) utilised a case study research design with a quasi-experimental single study design, and purposive sampling was used. Other research designs included patient file reviews (Pei et al., 2016) with no specified sampling technique, and screening (Zelner et al., 2012) which also used purposive sampling. Various intervention research study designs were used (Keil et al., 2010; Petrenko et al., 2019; Petrenko, Demeusy, & Alto, 2019; Tzilos et al., 2011) and these studies used random sampling techniques.

The sample sizes for the included studies ranged from 1 to 279 participants (Connolly et al., 2016; Pei et al. 2016). The research tools used varied among the studies and included self-administered questionnaires, file reviews, clinical assessments (Pei et al., 2016), structured and unstructured play and short stories for children (Wiskow et al., 2018), children's physical examination (Keil et al., 2010), applied behavioural analysis and assessments (Connolly et al., 2016), individual face-to-face interviews, parent support groups, brochures, and focus group discussions (Petrenko et al., 2019; Petrenko, Demeusy, & Alto, 2019).

5.3.3 RE-AIM framework

This section provides a descriptive overview of the findings and analysis of the included studies. It describes the RE-AIM framework in detail, explaining each component of the framework in relation to the study interventions that met the inclusion criteria. This information is presented in tabulated form below in Table 5.

Table 5: RE-AIM framework analysis

Authors	RE-AIM FRAMEWORK				
	Reach	Effectiveness	Adoption	Implementation	Maintenance
Connolly et al. (2016)	One (1) child with pFAS and pervasive developmental disorder	• Outcomes included rapid skill acquisition across several areas of functioning	• Director of the clinic, a licenced psychologist and doctoral level board certified behaviour analyst (BCBA-D), served as the primary case supervisor and provided clinical oversight for all decisions made regarding the patient's treatment and planning. • An experienced, master's-level BCBA functioned as the case manager, provided daily treatment monitoring, and reported directly to the psychologist.	• Over 23 months • No cost implications	• Follow up – intellectual, adaptive, emotional/behavioural functioning after nine months • Psychoeducational evaluation
Keil et al. (2010)		• Social skills intervention resulted in a significantly lower proportion of hostile attributions in peer group entry, but not peer provocation, scenarios.	• Took place at the Semel Institute for Neuroscience and Human Behaviour (University of California)	February 2003 – February 2005	Three-month follow-up period

		Limitations • Not entirely possible to accurately assess clinical significance of reductions in hostile attributions in the study.			
Pei et al. (2016)	A total of 279 children (174 with FASD and 105 with PAE) aged 1–17 years.	• Children with FASD received more recommendations. • Older children received fewer family support Limitation • Follow-up information only available to a subset of the entire sample.	• Clinic at the Glenrose Rehabilitation Hospital • Research assistants, principal, and co-investigators	2001–2010	Forty-five (45) (33 FASD and 17 PAE) of the 279 children were involved in the follow-up interventions. Parents of the 45 follow-up participants completed the Services for Children and Adolescents–Parent Interview (SCA-PI) (Jensen et al., 2004) to provide information regarding their family's use of interventions after clinical assessment.
Petrenko et al. (2019)	Twenty-four (24) foster and adoptive parents raising a child or adult with	• The objective was to understand the parents' experiences – the results document the parents' perspectives.	• Interviews and focus groups conducted by the first author • Upstate New York	• Round 1 lasted 74 minutes and Round 2 lasted 80 minutes. • All participants received a small financial	N/A (not mentioned in text)

	FASD aged from birth to 35	Implications • The results from the current study may not entirely transfer to foster and adoptive families whose children have not been diagnosed or who are not actively engaged in advocacy and securing services, or to other types of families raising children with FASD, such as biological parents or relative caregivers. • Parents also described how these protective actions increase stressors at various levels of the ecology. • The findings of study can be used to strengthen family-focused care practices with FASD individuals and their families.		incentive (US $20) for their participation.	

Petrenko, Demeusy, & Alto (2019)	Thirty (30) children aged 4–8 years with PAE and their caregivers.	• The interventions had a positive effect on child and caregiver outcomes immediately following the intervention. • This pilot study yielded promising effects on important areas of caregiver functioning. • However, the intervention's impact on child functioning waned over time, suggesting the need for sustained or alternate child intervention. Limitations • Statistical power was limited by the small sample size, which was further restricted by families	• Two facilitators and 1–2 undergrad assistants	Thirty weeks	• Families were assessed at baseline, post-intervention, and six-month follow-up visits. • A six-month follow-up of a small-scale pilot trial. • Data were collected from participants at baseline, post-intervention (immediately following intervention; approximately one year after baseline), and follow-up (approximately six months post-intervention).

		whose data were lost to follow-up.			
Reid et al. (2015)	Three female children and six parents recruited from FASD diagnostic service.	• The PuP intervention provided parents with increased understanding, emotional support, and practical guidance. Limitations • There were only three baseline studies, with no follow ups. Thus, the adequacy of this method cannot be accurately ascertained.	• University clinic or participants' homes • Therapists met with participants	Weekly or fortnightly for 1–2 hours	• Follow-up interventions included surveys to assess programme feasibility
Tzilos et al. (2011)	Fifty (50) pregnant women who screened positive for risky drinking during a routine	The study assessed the feasibility of the computer-delivered approach through the evaluation of the rate of identification of at-risk drinking and of the proportion of participants able to	N/A	40 minutes	• Follow-up was conducted one month after the intervention

	prenatal clinic visit.	complete the computer delivered session and acceptability of computer-delivered SBIRT via participant reports on the ease of use, helpfulness, and overall satisfaction. The secondary aims of this study were to conduct preliminary effect size estimation of intervention related changes in (1) alcohol consumption (frequency, quantity, and binge use) 30 days after the single-session intervention, and (2) birth outcome variables. The results indicate that participants in both conditions significantly decreased alcohol use at follow-up, with no group differences;			

		however, birth weights for infants born to women in the intervention group were significantly higher. Limitations: • The sample consisted of 82% African American women from low SES who received care in an urban hospital setting. This is a limitation as it may not apply to other groups of pregnant women. • The reliance on self-reported data is another limitation, as it is subject to bias since participants can answer questions with socially acceptable answers instead of expressing what they really feel/experience.			

