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**Water Stress and Early Childhood Development in Palestine:
Making the Link, and Implications for Policy and Practice**

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Thesis submitted in accordance with the requirements for the degree

of

Doctor of Philosophy

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Department of Public Health, Environments and Society

Faculty of Public Health and Policy

LONDON SCHOOL OF HYGIENE AND TROPICAL MEDICINE

UNIVERSITY OF LONDON

Partially Funded by Saïd Foundation

Dedicated to:

Ola, Nadeem, and Dina

My late father, bless his soul, and my mother

The Palestinian children, who deserve a better life

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I, Ghassan Shakhshir, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in this thesis. Signed _____ Date _____

Abstract

Introduction

The percentage of the Palestinian children considered “below level” – or “not on track” in their early childhood development is higher than their peers in neighbouring countries. This research presents a framework to explain pathways between water stress, child health, family wealth, parental support, and early childhood development in Palestine, and presents a different perspective in water stress and policies and services addressing children.

Objective

To assess evidence of the link between water stress and vulnerability in early childhood development and to examine the implications of this relationship for services and policies in Palestine.

Method and Results

Demographic and health data obtained from nationally representative surveys were merged and analysed. Descriptive analysis was used to investigate the features of household water stress and show its association with risk for delayed early childhood development in Palestine. Data on social, economic, health, and environmental conditions in 52 communities in Palestine were aggregated to develop a Child-Water Stress Index to be used as a single summary measure that captures the multidimensional influence of water stress. At the household level, a Mediation Model was developed and applied to investigate the pathways through which water stress interacts with child health, family care, and wealth level and in turn, influences early childhood development. An evaluation

strategy is presented, with new perspectives for enhancing the effectiveness of early childhood programmes and policies in the Palestinian context. Qualitative data using focus group discussions with parents and semi structured interviews with practitioners were conducted to provide in depth analysis of the findings.

Conclusion

Children experiencing water stress are more likely to not be on track in their early childhood development. Water stress is more likely to influence childhood development through indirect pathways by interacting with determinants of optimal early childhood development including disrupted family support, wealth level, and child health. Water stress exacerbates the impact of limited wealth and inadequate family support on early childhood health and development, suggesting the need for a holistic perspective in evaluating services and policies.

Table of Contents

Acknowledgements	3
Abstract	4
Table of Contents	6
Tables	13
Figures	15
Abbreviations	17
Chapter One Introduction	18
1.1 Introduction	19
1.2 Household Water Stress: A Real Life Context	21
1.3 Children’s Early Development in Palestine: Beyond Conventional Indicators	24
1.4 Water Stress in Palestine: The Exposure	26
1.5 Main Research Goal and Questions	31
1.6 Research Methodology	34
1.7 Motive and Significance	37
1.8 Content	40
Chapter Two Literature Review	41
2.1 Introduction	42
2.2 Literature Review Process	43
2.2.1 Search and Review Strategy	43
2.2.2 Scope of the Review	44
2.2.3 Information Management	45
2.2.4 Limitations	46
2.3 Early Childhood Development (ECD)	47
2.3.1 Definition of Early Childhood Development	47
2.3.2 Ecology and Early Childhood Development	49
2.3.3 Exposure to Stress and Children’s Translational Processes	53
2.3.3.1 Exposure, Risk, and Protective Factors	54
2.3.3.2 Translational Processes, Age, and Epigenetics	56
2.3.4 Conclusion	59

2.4	Characteristics of Water Stress; Beyond the Physical Exposure	60
2.4.1	Chronicity	63
2.4.2	Interrelated Influence and Combined Effect	63
2.4.3	Main Source of Drinking Water	64
2.4.4	Integrational Concepts of Water Stress	66
2.5	Child Water Stress, a Macro-Perspective of the Link	69
2.5.1	Introduction	69
2.5.2	Predictability, Controllability and Adaptability of Water Stress	70
2.5.3	Vulnerability to Water Related Risks for Delayed ECD	71
2.5.4	Integrational Models of Combined Effects	73
2.6	The intermediate processes; A Household Perspective of the Link	77
2.6.1	Introduction	77
2.6.2	The Mediation Influence of Wealth	79
2.6.3	Water Stress and Parenting	81
2.6.4	The Moderation Effect of Personal Characteristics	85
2.7	Implications for Policies and Program	86
2.7.1	Introduction	86
2.7.2	The Gap between ECD Practices and the Concept of Water Stress	87
2.7.3	Childhood Services in Palestine	88
2.7.4	ECD Services and Home Environment	91
2.7.5	The Impacts of Water Stress on Services	91
2.8	Conclusion	94
2.8.1	Introduction	94
2.8.2	Main Conclusions Related to the Research Questions	94
Chapter Three Problem Statement, Hypothesis, and Objectives		99
3.1	Problem Statement	100
3.2	Research Hypothesis	105
3.3	Research Objectives	109
Chapter Four Methodology		113
4.1	Introduction	114
4.2	Methodological Considerations	114
4.3	Method Framework	116

4.4	Data	120
4.4.1	Quantitative Data	124
4.4.1.1	Multiple Indicators Cluster Surveys	124
4.4.1.2	Household Environmental Survey	129
4.4.1.3	National Census 2017	130
4.4.1.4	Poverty Map for the Palestinian Territory 2016-2017	131
4.4.1.5	Services Data, Preschools' Survey	131
4.4.2	Qualitative Data	134
4.4.2.1	Focus Group Discussions (FGDs)	134
4.4.2.2	Semi-Structured Interview	140
4.5	Data Analysis	143
4.5.1	Water Stress: The Exposure	143
4.5.1.1	Individual Features of Exposure	146
4.5.1.2	The Common Features of Exposure	146
4.5.1.3	Interaction with Determinants of Early Childhood Development	147
4.5.1.4	Association between Water Stress and Delayed ECD	149
4.5.1.5	Qualitative Analysis; In Depth Views of Water Stress Features	150
4.5.2	Child Water Stress: A Community Perspective	152
4.5.2.1	Components, Variables, and Related Stress Features	155
4.5.2.2	Standardization of Data	161
4.5.2.3	Estimation of Water Stress Index, the Exposure	162
4.5.2.4	Estimation of Child Water Stress Index	162
4.5.2.5	Water Stress of Features: Predictability, Controllability, and Adaptability	163
4.5.2.6	Estimation of Relative Risk	166
4.5.2.7	Estimation of Vulnerability	166
4.5.2.8	Vulnerability and Delayed ECD; Establishing a Prediction Model	167
4.5.2.9	In-depth views Towards Child Water Stress. Qualitative Analysis	168
4.5.3	Child Water Stress: A Micro- Perspective	170
4.5.3.1	The Mediation Model	171
4.5.3.2	The Variables of Interest	174
4.5.3.3	Suppressor Effect: Family Wealth, Parent Support, and Education	177

4.5.3.4	Moderator Effect: Child and Parent characteristics	178
4.5.3.5	Confounders	179
4.5.3.6	Examining Possible Bias	182
4.5.3.7	Qualitative Analysis	188
4.5.4	Bridging the Theory-Practice Gap and Implications for Practice	190
4.5.4.1	Quantitative Analysis; Descriptive Analysis of Services	191
4.5.4.2	Qualitative Analysis: The Gap, as Viewed by Parents	194
4.5.4.3	Qualitative Analysis: The Gap, as Viewed by Practitioners	195
4.6	Methodological Limitations	199
4.6.1	Defining Water Stress	199
4.6.2	Early Childhood Development	199
4.6.3	The Cross Sectional Data	200
4.6.4	The Aggregated Data	202
4.6.5	Mediation Analysis	204
4.6.6	Services Data	205
4.6.7	Qualitative Methods	205
Chapter Five Exposure, Rethinking Water Stress beyond Physical Measures		208
5.1	Introduction	209
5.2	The Individual Features of Water Stressors	209
5.3	The Common Features of the Exposure	211
5.3.1	The Interrelated Effect	211
5.3.2	Chronicity	214
5.4	Interactions with Determinants of Early Childhood Development	215
5.4.1	Interactions with the Macro Geopolitical Condition	216
5.4.2	Interactions with Family Wealth	218
5.4.3	Water Stress and Parenting Practices	220
5.4.4	Water Stress, Age, and Gender	223
5.4.5	Gender and Water Collection	224
5.4.6	Water Stress and Child Health	225
5.5	Exposure and Delayed ECD	227
5.6	An In-depth View: In depth Views of Water Stress Features	231

5.6.1	Executive Summary	231
5.6.2	Key Findings	231
5.6.2.1	Water Stress as Viewed by Parents	232
5.6.2.2	Interrelationships	235
5.6.2.3	Chronicity	236
5.6.2.4	Interactions between Exposure and the Determinants of Early Childhood Development	237
5.7	Conclusion	239
5.7.1	Quantitative Analysis	239
5.7.2	Qualitative Analysis	241
5.7.3	Integrative Remarks	242
Chapter Six Child Water Stress: The Combined Effect		243
6.1	Introduction	244
6.2	General Overview: The Communities	245
6.3	Water Stress Index (The Exposure)	247
6.4	Child Water Stress Index	252
6.4.1	Child Wellbeing; The intermediate Factors	253
6.4.2	The Exposure and Intermediate Factors; Child Water Stress	255
6.4.3	Child Water Stress Features	259
6.4.4	Relative Risk	261
6.5	Child Vulnerability Index	262
6.5.1	Child-Water Vulnerability in Palestinian Communities	263
6.5.2	Child-Water Vulnerability and Delayed Early Childhood Development	266
6.6	In-depth views Towards Child Water Stress. Qualitative Analysis	271
6.6.1	Executive Summary	271
6.6.2	Key Findings	272
6.6.2.1	The Combined Effect	272
6.6.2.2	Predictability	274
6.6.2.3	Controllability	275
6.6.2.4	Adaptability	276
6.6.2.5	Vulnerability	276
6.7	Conclusion	279

6.7.1	Quantitative Analysis	279
6.7.2	Qualitative Analysis	281
6.7.3	Integrative Conclusion	282
Chapter Seven The Link in the Household Domain		284
7.1	Introduction	285
7.2	The Main Variables	287
7.3	Water Stress and Early Childhood Development	289
7.4	Water Stress and Parental Support	290
7.4.1	The Meditating Role of Wealth Level	290
7.4.2	Suppressing Factors	298
7.4.3	The Moderation Role of Refugee Communities	300
7.4.4	The Mediation and Moderation Effects: The Vicious Cycle	301
7.5	Water Stress and Household Chaos: Qualitative View	303
7.5.1	Executive Summary	303
7.5.2	Main Findings	305
7.5.2.1	The Indirect Effect: Water Stress, Wealth Conditions, and Parental Capabilities	305
7.5.2.2	The Direct Influence of Water Stress on Parents	307
7.5.2.3	Water Stress-Induced Household Chaos and Parental Capabilities	308
7.5.2.4	Water Stress-Induced Household Chaos and Children	311
7.6	Conclusion	314
7.6.1	The Quantitative Analysis	314
7.6.2	The Qualitative Analysis	316
7.6.3	Integrative analysis	317
Chapter Eight Implications of Child Water Stress for Child Development Services and Practices		319
8.1	Introduction	320
8.2	Relevance of ECD Services to the Macro-Context: Descriptive Analysis	322
8.2.1	Types of Services and Related Effectiveness	322
8.2.2	Relevance of Services to Stress and Vulnerability	327
8.3	A Micro-Perspective: Childhood Services and the Home Environment	329

8.3.1	Advantages and Disadvantages of Early Childhood Services	330
8.3.2	Gaps between ECD Services and Home Environment	333
8.3.2.1	Inadequate Consideration of Child Water Stress and Associated Factors	333
8.3.2.2	Continuity of Childhood Services across Age Groups	336
8.4	Impacts on Practices: Practitioner Views and Experiences	338
8.4.1	Summary Findings	339
8.4.2	Impacts on Long-term Outcomes	343
8.4.3	Short-Term Outcomes	346
8.4.4	Outputs	348
8.4.5	Inputs	349
8.5	Conclusion	351
8.5.1	The Quantitative Analysis	351
8.5.2	The Qualitative Analysis	352
8.5.3	The Integrative Analysis	353
Chapter Nine Discussion		356
9.1	Introduction	357
9.2	Early Childhood Development	360
9.3	Water Stress	362
9.4	Child-Water Stress: The Link	363
9.5	Understanding the Link	367
9.6	Implications for the National Policies	368
9.7	Implications for International Policy	371
9.8	Contribution to the Original Knowledge	374
9.9	The Need for Further Research	378
9.10	Dissemination Plan	379
Chapter Ten Conclusion		382
10.1	Introduction	383
10.2	The Hypothesis	386
10.3	Concluding Notes	393
10.4	Closing Notes	395
References		396

Tables

Table 2.1: Literature Addressing Water-Related Aspects in Palestine	62
Table 2.2: Summary of Water Literature, Composite Measures.....	67
Table 2.3: Literature that Guided the Development of the Index	75
Table 4.1: Method Framework.....	118
Table 4.2: Data, Objectives, Sources, and Utilization	121
Table 4.3: Brief Description of the Focus Group Discussions.....	136
Table 4.4: Brief Description of the Semi Structured Interviews	140
Table 4.5: The Analysis Framework of Water Stress: The Exposure	144
Table 4.6: The Logical Steps: Examining Child Water Stress.....	152
Table 4.7: Variables and Domains of the Ecological Data Set	156
Table 5.1: Brief Descriptive Summary of Water Stressors in Palestine	209
Table 5.2: Interrelations between Water Stress Dimensions and Water Quality	212
Table 5.3: Water Source, Consumption, and Related Cost.....	213
Table 5.4: Access to Improved Networks (Comparison of data from 2010 and 2014)	214
Table 5.5: Differential Comparison among Community Type	217
Table 5.6: Access to Improved Networks and Wealth Level (Comparison of data from 2010 and 2014).....	218
Table 5.7: Wealth Levels and Main Source of Drinking Water.....	219
Table 5.8: Cross Tabulation between Type of Water Source and Child Development with Respect to Age and Gender of the Child.....	223
Table 5.9: Water Collection: Gender and Age Differences in Each Wealth Level	225
Table 5.10: Water Stress and Child Health Outcomes.....	226
Table 5.11: Association Between the Use of Unimproved Water Sources and Health Outcomes.....	227
Table 5.12: Breakdown of children developmentally on track and water supply.....	228
Table 5.13: Test for Association between Unimproved Water Supply and ECD, using Dichotomous Variables	228
Table 5.14. Coefficients Table of the Relationship between Unimproved Water Source as Main Source of Drinking and Scale Variable of ECD.....	230
Table 6.1: General Overview: Communities Included in the Index	246
Table 6.2: Summary of Communities' Statistics	247
Table 6.4: Comparison Between Most and Least Stressed Communities.....	261
Table 6.5: SPSS Output Coefficient Table of the Linear Regression Analysis, indicating the Association between Vulnerability and Delayed Early Childhood Development ..	268
Table 7.1: Coefficients Table of the Relationship between Unimproved Water Source as Main Source of Drinking and Scale Variable of ECD	289
Table 7.2: Mediation Analysis, Water Stress, Wealth Level, and Parental Support.....	291

Table 7.3: Regression Analysis of Factors with Suppressing Effects.....	298
Table 7.4: SPSS Output Showing the Change in R-squared Value of Being a Refugee	300
Table 8.1: Types of Early Childhood Services and Related Effectiveness.....	323
Table 8.2: Comparison Between West Bank and Gaza Strip with Respect to the Standardized Scores of Stress Features and Effect Size of Early Childhood Services .	328
Table 8.3: Age-Service Gap	336
Table 8.4: Ecological Logical Framework of the Main Findings of the Impacts of Child Context on the Effectiveness of the Childhood Services	341

Figures

Figure 2.1: Bio-Ecological Development Model, Adapted from Hayes et al. (2017)	50
Figure 2.2: Exposure and Translational Processes (Walker et al. 2011.p 1327).....	53
Figure 2.3: Suggested Model of Exposure, Risks, and Protective Factors	55
Figure 2.4: Water Stressors and Risk and Protective Factors	69
Figure 2.5: Narrow Visualization Exposure, Risks, and Protective Factors	78
Figure 2.6: The Mediation Effect	81
Figure 2.7: The Suppressor Effect	82
Figure 2.8: Moderator Effect.....	85
Figure 2.9: Programme and Service Logic.....	92
Figure 3.1: Path Diagram: Water Supply, Early Childhood Development.....	108
Figure 3.2: The Method General Framework.....	110
Figure 4.1: Hypothesized Causal Mediation Effect	172
Figure 4.1.a: The Effect of Water Stress on ECD without Considering Mediation.....	172
Figure 4.1.b: The Effect of Exposure on the Outcome Variable including the Mediating Effect of M	172
Figure 4.2: Mediation Model. Water Stress, Wealth level, and Parental Support	177
Figure 5.1: Comparison between Children Provided with Parental Support Practices with Respect to Type of Water Service.....	221
Figure 6.1: Standardized Scores of Water Stress Index in Selected Palestinian Communities	250
Figure 6.2: Comparisons; Standardized Scores of Water Stress Variables.....	251
Figure 6.3: Standardized Scores of Intermediate Variables of Child Wellbeing	254
Figure 6.4: Child Water Stress Index	256
Figure 6.5: Visualization of Water Stress vs Child Water Stress, Community Ranking	258
Figure 6.6: Standardized Score of Child Water Stress Features	260
Figure 6.7: Standardized Scores of Vulnerability Index (Exposure, Adaptive Capacities, and Sensitivity).....	265
Figure 6.8: Linear Regression Fitted Line Between Vulnerability Index and Percentage of Children Not on Track in the Selected Communities	267
Figure 6.9: Actual vs. Predicted Values of Percentages of Children with Delayed Early Childhood Development	270
Figure 7.1: The Mediation Model	286
Figure 7.1.a: The Total Effect	286
Figure 7.1.b: The Direct and Indirect Effects.....	286
Figure 7.2: Mediation Model, Water Stress, Wealth Level, Parent Support, and ECD	291
Figure 7.3: Increased Magnitude of the Direct Pathway with Increased risk of Intermediate Factors	296

Figure 7.4: Visualization of the Mediating Role of Family Wealth and Suppressing factors Health and Mother Education and Age299

Figure 7.5: Visualization of the Moderation Effect of Being a Refugee 301

Figure 7.6: Mediation and Moderation: The Cycle..... 302

Figure 8.1: Graphical Representation of Pathways vs. Services Pathways 354

Figure 8.2: ECD Prioritization 355

Figure 10.1: The Water Stress Pathway and Wealth level..... 390

Abbreviations

BBC	British Broadcasting Corporation
CDC	Centres for Disease Control and Prevention
CRC	Convention on the Rights of the Child
DHS	Demographic and Health Survey
DST	Development System Theory
ECD	Early Childhood Development
ECDI	Early Child Development Index
HDI	Human Development Index
IPCC	Intergovernmental Panel on Climate Change
JMP	Joint Monitoring Programme for Water Supply and Sanitation
MDG	Millennium Development Goals
MENA	Middle East and North Africa
MICS	Multi-Indicator Cluster Survey
MOE	Palestinian Ministry of Education
MOH	Palestinian Ministry of Health
NGO	Non-Governmental Organization
OCHA	United Nations Office for the Coordination of Humanitarian Affairs
PCBS	Palestinian Central Bureau of Statistics
PNA	Palestinian National Authority
PWA	Palestinian Water Authority
SDGs	Sustainable Development Goals
UN	United Nations
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations Children Fund
WA	Welfare Association
CWSI	Child Water Stress Index
WHO	World Health Organization

Chapter One | Introduction

1.1 Introduction

Mahmoud Darwish,¹ a widely regarded Palestinian poet, said in his book, *The Memory of Forgetfulness*:

The sound of water mirrors the veins of living land
The sound of water is freedom
The sound of water is humanity

Darwish (1982) symbolized water as a living fluid, circulating all parts of the “living land,” supporting the functions of life, influencing survival, health, and wellbeing. The sound of water reflects a fundamental right of freedom, being accessible by all, with fairness, equity, and with no discrimination based on wealth, race, power, ethnicity, or religion. It reflects humanity and the way people treat each other, embracing values of peace, compassion, unity, and acceptance of who we are, while caring, helping, and supporting each other.

For many, especially the wealthy, water is a commodity accessible “by default,” always available, and at an affordable cost. For many others, mostly people from water-stressed developing countries, it may take days to obtain a small amount of water, for a high price, of poor quality, and an inadequate quantity for basic needs. “3.6 billion people worldwide are already living in potential water-scarce areas at least one month per year, and this could increase to some 4.8-5.7 billion in 2050” (United Nations -Water, 2018-1, p. 13). Factors including demographic shifts, climate change, and conflicts, among others, indicate that water-related challenges are intensifying.

¹ Mahmoud Darwish, is a Palestinian Poet who died in 2008, brief biography available at https://en.wikipedia.org/wiki/Mahmoud_Darwish

Twelve out of the top seventeen most water stressed countries are located in the Middle East and North Africa. By 2050, both regions may experience significant economic losses from climate-related water scarcity, estimated to reach between six and fourteen percent of their gross domestic product (GDP) (World Bank MENA region, 2018).

Palestine,^{2,3} located in the Middle East, is considered one of the top five “extremely high water stressed countries” (Luo et al. 2015, p. 6). Many Palestinian families experience a chronic state of water stress, wherein the quantity of water is inadequate, the quality unsafe, the services unreliable, and the price unaffordable. Local and international literature has extensively examined these stressors, including their influence on the health and survival of children. In Palestine, however, exposure to stressors related to water is compounded by macro and micro contextual factors including challenging geopolitical conditions, poor wealth level, and weak infrastructure.

This research is a holistic risk assessment of water stress for its association with children’s outcomes influenced by lengthy, multi contextual, multidisciplinary exposures, such as water stress. From this respect, this research examined the impacts of water stress on children’s vulnerability and risks for undermined early childhood development. This process refers to children’s early development of their physical, cognitive, social-emotional, and behavioural skills and abilities.

² Palestine is recognized as a state. The United Nation’s General Assembly resolution 67/19 upgraded Palestine to "non-member observer state" status in the United Nations, Available at; "A/67/L.28 of 26 November 2012 and A/RES/67/19 of 29 November 2012

³ Palestine consists of two areas separated from each other by the Israeli territory:

- The West Bank (5,655 km² including East Jerusalem) is a semi-arid mountainous area located between Israel and Jordan with a population of 2.9 million.
- The Gaza Strip (365 km²) is a thin coastal strip of about 36 km long and around 10 km wide. Gaza has a high population density with around 1.9 million people.

This chapter serves as an introduction to the research inquiry. The author shared real-life experiences related to water stress as a background of the research context. The author presented a brief status of children under five years old and described the main elements of water stress, the central aspect of the inquiry examined for its impacts on the Palestinian children.

The other introductory sections include a summary of the research process followed to establish the evidence, precisely the main goal, research questions, and brief methodology. The author shared the main motives and significance of the research with the reader and listed the next chapters' content.

1.2 Household Water Stress: A Real Life Context

The following experiences from the author's own family introduce the true and real-life context of water stress and its interaction with children and families in Palestine:

My wife and I have a small family with two children, who turned 16 and 12 years old in 2019, respectively. We live in the city of Ramallah in the West Bank. Our house is connected to a public municipal network, through which every year we receive a water supply, which is relatively constant from December to March. Every April, the water supply frequently becomes disconnected and interrupted, intensifying in frequency and length by July.

Once the water supply is disrupted, we begin an exhaustive adaptation process. We prioritize drinking, cooking, and handwashing, then bathing, flushing toilets, and cleaning the house. We rarely have reserves for the yard and garden.

During this time, we start looking for private water vendors who sell water using truck-loaded tankers. Water from these trucks costs about seven to ten USD per cubic meter, which is exceptionally high compared to water supplied through the public network, which costs one to two USD per cubic meter. In addition to the high cost, we do not trust the quality or safety of the water because we see strange solid particles at the bottom of the glasses we fill. We also know the vendors are neither regulated nor monitored by a proper safety and compliance system.

Therefore, in addition to the tanker water, every day we buy four to six litres of bottled water for drinking, cooking, and washing food. Unlike many Palestinians who suffer from economic hardship, we have a secure and continuous income above the average wage. Additionally, our house includes a water storage space. Technically, we can buy water as much as we want, but due to high demand, the quantity we receive is much less than the amount we order, and it is often late and inadequate for the needs and uses of my household. Our children have started blaming my wife and I for the water shortage when the vendors are late. On the third day of the water cuts, our ability to adapt decreases as a result of psychological fatigue.

Water dominates the family environment, and shortages create an increasing sense of discomfort, anxiety, and anticipation. My children feel unhappy with our “unpleasant” remarks while asking them to reduce their activities so as not to get dirty. They are unhappy because we are influencing the things they enjoy, mainly playing outside, having picnics, swimming, bathing every day, and cycling.

My wife expresses many feelings, including that she is frustrated, angry, and really sad. My children express other feelings—that they do not feel clean, they smell bad, they are frustrated, furious, and disgusted. As for me, I try, but many times, I feel helpless.

To share a different perspective, the following story was published as a case study by British Medical Journal BMJ, in 2017, about Shayma; a 13-year-old girl whose house was destroyed during the 2008-2009 military offensive on Gaza:

Before the invasion, I had my room. I had pictures posted in every corner of my room. Now, I sleep with my three sisters and three brothers in the same area. Before the offensive, I used to go to school, come back, shower, eat, study, and sleep. Now I go to school and come back without a shower because we always have a water shortage. I wouldn't say I like to study because I'm not comfortable. I do not feel at home at all. I stopped doing all the things I like, such as drawing and playing. I would not say I like watching TV now, which was my favourite hobby of all. My academic achievement is much worse than before the offensive.

I was getting excellent marks, but now I'm not that good at all, and I'm afraid that now I won't be able to be a doctor (Waterston and Nasser 2017, p.4).⁴

These stories correspond to a general situation of stress and vulnerability for children and their caregivers, sponsors, and supporters, mainly parents.

Mataria et al. (2009) indicated that 67% of Palestinian adults feel significant or extreme fear for their families in their daily life, 58% feel threatened by losing family income, 46% threatened by losing a home, 47% threatened by losing land, and 68% feel worried about their future and the future of their families.

This context, where children live, reflects a depressing reality, demonstrating overwhelmingly negative perceptions, a sense of fear and threat, and a low level of satisfaction with life quality. These feelings are primarily attributed to chronic geopolitical and socio-economic issues in their communities, including limited employment, decreased wealth, scarce natural water resources, and military and conflict events.

⁴ More information on the 2008-2009 Gaza War is available at: [https://en.wikipedia.org/wiki/Gaza_War_\(2008\)](https://en.wikipedia.org/wiki/Gaza_War_(2008))

1.3 Children’s Early Development in Palestine: Beyond Conventional Indicators

It is an undeniable fact known to humanitarian and development agents that Palestinian children, especially those under the age of five, face constant exposure to deteriorated and life-threatening situations (World Health Organization WHO, 2018). Palestinians have endured the pressure of the decades-long conflict, and children from both Palestine and Israel are adversely influenced by the enduring conditions of the conflict between the two countries (United Nations Children’s Fund UNICEF, 2016). Children sense this danger, which causes mental and emotional stress (Garbarino, 1991). Likewise, children and their families feel the burden of complex stress factors, including migration, economic hardship, poor access to healthcare, and violations of their rights (Waterston and Nasser, 2017).

Conventional indicators⁵ used in international reporting indicate that Palestinian children are doing well with acceptable standards of health. For instance, the prevalence of stunting among children under five years old, which refers to children’s length for age as a reflection of chronic malnutrition, is 7.4%. The infant mortality rate is 17.9 children per 1,000 live births, and under five mortality is 20.9 children per 1,000 live births. Other indicators include a 96.9% literacy rate among adults, a 99.4% literacy rate among youth aged 15-24 years old, and 95- 97% school enrolment rate among children in primary schools (United Nations Development Programme UNDP, 2019).

⁵ List of conventional indicators as presented by World Health Organization, Selected Health Indicators <https://www.who.int/hac/techguidance/tools/en/Selected%20Health%20Indicators%20.pdf>

UNICEF World Data⁶ for monitoring the global situation of women and children indicated that 28% of Palestinian children aged three to five years old are below age-specific developmental benchmarks in the physical, social-emotional, learning, and literacy aspects. This score is higher than many countries, such as Panama (20%), Cuba (12%), Georgia (12%), Indonesia (15%), Mongolia (14%), Kazakhstan (15%), and Iraq (11%). The same data source indicated that more than 90% of Palestinian children aged two to four have experienced violent discipline, including psychological aggression or physical punishment, placing Palestine third out of the 59 countries included in the data set. It also indicated that only 12% of children aged 0-59 months have three or more children's books at home, and more than 40% of children with an adult household member have not engaged in four or more activities to promote learning and school readiness. Developmental challenges in children are not limited to their early years. Palestinian children 6-12 years old scored among the lowest for educational achievements compared to neighbouring countries based on international exams that evaluate learning skills at the primary education level (World Bank, 2014, p. 13). This data indicates a significant dilemma as conventional indicators are at acceptable levels, while indicators that reflect development in social, emotional, and learning domains are low.

While they grow, Palestinian children, as well as many other children are living chronic conflict and challenging socio economic conditions. The United Nations (2018), in its report entitled "Development Assistance Framework (UNDAF) in Palestine 2018-2022,"

⁶ Data collected on regular basis from the several countries including Palestine, to monitor progress mainly towards Sustainable Development Goals, UNICEF 2019, <https://data.unicef.org/> Viewed August 10, 2020

described the operational environment of the “lives of people,” reflected by the following quote:

Palestinians suffer from continuous measures imposed by Israel and include: limited access and movement of people and goods, limited access to natural resources, economical and productive activities, as well as the practice of demolitions and the threat of forced displacement and violence. United Nations 2018, P. 2

Garbarino (1991), and later Horton (2009) indicated that Palestinian children who face emergency related events and experiences suffered mental and emotional disorders. Children feel the burden of the macro-level and complex stresses their family and community face (Waterston and Nasser 2017). Even if they do not interact with stress directly, they may sense the stress through their parents.

Considering the above context, this research argues for the need for holistic perspectives when examining the influence of exposure to lengthy and complex stresses on children's livelihood and wellbeing. The holistic perspectives require relevant children indicators that capture the prolonged effects of the exposures while providing adequate considerations to children and their families' unique conditions.

1.4 Water Stress in Palestine: The Exposure

According to Falkenmark (1989), and later Damkjaer and Taylor (2017), a country with an individual annual fresh water availability of less than 500 cubic metre per capita, per year for all uses is a country with absolute water stress. Bridges (2016) indicated that Palestinians only have 320 m³ per capita, per year, indicating the concerning state of water stress in Palestine.

According to the World Bank (2018), per capita water consumption is around 60 l/c/d in the West Bank and 89 l/c/d in the Gaza Strip. This quantity is less than the minimum threshold recommended by WHO for optimal household use (Howard, Bartram, and Water, 2003).

Along with the limited natural resources related to the semi-arid climate of the region, the ongoing conflict between Israel and Palestine directly and indirectly contributes to water stress that is experienced at the community and household level. The primary sources of water are mountain aquifers replenished annually during the rainy season. These aquifers are controlled by Israel. Accordingly, water is considered a significant component of the political dispute. The level of insecurity and stress are conditioned mainly by the absence of a stable political resolution to the Israel–Palestinian conflict (Shomar, 2011; Selby and Hoffman, 2012).

The Oslo Peace Agreements⁷, signed between the Israeli government and the Palestinian leadership, specifically accord II, 1995, stipulated for the Palestinians and guaranteed around 120 cubic metres of water per year. Due to the deterioration of the political situation, and absence of negotiations between Israel and Palestine, as well as weak infrastructure and limited access, Palestinians received only 32 million cubic meters of water per year, most of which is purchased from the Israeli company Mekorot⁸ (World Bank, 2018). Conflict related measures such as the construction of the separation wall by

⁷ Oslo Agreement is a landmark agreement that aimed at achieving a peace treaty between Israel and the Palestinian Liberation Organization, based on United Nations Security Council Resolutions, with the endeavour of assuring a peaceful settlement based on two state solution.

⁸ Mekorot is the main Israeli national water company. More information on Mekorot is available at; <https://en.wikipedia.org/wiki/Mekorot>

Israel on the Palestinian territories, enclosed Palestinian lands, and depriving them of access to land and water resources (Malone, 2004).

Neutral opinion that examine innovative solutions to separate access to water and other environmental resources from the conflict seem challenging. Fischer (2006) indicated obsession of macro-politics, control, and ownership is an overwhelming reality. While it is considered an aspect of the conflict and dispute, equitable distribution and free access to water can be a source of economic and social development for both peoples based on an equal, and shared vision (Chenoweth, 2010).

Within this construct, Palestine households live a state of water stress formed of four main elements; poor quality, inadequate quantity, cost difficult to afford, and weak reliability of water services. The present research hereafter examines these elements as water stressors that Palestinian families are exposed to.

According to the World Bank (2018) about 60% of the population in Gaza experiences problems in water quality, specifically pertaining to taste, colour, and smell. This confirms previous studies which indicated that water in Gaza is below the required standards for drinking with the existence of high levels of chemicals, microbes, and organic compounds, mainly pesticides (Shomar, 2011). The poor levels of water quality are not limited to Gaza. A study conducted by Al-Khatib et al. (2003) on water samples collected in the Tulkarem area of the West Bank found that 34% were microbially contaminated, and posed a high risk if ingested.

More than 95% of Palestinian households are connected to public water services. The World Bank (2018) reflected on the population's concerns over the reliability of services including the responsiveness of service providers to customer needs discontinuity, and water pressure of water supply. Palestinians, especially during summer, experience

disruptions in the water supply from the public network, and start purchasing water from private tanker vendors. Water supplied through tankers is five to six times more expensive than piped water creating a significant burden on Palestinian families (Assaf, 2004).

Access to adequate quantities vary between Palestinian communities and households. For example, Yatta and Dura, two towns in Hebron, have access to about 26 litres of water per capita, per day, while residences in the city of Jericho have access to over 250 litres per capita, per day (World Bank 2018, p.10).

Several reports prepared by neutral international agencies reported on macro and micro challenges that influence the lives of the Palestinian families and children. These conditions co-occur and interact with water stress, which would be difficult to ignore while examining the impact of lengthy stresses with multidisciplinary consequences such as water stress. “Palestinians living the unique socio economic and political challenges are increasingly without hope” (Human Rights Council 2019, p. 2). “The daily life of Palestinians is plagued by restrictions on movement, separation of communities, checkpoints, barriers, and separations walls” (United Nations, 2003). In the “Right to Health Report” the World Health Organization indicated Palestinians do not endure free movement of people, goods, and services, (World Health Organization, 2018).

29% of Palestinian families are with limited income indicated by minimum income line (14% in the West Bank and 53% in the Gaza Strip), and one-third of the participants in the labour force were unemployed in (Palestinian Central Bureau of Statistics, 2019).

Extensive literature, studies, and international initiatives, especially those undertaken based on the WHO and UNICEF Joint Monitoring Programme for Water and Sanitation

(JMP) have addressed water-related issues globally and nationally.⁹ These efforts primarily focused on physical aspects related to water stress including; water resource management, quantity, reliability, and hygiene and sanitation, and measured their impact mainly using indicators related to children's health and survival.

The stories and related context, reflected above, indicate that water stress is early life stress that can chronically disrupts the safe and healthy, social, and physical environment. This research highlights children's early development as an appropriate outcome influenced by chronic and lengthy stresses combined with the unique context. This research argues that applying international indicators is essential for obtaining comparable data to measure countries' progress towards achieving global targets, mainly the Millennium Development Goals (MDGs) and later the Sustainable Development Goals (SDGs). Complete reliance on these mechanisms may conceal localized contextualization needed for country-specific improvements, strategies, and services.

⁹ More information on WHO, UNICEF Joint Monitoring Programme available at: <https://washdata.org/>

1.5 Main Research Goal and Questions

The main goal of this research is; **To assess evidence that children under five years old living in Palestine are at higher risk of developmental delays due to their exposure to water stress combined with challenging geopolitical and socioeconomic conditions.**

The main question that guides this research is stated as follows:

Do children under five years old who experience water stress in Palestine face increased risks of not achieving their optimal early childhood development potential? What are the implications of water stress for childhood services and policies?

The knowledge gap that this research is attempting to fill is to define water stress in Palestine beyond its conventional physical terms, and establish an evidence supported by human development theories to consider its influences as risks for children not to develop optimally. The features of water stress suggest increased likelihood for children enduring water stress not to achieve their optimal social, emotional, cognitive, and physical development at an early age.