		• There was no effect of treatment on reported alcohol use at follow-up, but both groups significantly reduced their self-reported alcohol use at follow-up, and infants born to women in the intervention group had significantly higher birth weights. • The high acceptability of the intervention evaluated in this study, even among participants who denied active drinking, raises an intriguing possibility.			
Wagner et al. (2018)	Twenty-six (26) community members, stakeholders, and	• Outcomes included measuring executive functioning. • Programme training for school staff was reduced in	• Australia- Aboriginal community schools • Facilitated by a senior Aboriginal community researcher	• N/A • This study was funded by a National Health and Medical Research Council project grant (GNT1086145).	• Students completed multiple assessments pre- and post-intervention and at follow-up.

	occupational therapists	length to alleviate staff burden. • Effective implementation of this programme is key to delivering robust evidence about the efficacy of a self-regulation intervention in remote Aboriginal communities where the prevalence of FASD in primary school age children remains of great concern. Limitation: • Due to the limited time schools and their staff have available for professional learning, it was also decided to exclude the remaining modules from future training plans.		• The training package would take 20 hours to complete. • Staff were to undertake Modules 1 to 5, seven weeks prior to delivering the curriculum in their classroom.	

Wiskow et al. (2018)	One (1) boy with FAS and peers	• The results showed that the GBG was effective to decrease disruptive behaviour to similar levels as peers in the group. • Furthermore, it did not conduct preference assessment of edible items.	• Sessions in a university-based laboratory, which looked like a classroom. • Therapists	3 weeks, 1 to 4 times per day for 2.5 hours, Monday–Friday	N/A
Zarnegar et al. (2016)	Fifteen (15) young children and their adoptive families (10 completed).	• Based on the outcomes of a neurodevelopmentally informed assessment protocol, the data of the 10 children presented recommended that they receive a range of regulatory, somatosensory, relational, and cognitive enrichments. • The scores of several measures of child developmental functioning improved from pre- to post-intervention. Additionally,	• Southern California	• Six consecutive months of treatment interventions, some of whom completed 1 year. However, due to the small sample size, only data from the first 6 months were used. • Three PhD and master's level clinicians with general training in early childhood mental health and specific training in CPP, MPE, and NMT delivered the	• Six consecutive months of treatment interventions, some of whom completed 1 year. However, due to the small sample size, only data from the first 6 months were used. • A window of six months was chosen for follow-up so that at least 10 children could be assessed at the same time/point – prior to a significant number of families departing from or completing treatment.

		parents' caregiving skills improved while their caregiving stress decreased. Limitations • More research on the neurodevelopmentally informed assessment protocol is needed to inform early intervention of FASD.		interventions under the supervision of a licenced paediatric psychologist.	
Zelner et al. (2012)	Forty-seven (47) mothers and 39 neonates (newborns)	• The study aimed to facilitate the detection and management of FASD. • Follow-up, interventions, and support programmes were individualised and offered within the framework of currently available services in the area, thereby modelling a programme that could be implemented in clinical practice.	• Screening was offered for women residing in the region of Grey-Bruce, Ontario, who were delivering at St. Joseph's Health Care (SJHC) in London, Ontario.	• Costs were based on current prices, varying depending on the site of screening implementation and time ($8 371– $12 271 per year).	• Follow-up, interventions and support programmes were individualised and offered within the framework of currently available services in the area, thereby modelling a programme that could be implemented in clinical practice. • The follow-up of the infants' development proved of immense value as delays in

		• The results of the study show that women's unwillingness to participate, despite the potential benefits of such screening programmes, and maternal unwillingness to consent, likely due to fear, embarrassment, and guilt, may limit the effectiveness of meconium testing for population-based open screening, highlighting the need for public education and social marketing efforts for such programmes to be of benefit. Limitation			motor development became apparent starting at six months.

		• The implementation of screening programmes in clinical practice may be hindered by women's unwillingness to participate, particularly among those who consumed alcohol during pregnancy.			

5.3.3.1 REACH

Every article in this review covered all aspects necessary to address the 'REACH' component of the RE-AIM framework. Eleven articles detailed who the programme or intervention was intended for, which included children exposed to FASD or PAE, ranging from pregnancy to age 17, and their families. Additionally, the study by Wagner et al. (2018) focused on community members and stakeholders. To critically appraise intervention programmes, the REACH component of the RE-AIM framework also reports the representativeness of the target population and the participation rate (Shaw et al., 2019). The target population for all the studies consisted of children diagnosed with FASD or PAE and their caregivers.

Furthermore, Pei et al. (2016) had the largest reach, with a sample size of 279 children with FASD and PAE. This intervention was a patient file review, examining 174 FASD and 105 PAE cases. Similarly, Keil et al. (2010) conducted a two-group CFT or Delayed Treatment Control (DTC) longitudinal intervention design, sampling 100 children with PAE aged 6–12 years. Based on their inclusion criteria and sample size, these two studies had the most effective reach, with the largest population sample size and participation rate, representing the population well (Pei et al., 2016; Keil et al., 2010).

Conversely, the intervention studies with the least effective reach were conducted by Wiskow et al. (2018) and Connolly et al. (2016). Wiskow et al. (2018) used a mixed method observation to assess one four-year-old boy and three of his peers, while Connolly et al. (2016) administered a quasi-experimental single-subject design case study to assess one child with pFAS and pervasive developmental disorder.

Although the compiled file review of participants' interventions by Pei et al. (2016) had a high initial participation rate of 279 participants, only 45 children with FAS and PAE completed the follow-up intervention. The CFT or DTC intervention maintained the same number of participants pre-intervention and during the follow-up intervention.

5.3.3.2 EFFECTIVENESS/EFFICACY

This study considered the assertion by UNICEF (2019) that best practice interventions should have clear goals and measurable progress. To explore the 'EFFECTIVENESS' of an intervention or programme, researchers need to determine whether the intervention achieved its intended objective. They also need to report on the limitations and at least one outcome of the study (Mpelo et al., 2018).