The aim of this question is to provide a logical framework broken down into to four sub-questions that follow “what” and “how” perspectives. “What” is used to identify the features of water stress that impact the milestones of optimal early childhood development. “How” is used to explore mechanisms to explain how household water stress influences early childhood development within macro- and micro-contexts. To investigate the implications of the definition of water stress for services and policies, this research raises a final question regarding how the effectiveness of the services addressing

children under five, are influenced by water stress. The following research questions serve as the main four milestones of this research inquiry;

Research Question 1

What are the characteristics and features of household water stress associated with risks for delayed early childhood development?

The present research examines the individual characteristics of water stressors represented by the frequency of water supply disconnection, average consumption amount, and perceptions regarding quality and cost. While considering the intensity of the individual characteristics, the present research argues that common features are more likely to link water stressors under a state of water stress with risks for delayed early childhood development. These features include the chronicity of water stressors, interrelated and combined actions that influence the steady and safe environment that children need for optimal development.

Research Question 2

How does growing up in communities with water stress predict children's risks for delayed early childhood development?

Water stress is part of routine daily life, with dynamic processes of interactions with intermediate macro- and micro-factors considered as determinants of early childhood development. The intermediate factors are mainly related to the macro geopolitical and community environment, micro socio-economic conditions, family features, and children characteristics.

The present research argues that it is essential to assess exposure, but not in isolation of its interactions with intermediate factors influence a family's capabilities to predict, control, and adapt to the exposure, keeping children vulnerable and exposed to the adverse consequences of water stress.

Research Question 3

How do exposure to household water stress and the intermediate factors of wealth and parental support interact and establish risks of delayed early childhood development?

This research explored mechanisms and models that explain how water stress factors interact with other factors that impact children within their household context. The research identified an over-emphasis on the use of direct independent-outcome relationships, and therefore argued that the influence of water stress is more likely to be through indirect effects mediated by micro contextual factors, especially wealth level and parental support.

Research Question 4

How does child water stress influence the effectiveness of services meant to support children in achieving their developmental potential?

The present research focuses on practice and policy, aiming to examine the implication of the link between water stress and early childhood development on childhood services. Childhood services, such as clinics and pre-primary schools, emphasize conventional paradigms in service provision, focusing on health, learning, and cognition. Children living in Palestine and other countries facing chronic conflicts, challenging socio-economic conditions, and water stress are highly influenced by their own home and

community contexts. This research examines how the effectiveness of childhood services in supporting the desired positive developmental outcomes of children may be undermined, if they inadequately consider children's context at home and in their community in the development and implementation of activities and interventions.

1.6 Research Methodology

The methodology aimed at assessing an evidence of increased risks among children enduring water stress, not to develop optimally. The author used models that characterize water stress, and explain how its features increase risks and vulnerabilities associated with delayed early childhood development.

Considering the contextual features of water stress and early childhood development, the author utilized a wealth of reliable demographic, health, population, and environmental surveys as secondary data to provide information on exposure to water stress and related contextual factors at the macro- and micro-levels. The author used primary qualitative data collected during four focus group discussions with 38 parents from four districts in Palestine. Each focus group discussion addressed the same four research questions used in the quantitative data analysis. Semi-structured interviews were conducted with 11 key informants working in the field of childhood services to better understand the influence of child water stress on the effectiveness of childhood services.

Guided by the research questions, objectives, problem statement, and literature review, a logically-oriented methodology was followed for data collection, management, and analysis. To assess the evidence, the methodology followed logical and integrational approach.

1- Assess the individual and common characteristics of water stress exposure and identify its association with delayed early childhood development.

A descriptive analysis of the features and characteristics of water stress was conducted to examine its relationship with the determinants of early childhood development, and risks for delayed early childhood development. The quantitative analysis was supplemented by primary qualitative data obtained from caregivers who participated in four focus group discussions and expressed their views, experiences, and perceptions regarding exposure to water stress and related interactions with their real-life context.

2- Within a macro perspective, define the link between water stress and early children development as a state of combined effect of water stress and macro- and micro-conditions where children are living in their communities.

From a macro community perspective, ecological data from 52 communities was extracted and analysed to establish a composite standardized measurement of stress and vulnerability. The composite measurement assessed the intensity of water stress features' predictability, controllability, and adaptability. It also facilitated the measurement of children's relative vulnerability as a function of exposure and undermined controllability and adaptability.

The main stress domains were addressed by focus group participants who provided details on the combined features of stress and vulnerability, equity among communities, and use as a predictor of risks of delayed early childhood development.

3- From a micro household perspective, describe and explain interactions between household water stress, family wealth and parental care and delayed early childhood development.

Within a micro-household perspective, and using secondary data from a nationally representative demographic and health survey, a mediation model was developed to explore how exposure influences children directly, and is indirectly mediated or suppressed by factors related to children's context especially family wealth.

Primary qualitative data from caregivers provided an in depth understanding of how micro factors, especially family wealth, interact with exposure and undermine the ability to predict, control, and adapt to water exposure, and consequently, how they influence the social and physical environment, family processes, dynamics, and relations needed for optimal development.

4- Examine implications of the link on policy and practice, specifically how child water stress influences the effectiveness of childhood services.

Fifty-six preschools offering childhood services were used as case studies to explore how the effectiveness of service providers are influenced by child water stress. Effect size approach, which is a statistical method that measures the magnitude of the difference made after certain intervention, was used to measure the effectiveness of the services. To explore the gap between childhood services and home context, parents and caregivers participated in focus group discussions, provided their insights and experiences regarding the gaps between childhood services and the home environment. To obtain practice-based and policy perspectives, semi-structured interviews with key informants from childhood

services working in education, early childhood development, and water and health were conducted. Descriptions and details of each data source and its advantages and disadvantages are provided in the method chapter.

1.7 Motive and Significance

The main endeavour of this research is to assess policy oriented evidence to minimize the chances that undermine Palestinian children, and children from other countries, from achieving their optimal development.

The author aimed to raise awareness, increase knowledge, and improve practices in water stress and children's development and well-being. The author focuses on children living in chronic conflicts, the most at risk, who need relevant modalities that capture and prevent risks, improve services and policies, and hopefully; buffer them from consequences of conflicts they having nothing to do with.

This author sought to contribute to better understanding of water stress, which is a chronic challenge that children live starting from their early years that contribute to their vulnerability to risks for optimal livelihood and wellbeing.

The scope of this research is influenced by the authors' professional background and experience in the implementation of emergency and development programmes in Palestine, having served for 15 years with humanitarian and development agencies including the International Committee of the Red Cross, Care International, the Welfare Association, and Norway's governmental support to Palestine. The specific motives of this research aim to fill knowledge and policy gaps at different levels:

- 1- Address delayed early childhood development as an outcome of lengthy stresses that highlighting the large proportion of children who are not developmentally on track and propose models for linking this outcome with water stress to act as a model for addressing childhood issues related to social, emotional, and physical development. The use of early childhood development as an appropriate outcome is an attempt to provide a different perspective to this concept and its connection to environmental stress.
- 2- Provide a workable definition of water stress in Palestine representing exposure to water-related failures and deficiencies regarding water adequacy, quality, quantity, and reliability.
- 3- Extend the scope of water stress research from examining water-related exposure to include the interaction between exposure to water stress and the real-life context involving macro- and micro-factors reflecting stress and vulnerability. Present composite summary indices for measuring water stress, and children vulnerability. The present research aimed to supplement conventional international indicators with approaches to adapt and measure water-related concepts within the local context.
- 4- Present mediation models to explain how protective and risk factors interact with exposure and influence children indirectly through intermediate factors.
- 5- Bridge the gap between the services provided to children and the human development theories that guided this investigation.

The author intended to utilize the concept of human development theories as a foundation of linking water stress and early childhood development. The concept of human

development was used by this research as a mean of effective utilization of multidisciplinary, multi-contextual, and integrated approaches to understating how complex stresses such as water stress influences children, and at the same time as a mean to reducing gaps in services and policies addressing children.

The author wanted to share with research community, community leaders and policy makers workable and simplified models to assess and evaluate child based interventions and policies. The use of composite measurements can be easier to communicate with policymakers, programme managers, and service providers who may find research papers difficult to comprehend. The author adapted mediation model as a logical method of learning how stressors interact with each other and influence the main processes needed for child care, support, and development. Finally, and noting the author's professional humanitarian and development background, a practice-oriented component was proposed. The model suggests a closer link between service providers and the macro- and micro-context, given that services provided to children are not always effective and that the macro- and micro-settings are obscured.

Adapting water stress to the local context is relative, subject to local social and cultural constructs and depends on how people perceive water stress, as well as the macro and micro contextual and personal factors, as well as variations in capacities of the families to cope, adjust, and tolerate these factors. However, it is essential to shed light on the features of water stress and their adverse consequences on children. The product of the present research may not be able to be generalized and applied globally, but the mechanisms and models suggested for application to the local contexts may be useful for other countries.

1.8 Content

This research is structured into the following chapters:

Chapter 1 presents an introduction to the thesis. It presents the main two variables of research interest and the context in which this research was conducted. It also presents brief about the research questions, methodology, motives, and significance.

Chapter 2 presents a literature review of relevant topics based on a systematic search for published articles, reviews, and international development documents with specific focus on developing countries.

Chapter 3 provides the problem analysis based on the critical literature review, research hypothesis, and objectives.

Chapter 4 describes the methodology to build an evidence related to the impact of water stress on risks for delayed early childhood development.

Chapter 5 presents the findings of the features of water supply and early childhood development based a descriptive analysis, and paves the way for the establishment of the hypothesis.

Chapter 6 presents the Child Water Stress Index, which was used to study the interaction between water supply and wellbeing factors at the community level.

Chapter 7 narrows down the analysis to the household level, explains the interactions between the exposure to water stress and intermediate factors using mediation analysis

Chapter 8 presents the implications for the findings on services and policies addressing children.

Chapter 9 provides a discussion on the findings of the research and implications for the field of child development.

Chapter 10 includes the summary, conclusion, and recommendations based on the study.

References includes the literature reviewed and referred to throughout this paper.

Chapter Two | Literature Review

2.1 Introduction

The primary purpose of this review was to gain a better understanding of existing and previous research, theories, and experiences related to pathways linking water stress and early childhood development. The review constructed a theoretical framework that facilitated research inquiry that was meaningful to the local context, theoretically sound, and balanced for its generalizability and in-depth understanding.

This review served as a knowledge base for answering the research questions, identifying gaps, and formulating a hypothesis and research methods. Local and international research was reviewed with a specific focus on experiences and models in similar settings. Both water stress and early childhood development are considered broad, multi-dimensional, and multi-contextual concepts. Much literature was found addressing both aspects, which made setting clear boundaries a challenge. Thus, the review focused on theories, areas of overlap, and links between both aspects.

The content of this review includes the research strategy; concept of early childhood development; ecological human development theories; local literature addressing exposure to water stress; concepts of composite measures addressing the collective effects of child water stress and vulnerability; and mediation and suppression models to explain the interactions at the micro-context. Finally, the review examined concepts related to the gaps between the children's context and childhood services and policies in Palestine.

2.2 Literature Review Process

2.2.1 Search and Review Strategy

The literature search and review process included the use of electronic databases and search engines such as PubMed, Science Direct, and Google Scholar. The analysis utilized keywords and phrases including water stress, water scarcity, water insecurity, children's outcomes, human development theories, family system, family support specially parents, wealth, community well-being, parenting, and early childhood development, vulnerability, and stress. The key words were grouped according to concepts related to the research questions. The search process also followed a snowball search of literature cited by the literature found relevant to the present research.

The evidentiary base, analysis, and interpretation of the body of evidence is derived from the following primary sources: 1) peer-reviewed scientific literature; 2) reports and research from the UN and other international agencies, especially the World Health Organization (WHO), United Nations Children Fund (UNICEF), UN-Water, and Centres for Disease Control and Prevention (CDC); 3) reports, strategies ,and policies from local government and civil society groups; 4) local literature published in credible journals. The author set clear inclusion criteria for selecting literature. The preference was for peer-reviewed research with several citations, full text, in the English or Arabic language, and relevant to the principal subjects and research questions. The requirements also included recent studies, preferably conducted after 2010. Older research was used to a lesser extent, primarily to provide historical background for an in-depth understanding of the development of related models and theories. Due to the political sensitivity of water stress in Palestine, the author addressed the political aspects with neutrality and based on reports generated by neutral organizations, especially UN agencies.

2.2.2 Scope of the Review

The review explored early childhood development ECD as a child outcome influenced by exposure to complex stresses such as water stress. The review addressed the ecological human development theories as a theoretical framework for linking water stress with ECD, within an ecological perspective, noting the child's social, economic, political, and environmental context factors. Keywords included determinants of early childhood development, ecological development models, risk and protective factors, and translational processes.

To assess hypothetical evidence of the link between water stresses with ECD, four logical steps that correspond to the four research questions were followed. At each steps, relevant theories, concepts, and methods were reviewed

- 1- The review explored the individual and common features of water stress, measurement models, and water stress interactions with children's living conditions. Keywords: water stress, water insecurity, water quality, quantity, affordability, cost, water stress and insecurity in Palestine.
- 2- The review explored the link between water stress and ECD within a macro-perspective. Composite summary measures for children vulnerability and wellbeing were explored while considering combined features of controllability, predictability, and adaptability of stress, and its association with children's vulnerability to delayed early childhood development. Keywords: child wellbeing, vulnerability, standardization of data, composite measures, stress features.
- 3- To narrow down the scope of the research, the review explored mechanisms and models that explain interactions in the micro-household context. The mediation

model was explored to study how intermediate factors influence water stress on children. The review included suppressing and moderation models that may influence this relationship. Keywords: exposure-outcome interactions, mediation analysis, direct and indirect effects, wealth level, childcare, and parenting.

- 4- Finally, the review examined the implications of child water stress for early childhood development services and policies. The review explored gaps related to the influence of water stress on the effectiveness of early childhood services and policies. Keywords: effectiveness, effect size, service gaps, theory of change, strategy and policies, international experiences.

2.2.3 Information Management

The author developed a database for classifying and archiving the literature included in the study. The database followed the Harvard referencing system, organized using an excel sheet filtered by title, first author, co-authors, date of publishing, publisher, the geographical focus of the research, and a brief abstract. The literature was categorized according to the key words which were grouped into four main categories: exposure, collective and combined effects, micro-context, and practices.

The data base included comments made by the author, primary findings, and conclusions for each article. It also provided a specific code for each literature item according to its key words and discipline. Being filtered according to the key words, discipline, and research question, the data base enabled the author to establish summaries and conclusions, narrow down the research problems, scope the research, and explore the methodological framework.

2.2.4 Limitations

The review followed a structured approach to support a logical process of knowledge management and help generate conclusions, identify research gaps, and articulate the theories and suitable method framework. Guided by the research questions, the review supported a conceptual understanding of the complexity of water stress and its relationship with early childhood development and related factors. However, this approach had certain limitations:

- 1- The current research addresses a wide variety of topics. Setting boundaries and frameworks was challenging. Accordingly, relevant literature addressing aspects related to the research could have been missed.
- 2- The author was unable to check the reliability, neutrality, and credibility of different locally prepared reports, so many of them were not considered. As a result, information on the local context could have been missed.
- 3- Looking for literature written in the English language might have resulted in missing relevant literature in other languages including French, Spanish, and Hebrew.
- 4- Many of the aspects related to the context implied political sensitivity. For this reason, only reports from neutral and UN agencies were considered.

2.3 Early Childhood Development (ECD)

2.3.1 Definition of Early Childhood Development

The main aim of this section is to explore early childhood development (ECD) as a child outcome influenced by water stress. The literature provided different terminologies including early childhood care, education, and services. In this review, the author used the term early childhood development as an outcome-based concept, considering the present research's interest in studying the pathways and mechanisms of the influence of water stress on children outcomes.

Early childhood development involves a wide variety of fields, including neuroscience, physiology, psychology, health, growth, and nutrition. It is defined as the development process of children's physical, mental, cognitive, social and emotional, and behavioural skills and abilities. This process is an outcome of interactions between the genetic make-up of children and their surrounding environment. During this period, children (mainly at the age of five years old and below) undergo rapid brain development. This process is shaped by children's genes, interactions, and experiences, including having adequate and healthy food, care, protection, and stimulation from talking, playing, and conscious attention from caregivers and parents (UNICEF, 2017; Britto, Engle, and Super, 2013. 2013).

Agencies such as UNICEF have developed indices for age specific benchmarks for "optimal" ECD.¹⁰ Children are assessed as developmentally on-track when they exhibit adequate social/emotional development when children experience and express emotions

¹⁰ Information on UNICEF Child Development Index, is available at; <https://www.unicef.org/earlychildhood/index.html>

and develop relationships (Cohen et al. 2005). It also when children development their cognitive, and physical skills compared to the majority of children their age. For instance, children between three and five years old start getting along well with others, show interpersonal skills, start commanding a certain level of literacy and numeracy, follow the directions of adults, and possess certain physical abilities (UNICEF, 2017).

The significance of ECD stems from different aspects. It lays the foundation for children to meet their development potential in terms of social and cognitive skills, knowledge, and abilities, and lead to better health, educational achievements, and youth development. Strategically, it is a holistic concept that reflects the child's right to have an optimal start in their lives, reflected with healthy life, productivity, and achievements. ECD recognizes children as individuals with the right to live in dignity and is considered a significant contributor to development in any community.

ECD is attracting increasing attention among international agencies and platforms including the UN Convention on the Rights of the Child (1989); World Conference on Education for All (Thailand, 1990); Dakar Framework for Action on Education for All (2000); and the Sustainable Development Goals (SDGs).¹¹ Despite the above efforts, the gaps in ECD are still worrying. The World Health Organization (2016) indicated about 250 million or 43% of children in low- and middle-income countries are not developmentally on-track.

¹¹ Early Childhood Development is addressed by Sustainable Development Goal No 4. List of Sustainable Development Goals Available at <https://www.un.org/sustainabledevelopment/https>. Viewed on August 14, 2020.