Additionally, when analysing the effectiveness of a study intervention, the strength or attrition of the intervention needs to be reported (Holtrop et al., 2018). Seven articles met all four requirements of the EFFECTIVENESS component of the RE-AIM framework (Connolly et al., 2016; Pei et al., 2016; Petrenko et al., 2019; Petrenko, Demeusy, & Alto, 2019; Tzilos et al., 2011; Zarnegar et al., 2016; Zelner et al., 2012). These studies reported on whether the programme achieved its intended objectives, the limitations, at least one outcome, and attrition.

Of the interventions included in this study, three were the most effective: the behavioural intervention (Wiskow et al., 2018), the computer-based intervention (Tzilos et al., 2011), and the child-parent and parenting education intervention (Zarnegar et al., 2016). These interventions were selected as best practice interventions as they met their desired objectives despite the limitations.

The behavioural intervention (GBG), conducted 1–4 times a day (1–2 hour sessions) for three weeks, was effective in that preliminary results showed a decrease in disruptive behaviour among the participants. It was recommended for replication in classrooms with learners with special educational needs and disabilities (Wiskow et al., 2018). On the other hand, the computer-based T-ACE intervention took approximately 15–20 minutes, with a follow-up of 10–15 minutes. This intervention was effective both during and after implementation, resulting in decreased alcohol use and higher birth weights of infants born to the participating women (Tzilos et al., 2011).

Zarnegar et al. (2016) reported that the objective of the CPP (Child-Parent Psychotherapy) and MPE (Mindful Parenting Education) study was to use an assessment and intervention planning process to identify broad neurodevelopmental problems experienced by young, maltreated children with FASD. This aimed to identify interventions that would improve developmental outcomes in children. The outcomes included improved developmental functioning in children and enhanced caregiving skills and reduced stress in adoptive parents. Therefore, this study achieved the desired objectives.

Moreover, despite meeting the objectives, these best practice interventions had limitations. The limitations included not applying a preference assessment (Wiskow et al., 2019), participant bias (Tzilos et al., 2011), and limited research (Zarnegar et al., 2016). Wiskow et al. (2019) did not conduct a preference assessment of edible items, meaning the rewards provided may not have been highly preferred by the participant. The T-ACE intervention faced participant bias, as self-assessments may not always be truthful (Tzilos et al., 2011), leading to the outcome that there was no effect of the treatment on reported alcohol use at the follow-up. The CPP and MPE study highlighted the need for more research on neurodevelopmentally informed early interventions for FASD (Zarnegar et al., 2016).

5.3.3.3 ADOPTION

When analysing the ADOPTION of interventions, several aspects need to be considered. Researchers need to determine whether studies report on the settings in which the intervention or programme occurs, the intervention agents who initiate a programme, and the reasons behind its initiation. Of the 11 articles included in this study, two articles (*n=2*) (Pei et al., 2016; Keil et al., 2010) reported on all the components that make up the adoption of the intervention, making them the best practice interventions in terms of 'adoption'. These interventions took place in both a rehabilitation hospital and a university laboratory setting, administered by research assistants, principals, and co-investigators.

The follow-up intervention recommendation for children with FASD/PAE, in the form of a patient file review, took place at a clinic at the Glenrose Rehabilitation Hospital (Pei et al., 2016). On the other hand, the Delayed Treatment Control Longitudinal Design (DTC) was conducted at the Semel Institute for Neuroscience and Human Behaviour (University of California) (Keil et al., 2010). Other findings of the current study also showed that behavioural interventions were administered in university-based laboratories (Wiskow et al., 2018) and were conducted by psychologists, analysts, and clinic directors (Connolly et al., 2016).

5.3.3.4 IMPLEMENTATION

Of the interventions included in this study, seven (*n=7*) reported on all requirements of the IMPLEMENTATION component. These included study duration and frequency; adaption made to interventions and implementation strategies; the degree to which the intervention was intended and delivered; and cost implications (Connolly et al., 2016; Keil et al., 2010; Pei et al., 2016; Petrenko et al., 2019; Petrenko, Demeusy, & Alto, 2019; Reid et al., 2017; Wagner et al., 2018; Zelner et al., 2012). Among these, the best practice intervention in terms of implementation is the Alert Programme intervention by Wagner et al. (2018), providing the most detailed information regarding the duration, adaptions made, and cost implications, as described below.

This RE-AIM review found that interventions occurred at different durations ranging from years to a few minutes. The Alert Programme intervention by Wagner et al. (2018) was implemented in three phases. Phase 1 involved engagement with the community and stakeholders through home, community, and school visits, which were conducted over a six-month period. Phase 2 included unstructured telephonic interviews and one-hour face-to-face focus groups with teachers to gather the necessary information. Phase 3 involved the completion of questionnaires by teachers, parents, and caregivers before and after the delivery of the Alert Programme intervention, as well as an eight-week follow-up. The Alert Programme intervention required that training packages take 20 hours to complete, and staff were to undertake modules seven weeks prior to implementing the curriculum in the classroom (Wagner et al., 2018). This intervention underwent changes in the lesson plans, and programme resources were modified to reflect the remote community contexts, classrooms, and children's behaviours.

Similarly, the intervention that spanned the longest period of time was the patient file review conducted by Pei et al. (2016), which lasted for nine years (2001–2010). This retrospective file review involved an examination of clinical assessments conducted at the clinic between 2001 and 2010, with a total of 279 children's files included in the analysis. Out of these, only 23 participants returned for a second assessment. However, this study solely utilised data from the first assessment. On average, the follow-up assessment took place 4.3 years after the initial assessment (Pei et al., 2016).

Additionally, the Applied Behavioural Analysis (ABA) intervention lasted for 23 months (Connolly et al., 2016). The intervention involved the participant receiving 15 hours of one-on-one sessions each week. The Family Based intervention lasted for 74 minutes in the first round and 80 minutes in the second round (Petrenko et al., 2019). This intervention was delivered by clinical psychologists and graduate students who had received 50 hours of training in motivational interviewing and intervention models.

Similarly, the Parents Under Pressure (PuP) intervention took place weekly or fortnightly for 1–2 hours (Reid et al., 2017). The intervention with the shortest duration and frequency was the T-ACE intervention (Tzilos et al., 2011), which lasted for 40 minutes.