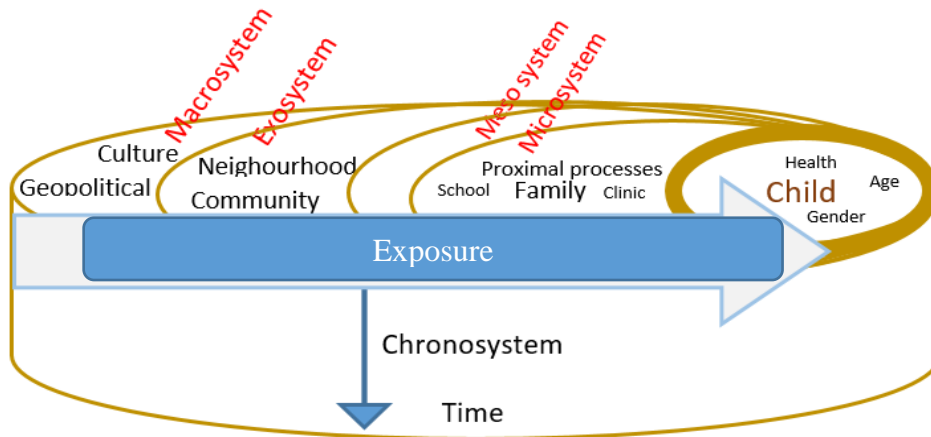
Children in developing countries have fewer developmental opportunities than their peers in developed countries, mainly due to higher deprivation, vulnerability, and environmental risks. Noting the challenging geopolitical and socio-economic context, Palestinian children experience immense and combined challenges.

2.3.2 Ecology and Early Childhood Development

The author explored several theories to understand how ecological adversities such as water stress influence the development process of children. Relevant theories include emotional interaction between children and people around them especially parents (Kline, 2013), gaining skills, knowledge and learning through observation and modelling (Grusec, 1994), assimilating and imitating behaviours (Nabavi, 2012), learning through hands-on experiences (Esteban-Guitart, 2018), and attachment and relationships between children and their parents (Rosnay & Harris, 2002). The theories emphasized that children's outcomes are influenced by close and intimate relationships, interactions, and experiences especially with their parents.

While the above theories highlighted developmental aspects within certain focus, Britto, Engle, and Super (2013) highlighted that the child is a holistic synthesis of physical, social, neural, and cognitive aspects. Urie Bronfenbrenner, a Russian born American psychologist, pioneered lengthy efforts between 1979 to 2006, to develop a holistic theoretical framework referred to as the bio-ecological human development model. This model captures children's interactions, experiences, and personal characteristics within multi-level context. As indicated in Figure 2.1 this model refers to the progressive and mutual accommodations between the developing person (the children) and the changes in their environment, based on four factors: The processes, persons, context, and time (PPCT) (Bronfenbrenner and Morris 2007).

Figure 2.1: Bio-Ecological Development Model, Adapted from Hayes et al. (2017)



Based on the above model, and following Tudge et al. (2009), the main elements of the bio ecological development model can be summarized as follows;

The processes refer to repeated interactions between children and the people around them, especially parents and other close caregivers. These processes are considered proximal processes as the engines of development as they include much of the daily activities with children, including supporting learning by reading books, language and verbal engagement, singing, reading, and playing with the child.

The person refers to the child's characteristics. These characteristics are divided into three groups: Demand, Resource, and Force. The demand characteristics stimulate reactions and expectations from other people, such as age, gender, skin colour, and physical appearance. Resource characteristics reflect mental and emotional resources, including skills and intelligence combined with physical resources such as good food, housing, and caring parents. On the other hand, force refers to the characteristics related to personal qualities such as differences of temperament, motivation, and persistence.

Time refers to events and occasions that influence children. Time serves as the chronosystem model accounting for the changes that occur over the individual's lifetime caused by events or experiences. Children age can serve as a timeline of previous events indicating more likelihood of experiences and exposures than children of younger age.

The context refers to the multi-contextual levels where children experience interactions between risk and protective factors, related to process and personal characteristics at certain, or along certain times. The following explains the contexts suggested by Bronfenbrenner's theories:

- 1- The microsystem refers to the close environment in which most proximal processes occur as the child spends more time with immediate family members. Most interpersonal relations, psychological functioning, and communication interrelated with characteristics occur at this system.
- 2- The mesosystem is simply one or more microsystems. A child spends time and interacts in another home in addition to her or his home prior to primary or nursery school where children interact closely with caregivers and peers.
- 3- The exo-system refers to the surrounding environment at the community level with indirect effects on the developing child, including parents' work, health clinics, and social service departments.
- 4- The macro-system acts as an overarching pattern of three levels of a given culture: subculture, social norms, or other extended social structure. It refers to community social, economic, or demographic patterns, social and financial resources, hazards, lifestyles, social classes, and ethnic or religious groups. Within each

level, the risk and protective factors interact and individually or collectively influence children.

Interestingly, Cairncross et al. (1996), speaking from the water and sanitation field, proposed two interrelated contextual domains for transmitting water-related to infectious diseases. The domestic domain refers to the area usually occupied by and under the control of a household. The public domain includes playgrounds, neighbourhoods, schools, and clinics. The domestic domain addresses risks for diseases at the individual level, whereas individual cases may lead to epidemics in the public domain.

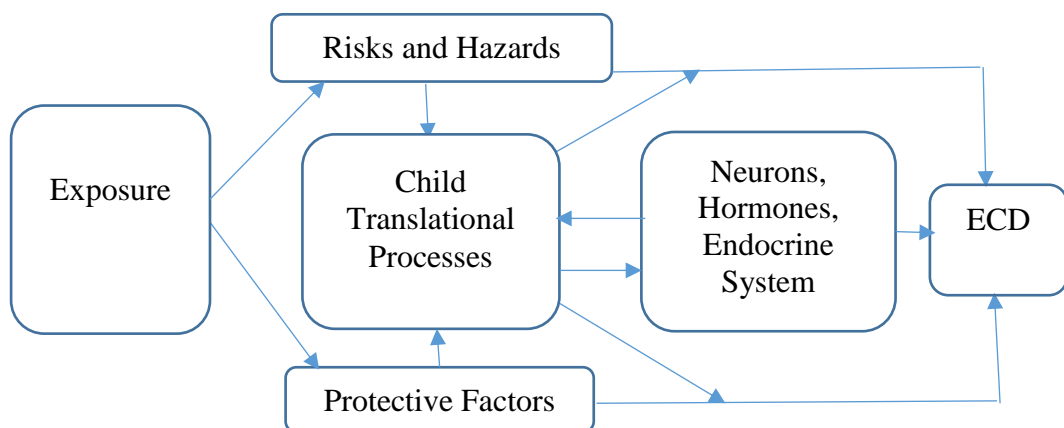
While early childhood development and water stress differ with respect to objective and focus, both aspects are influenced by common ecological and contextual levels, including community features, household environment, parents' interactions, and personal characteristics. By utilizing the contextual factors that both ECD and water stress have in common as intermediate factors, the ecological model enables a framework of linking both aspects through a real-life child construct. Referring to Figure 2.1, at each of the contextual levels, exposure to water stress may interact with intermediate factors related to children's processes, personal characteristics, and macro- and micro-factors relevant to each of the contextual levels. The factors may increase or decrease the effect of water stress on children being risk or protective factors respectively.

2.3.3 Exposure to Stress and Children’s Translational Processes

This section uses a neuroscience perspective to deepen the understanding of the link between exposure to stress at an early age and risks for alterations in children's functions, skills, and practices and undermines their normal development processes.

Figure 2.2, suggested by Walker et al. (2011) demonstrates a logical pathway linking exposure to certain stressors with protective and risk factors. The model delineates how children’s exposure to stress at their early age can combine with risk factors, and alter the child’s normal translational processes related to brain and behavioural development processes increasing the risks for early mental, physical and behavioural problems that can lead to long-term adverse outcomes. These processes translate the outcomes of the interactions between the genetic set and live experiences, including exposures to risk and protective factor, and impact brain physiology and related response systems indicated by children’s skills, knowledge, behaviours, and skills.

Figure 2.2: Exposure and Translational Processes (Walker et al. 2011.p 1327)



The diagram can be view in two parts. The first part addresses the interactions between exposure and risk and protective factors. The second part is related to how these

interactions establish risks for translational processes and influence children's normal neural and motor development.

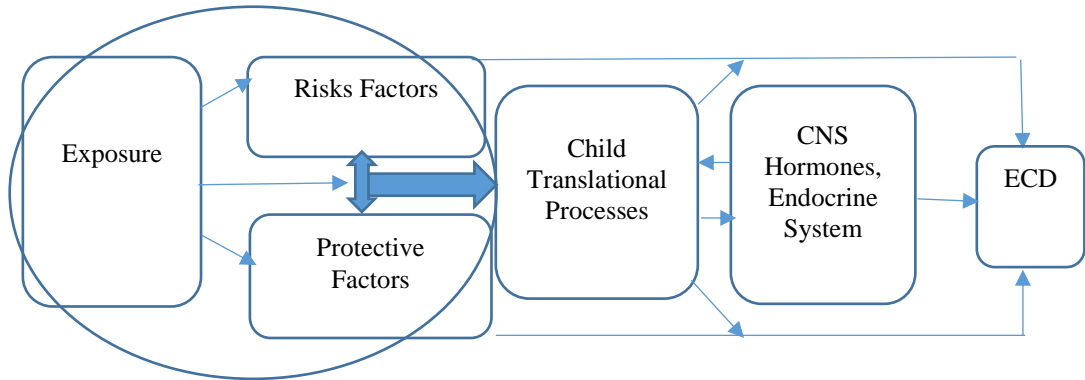
2.3.3.1 Exposure, Risk, and Protective Factors

Unlike much emphasis paid to the role of risk factors, the exposure interacts with protective factors that buffer children from risks, such as good parenting, acceptable wealth, parents' education, and child health. The social and environmental protective factors can, at early ages, suppress the influence of the exposure to stress and can also reverse some neurobiological effects of early adversity (Fisher et al., 2016).

The balanced perspectives of risks and protective factors, can facilitate effective strategies to counteract risks and disparities and enhance prevention and mitigation interventions (Fisher et al. 2016). The model suggested by Walker et al. (2011) indicates that interactions between exposure and children's related factors occur through pathway of "stressors-intermediates -outcomes" instead of the conventional pathway of "stressors – outcomes.

Noting the co-occurring and simultaneous interactions between the exposure and intermediate factors related to children's living conditions, the diagram suggested by Walker et al. (2011) does not adequately visualize the collective effect of the exposure, risks, and protective factors. The author suggests a mechanism adapted from that of Walker et al. (2011) demonstrated in Figure 2.2. This adapted model presents the risks and protective factors at an earlier stage from the translational processes. It suggests a combined and simultaneous construct of interactions between the exposure, risk, and protective factors.

Figure 2.3: Suggested Model of Exposure, Risks, and Protective Factors



The adapted model suggests that the protective factors including wealth, education, steady relationships, safe environment, good health, and education can reduce the intensity of exposure. At the same time, the risk factors can enhance and strengthen the effect of the exposure. This combined influence is addressed in chapter 6.

Accordingly, this model explains the interaction between exposure and the intermediate factors especially the personal characteristics and proximal processes within the various contexts suggested by the bio-ecological model. This hypothesized model suggests a different perspective that combines the bio-ecological model with that of Walker et al. Exposure to certain stresses such as water stress, does not occur in isolation. It binds with related risks and protective factors and yields a collective effect resulting from this interaction. The severity of the influence of exposure is determined not only by the intensity, dose, and time of the exposure, but also by the intermediate factors related to personal characteristics, processes, socioeconomic and geopolitical factors.

Using a narrow perspective, the exposure influences children directly, but more so through indirect pathways including risk and protective factors. In this respect, water

stress may influence children directly through direct exposure to contaminated water or inadequate quantity accessed for their self and hand hygiene.

Depending on the directionality of the intermediate factors (being risk or protective factors), family and personal characteristics can either enhance or suppress the influence of the exposure and shape how families at the micro-context and community at the macro-context prevent, control, adapt to water stress and provide their children the support they need for their wellbeing, growth, survival and development. Children may be at risk of the impacts of certain exposure, but their parents might have adequate financial capacities, good education, and provide adequate and steady care, and buffer their children from the adversities and risks.

2.3.3.2 Translational Processes, Age, and Epigenetics

Neuroscience literature indicates that children undergo fast brain development at their earliest age, especially children under 5 years old, with highest rate among children from 0-3 years old (Britto, Engle, and Super, 2013; Phillips and Shonkoff, 2000). During this period children's early exposure to environmental risks leading to illness and malnutrition might delay the growth of neural and motor neurons (Lozoff et al. 2006; Stewart et al. 2013). Underdevelopment may result from a lack of nutrients needed for the growth of neural cells, but also due to less stimulation, interactions, and experiences that could possibly impact mental, physical and psychological development.

Repetitive and lengthy exposure to stressors may contribute to changes in gene expression of the neural cells and connections, translated into long-lasting underpinned brain functions. The changes in gene expression occur without changing the order of the child's DNA sequence (Bhutta et al. 2017). This concept is referred to as epigenetics.

Phillips, and Shonkoff (2000) highlighted the concept “use it or lose it.” Rapid brain development with high rate of synapse development is a unique opportunity for optimal childhood development. If the neurons are not stimulated and used, the functionality of the neurons may decline, and synapses that are used are retained and those not used are eliminated.

The changes in the gene expression influence the cellular and molecular set up and may lead to alterations and changes in certain functions of the neural and brain cells. Based on the severity, length, and intensity of the exposure, the changes influence the brain architecture and affect various functions, including social interaction, cognitive abilities, and physical and motor skills. Accordingly, children do not only need to be observed and cared for, but also require stimulation and interaction within a safe and supportive environment to enhance their senses and develop their capacities.

To continue the discussion with neuro physiological depth, Murgatroyd and Spengler (2011) explained that adversities in early life influence the hypothalamic-pituitary-adrenal axis (HPA axis) in the brain. This axis refers to the central stress response system of the child and structured mainly by the hypothalamus and pituitary gland in the brain, and the adrenal glands in the body located near the kidney. This complex axis is responsible for the neuroendocrine response and adaptation to stress, including the release of glucose into the bloodstream to facilitate the "flight or fight" response, the physical reaction to an event that is perceived as stressful or frightening. The feeling of threat activates the sympathetic nervous system and triggers an acute stress response that prepares the body to fight or flee. The brain's short loop prepares the child to anticipate and respond optimally to a threat. Following periods of sustained stress, negative

feedback control of the HPA axis can become dysregulated and may be an underlying factor in the development of disorders such as major depression.

Dose and timing are vital in this regard. Roos et al. (2018) explained that exposures linked with repetitive or prolonged early life stress, such as experiences of abuse, neglect, and domestic violence can establish long-lasting impact on the maturation of structures related to physiological response and emotional functions in the children's response and reactivity, that influence their characters, practices, skills during childhood and sometimes persisting into adulthood and influence.

Authors such as Britto, Engle, and Super (2013) presented age as a significant dimension of the translational processes, being a retrospective timeline that may indicate susceptibility to exposure, and at the same time, indicates the frequency and length of the exposures, and related experiences.

From conception to three years old, children's brains undergo fast mental, physical, and neural development. At this age, children are strongly attached to and dependant on their caregivers, especially for their basic life necessities such as nutrition, mobility, hygiene, nurturing, and care. Much of the literature related to this period is on children health and malnutrition as a determinant to physical, mental, social, and emotional development potentials. Scholars such as Phillips and Shonkoff (2000) indicated that the fastest rate of development for cognitive functions takes place during the first and second year of life. Children aged three to five years old are exposed to more risks and hazards being more independent. Their brain development continues, but at a lower frequency than younger children. They are less dependent on caregivers and interact with more people, but can be more exposed to injuries, violence, abuse, isolation, and neglect and need protection

(Britto, Engle, and Super 2013). At this stage children benefit from educational interventions at home through informal pre-primary care and support.

During the period of six to eight years old, the final transitions take place from the early childhood development to school. At this stage, children can better shape their skills and knowledge, learn, express themselves, and interact.

2.3.4 Conclusion

As Britto, Engle, and Super (2013), as well as many other scholars indicated, Early childhood development is a cumulative synthesis of interactions between the child and his or her surrounding environment.

The literature highlighted the importance of a healthy start considering the fastest brain and neural connections developing at an early age, mainly under the age of three. It also noted the importance of healthy social and physical environments that secure optimal translational processes, as well as social-emotional, physical, and cognitive development.

Children live within a construct of protective and risk factors that are co-occurring, simultaneous, and interrelated. The child is influenced by the collective interaction of these factors. If the risk factors are not significant and the protective factors are active, the child can progress under optimal translational processes.

Based on the information above, lengthy exposure to specific stress, that interacts with risk and protective factors and establishes a combined effect with physical, social, emotional, and economic consequences is more likely to influence children's normal translational processes. The influence is established directly, but to a more significant extent indirectly through other factors related to the main determinants to early childhood

development, such as family processes, child characteristics, family capacities, and physical environment.

To be early life stress that impacts children's development, exposure to a particular stressor is repetitive, prolonged, interacts with social and emotional adversities, and is related to adverse experiences. The dose is an essential determinant with exposure to stressors combined with other intermediate-risk factors more than protective factors with long-lasting impact on the maturation of structures related to physiological response and emotional functions in the children. The next section examines water stress as potential early life stress that influence children development.

2.4 Characteristics of Water Stress; Beyond the Physical Exposure

This review examines exposure to water stress as complex early life stress contributing to children's risk for delayed early childhood development.

This review examined previous research and related gaps regarding exposure to water stress in Palestine, as well as features associated with risks for delayed early childhood development. The first research question guides the inquiry:

What are the characteristics and features of household water stress associated with risks for delayed early childhood development?

Referring to section 1.4 water stress was defined as a situation when the families experience part or all of the following deficiencies; inadequate quantity, unsafe quality, cost difficult to afford, and weak reliability of water supply. This section examines the common features of these stressors featuring water stressors as early life stress.

Table 2.1 lists various literature addressing water-related topics in Palestine. Political sensitivity around the topic has influenced the local literature. Israel is referred to as the primary controller who performs inadequate and inequitable distribution of water resources in the area (Rabi et al. 2008; Fischer 2006; Chenoweth 2011; Selby 2003; and Malone 2004).

Palestinian communities face severe shortages with inadequate availability for their basic needs (Rabi et al. 2003; Nazer et al. 2008). Scholars have advocated for equal distribution, highlighting access to water as a fundamental human right (Klawitter, 2007; Sour and Omran, 2011). Others considered water as a source of prosperity and a window of peace if equitably distributed and managed (Fredericksen, 2004).