Two articles (*n=2*) (Petrenko et al., 2019; Zelner et al., 2012) had cost implications for their interventions. The Open Meconium Screening programme (Zelner et al., 2012) reported that the cost implications for the intervention varied based on the site of screening implementation and might also differ depending on the time. For example, Zelner et al. (2012) identified that after a year of meconium screening between two sites, the cost implications would be $50 000–$94 000. However, with the one-year and six-year meconium follow-up of participants testing positive at one site (Owen Sound Hospital), the cost implications would be $106 171–$200 642. Conversely, at a different site, the cost implications would be ($58 771–$98 671) (Zelner et al., 2012).

Petrenko et al. (2019) reported that all participants received a small financial incentive (US $20) for their participation. On the other hand, other studies did not give participants an incentive but the programme itself – the Alert Programme – was funded by the National Health and Medical Research Council project grant (Wagner et al., 2018). On the contrary, Connolly et al. (2016) reported that their study had no cost implications involved.

5.3.3.5 MAINTENANCE

The MAINTENANCE component of the RE-AIM framework explores whether or not the interventions focus on the long-term effects, typically after six months. Although follow-up interventions occur after six months, the T-ACE intervention (Tzilos et al., 2011) reported that the follow-up was conducted one month after the initial intervention. On the contrary, five of the interventions included in the current study (*n=5*) reported on the long-term effects of the intervention and the interventions used as follow-up (Connolly et al., 2016; Keil et al., 2010; Petrenko et al., 2019; Wagner et al., 2018; Zarnegar et al., 2016).

The CPP and MPE interventions (Zarnegar et al., 2016) took place over six consecutive months, with some participants completing it in one year. The follow-up was conducted at six months to ensure that at least 10 children could be assessed simultaneously (Zarnegar et al., 2016).

Follow-up assessments for the Alert Programme (Wagner et al., 2018) were conducted at eight weeks. Some participants withdrew their participation at the follow-up stage due to the questionnaire cluster for a randomised controlled trial (RCT) (Wagner et al., 2018).

Follow-up interventions for the Open Meconium Screening intervention reported that the interventions and support programmes were individualised and offered where services were available in the area (Zelner et al., 2011). The PuP intervention's follow-up included surveys assessing its feasibility (Reid et al., 2017).

Two interventions (*n=2*), the GBG intervention (Wiskow et al., 2018) and a family-based intervention (Petrenko et al., 2019), did not report on any follow-up or long-term effects of the intervention, thus not addressing the maintenance aspect of the RE-AIM framework.

In contrast, the CFT and DTC interventions (Keil et al., 2010) reported on the effects of the intervention and provided information on the indicators used for follow-up. The follow-up occurred three months after the intervention. Additionally, the follow-up for the ABA intervention (Connolly et al., 2016) occurred after nine months and included assessments of intellectual, adaptive, emotional, and behavioural functioning, as well as a psychoeducational evaluation (Connolly et al., 2016).

5.4 CONCLUSION

This chapter presented the findings of the RE-AIM review. The data included 11 studies that addressed the research questions, aims, and objectives. Data were extracted in relation to the five components of the RE-AIM framework: Reach, Efficacy, Adoption, Implementation, and Maintenance. An in-depth description of the data was tabulated for each step of the data extraction process, which will allow for the interpretation of the extracted data in Chapter 6.

The findings suggested that the interventions included in this study used various research methods and designs in their implementation. Some studies reached more participants than others. While some interventions reached a larger audience, they did not necessarily achieve their objectives or retain the same number of participants post-intervention, thus making them less effective. Not all interventions included in this RE-AIM review were effective when implemented in different settings, and some had to be adapted to fit the criteria of the population sample. Each component of the RE-AIM framework had best practice interventions based on reach, efficacy, adoption, implementation, and maintenance.

The next chapter will provide a more thorough explanation of these results.

CHAPTER 6

DISCUSSION

6.1 Introduction

The interventions of the 11 included studies exhibited strengths that contributed to the effectiveness of the programmes, as well as various limitations and weaknesses. These aspects are discussed in more detail below, and suitable and/or possible solutions are suggested.

6.2 Discussion of Findings

Upon analysis of the studies included in this RE-AIM review, it became apparent that these interventions, all using different techniques, aimed to treat and improve not only the individual with FASD but also everyone involved in their lives. This suggests that a child with FASD should receive treatment and developmental improvements in a holistic manner, involving their family, peers, community, and stakeholders. Interventions need to occur at all levels of the bio-ecological system, including the individual (microsystem), their family, friends, and peers, as well as the societal level encompassing the community and stakeholders.

The implementation dimension of the RE-AIM framework examines the consistency of an intervention and the cost at which it is delivered (O'Connor, 2018). Early diagnosis of FASD is beneficial for patient outcomes; however, the diagnostic process can be costly (Berrigan et al., 2019). Since FASD encompasses a wide spectrum of disorders, different diagnostic tools are needed for accurate diagnosis. Similarly, different cases on the FASD spectrum require diverse types of interventions (Oh et al., 2017).

On the other hand, early diagnosis of FASD can lead to the prompt implementation of intervention strategies (treatment and management), as well as improved patient outcomes through access to services (Hanlon-Dearman et al., 2015; Thanh et al., 2013). However, as mentioned, the diagnosis and treatment of FASD can be a very expensive process, as noted by Petrenko et al. (2021).

Research suggests that interventions with longer durations and follow-up periods are often more costly than those with shorter durations (Berrigan et al., 2019; Petrenko et al., 2017). However, the current study found that this is not always the case. Patient file review interventions were prevalent in the current study. Reviewing clinical file records allows for data collection to address clinical queries, such as those related to FASD (Sarkar & Seshadri, 2014). Patient file reviews can also aid in diagnosis, treatment planning, and care management to ensure adherence to guidelines (Aggarwal et al., 2012; Cheng et al., 2011).

While these types of studies or interventions are advantageous due to requiring less time, effort, and funds compared to other methodologies like patient screening and interviews (Sarkar & Seshadri, 2014), they often lack accuracy. This is because patient records rarely include documentation regarding alcohol use (Singer et al., 2021).

On the other hand, screening children prior to testing is also a cost-effective intervention for FASD. This approach helps avoid unnecessary testing for children who are less likely to receive a diagnosis (Berrigan et al., 2019). Similarly, effective screening of pregnant women for alcohol use is beneficial for treatment, prevention, and management. Screening pregnant women and women of childbearing age for alcohol use can serve as a preventative measure for FASD, potentially reducing support costs for individuals with FASD by 3% (Greenmyer et al., 2019). Therefore, screening for FAS or PAE is regarded as one of the most preferred forms of intervention for prevention, as it not only reduces service costs but also alleviates the burden on healthcare systems globally (Dozet et al., 2023).

However, screening does have limitations. For example, screening tools may not always accurately report findings, which can be problematic if children who test positive are not recommended for further diagnostic testing (Berrigan et al., 2019). Additionally, for screening to be effective, women must willingly participate in the process. Unwillingness to participate can hinder intervention methods and the management of FASD.

For example, the current study's results concur that screening programmes are beneficial. However, factors such as maternal unwillingness to consent – due to fear, embarrassment, and guilt – may limit the effectiveness of meconium testing for population-based open screening (Zelner et al., 2012). Symons et al. (2022) state that FASD is a prevalent neurodevelopmental condition, with significant barriers preventing families from accessing FASD-informed care. To improve accessibility, a scalable mobile health intervention for caregivers of children with FASD is under development. Petrenko et al. (2017) note that FASD is present across countries and cultures, with prevalence rates expected to rise in the coming years. To support children and families with FASD worldwide, researchers must work to disseminate and implement evidence-based interventions. However, each cultural context presents unique elements and barriers to the implementation process.

Stigmatisation is often closely linked to maternal unwillingness to participate, and the stigma surrounding FASD and alcohol consumption during pregnancy can influence the identification, prevention, and management of FASD (Bell et al., 2010). In alignment with this, Paley and O'Connor (2011) highlight that mothers often experience stigma and judgement about alcohol consumption during pregnancy. As a result, mothers may be unwilling to participate or disclose any information, fearing that their child may be taken away by child welfare services (de Boer & Kuijper, 2021). Consequently, this serves as a limitation, making it difficult for practitioners and other stakeholders to gain an in-depth understanding of alcohol consumption during pregnancy, which also impacts the implementation of interventions.

Furthermore, participants are often unwilling to participate unless they receive some form of incentive. The current study reported that only one study used incentives for participants (Petrenko et al., 2019; Petrenko, Demeusy, & Alto, 2019). Incentives can be advantageous to researchers as they increase the likelihood of reaching the targeted group (Head, 2009). In cases involving FASD and maternal alcohol consumption during pregnancy, women often feel reluctant to participate for fear of judgement. Therefore, offering incentives can be beneficial as it can encourage participation of the necessary participants. However, this approach can also raise ethical concerns. Providing incentives could be perceived as coercing participation (Vorgias & Bernstein, 2020) and might influence how participants answer questions or engage in the activities.

In addition, it is imperative to maintain an intervention as it is crucial for both long-term outcomes and determining whether the treatment was beneficial. Some interventions have follow-up sessions as soon as one month after, while others would, on average, be six months after the initial intervention or treatment. By having a good understanding, it also helps with identifying that, in many cases, having one intervention method for preventing behaviours such as alcohol consumption during pregnancy is not effective. For example, a study by Peadon et al. (2011) found that intervention alone is not effective for prenatal alcohol consumption; it needs to include the community aspect, as community attitudes toward prenatal alcohol consumption need to change.

According to Agabio et al. (2022), these therapies include medication, support groups, and psychosocial approaches. Examples of psychosocial therapies are cognitive-behavioural therapy, contingency management, and motivational interviewing. Medications approved by the American Food and Drug Administration (FDA) and/or the European Medicines Agency (EMA) for the treatment of AUD include disulfiram, naltrexone, acamprosate, and nalmefene, which assist patients in achieving sobriety or at least reducing alcohol intake.

Despite evidence of their effectiveness, less than 10% of individuals with AUD receive any form of treatment, and less than 2% receive medication specifically designed to address AUD. The undertreatment of AUD can be attributed to various factors, such as insufficient availability of highly trained healthcare personnel and the stigma surrounding AUD in the community. However, despite these limitations, these interventions have their strengths.

Therefore, this review of FASD interventions emphasises that efforts should not only target the microsystemic level but also encompass families, communities, and stakeholders. Given the diverse manifestations of FASD and its associated disabilities, treatment and management should be multifaceted and multidisciplinary, aiming to improve symptoms based on individual cases (Signal et al., 2018).

Considering the complexity and multidisciplinary nature of FASD treatment, interventions are often adapted to fit specific cases (Signal et al., 2018). Similarly, the current study shows that in the RE-AIM review, interventions were modified to meet the needs of children with FAS and their families. Many of these interventions were adapted from those used for other disorders and conditions.

Petrenko and Alto (2017) concur with this finding, stating that during the preparation and implementation of interventions, adaptations may be necessary to align the intervention with the target population or better fit existing systems. For example, the CPP intervention, typically used to assess the parent-child relationship and restore normal developmental functioning in cases of domestic violence and trauma (Hooker et al., 2019; Stronach et al., 2013), was adapted in a study by Zarnegar et al. (2016) to assess 15 young children with FASD and their adoptive families.

Similarly, interventions such as ABA and GBG, designed to monitor and assess child behaviour in the classroom, were adapted to include the behaviour of children with FASD or

PAE (Connolly et al., 2016; Wiskow et al., 2018). This adaptation does not exclude the fact that some interventions were specifically designed for FASD or PAE monitoring and assessment. For instance, interventions like Families on Track (FOT) (Petrenko, Demeusy, & Alto, 2019), T-ACE (Tzilos et al., 2011), and the Open Meconium Screening Programme (Zelner et al., 2012) were specifically designed to assess maternal behaviours, identify risks associated with alcohol consumption during pregnancy, and identify protective factors for children and their families with FASD (Vorgias & Bernstein, 2020).