Child outcomes influenced by water stress were assessed mainly by focusing on the association between weak chemical and biological water quality (Al-Khatib and Arafat, 2009) and hygiene practices (Mimi and Salman, 2008) associated with health outcomes, primarily intestinal parasites (Abu Sada et al. 2008; Da'as, 2010; Mourad, 2004).

By looking at the local literature's topics and aspects, many features can be highlighted that can characterize water stress as a chronic exposure that families and children experience. The macro context very much influences water stress, yet its main impacts are sensed at the household level, whereby water stressors act concurrently. While the local literature addressed specific stressors, mainly water quality, it is evident that they eventually face a holistic state water stress mostly because one stressor is more likely to lead to other stressors.

Table 2.1: Literature Addressing Water-Related Aspects in Palestine

Authors	Year	Focus	Type
Garbarino et al.	1991	Vulnerability, Psychological Stress in Conflict	Research Article
Agha and Teodorescu	2002	Water Quality, Intestinal Parasites	Paper
Rabi et al.	2003	Water Resources Management, Conflict	Paper
Selby	2003	Power, Politics and Water	Paper
Fredericksen	2004	Water Resources, Conflict, Peace, Natural Resource Availability, Economic Growth	Paper
Malone	2004	Conflict-related measures	Paper
Assaf	2004	Human Rights and Equity	Paper
Mourad	2004	Quality, Intestinal Parasites and Diarrhoea	Research Article
Fischer	2006	Water Resources Availability and Politics	Paper
Klawitter	2007	Water and Human Rights	Paper
Nazer et al.	2008	Water Availability and Resources Management	Paper
Mimi and Salman	2008	Water Quality and Hygiene Practices	Research Article
Abu Sada et al.	2008	Water Quality, Intestinal Parasites	Research Article
Al-Khatib and Arafat (2009)	2009	Chemical and Microbiological Quality in the Gaza Strip	Research Article
Da'as	2010	Water Quality, Intestinal Parasites	Research Article
Shomar	2011	Adverse Consequences, Political	Paper
Chenoweth	2011	Availability, Equity and Politics	Paper
Sour and Omran	2011	Water, Access, Safety, Politics and Human Rights,	Paper
Megdal et al.	2012	Political perspectives Israel and Palestine	Book
Galaiti et al.	2015	Relationship between price elasticity, water insecurity and domestic water demand.	Research Article
World Bank	2018	Securing Water for Development	Report

2.4.1 Chronicity

The author failed to identify longitudinal studies that track the chronicity of water stress and its impacts on children. However, Table 2.1 listed several reviews and articles prepared over the last 20 years. The chronological timeline of these studies demonstrates that this problem is both continuous and a chronic disparity. The literature indicated that Palestinian households are continuously exposed to one or more water stress elements.

The central factor that signifies chronicity is the prolonged and frequent exposure to water-related stressors. Early childhood development is a process of continuous, regular care and support. The chronicity of water stress may disrupt the steadiness, content, and power of the proximal processes. It implies the prolonged impact of hazards depleting the families' resources and abilities to adapt, respond, prevent, cope, or mitigate its risks and consequences. Such features make a case for environmental stress, as chronicity of the exposure may exhaust people's capacities to control and adapt (Lazarus and Cohen 1977; Evans 1984).

2.4.2 Interrelated Influence and Combined Effect

The combined effect of water stressors refers to the intensity and strength of more than one exposure. The interrelated influence refers to water stressors being influenced by each other. The context analysis in chapter 1 indicated that when families experience challenges with reliability of improved public water network, they are more likely to access alternative sources with higher cost, poor quality and inadequate quantity. These stressors then burden the households collectively, within a state of stress and insecurity.

The World Bank (2018), and Galaitsi et al. (2015) addressed multiple risks related to water quality, quantity, reliability of services, and affordability. These studies highlighted that water stressors contribute to a state of insecurity among Palestinian communities and

demonstrated the need for improved capacities to manage adequate resources, enhance policies, and make services more effective.

With respect to its impacts on children, the examination of single stressor-outcome pathways was a common trend among the local literature. As highlighted in Table 2.1, poor quality, inadequate quantity, and health impacts are the focus of local water research. The absence of studies on interrelated and combined effects of multiple stressors seems to be a gap in the literature. This research argues that the four elements should be addressed in an interrelated manner, as the occurrence of one stressor is more likely to indicate broader holistic exposure.

2.4.3 Main Source of Drinking Water

The use of improved drinking water sources as the primary drinking source is an indicator developed by the WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation (JMP).¹² Demographic and health surveys implemented by the national statistical centres collected data for setting national policies. Originally, these surveys are implemented to support international efforts to track progress towards meeting global targets set by Millennium Development Goal 7c, which aimed to reduce the proportion of people without sustainable access to safe drinking water by half by 2015 (from the 1990 value). Later on national authorities in every country were guided by goal number six of the sustainable development goals, which aimed to “ensure availability and sustainable water and sanitation management for all.”¹³ As indicated by JMP outlines, the SDGs included extensive classifications of improved or unimproved water sources based

¹² An official mechanism implemented by the United Nations, specially UNICEF and WHO to monitor the progress of the countries towards the target set by the sustainable development goal No 6, related to water and sanitation. Description of the Programme Available at; <https://washdata.org>.

¹³ More description of SDG No 6 available at <https://sustainabledevelopment.un.org/sdg6>

on a service ladder. This ladder contains different services, starting with the “basic” source, which refers to “safely managed water sources” of drinking water from an improved source, located on-premises, available when needed, and free from contaminants.

“Unimproved” sources include unprotected wells or springs, and surface water if drinking water comes directly from a river, dam, lake, pond, stream, or irrigation canals. The service-ladder approach provides a holistic assessment of water-related variables as it combines service level, availability, access, and quality.

In this respect, the use of unimproved water sources may indicate a holistic perspective of the exposure to more than one physical water related stressor. Families whose main source of drinking water is an unimproved sources, are more likely to purchase water from unimproved sources with higher cost, less quantity, and concerning quality. Considering the features of water stress in Palestine this classifications seems service-oriented and may mask essential aspects related. It also lacks characteristics that reflect interrelated socio-economic experiences and conditions such as affordability, use and management, uncertainty, and adverse life experiences. It also masks people’s perception towards water stress while considering their capacities to manage and mitigate its impacts on their livelihood. The next section addresses international experiences that combined water stressors under clear and holistic perspectives.

2.4.4 Integrational Concepts of Water Stress

Recent literature introduced integrative approaches and summary measures that combine water-related variables to report on holistic state of water challenges that households and communities experience. Households, especially in countries such as Palestine access water of poor quality, contaminated with hazardous chemicals and pathogens face. Services are unreliable and interrupted, and the cost is often high and challenging to afford. Exposure to one or all of the of these conditions indicates a state of household water stress and insecurity (Wutich et al. 2009; Stevenson et al. 2012; Jepson et al. 2017; and Shrestha et al. 2018). Table 2.2 presents studies conducted in developing countries that primarily address quality, quantity, cost, and reliability within one combined construct. Stevenson et al. (2012) indicated that much of the focus was on females, especially mothers, in bearing most of the burden and impacts of water stressors. Shrestha et al. (2018), Tsai (2016), and Young (2019) highlighted the multidimensionality of water stress aspects using summary measures. These measures capture the interplay and interrelationship between water insecurity elements. Interestingly, much of the measures were established based on qualitative data obtained through the experiences of caregivers.

Cooper-Vince et al. (2017) and Tsai (2018) addressed household water stress based on the feedback of households, particularly mothers, about the adverse life consequences of water stress, including being distressed and frustrated.

A study by Wutich et al. (2009) implemented in Bolivia indicated emotional distress among mothers who experience inadequate, unreliable, and unsafe water supply.

Table 2.2: Summary of Water Literature, Composite Measures

Author	Year	Location	Focus	Type
Wutich et al.	2009	Bolivia	Water insecurity and emotional distress	Household experiences
Stevenson et al.	2012	Bolivia	Women's water insecurity	Mixed quantitative and qualitative methods to assess household water stress
Subbaraman et al.	2015	India	Household water affordability, quality, quantity, and safety.	Mixed method using focus group discussions to examine the adverse impacts of water deficiency. Household-based quantitative data was used to identify indicators associated with inadequate water supply.
Tsai et al.	2016	Uganda	Water insecurity, perceptions on insufficient quantity, quality, the feeling of uncertainty or anxiety	8 item household water insecurity scale Perceptions of used factor loading and item test correlations
Jepson et al.	2017	General	Micro-level metrics	Overview and systematic evaluation
Shrestha et al.	2018	Nepal	Water Security Index measured for association with quality of life	Water Security Index standardization following HDI of quantifiable indicators centred on household use behaviour grouped under seven dimensions of Quality of life
Cooper-Vince et al.	2017	Uganda	Water insecurity	Household water insecurity, missed schooling, and the mediating role of caregiver depression
Collins et al.	2019	Kenya	Lived water experiences	Subjective analysis based on in-depth interviews

Subbaraman et al. (2015) and a recent study by Collins et al. (2019) used qualitative methods based on data generated from focus group discussions and interviews with members of households to examine the adverse social and emotional consequences for caregivers. Japson et al. (2017) signified the need for considering metrics at the micro household level to provide necessary tools to explain the complexities of the determinants and outcomes of water stressors.

Shrestha et al. (2018), Tsai et al. (2016), and Cooper-Vince et al. (2018) used standardized models to assess the level of insecurity that households experience due to water stress. The general score of the insecurity index was calculated based on the average standardized scores for all areas. The authors also produced sub-indices by combining data from different variables that correspond to certain objectives, depending on each index's objective and the features of the variables. These measures highlight the integrative concept of water stressors and provide holistic perspectives of water stress related to households' situations and related risks. However, these metrics are a distal prediction tool that may conceal the mechanisms and pathways through which water-related variables influence family members. Much of the focus of the literature was on water stressors and direct impacts on children and did not adequately make balanced considerations of the macro and micro contextual factors that interact with water-related variables. Households that experience water stress are aware of the fact that accessing, collecting, storing, and using water occur within an interrelated construct involving economic capacity, as well as geopolitical, social, and cultural settings.

2.5 Child Water Stress. A Macro- Perspective of the Link

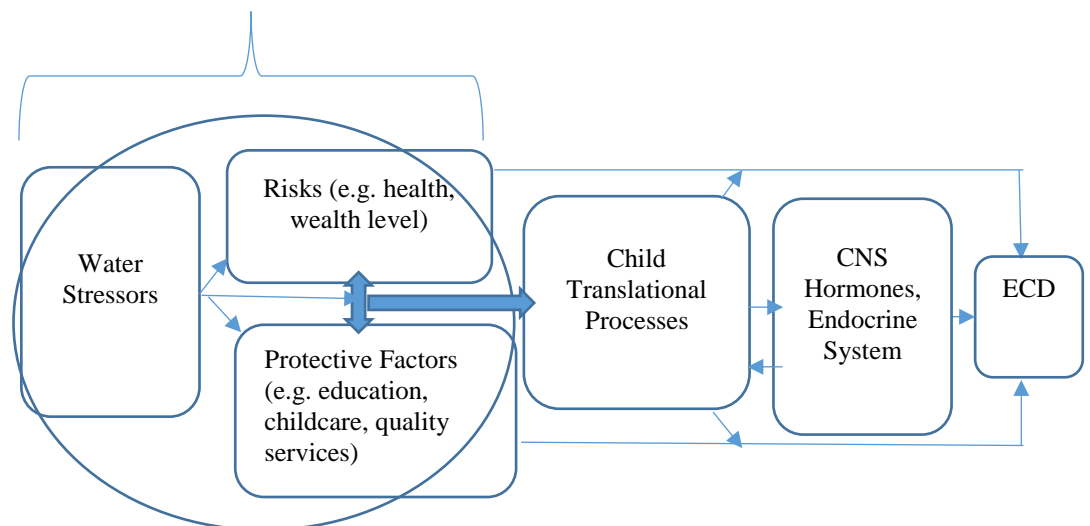
2.5.1 Introduction

This review addresses simultaneous and co-occurring interactions between water-related exposures (water stressors) and macro and micro contextual factors. The second research question guides this review:

How does growing up in communities with water stress predict children’s risks for delayed early childhood development?

The present research hypothesized that examining the link between water failures and child outcomes without considering intermediate factors would overlook vital processes needed for explaining this link. This is based on the hypothetical diagram adapted from the hypothetical diagram suggested by the author in Figure 2.3 and applied for water stress as indicated in Figure 2.4 below.

Figure 2.4: Water Stressors and Risk and Protective Factors



This section presents water stress as co-occurring interactions. The exposure to water stressors combines with risk and protective factors and consequently establish a state of

water stress. The following addresses this stress within the scope of households' capacities to predict, control and adapt to water stress.

2.5.2 Predictability, Controllability and Adaptability of Water Stress

The integrative approach of the physical features of water stress provided an advanced perspective to manage stressors through a holistic perspective. However, the real-life context indicates that children experience continuous and co-occurring interactions between factors of exposure to water stress related to quality, quantity, cost, and reliability, as well as intermediate factors related to macro- and micro-determinants to early childhood development.

The concept of environmental stress (e.g. Cohen et al. 1995; Salleh 2008; and Anisman and Merali, 1999) suggested viewing water environmental stress (i.e. water stress) as a combined construct of exposure and factors that shape the controllability, predictability, and adaptability to the stress. Applying this concept to children may indicate the combined effect of water stress and the macro, micro intermediate factors that influence the characteristics of the families to predict, control and adapt to water stress specifically to buffer their children from its adverse consequences;

Predictability refers to the ability to foresee changes occurring related to stress. Families and children are chronically vulnerable to unexpected shocks, including unpredicted water cuts and increasing prices, and become unable to act as steady buffers for their children or respond to the dimensions of water insecurity. Predictability is critical in countries like Palestine. The geopolitical conditions contribute a high level of uncertainties and unexpected shocks that occur at the macro- and micro-levels and limit the ability of households to adequately prepare.

Controllability refers to the helplessness and inability of households to control and mitigate environmental challenges. It is a critical factor in influencing individuals' and families' behaviours and practices in response to water stress. Controllability mainly influences the family's capabilities, skills, and knowledge related to how they respond, adjust, and control stressors and prevent their negative consequences (Henderson et al. 2012).

Adaptability refers to the ability of the family to resist, adjust, absorb, adapt, and cope with water stress. Lazarus and Cohen (1977) and Evans (1984) explain the personal characteristics that reflect the ability of the individual to adapt to and mitigate water stress as a function of characteristics of exposure and the features of the context.

2.5.3 Vulnerability to Water Related Risks for Delayed ECD

Vulnerability reflects the level of risk that exceeds the family's and communities' capacity to buffer their children from risk and related harm.

Vulnerability is a function of exposure and a variation to which a system is exposed to that system's sensitivity and adaptive capacity. It also reflects the extent to which a society is prone to and endangered due to an exposure to certain risks while living within a sensitive context (Etwire et al. 2013). The Intergovernmental Panel on Climate Change (IPCC, 2007) defined vulnerability as the degree to which a system is susceptible to and unable to cope with climate change's adverse effects. Such a concept facilitates the examination of variabilities among communities exposed to risks.

Stronger exposure and weaker capabilities of families and their children keep children susceptible, sensitive, and exposed. If water stress is not predicted, controlled, and adapted to, children remain exposed and vulnerable to risks generated by exposure,

including poor household environment, inadequate and poor-quality water, and scarce family capacities. Exposure can also result in a depressed mother, disrupted family relations, and the absence of a safe place to play. All are requirements for optimal early childhood development.

When living under a state of vulnerability, persons are more likely to experience higher tendency to intense episodes of distress, depression, or anxiety disorders (Gois et al. 2012). The psychological stress may be combined with a physical burden, as caregivers from households facing all or part of water stressors become engaged in time-consuming activities to cope with water stress, including carrying water from distant sources, storing water, and cleaning using unimproved water sources (Okun, 1988). Living in such situation, children may face inadequate dietary intake, as well as poor quality and insufficient water for cleaning and washing, leading to increased risks of diarrhoea and malnutrition. Socially, children living with families stressed by water risks, may receive less cognitive support, have less interaction, and less time and resources to stimulate their cognitive and language development.

Inadequate care and stimulation may not be the result of time spent on water collection by parents. Several studies indicated that mothers experiencing water stress feel insecure, distressed, and frustrated (Wutich et al., 2008; Stevenson et al., 2012), uncertain and anxious (Tsai et al., 2016), and perceive their lives as being of poor quality (Subbaraman et al. 2015). Wutich (2009) indicated the presence of gendered disparities, whereby women, as the primary caregivers, mostly feel worried, scared, annoyed, and angry with family members, including children. A recent study conducted by Maxfield (2020) indicated that the sense of water insecurity is interrelated with food insecurity and reflected on reduced buffering capacities, whereby fathers feel insecure anxiety and

depression. (Cooper-Vince et al. (2017), on the other hand, suggested that children of women who are depressed from water insecurity are more likely to miss schooling.

2.5.4 Integrational Models of Combined Effects

Following the human development concept, many scholars established and developed indices to measure broader aspects of livelihoods and vulnerability. Hahn et al. (2009), followed by Tewari and Bhowmick (2014), and Etwire et al. (2013), developed vulnerability indices by evaluating livelihood vulnerabilities and related capacities to anticipate, cope with, resist, and recover from the impact of natural disasters. The metrics comprised variables from different disciplines, which were normalized, grouped, and categorized into groups of underexposure, susceptibility, and adaptability.

Bradshaw, Hoelscher, and Richardson (2007) measured children's wellbeing as a conflicting term of deprivation based on the concept of highlighting the realization of children's rights and opportunities for every child within holistic perspectives. Accordingly, they developed an index by combining factors related to children's livelihood, including health, environment, education, and social services. Sullivan et al. (2003) measured children's status based on the combined state of water stress and economic capacities. The index included measures of water of access, quantity, quality, and variability, as well as water use management capacity and environmental aspects.

The aggregated models' main advantage is the holistic and integrational perspectives that reflect children's right for a safe and healthy start of life. These models can treat the child as an integral unit, viewed holistically through rights and well-being rather than viewed through narrow service-oriented or specific aspects of health and education. These concepts look at holistic conditions that should be available for children to have a safe and successful start in their lives. It is also in line with the foundational definition of the

convention on the child's rights that a child is a person under 18 years old to whom the states are obliged to provide comprehensive services, not only education, health. The States are guided by the child's inherent right to life to ensure survival, development, and protection without discrimination¹⁴.

Standardization of data from different disciplines was the primary method used for calculating indices. The authors aggregated community-based data categorized according to different domains (e.g. health, education, environment, food), determined according to the index's features and objectives. Each domain included a set of variables. The values of variables were standardized following mainly the technical notes of the Human Development Index (United Nations Development Programme UNDP, 2019).

The index score of each domain was computed as the average of the standardized scores of the variables under the relevant domain. The total average of all domains was computed as the average stress score indicating the child's status in each community. In addition to estimating the indices per domain, Etwire et al. (2013) and Tewari and Bhowmick (2014) used the index to group the variables under the stress features and measured vulnerability as the difference between the standardized scores of the adaptive capacities and the exposure.

¹⁴ Convention on the Rights of the Child is an international human rights treaty ratified by the UN members states to ensure rights of children are met with holistic perspectives including their civil, health, education, social and cultural rights available at; https://en.wikipedia.org/wiki/Convention_on_the_Rights_of_the_Child

Table 2.3: Literature that Guided the Development of the Index

Author	Date	Geographic Area	Index	Type
UNDP	2019	Global	Human Development Indicators (life expectancy, education, and living standards) Technical Notes	Normalized summary method. Used the concept of Human Development Index by standardization of data using the difference between the maximum and minimum quantities and combining the components. Weighing method based on number of indicators under each component was used.
Etwire et al.	2013	Ghana	Livelihood Vulnerability Index	Followed the process of combining standardised data adopted from the computation of the life expectancy index of the HDI (Hahn et al. 2009)
Tewari and Bhowmick	2014	Northern Ghana	Livelihood Vulnerability Index	The risk-hazard model used to combine data with standardized method (maximum and minimum values) combined with weighting method
Bradshaw et al.	2007	Europe	Child wellbeing Index	Developed standardised measures based on the dispersion from the mean Used provided summary score for each country by combining 23 domains with 51 indicators
Sullivan et al.	2003	South Africa, Tanzania and Sri Lanka	Water Poverty Index	Used the concept of Human Development Index by standardization of data. Measure water stress at household and community levels.

Examining stress features evaluates the communities' capacities to predict, control, and adapt to water stress and indicates the level of vulnerability of children to risks for delayed ECD. From a human development perspective, the index can provide an assessment of the macro-context, an overarching concept that includes aspects and trends for children based on the available data and within the communities involved in the study. It also highlights the differences between the communities based on the macro-context's uniqueness and available capabilities and capacities to adapt and control the exposure.

However, this approach has significant limitations. The index is not statistically generalized and not used primarily for establishing significant associations. Water stress and vulnerability are relative concepts determined by multiple interactions among different factors. The influence of the exposure is determined not only by its intensity but also by intermediate factors that shape the ability to predict, control, and adapt to water stress. Uncontrolled and unadapted exposure leaves children susceptible to stress. At the same time, exposure might be the same, but families differ in terms of the intensity of exposure and their level of stress and vulnerability.

2.6 The intermediate processes; A Household Perspective of the Link

2.6.1 Introduction;

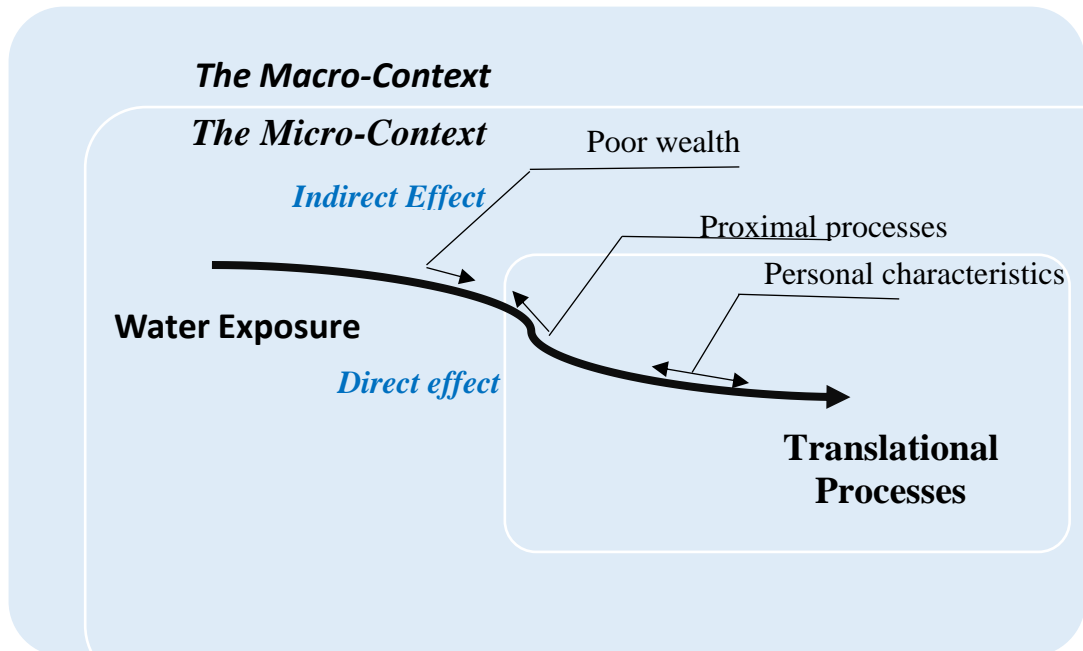
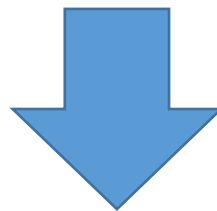
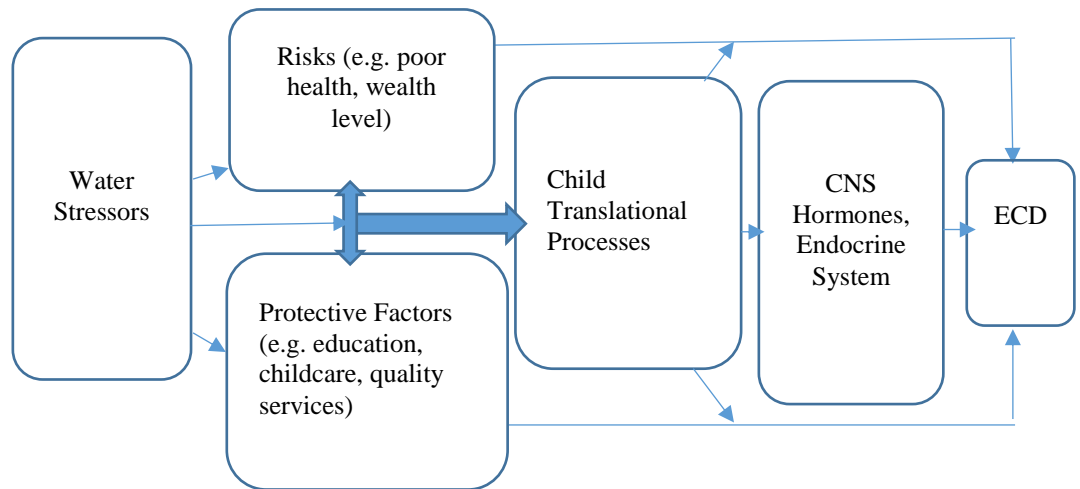
The previous section addressed child water stress as a continuous process of interactions between exposure and intermediate factors related to the macro- and micro-children's context. This section's primary purpose is to narrow down the scope of the review and explore mechanisms to explain interactions at the household level. The third research question guided the review of this section:

How do exposure to household water stress and the intermediate factors of wealth and childcare interact and establish risks of delayed early childhood development?

The intermediate factors under the current research are related to the determinants to early childhood development that mediate, suppress, or moderate the effects of the exposure on children. Based on the concept of the bio-ecological model, Figure 2.5 provides a microscopic view derived from Figure 2.3 of the hypothesized interaction between exposure and risks and protective factors related to the determinants to early childhood development. The diagram indicates the direct pathway between the exposure and children's translational processes and indirect pathways through risk and protective factors.

To set clear and specific boundaries for this section, the review focused on the domestic level by addressing interactions between the uses of unimproved water sources for drinking, representing the exposure; family wealth level, quality of caregiving, and child characteristics as intermediate factors; and the developmental status of children as the dependant variable.

Figure 2.5: Narrow Visualization Exposure, Risks, and Protective Factors



Referring to Figure 2.5, this review explores how water stress impact children through indirect pathways. Mediation is a process that examines direct and indirect pathways. It describes the relationship between three variables by decomposing the effect of the independent variable on the dependent variable to the direct effect between the independent and dependant variables, and the indirect effect between the independent variable, mediator variable, and the dependant variable. Baron and Kenny (1986) and VanderWeele (2016) provided detailed guidance of how to statistically measure these relationships using a stepwise, logically ordered regression analysis explained in more details in the method chapter, section 4.5.3.

While the focus of this study is on mediation pathways, two other concepts are always incorporated with mediation analysis. The suppression effect implies the opposite effect of the mediator that reduces or undermines the indirect influence of the independent variable. This effect can be applied to positive proximal practices that buffer children from the negative impacts of water stress. Moderation effect indicates that the influence of the independent variable is categorized or influenced by the characteristics of the intermediate factor such as age, sex, and education.

2.6.2 The Mediation Influence of Wealth

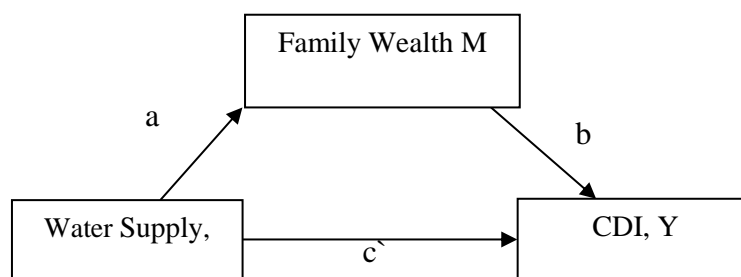
Recent literature shifted the definition of concepts related to poverty from insufficient income to unrealized “capabilities to live in dignity” (United Nations Economic and Social Council 2001, p.2). This definition recognizes poverty within the scope of limited capabilities and capacities with undermined abilities and the potential to obtain essential needs to avoid hunger, stress, vulnerability, inequality, discrimination, and social exclusion.

The World Bank defines family poverty as “pronounced deprivation in well-being” (World Bank 2001, p. 15). This definition refers to the poor as those who are vulnerable to adverse conditions they can’t control. With respect to water stress, Feitelson and Chenoweth (2002) defined water poverty as a situation in which a nation or region cannot afford the cost of sustainable clean water for all people at all times. The broad definition of poverty relates to the wealth status indicated by available assets and capacities, income, employment, and abilities to secure adequate resources, food, and water for their children, themselves, and households' needs. Concerning water stress, the wealth level reflects families' sensitivity to risks and shocks, and ability to control, prevent, and adapt to the impacts of water stress.

The broader concept of poverty indicates limited wealth with higher risk of developing cognitive, behavioural, and emotional difficulties and delayed academic achievement (Engle and Black, 2008). Being represented by the limited wealth level and considering the definitions of water stress and early childhood development, poverty correlates with both aspects.

Traditionally, the literature indicated that low-wealth level families possess fewer capacities to provide safe and adequate water resources. The poor are more likely to access unimproved water at high costs and lower quantities (Briscoe 1992). The mediation concept entails additional concepts including that water stress adds to the burden of poverty on children and their families. As indicated in Figure 2.6, children of families with undermined wealth, when exposed to water stress experience a combined burden as water stress is exacerbated by the social and economic burden of poverty. In other words, the wealth level acts as an intermediate factor that carries the indirect influence of water stress and mediates its impact on children.

Figure 2.6: The Mediation Effect



Capitalizing on the above definitions of poverty, this research highlights the need for a concept broader than income only. Noting that ECD is influenced by risk and protective factors, this research suggests the use of wealth level instead of poverty. In other words, the negative consequences of water stress can be mediated by the low level of wealth levels, while high or good wealth levels can serve as protective factors.

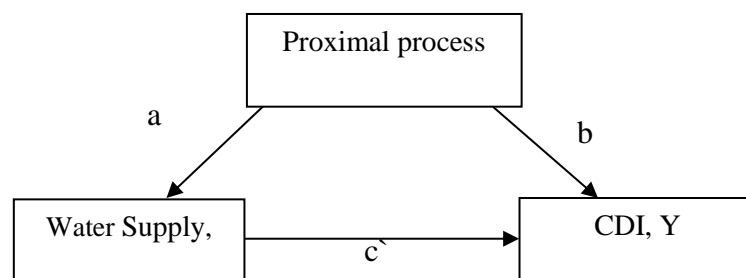
Considering the protective factors facilitates balanced perspectives to support services and policies. For instance, adequate access to water can contribute to better health and wellbeing, and more opportunities for mothers to work (Koolwal and Van deWalle, 2013), use water in income-generating activities (Pickering and Davis, 2012), and for small-scale productive use in food production (Howard, Bartram, and Water, 2003).

2.6.3 Water Stress and Parenting

In addition to the biological and relationship, parents interact closely, spend time with, and provide care, as well as nutritional, physical, and emotional support to children. In certain cases, the term “caregivers” is used when the primary persons providing care and support to children are not their biological parents, but rather close relatives or workers at nurseries and schools.

The proximal processes referred to by Tudge et al. (2017) are interactive processes whereby parents and other caregivers provide children with stimulation, interaction, and support. These processes reflect parents' capacities of providing quality of care, support, and risk buffering that children need for optimal development. Referring to the mediation model, ideally, the parenting role regarding water stress can be a suppression role, as described in Figure 2.9, whereby parents can alleviate and reduce the risk of water stress on their children. This requires a safe and healthy proximal surrounding environment as a hub of stimulation and learning that can enhance protection from actual or potential risks and harm (Daly et al. 2015).

Figure 2.7: The Suppressor Effect



Daly et al. (2015) and De Stone et al. (2016) defined parents as the closest and main persons providing care and support to children. Sometimes, individual providing care might not be the biological parent and then referred to as a caregiver. Parents have multi-
dual roles. They secure essential food and dietary needs, ensure their children's wellbeing, provide care, respond to urgent needs, and interact with and stimulate their children while buffering them from the negative consequences of risks and hazards. To buffer children from water stress, parents and caregivers undertake different strategies to reduce the burden of water stress, such as boiling water, hygiene practices, water storage, ensuring

proper education, ensuring a nurturing and supporting family atmosphere, and being responsive to children's needs and aspirations.

Conventional water literature emphasizes the protective role of the family. While this is often accurate, the present research argues that water stress contributes to undermining the family's social environment and disrupting relations and dynamics that may negatively affect children, including abusive parenting. De Stone et al. (2016) indicated that positive parenting requires no harsh or abusive actions. Harsh parenting refers to aggressive physical acts such as hitting, and emotional expressions parents direct towards their children. This kind of parenting has different forms and causes such as emotional and physical abuse and other practices and behaviours that negatively influence children.

It is a known fact that limited wealth and economic capacities can lead to financial stress, parental mental health problems, and emotional disturbances that may lead to inconsistent parenting or harsh treatment (De Stone, 2016). Based on the mediating role of limited wealth discussed previously, water stress adds to economic and social burdens and exacerbates social pressure which may contribute to harsh treatment by parents already providing inconsistent parenting or cruel treatment due to other hardships. However, the present research views this phenomenon through a closer lens related to real-life and daily routines.

"Household Chaos" is a concept that can provide a narrower perspective on the influence of water stress on harsh parenting. It is a human development concept that refers to chaotic family and community life that is troubling, disturbing, and undesirable for parents and children (Evans and Wachs, 2010). The chaotic household environment includes loud noise, crowding, air pollution, and water danger. It also refers to a combination of ecological and environmental situations that contribute to low regularities and routines

with difficulties in sustaining steady routines. It includes interrelated, chronic, and persistent water danger, wealth level, ecological challenges, inadequate nutrition, and family conflicts that undermine children's development (Evans and Wachs, 2010).

Coldwell et al. (2006) and Deater-Deckard et al. (2012) linked chaotic household with stressful environments that tax parents' capacities for regulating their emotions in challenging situations, increasing the likelihood of hostile acts and practices on their children. Evans and Wachs (2010) included water danger as one of the elements of chaotic households but did not explicitly indicate water stress as an exposure. When added, it may enhance household chaos and establishes more social and emotional pressure on parents. However, according to environmental stress literature (e.g. Cohen et al. 1995; Salleh, 2008; and Anisman and Merali, 1999) inadequate water for domestic use, unsafe quality, and disconnected services are features of environmental stress that strain a person's mental, physical, and social capacities and behavioural changes. Considering its features in Palestine, water stress can be a significant contributor to this chaos. It contributes to insecurity, uncertainty, inconvenience, economic pressure, poor hygiene, and disrupted relations, emotions, and distress.

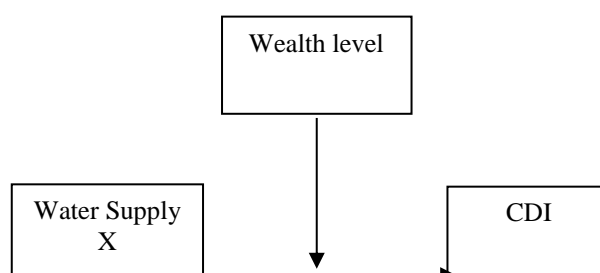
A significant advantage of this concept is the simulation of the real-life context whereby water stress and other social and environmental relations are compiled within one chaotic system. The literature did not suggest order and predictability as to the different constructs to reducing household chaos. Evans and Wachs (2010) indicated that improved wellbeing with the active engagement of family members in desired activities and actions can reduce the chaos. However, the intensity and shape of the chaos are vital in determining how parents can control it, and if not, how they can control their emotions and behaviours.

No literature was found explicitly addressing the chaotic household in Palestine. However, different studies addressed deteriorated wellbeing and deprivation (Mataria et al. 2009; Garbarino 1991; Horton 2009; and Waterston and Nasser 2017) and reflected on the challenging social and emotional state of Palestinian children and their caregivers. While it may be hard to capture as it includes different dimensions and features, an in-depth understanding of how water stress contributes to the chaotic household may reflect the risks and challenges that water stress establishes on dynamics and relations, especially parent-child relationships. Most importantly, it examines water stress without isolating it from other interrelated aspects within a holistic construct.