Therefore, if necessary, pharmacological interventions (medication) should be prescribed and administered to treat comorbid conditions such as depression (Signal et al., 2018). Conversely, non-pharmacological interventions can be introduced as a means to treat FASD. These interventions, aimed at individuals and families with FASD, as well as communities and stakeholders working with FASD, should be implemented to effectively treat FASD and raise community awareness. For example, previous research on parent-child interventions, such as the CPP intervention, has reported that this approach is appropriate for children with FASD and their families. The CPP intervention integrates psychodynamic and attachment-based approaches to balance or correct the emotional relationship between parent and child (Hooker et al., 2019; Stronach et al., 2013; Zarnegar et al., 2016).

In accordance with this, the current study strengthens this statement by showing that evidence-based interventions like CPP and MPE, which focus on early parent-child relationships, yield positive results. The CPP intervention, aimed at identifying the neurodevelopmental problems experienced by maltreated children with FASD, showed improvement post-intervention. Parents also exhibited reduced stress levels (Zarnegar et al., 2016). This is beneficial for both the parent and the child. For example, less-stressed parents are more likely to provide nurturing and responsive care, tending to their child's specific needs, which improves the parent-child relationship and attachment. This ultimately allows the child to develop to their full potential (WHO, UNICEF & World Bank Group, 2018).

A strong parent-child relationship not only supports the child's optimal development but also leads to better outcomes in other aspects of their life, including relationships with peers and other family members (Vorgias & Bernstein, 2020).

Moreover, the family plays a crucial role in the behaviours, mental health, and substance use behaviour of an individual (Kumpfer, 2014). Hence, family-based interventions can have positive outcomes for individuals (Kumpfer, 2014). For example, the family-based prevention intervention, the FOT (Symonds et al., 2022), has suggested that the programme had a large impact on child-related outcomes of emotion regulation and self-esteem. These interventions are not only based on the individual who uses substances but also on their children and their families. The children of substance users or abusers are included in family-based interventions as they are at a higher risk of child maltreatment (Vorgias & Bernstein, 2020). The current study found that more recent FOT interventions resulted in families showing continuous improvement of parenting efficacy and gained improvements in FASD knowledge, post-intervention.

These interventions can also impact child behaviour. When parents, families, and even teachers understand FASD and its associated behavioural problems, it can help with how they handle situations and how to manage misbehaviour. Petrenko, Pandolfino & Robinson (2017) opine that parents who identify their child's misbehaviour with their FASD condition and disabilities are more likely to use pre-emptive strategies designed to help prevent undesirable behaviours. Similarly, when teachers are aware of the behavioural problems associated with FASD, they are able to manage the misbehaviour in ways that will not negatively impact how the child learns (Koren, 2015).

In a study by Symonds et al. (2022), the results demonstrated that the FMF Connect intervention is acceptable and feasible for caregivers raising children with FASD. They will guide subsequent application refinement before large-scale randomised testing. This study employed a systematic, user-centred design approach for the development and evaluation of the application. The approach used can serve as a model to inform the development of mobile health and digital parenting interventions. Consistent with this, the findings of the current study indicate that the GBG approach was effective in reducing disruptive behaviour in children with FASD, benefiting both the child and the teacher (Wiskow et al., 2018).

As previously mentioned, the implementation and maintenance dimensions of the RE-AIM framework also address the consistency of an intervention (Compernolle et al., 2014). This is significant in determining whether the treatment was helpful and beneficial for long-term outcomes. Consistency in delivering the intervention is equally important in establishing a baseline understanding of its effectiveness (Symonds et al., 2022). The current study supports this by reporting that two studies were effective in consistently implementing the intervention and achieving positive outcomes. For example, the GBG (Wiskow et al., 2018) consisted of 1–4 sessions per day (each session lasting 1–2 hours) for three weeks. It was effective in decreasing disruptive behaviour among participants, as shown by preliminary results, and should be replicated in classrooms that include learners with special educational needs and disabilities (Wiskow et al., 2018). On the other hand, the computer-based T-ACE intervention took approximately 15–20 minutes, with a follow-up duration of 10–15 minutes. This intervention was effective both during and after the intervention, as evidenced by a decrease in alcohol use during the follow-up and higher birth weights of infants born to the women involved (Tzilos et al., 2011).

Moreover, to ensure that the adoption of the interventions is accurate, consistent records need to be kept, thus linking back to the implementation of the intervention. In order to create an accurate record of the case at hand, proper note keeping and safekeeping of information are essential for intervention implementation and its outcomes (Vorgias & Bernstein, 2020). For example, capturing data correctly and protecting the data is important in identifying high-risk groups and helping with prevention and treatment (Petrenko & Alto, 2017). In the current study, the loss of data due to follow-up could mean physically losing data or not obtaining enough data in the follow-up intervention due to a significant change in sample size (Petrenko et al., 2019). This is essential in understanding the risk factors associated with targeted intervention (Petrenko & Alto, 2017).

The ecological systems theory is applied to children in preschool and early primary levels. Berger (2013) claims that the child's behaviour can be analysed by considering environmental influences as well as cognitive factors. This situation can be observed in preschool or primary school, where the classroom acts as the microsystem that influences the child. For example, if a teacher enters a classroom brightly, it automatically sets a warm and friendly mood, which positively affects the child's cognitive sphere and encourages the learning process (Watt et al., 2016). Similarly, if a teacher teaches with excitement and happiness in the classroom, the learners will become more interested in listening because they have been influenced by the teacher's positivity. Additionally, the teacher's behaviour can also affect the learners and serve as a model for considering the feelings of others and the value of interactions (Blazar & Kraft, 2017; Wells et al., 2012; Zheng, 2021).

Furthermore, patient file review interventions are based on information that is already available. Therefore, if information is not recorded reliably, it can hinder the analysis process (Sarkar & Seshadri, 2014). Consequently, patient file review implementation also has its disadvantages or weaknesses. In the current study, patient file reviews were compiled by clinic staff with the assistance of a social worker (Pei et al., 2016). They reported demographic and diagnostic information. However, this approach can have limitations in its interpretation. Some information in the patient file reviews may be missing or incomplete (Sarkar & Seshadri, 2014). The limitation of the patient file review by Pei et al. (2016) is that it only included 45 participants in the follow-up intervention, compared to 279 in the initial test. This can skew the data and analysis as the pre- and post-intervention numbers are significantly different. Moreover, the results obtained from the patient file review may not accurately reflect the effectiveness of the intervention. Another limitation of the patient file review intervention is the lack of information regarding the validity and reliability of the approach (Madden et al., 2018). This is consistent with the findings of the current study, which also did not provide any information about the validity and reliability of patient file reviews.