2.6.4 The Moderation Effect of Personal Characteristics

The moderation effect implies that the impact of the independent variable varies across the intermediate factor characteristics. As indicated in Figure 4.3, low-income families are more likely to have less access to domestic water supply, and therefore are less able to care for their children's health and development.

Figure 2.8: Moderator Effect



Children's characteristics can moderate the impact of stress and protective factors on children (Tudge et al. 2017). The personal characteristics of children moderate the influence of water stress on children. Demand characteristics, such as age and gender,

may shape the interactions and relationships as caregivers may be more caring for younger children. Families may pay males more attention than girls. More educated mothers and fathers are more likely to be employed, provide safe and healthy food, and have proper housing conditions. Mediation and moderation create a cycle of risk whereby low-wealth families are more likely to access less water (moderation), while at the same time, water stress induces or adds to the burden of limited wealth on children. The above models are a hypothetical and logical model that may imply many confounders and other intermediate factors. However, noting the social and cultural aspects of the present research, this model provides a logical approach with a robust platform for creating standardized assessment tools to understand the influence of wealth levels by services and interventions. This approach was also used by Engle and Black (2008) to explain the influence of limited wealth on early childhood development through the mediated and moderated effects of family characteristics.

2.7 Implications for Policies and Programs

2.7.1 Introduction

A specific motive of this review is derived from the relationship between services provided to children and their home context. This review focusses on the pre-primary schools as an example of services provided to children below five years old. These schools focus on supporting children in learning and cognition development, as well as the development of skills and knowledge. They provide an environment for interaction and interpersonal communication. Considering the context of Palestine, every morning, many children, most likely from poor households, may see, witness, interact, and suffer

from situations related to water stress combined with stagnated social and economic constraints. The main objective of this section is to answer the fourth research question:

How does child water stress influence the effectiveness of services meant to support children in achieving their developmental potential?

This review explores how children's context, including living in water stress at their households and communities, impacts the effectiveness of the services provided to children and how the parents and practitioners view and perceive this gap. Being relevant to the research objectives, ECD services and related policies served as a case study, presenting a pertinent example of other childhood services, including health and social support. The case study approach would be best suited to obtain an in-depth description and analysis of cases based on previous experiences, events, or projects. This approach enables the studying of practices with why and how questions using research agendas should that combine practices and theories with flexibility and adaptation, noting cultural appropriateness and rigor (e.g. Creswell 2014; Easterby-Smith, 2012)..

2.7.2 The Gap between ECD Practices and the Concept of Water Stress

The gap between theory and practice in the services provided to children is a common phenomenon. Researchers focus exclusively on theory formulation, while practitioners focus on practical application and hand-on experience (Phillips and Shonkoff, 2000). Research agendas should build practices and methods with flexibility and adaptability, noting cultural appropriateness and rigor (Haddad, 2002).

Tudge et al. (2009) indicated that the gap might occur when focusing on specific aspects related to the determinants of early childhood development, and pay less attention to the holistic construct that involves all determinants of early childhood development.

However, Tudge and her colleagues did not elaborate on how factors related to the determinants to early childhood development, including the services provided to children, interact.

Viewing this challenge from a practice-based lens, the mechanisms of interaction among risk and protective factors could facilitate the design and planning of interventions that are more effective in supporting children achieve their development potential. Based on practical experiences from twenty-one countries, UNICEF (2006) demonstrated that successful ECD services supporting children to achieve their potential followed holistic approaches based on their rights to survive, live, and grow within a healthy and safe environment.

While the bio-ecological human development theory was a landmark development for research and practice in the field of childhood development, researchers and practitioners still do not adequately apply this concept while considering its holistic nature (Tudge et al. 2009; Tudge et al. 2017). Child-based services primarily emphasize health, nutrition, cognition, and learning, but to a lesser extent with respect to child protection (Britto et al. 2013).

2.7.3 Childhood Services in Palestine

Childhood services in Palestine face similar challenges. ECD services and policies implemented by nongovernmental organizations in Palestine lack an essential integrated approach. Childhood services, especially health and early childhood services, are offered through different sectors and are characterized by a lack of interconnections and overlaps in service delivery (e.g. Songco, Nijem, Elfarra 2013; Awashra and Awashreh 2012).

As a developing country, and considering the unique context, this research argues that childhood services can perform additional role of alleviating vulnerability, stress, and suffering. These services yet, require more considerations to children's context with most the vulnerable and disadvantaged backgrounds, including those with special needs, which can boost their education and livelihood experiences (Haddad 2002).

The Palestinian National Strategy for Early Childhood Development and Intervention 2017-2022¹⁵ highlighted the importance of ECD for Palestinian children's wellbeing, primarily if implemented within integrated and holistic approaches. The strategy addressed interventions to improve cognition and learning abilities, quality of services, health interventions, child protection, and awareness among families and communities. The strategy addresses stakeholders from different sectors highlighting the need for holistic perspectives, however, it is mostly a service focused strategy as it designated roles and responsibilities to each sector, but did not suggest integrated models whereby each sector set interventions that consider aspects of early childhood development relevant to the local context. The preschools' primary focus of these services is supporting children through learning and cognition. To date, no literature was available in Palestine addressing how water stressors influence the effectiveness of these services and how these services can be more effective if children's context is considered in the design and implementation of these interventions.

¹⁵ Joint Efforts made by several national organizations in cooperation with UNICEF. The Palestinian National Strategy for Early Childhood Development and Intervention 2017-2022, Available at: https://reliefweb.int/sites/reliefweb.int/files/resources/ECD_National_Strategy_Proof_read_13022017_EN.pdf.pdf

According to Walker et al. (2011), child-based services need to be aware of the dynamics and interrelationships between the risks and protective factors to develop responsive and effective activities and services for children. In this respect, it is important to assess the level of support services are providing with respect to risks and challenges beyond learning and cognition. In other words, the level of interaction between childhood services and children's living conditions related to the bio-ecological human development theory, which was a landmark development for research and practice in the field of children development, and many researchers and practitioners still fail in applying all its concepts (Tudge et al. 2009; Tudge et al. 2017; Eriksson et al. 2018).

In this respect there is a need to assess the level of involvement of these services in responding to the needs of children within the macro- and micro-context, including geopolitics, wealth levels, parental support, and personal characteristics. This research argues that while most pre-primary schools offer learning and cognition services, supplementary services that address challenges related to the macro- and micro-context can make the difference in their effectiveness.

The effect size approach can be used to assess the effectiveness of the services and interventions among the selected cases. The National Forum on Early Childhood Program Evaluation (2007) suggested the effect sizes as standardized measures to compare between interventions, mainly to identify how large the effects were before and after the intervention. Cohen (1988) provided guidance on how to normalize data and calculate the effect size for means and proportions. This concept was utilized by the method section 4.5.4 for measuring compatibility of child services and the intensity of water stress in these selected communities in Palestine.

2.7.4 ECD Services and Home Environment

The scores related to effectiveness may provide a relative quantitative view of how close the ECD services are to the macro-context which pertains to the family's wealth, life routines, dynamics, and relations. Such aspects require in-depth understanding based on life experiences. Qualitative methods can enable this understanding, including the opportunities, challenges, and recommendations related to interventions that address household water stress. These methods can include gathering the perceptions, views, and experiences of service providers and related stakeholders who support children facing water stress to achieve their development potential. The focus group discussion (FGD) is a qualitative method in the form of a group interview to understand the social dynamics and interactions between participants through the collection of verbal and observational data (Redmond and Curtis 2009). It is implemented with a small group of people, and is facilitated, moderated, and guided to obtain perceptions on defined aspects (Jordan et al. 2007).

2.7.5 The Impacts of Water Stress on Services

To obtain a comprehensive view of the compatibility between childhood services and the child context, including macro- and micro-assessments from the communities and homes, complementary conceptualization based on views and experiences from the practice side are necessary. To obtain a practice-based logic, the opportunities, challenges, and recommendations can be categorized in accordance with the programme logic, including defined long-term goals, outcomes, and activities. This approach detects which interventions in the pathway were successful in producing the outcomes and/or which interventions are missing that made the work unsuccessful (Taplin et al. 2013).

Figure 2.9: Programme and Service Logic



Input-output-short-term outcome-long-term outcome

- Impact: Generally oriented objective reflecting the contribution to enhancing the strategies and efforts to reduce risks related to delayed ECD
- Effect: Change in the practice, skills, and knowledge of the parents and service providers
- Outputs: Products and services put in place to achieve the effects and impacts
- Activities: Operational and technical tasks needed to produce the outputs
- Inputs: Professional and financial resources needed to implement the activities

To combine the practice-based logic with the child development theories, theory-oriented assessment can be an appropriate methodology. The theory-oriented assessment is a conceptual analytical model used by delineating the current theory that guides the mechanisms used to achieve outputs and results (Funnell and Rogers 2011). This approach creates a theory of change¹⁶ to conclude why, how, and under what conditions the programme will achieve the desired effects. To examine the implications for the modalities, the scope of services and interventions and related effectiveness can be

¹⁶ The theory of change is an approach that explains how actions are expected to produce change (results). The programme theory follows a sequence of events including outputs, immediate outcomes, intermediate outcomes, and ultimate outcomes. It operationalizes programme logic with defined long-term goals and then tracks backwards to detect the changes that should happen according to the underlying theory (Taplin 2013).

described; then challenges, opportunities, and experiences related to the application of the mediated, suppressed, and collective effects can be examined.

The theory-oriented assessment can be applied by examining the influence of child water stress on each component of the service logic, detailing the challenges and risks established in accordance with the main contextual elements of the bio-ecological development theory. Semi-structured interviews entail listening, being open to responses, and remaining non-judgmental after creating a comfortable environment. It is a very flexible technique for small-scale research and helpful in mini-studies and case studies (Longhurst 2003; Drever 1995).

2.8 Conclusion

2.8.1 Introduction

The main conclusion derived from this review is that water stress can be linked with increased likelihood of children to risks of delayed early childhood development. Considering the characteristics of both features of water stress and ECD, the link is less likely to be a direct causal stress-outcome relationship. The review suggests that the link is more likely to be a continuous process of interactions between factors related to water stress, child characteristics, family capacities and features, and macro and micro contextual factors considered part of the child's spheres of influence.

After diving more into the field of ECD through the angle of human development, the review defined ECD as a continuous process of physiological, physical, mental, social, and emotional development that progress with age. The main risks and opportunities to secure optimal development occur at an early age, especially under three years old, when children undergo rapid brain development. Risks such as inadequate stimulation and malnutrition may influence the development of neural capacities, social skills, knowledge, and behaviour.

The lengthy exposure to complex and prolonged stresses that interact with the determinants of ECD, may influence the translational processes of children's social-emotional, cognitive, and physical outcomes.

2.8.2 Main Conclusions Related to the Research Questions

The following presents the main conclusions organized according to the research questions. This review's findings facilitated setting up the hypothesis and paved the way

for selecting appropriate methods and data to assess water stress as early life stress that increases the risks for delayed early childhood development.

1- Understanding the features and characteristics of the exposure associated with risk for delayed early childhood development

The review concluded that the features of water stress suggest water stress as an early life stress with lengthy exposure, that interact with social, emotional, health, economic and physical detriments of optimal ECD.

Quantity, quality, reliability, and cost are the main elements of water stress (water stressors) that enhance and exacerbate each other. The literature emphasized volumetric and engineering features of water stress. This review concluded that common features of water stressors; chronicity, interrelated physical effects, and likelihood of combined interaction with the determinants to early childhood development at the macro- and micro-levels may explain its possible association with risks for delayed ECD.

2- Explain how children live and grow in communities with combined effect of water insecurity and risks, and protective factors related to determinants to early childhood development

The review concluded that the link between water stress and ECD is largely explained by continuous interactions between the exposure and intermediate factors related to child's characteristics and her micro and macro surrounding context. This concept is referred to by this research as child water stress, and reflects the combined effect of these interactions. The review concluded that defining water stress exposure only may not reflect the intensity of the exposure fully. The capacities to predict, control, and adapt to water stress are vital for shaping the influence of the exposure on children. These

capacities reflect the status of the child's wellbeing in their households and communities, and include risk and protective factors related child's characteristics, family, and surrounding context,

Supported by literature on environmental stress and bio-human development theories, the review attempted to define the predictability, controllability, and adaptability to water stress as holistic concepts related to child's wellbeing based on their living conditions and capacities.

The combined scale of the three stress features reflected the child water stress level in each community. Children in communities with limited capacities to predict, control, and adapt to water stress were indicated as vulnerable and susceptible to the exposure, and consequently, their normal translational processes remain at risks. Accordingly, the level of children's vulnerability may predict risk for delayed early childhood development. To measure and assess child water stress and its combined features, many methods were reviewed, though they all suggest composite standardized measures to combine data from different disciplines and produce a scale that reflects the child status within their communities.

3- Understand how the exposure to household water stress and the intermediate factors of wealth and parental support interact and establish risks of delayed early childhood development?

Mechanisms at the family level, being the foundational unit of the community and the micro-environment, may explain the interactions between the exposure, risk, protective factors, its influence on children, and the resulting delay in their development.

The literature conventionally addresses the impacts of risks on children through the stressor-outcome relationship. The context highlighted for both water stress and ECD suggested most of the interactions occur through intermediate factors. Accordingly, the review explored the mediation analysis to examine the relationships based on the stressor-intermediate factor-outcome. The review examined family wealth as an intermediate factor and delayed ECD as an outcome of interest. However, the review suggested that the water stress and delayed early childhood development are interrelated with a wide variety of intermediate processes and factors, and therefore may be hard to establish. The review suggested that proximal processes, which are vital processes for optimal early childhood development, are influenced by the combined effect of water elements and intermediate wealth effects.

Other factors were examined for opposite effects (suppression factors), including mother's education and enrolment in preschool. The review suggested child characteristics as moderators for this relationship, with the influence of stressors being categorized according to the features and characteristics of children. The review suggested an in-depth understanding of how water stress influences the family system, especially the dynamics and relationships needed for optimal development.

4- Explore Implications for policy and practices by understanding how Child Water Stress influence the effectiveness of services meant to support children in achieving their developmental potential?

Given the research's aim to reflect the findings on services and practices addressing children, the review explored literature that examined gaps and models related to compatibility between theories and practices. The review explored a comprehensive view of the gap through three dimensions:

- The gap between the services and the macro-context; The current services and activities offered to children with specific focus on the supplementary activities that ECD services offer to children, relevant to the context
- The gap between the services and the micro-context based on early life experiences, as well as perceptions and views of parents and caretakers.
- The gap as viewed by practitioners noting the challenges and opportunities, they encounter due to child water stress

The above hypothetical answers to the research questions established a framework for setting the central hypothesis of the link between water stress and delayed early childhood development. It also paved the selection of appropriate methodology that logically yield an answer to the main research question. Water stress and ECD matter children's processes while living among family dynamics, relationships, and behaviours. Such content requires mixed methods that seek a descriptive analysis of the features, characteristics, and interactions of the problem, supplemented by the humanistic side generated by in-depth views and experiences.

Chapter Three | Problem Statement, Hypothesis, and Objectives

3.1 Problem Statement

The present research hypothesizes a link between two aspects that impact children's lives and wellbeing: Water stress and delayed early childhood development (ECD). This link is reflected in the problem statement for this thesis:

Palestinian children who live in households and communities facing water-stress are more at risk of not developing optimally.

Optimal early childhood development is a result of the synthesis of children's macro and micro living conditions, dynamics, and relationships, combined with health, education, economics, childcare, environment, neurological factors, and genetics. Policies and services related to ECD, such as those implemented in Palestine, are included under the education sector.

While optimal early childhood development is an indicator of a safe, healthy, and supportive environment, delayed development, indicated by inadequate social, mental, and cognitive skills and abilities, is a result of the cumulative and combined influences of complex stresses and disparities. Water access and use is an easy routine for many people around the world, but is a continuous challenge for many others, especially those in developing countries. It is more challenging and problematic in counties living under natural scarcity and chronic conflict, such as Palestine, where the dispute over water resources is a significant pillar of the Israeli-Palestinian conflict.

Considerable literature has examined water-related challenges and failures, including the inadequate quantity for domestic use, unsafe quality, unaffordable cost, and weak and unreliable services from engineering and volumetric perspectives. These challenges and impacts have also been viewed through the lens of physical effect and child outcome.

Regarding the context of water in Palestine, water-related failures and challenges contributing to water stress are real-life commodities that interact and influence daily life routines, dynamics, and relationships, as well as economic, social, cultural, and environmental conditions. Water stress and related challenges and failures are continuous and interrelated, and interact with factors from other disciplines that matter to the wellbeing and livelihood of children.

Water literature typically emphasizes conventional and internationally comparable indicators, such as the prevalence of diarrhoea, wasting, stunting, and mortality rates. Such indicators are essential to measure the status of countries within specific sectors, and to assess their progress towards international targets such as the SDGs. However, different disciplines influence children's health, social, and cognitive outcomes. Accordingly, the conventional sector-specific indicators may not reflect an adequate assessment of children's status, overlooking significant processes and mechanisms that influence children through holistic perspectives relevant to the uniqueness of their contexts.

ECD can add a broader perspective of children's status beyond sector-specific indicators, and reflect the outcome of children's exposure to the synthetic interactions of real-life multidisciplinary effects. While addressing this relationship, the present research utilized logical processes to identify gaps and challenges related to the main problem, as summarized below. The following highlights problems related to features of water stress, followed by aspects with three perspectives; community, household and services.

1- Exposure to be defined.

The present research identified the need to reach a clear definition of exposure to water stress. The literature review identified significant progress in examining comprehensive

and holistic perspectives related to water stress and insecurity, combining inadequate water quantities, poor quality, high and unaffordable cost, and weak service reliability. However, the literature primarily addressed the elements of water stress through physical and volumetric terms.

The present research argued that the common, interrelated, and combined features of the elements of water stress (quality, quantity, affordability and reliability), such as chronicity, interrelated influence, and combined effects are features that correspond to the deficiencies influencing children's surrounding environment.

2- Defining exposure only is not enough. Water stress does not act in isolation; it interacts with child's surrounding contexts. A macro-overarching context.