6.3 Conclusion

Numerous FASD interventions have been conducted over the years, yet certain areas, such as neurodevelopmental interventions for FASD, remain under-researched. Many interventions and studies focus on children and their families. Research indicates that while interventions can be costly, preventive measures are more cost-effective. However, these cost-effective interventions come with their own limitations.

Since there is no correct way to treat the multifaceted nature of FASD, multidisciplinary interventions are essential for effective outcomes. Involving the child, their families, communities, and stakeholders collectively in the intervention process will lead to more effective treatment for those affected by FASD. Additionally, this approach will raise awareness, potentially leading to the prevention of FASD, reducing the rates among children, and preventing alcohol consumption during pregnancy.

The final chapter that follows next summarises the study, acknowledges the limitations encountered, and provides recommendations for future research based on the insights obtained.

CHAPTER 7

CONCLUSION

7.1 Introduction

The aim of this study was to identify interventions used for children with FAS within ECD. To address this aim, a RE-AIM review methodology was employed. The present RE-AIM review sought to answer the following question:

> "What interventions exist for children with FAS within ECD?"

The objectives of the current study were to:

- Explore interventions used for children with FAS within ECD.
- Identify interventions and their effectiveness for children with FAS.
- Systematically appraise the methodological rigour of studies exploring interventions used for children with FAS within ECD.

7.2 Executive Summary

FASD remains a significant issue worldwide, with a complex and multifaceted nature that makes treatment and management challenging. The cost of interventions and diagnosis often leads to many cases of FASD going undiagnosed. Furthermore, mothers frequently do not disclose alcohol consumption during pregnancy due to fear, stigma, shame, or the risk of having their child removed, resulting in missed opportunities for early detection and intervention. Preventative measures, such as screening pregnant women and those of childbearing age, are encouraged to promote FASD awareness, reduce stigma, and improve treatment outcomes.

This study demonstrates that interventions can be adapted to meet the specific needs of each FASD case. High-quality studies reporting on FASD interventions within ECD were reviewed, with eleven studies meeting the predetermined inclusion criteria, scoring between 66%–100%. These studies were systematically screened, extracted, and critically appraised.

Based on the research findings, the following objectives were achieved:

1. **Objective 1** sought to *explore interventions used for children with FAS within ECD*. The findings indicate that the FMF Connect, PuP, GBG, CPP, and MPE interventions were acceptable. The FMF Connect, PuP, CPP and MPE interventions are feasible for caregivers raising children with FASD to educate them, and the GBG is feasible for children within ECD to decrease disruptive behaviour. Furthermore, pharmacological interventions are used to treat comorbid symptoms such as ADHD, depression, and anxiety.

   Despite numerous FAS interventions having been conducted over the years, areas like neurodevelopmental interventions for FAS remain under-researched. Research suggests that preventative interventions are more cost-effective than treatment interventions.

2. **Objective 2** sought to identify *interventions and their effectiveness for children with FAS.* The study's findings suggest that the interventions listed above can be effective, given that further research is done. The GBG intervention for children with FASD was effective to decrease disruptive behaviour to similar levels as their peers. The FMF Connect, PuP, CPP, and MPE predominantly aim to improve knowledge, access to services for parents and caregivers, and provide necessary support, proving effective.

3. **Objective 3** sought to *appraise the methodological rigour of studies exploring interventions directed at reducing high-risk behaviours in adolescents*. This objective

was achieved in Chapter 4 at the *eligibility* level of the review. In this section, reviewers independently appraised articles identified as eligible for methodical inclusion in the current study, using a critical appraisal tool. The 11 studies that were ultimately included in this review were systematically appraised and deemed suitable.

7.3 Significance of the Study

The current study highlights the interventions used for children with FAS within ECD. It provides evidence from high-quality studies, shedding light on the limitations and gaps in the existing body of research on FAS interventions in ECD. Consequently, these research findings may contribute to and guide future research. They also offer insights into current thinking in previous research and interventions, potentially guiding new perspectives and aiding in the development of policies and interventions.

Furthermore, the findings of this review can inform the development of programmes and workshops aimed at FAS and ECD, providing appropriate services and support structures for parents, families, governments, and other stakeholders. This will help improve awareness and understanding of interventions and their outcomes within ECD.

7.4 Limitations of the Study

The limitations of this study are acknowledged as follows:

- Database restriction: Information not available on UWC's database was not reviewed.

- Access limitation: Studies that were not open access were excluded, limiting the number of eligible studies for inclusion.

- MeSH terms: The study did not use MeSH terms for data extraction, likely excluding relevant studies and limiting the number of studies eligible for inclusion.

- Reference mining: The study did not utilise reference mining, meaning the reference lists or bibliographies of relevant studies were not consulted to find additional sources.

- Unpublished studies: Unpublished studies were omitted, which may have significantly contributed to the current knowledge.

- Focus limitation: One study focused on FASD and interventions but did not specifically address ECD, leading to a loss of depth despite its valuable contribution.

- Publication bias: Articles were published according to the requirements of their respective journals, possibly overlooking relevant methodological information during the abstract screening phase and excluding potentially relevant studies.

- Language bias: The study was limited to English-language studies, excluding relevant studies published in other languages.

- Follow-up interventions: Some studies did not include follow-up interventions, skewing evaluations. All interventions were equally weighted in terms of the RE-AIM components, potentially excluding studies that did not report on all components equally.

In light of the study's findings, the following recommendations are made for future research.

7.5 Recommendations

With the findings of the present study in mind, the following recommendations are made:

- Although RE-AIM dimensions do not need to be applied to all studies and interventions, it is recommended for future research to report on all five dimensions where possible. Reporting across these dimensions allows for greater value and understanding, providing insights into why certain outcomes occur or do not occur within some interventions. Each dimension is important individually, but they are also interdependent, explaining how one level can affect another.

- The findings of this review can inform the development of programmes and workshops aimed at FAS and ECD. These programmes should offer appropriate services and support structures for parents, families, governments, and other stakeholders to improve and inform them about interventions and their outcomes in ECD.

- Despite FASD being preventable, its prevalence remains high worldwide. More efforts should be geared towards prevention. Governments should allocate appropriate funds within the Basic Education Department to enable effective interventions.

- Where prevention is not possible, establishing early intervention programmes in schools for children with FASD is recommended. These programmes may include speech therapy, occupational therapy, physical therapy, social skills classes, and counselling with mental health professionals.

- There is a notable scarcity of interventions developed and implemented in countries with a higher prevalence of FASD, particularly in Europe and Africa. It is crucial to share and implement contextually and culturally appropriate interventions for the prevention and management of FASD. This effort should inform South African-specific guidelines for screening, referral, and support.

- To comprehensively capture the nation's alcohol consumption patterns, a focused census-style study on alcohol consumption is advised. This will enable researchers to pinpoint precise patterns of alcohol use and prioritise areas for intervention.

7.6 Final Conclusion

The findings of this study highlight the importance of prevention interventions, such as screening pregnant women and those of childbearing age and raising FASD awareness to reduce stigma and facilitate effective treatments. Given the multifaceted nature of FASD, achieving effective outcomes requires multidisciplinary interventions, potentially including a combination of pharmacological treatments for comorbid symptoms and behavioural interventions.

Acceptable interventions aimed at parents and caregivers include FMF Connect, PuP, CPP, and MPE. These programmes educate parents, inform them of available services, and provide necessary support. For children with FASD, acceptable interventions include the GBG intervention within ECD to decrease disruptive behaviour, as well as pharmacological treatments for comorbid symptoms such as ADHD, depression, and anxiety.

In conclusion, many interventions and studies focus on children with FASD and their families. Preventative interventions are encouraged as they are more cost-effective. However, despite extensive research on FAS interventions over the years, certain areas, such as neurodevelopmental interventions for FAS, remain under-researched.

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APPENDICES

APPENDIX A: A-Z DATABASES

Natural Sciences	Social Science	Education & Health
• BioMed Central • BioOne • Health Source: Consumer Edition • Health Source: Nursing Edition • Medline (Pubmed) • Medline (EbscoHost) • PubMed • ScienceDirect • SCOPUS	• African Development Indicators • The African Journal Archive • AnthroSource • Cambridge Journal Online • CINAHL • Jstor • Nexus • Oxford Journals Online • PsychARTICLES • Sabinet African Journal Archive • Sage Journal Online • SocIndex	• Academic Search Complete • EbscoHost Web • Emerald eJournal Premier • MasterFile Premier • SA ePublications • Wiley Online Library

APPENDIX B: TITLE SHEET

Author	Date	Title and source	Database	Location Stored	Outcome (inclusion/exclusion)

APPENDIX C: ABSTRACT SHEET

Type of study design	Study population	Instrument/s used	Outcome	Results of study analysis/ quality of results

APPENDIX D: RE-AIM FRAMEWORK APPRAISAL TOOL

R	**Reach**	**Score yes – 1; no - 0**
	• Does the article indicate who the program is intended for (Inclusion and Exclusion criteria)?	
	• Does the article report on the representativeness of the target population?	
	• Does the article report on participation rate?	
E	**Effectiveness**	**Score yes – 1; no - 0**
	• Did the program achieve the intended objective?	
	• Do they report on the limitations of the intervention?	
	• Reports on at least one outcome of the intervention	
	• Reports on attrition	
A	**Adoption**	**Score yes – 1; no - 0**
	• Is the setting clearly described?	
	• Does the evaluation report on the adoption of the intervention by the participants or the organisation? • Who delivered the program?	
I	**Implementation**	**Score yes – 1; no - 0**
	• Describe the duration and frequency of the interventions?	
	• Has the staff/ participants of the organisation / intervention been involved in deliveringthe program (cost implication?	
	• Reports on intended and delivered interventions.	
M	**Maintenance**	**Score yes – 1; no - 0**
	• Does the article report on long term effects of the intervention (after 6 months)	
	• Do they report on the indicators used for intervention follow – up?	

APPENDIX E: SCORING SHEET FOR THE CRITICAL APPRAISAL TOOL

	Reach			Effectiveness				Adoption			Implementation			Maintenance		
Author	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	**Score**

APPENDIX F: RE-AIM DATA EXTRACTION SHEETS

General Description

Author	Population and Sample size	Geographical Location/ Country	Aim	Problem Statement

Findings and Analysis

Ref	Author	Study Design	Duration	Intervention	REACH	EFFICACY	ADOPTION	IMPLEMENTATION	MAINTENANCE
1									
2									
3									
4									
5									
6									

APPENDIX G: ETHICAL CLEARANCE FORM

UNIVERSITY of the WESTERN CAPE

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16 January 2019

Mr LC Blouw
Child and Family Studies
Faculty of Community and Health Science

Ethics Reference Number: HS18/10/6

Project Title: Interventions for children with Foetal Alcohol Syndrome within Early Childhood Development: A RE-AIM Framework Review.

Approval Period: 30 November 2018 to 30 November 2019

I hereby certify that the Humanities and Social Science Research Ethics Committee of the University of the Western Cape approved the methodology and ethics of the above mentioned research project.

Any amendments, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval.

Please remember to submit a progress report in good time for annual renewal.

The Committee must be informed of any serious adverse event and/or termination of the study.

Ms Patricia Josias
Research Ethics Committee Officer
University of the Western Cape

HSSREC REGISTRATION NUMBER - 130416-049

FROM HOPE TO ACTION THROUGH KNOWLEDGE.

APPENDIX H: EDITOR'S LETTER

PROOF-READING

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25 June 2024

TO WHOM IT MAY CONCERN

RE: LANGUAGE EDITING

This letter serves to confirm that I have edited the thesis titled:

Interventions for Children with Foetal Alcohol Syndrome within Early Childhood Development: A RE-AIM Framework Review

By

Lorenzo Blouw

(This certificate does not cover any alterations made subsequent to the editing process).

Please feel free to contact me if you need any further information.

Yours sincerely,

Dr Lee-Anne Roux