The present research argues that defining the features of the exposure is essential to indicate its possible effects on children. However, the effect of exposure on children is also determined by the ability and capacity of the family and child to predict, control, and adapt to exposure. Exposure to water stress, combined with limited ability to predict, control, and adapt to exposure creates direct stress represented by undermined capacity of their family and the community to buffer children from the associated risks and hazards. This limited capacity keeps children vulnerable to the adverse effects of exposure. Therefore, children (and their families) with limited capacity are more likely to remain in an environment with conditions that are inadequate for reaching optimal development. These deficiencies include physical conditions such as less water for washing, drinking, cooking, eating, bathing, and cleaning. The social and emotional deficiencies include stressed and distressed caregivers, disrupted care and support, and inadequate stimulation and responses. As indicated by the literature, much of these micro-

and macro-factors are foundationally determinants of optimal translational processes and development.

Appropriate measures are needed to capture the combined interaction between water insecurity elements (quantity, quality, cost, and reliability) and the main determinants of optimal ECD including the macro-context, which includes the geopolitical conditions, community features, population, health, and demographic trends.

3- Interactions between exposure and intermediate factors require explanations at the micro-context.

Much of Palestine's data and surveys reflect community-based trends and features based on aggregated data collected from households. Studies and analyses that examine the real-life interactions inside families seem to be less emphasized. Filling this gap may improve understanding of the trends produced by the aggregated data, mainly because the family is the foundational unit of Palestinian society.

The present research argues that examining the relationship between two variables in the household context may generate misleading conclusions by overlooking much of the influence of exposure (independent variable) made through other variables that may mediate or suppress the effect. In other words, the exposure children face from a prime variable is always combined with exposures from other variables, including family wealth, parental support, and child characteristics.

Noting that ECD is determined by the context, processes, children's characteristics, and duration of the exposure, the direct influence of water stress on children's early development may be minimal. The effect of water stress on children through intermediate factors, such as family wealth and parental support, is more likely to be with a larger

magnitude. Accordingly, water stress is more likely to influence families with limited wealth and influence families' capabilities and quality of parental care, taking into consideration moderating characteristics of children such as age, sex, and enrolment in ECD services. However, exposure can be suppressed by protective factors such as improved wealth, maternal education, employment, good health, and quality pre-primary education and care.

4- Childhood services inadequately match with children's context.

Water stress combined with stagnated socio-economic conditions can undermine the effectiveness of childhood services aimed at supporting children to achieve their development potential. Effectiveness is measured by the ability of services to support children who experience complex stress to achieve positive developmental outcomes.

In countries such as Palestine, many children start preschool having come from homes that experience water stress combined with stagnated social, economic, and even geopolitical conditions. The present research argued that a broader scope of ECD services may be required as they are the first formal services that children may access. Since all preschools offer learning and cognitions services, the supplementary activities that support children can help alleviate the influence of child water stress (i.e. exposure combined with contextual factors).

The relevance of childhood services to the context seemed to have significant gaps. At the macro-level, the effectiveness and level of supplementary activities need to be relevant to stress and vulnerability. ECD services need to consider gaps related to age groups at the micro-level, particularly those resulting from the absence of continuity of care provided through official and stable systems. Many children do not go to preschool for several reasons, including financial and cultural factors.

The four problems outlined above indicate gaps and challenges that, if filled, may contribute to identifying mechanisms that could explain possible links between two major aspects that matter to children's livelihood, wellbeing, and future. However, the present research acknowledges the multilevel, complex, and interrelated features of both aspects that make it difficult to produce minute and precise estimations of direct effects and associations. Bearing in mind the importance of both aspects, the present research signified the need to better understanding and conceptualization of both aspects related risks and vulnerabilities.

3.2 Research Hypothesis

This research is intended to assess evidence that exposure to water stress is linked with increased risks for delays in ECD. It aims to establish this relationship and explain the multi-levelled interactions that include both the household and the community. This hypothesis builds upon the ecological development theory of Bronfenbrenner and Morris (1998), which stipulates that the development of children occurs within the multiple interactions of interrelated levels, represented as spheres of influence: the child, the family, the community, and programmes (Irwin, Siddiqi, and Hertzman, 2007). Studying the impact of water stress on children within different spheres of influence demonstrated the existence of the association:

Main Hypothesis

The main hypothesis of the present research is based on the following:

Children under five years old living in households and communities with water stress are less likely to be on track in their early development.

This statement is derived from the main interest of the present research. It aims to advance knowledge on aspects that matter to children in Palestine and other countries facing, in addition to water stress, chronic socio-economic vulnerabilities and disparities. It is consistent with existing knowledge and contextual analyses that demonstrate that children exposed to constant and complex stresses lead to outcomes that reflect the synthesis of multidisciplinary risk factors such as ECD. The statement above reflects the general endeavour of this inquiry to contribute to efforts calling for holistic approaches that better serve children through integral paradigms beyond stressor-outcome links, and sector-specific services and policy arrangements.

The general hypothesis is divided into four hypotheses that correspond to the four research questions and objectives:

Hypothesis I:

Exposure to water stressors in Palestine is indicated by inadequate quantity, unsafe quality, weak reliability of services, and high and unaffordable cost. The present research hypothesizes that the physical features of water stress (inadequate quantity, quality, reliability, and cost) are featured, in common with; chronicity, interrelated and combined influence that disrupts the steady, constant, and safe environment needed by children for optimal ECD. The first hypothesis is as follows:

The main elements of water stress are characterized with chronicity, combined interactions, and interrelated influence that associate the exposure to water stress with the increased likelihood of delayed early childhood development.

Water stress is associated with macro- and micro-factors considered the primary determinants of optimal early childhood development such as wealth level, parent

support, child characteristics, and geopolitical conditions; accordingly, it increases the likelihood of delayed early childhood development.

Hypothesis II:

The interaction between physical water stress and the determinants of early childhood development is a combined interaction resulting in a combined effect addressed by the present research as Child Water Stress. The second hypothesis is as follows:

Child Water Stress, resulted from combined interactions between factors of exposure to water stress and children’s macro and micro contextual factors, is a predictor of child vulnerability to risks for delayed early childhood development.

Water stress is comprised of factors related to exposure and macro and micro contextual factors, family features, and child characteristics. Child Water Stress reflects a macro perspective of the intensity of the exposure combined with the macro geopolitical conditions, and the socio economic capabilities of the communities to predict, control, and adapt to water stress. It is hypothesized that when the magnitude of the exposure to water stress is higher than the capabilities to control and adapt to water stress, children remain vulnerable and susceptible to risks that disrupt the social and physical environment needed for optimal development.

Hypothesis III:

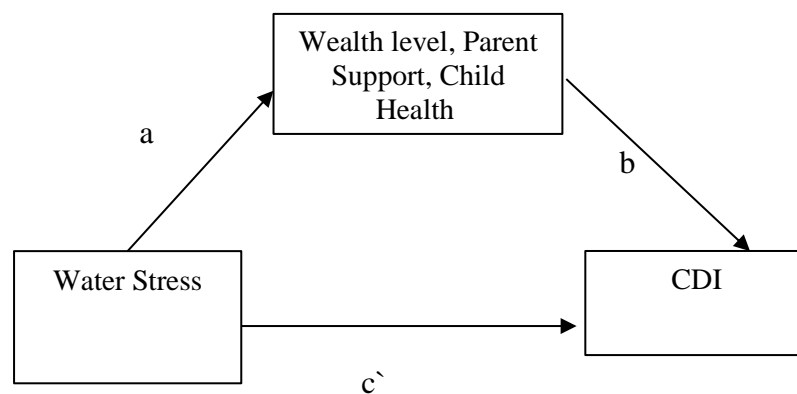
This hypothesis is intended to explain the interactions under child water stress at the household level. The interactions referred to are between the exposure to water stress, and factors related to children living conditions (categorized under the determinants of early childhood development).

The effect of the exposure to water stress decomposes to direct effect influencing children directly, and indirect effects. The indirect effects are effects mediated by intermediate factors that enhance, suppress or moderate its effects on children. The third hypothesis is as follows:

At the household level, water stress, indicated by the use of unimproved water supplies for drinking, influences children directly. However, children are influenced indirectly to a larger degree by inducing the effects of wealth level and parental support.

The path diagram demonstrated in Figure 3.1, below, explains Hypothesis III. The total effect between water supply and ECD will be estimated and divided into direct effect (c') and indirect pathway (ab).

Figure 3.1: Path Diagram: Water Supply, Early Childhood Development



Total effect $C =$ The direct effect $c' +$ the indirect effect $a \& b$, thus $C = c' + ab$, where (a) is the effect of water supply on the intermediate factor, (b) is the effect of the intermediate factor on childhood development, and c' is the direct effect.

The hypothetical pathway of the link is formed with water stress as the independent variable, and the effect of wealth, parental care, and child health as the mediators, and early childhood development the dependent variable.

Hypothesis IV:

The present research hypothesized that the effectiveness of supplementary interventions that address the indirect pathways is higher than the effectiveness of interventions that address conventional cognition and learning. However, from a macro-perspective, the effectiveness of childhood services decreases with increased vulnerability. The fourth hypothesis is stated as follows:

Children’s home context, of water stress and challenging socio-economic conditions, reduce the effectiveness of early childhood development services in supporting children to achieve their development potential.

Children and families are exposed to constant and combined stresses that make it hard for ECD services and establishments to manage and support them.

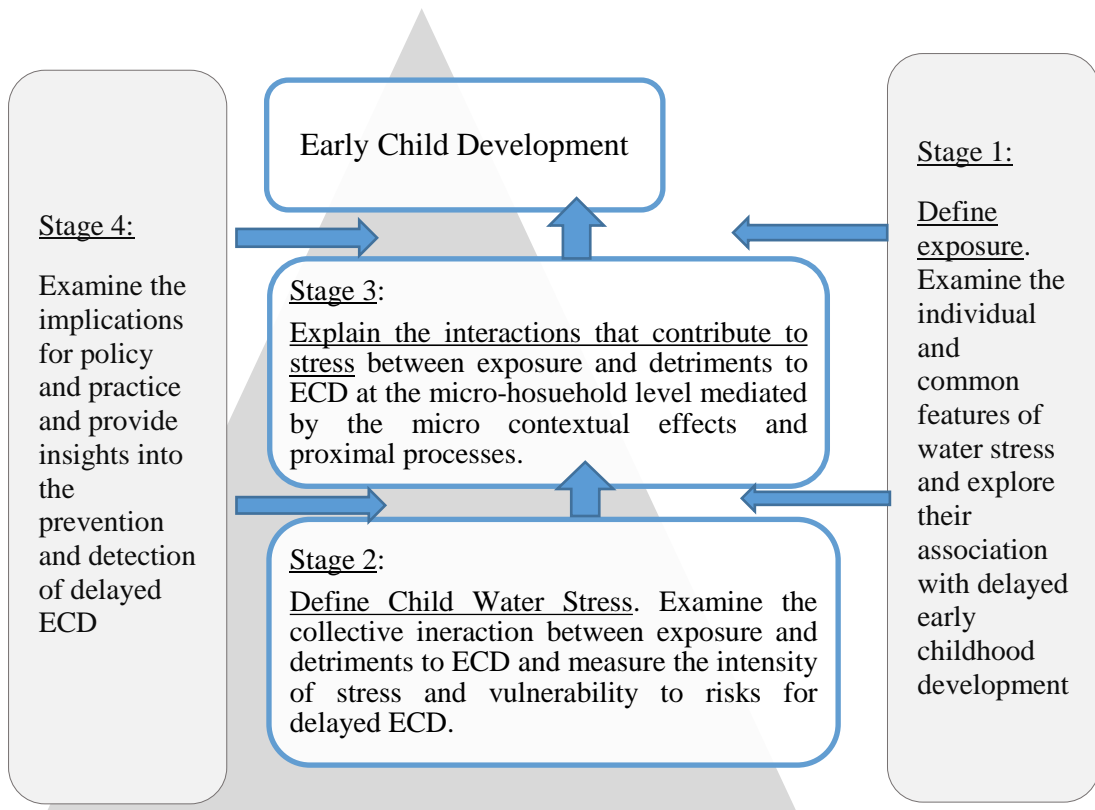
3.3 Research Objectives

The overall goal of this research is to present evidence-based planning and formulation with respect to policies and programs addressing children’s early development. It aims not only to prove association between water stress (independent variable) and ECD (dependant variable), but also presents a logical framework of how this interaction occurs throughout the child’s sphere of influence. The study provides evidence that addressing direct pathways of the determinants and risks is not enough. Rather, the mediated effects

of the causal factors should be considered in the development of programs and policies. Thus, the study presents how children are influenced by mechanisms through water stress in Palestine interacts with key elements of child welfare and reduces opportunities for Palestinian children to develop optimally.

Figure 3.2 below demonstrates the main themes of the present research. The basic milestones of the method framework are structured logically according to four milestones corresponding to the four research questions:

Figure 3.2: The Method General Framework



Objective 1: Define the features of the exposure associated with risks for delayed ECD

Examine the features of water stressors and their individual, co-occurring, and common aspects, as well as their correlation with the main determinants to early childhood development.

The qualitative method sought views and life experiences of people facing water stress and their interactions with the micro- and macro-environment and adverse consequences.

Objective 2: Define the combined effect of the exposure and children's micro and macro context, Child Water Stress.

Establish a composite measurement of child water stress based on collective and combined interactions between the variables related to exposure and determinants to ECD. Measure child water stress intensity based on the stress features' predictability, controllability, and adaptability.

The risks for delayed ECD were examined through the perspective of vulnerability and susceptibility to risks based on the ability to predict, control, and adapt to water stress.

The stress and vulnerability were examined for association with delayed early childhood development. The qualitative measures utilized primary data using focus group discussions with parents, and sought views and perceptions of selected households of child water stress within a holistic and combined perspective.

Objective 3: Explain the interactions between the exposure and the micro contextual factors at the micro context.

Narrow down the investigation to a micro-perspective and quantify the hypothesized indirect effect of water stress, mediated by the micro contextual factors and proximal processes. The qualitative method presents an in-depth understanding of how water stress interacts with family wealth and influences proximal processes specially the quality of parental care and family's sensitivity and responsiveness to their children, support with learning, and time spent with their children.

Objective 4: Examine the implications for childhood services

Examine the influence of child water stress within its micro- and macro-perspectives on the effectiveness of child-based services. The quantitative approaches intended to provide an overview of the scope of services offered to children and measure its relevance to children's context. The qualitative measures sought the views of caregivers regarding the gap between the services provided and child water stress. It also sought views of programme managers working in the field regarding the opportunities and challenges of considering the macro-perspective and related interactions in the design of their programmes and services.

Chapter Four | Methodology

4.1 Introduction

This chapter explains the methods chosen to meet the primary research objective. Guided by the problem statement and research questions, it presents the overall approach, and provides a description of the specific steps followed. The objective of this research is not to establish cause-effect inference or causality between the exposure to water stress and delayed early childhood development. The primary objective of the investigation is to provide a risk assessment of water stress in Palestine, with specific focus on its association with delayed early childhood development.

4.2 Methodological Considerations

The method design was grounded by the unique social, economic, and political context in Palestine. Considering the conflict and challenging socio-economic conditions, the present research referred to agencies who have conducted research in conflict-sensitive contexts such as Relief Web (2018), and the Swiss Academy of Science (2017), as well as researchers such as Moss et al. (2018). The author wanted to share with the reader aspects and issues taken into consideration during the design and implementation of this research:

- 1- Restrictions on movement influence investigators and data collectors who may find it difficult to visit households, meet people, and stay for an extended period to observe. This may be the main obstacle for conducting studies with lengthy observations and follow-up (e.g. observations of behaviours and practices, and longitudinal surveys).

- 2- The security and safety of data collectors and investigators require employing data collectors from the same community, eliminating the need for extensive travel.
- 3- The research requires steady and solid partnerships with local institutes and organizations working in the field and in the communities of research interest. It is important to emphasize good relations, cooperation, and practical outcomes, and to address significant problems and enduring consequences.
- 4- Maintaining cultural and social sensitivity during data collection is crucial, particularly in order to build trust. This includes sensitivity regarding resistance to recording interviews (Moss et al. 2018), external males interviewing females, language, religion, and seeking consent. Therefore, this implies employing data collectors who are aware of the social and cultural context, who can build trust, and generate openness and comfort.
- 5- Confidentiality of data especially names, families, and titles should be upheld.
- 6- The uncertainty of the local context requires a flexible research design with the possibility of adapting or changing the methodology, cumulative designs, use of available data, research partners, or case studies.

Keeping in mind the above factors, as well as the scope of the two aspects addressed by the research, the author developed a mixed flexible method utilizing available data.

The author utilized a wealth of quantitative data on the physical features of water stress, as well as macro and micro contextual factors including health, social, and economic conditions collected by credible institutes through national health, environmental, and demographic surveys in Palestine.

Evidence was supported through a qualitative approach for in-depth elaboration, enhancement, illustration, and clarification, and to strengthen the credibility, integrity, and contextual understanding of findings.

4.3 Method Framework

Table 4.1 demonstrates the breadth and depth of the research design developed to gain an understanding and conceptualization of water stress in Palestine and its possible relationship with delayed early childhood development. The breadth track addresses the features of water-related exposure and its interactions within the macro- and micro-contexts. The in-depth track was pursued by examining and explaining modes of interaction between water-related exposure and its determinants of early childhood development within the contextual levels, specifically the collective effect within a macro-perspective and the mediated/suppressed effect at the household level.

Table 4.1 demonstrates the mixed methods utilized in the present study. The quantitative approaches were used to characterize exposures and measure the interaction between the exposure and intermediate factors that shape the intensity of water stress, including geopolitical conditions, family wealth level, proximal processes, and personal characteristics. The quantitative methods were also utilized to explain the exposure-intermediate and outcomes relationship, and finally, to examine the influence of water stress on the effectiveness of the childhood services in supporting children's developmental outcomes.

The qualitative method aimed to implement a systematic and rigorous inquiry of the four themes addressed by the quantitative methods relevant to the four research questions. Focus group discussions with caregivers and semi-structured interviews with

practitioners were conducted to provide in-depth humanistic views of the results obtained through the quantitative approaches.

Table 4.1: Method Framework

Research Questions	Quantitative	Qualitative	Method Objectives
<p><u>Research Question 1</u> What are the characteristics and features of household water stress associated with risks for delayed early childhood development?</p>	<p>Descriptive analysis of the individual and common characteristics of water stress including frequencies, percentages, and correlation</p>	<p>Caregivers’ view and experiences of water stress examining its adverse life impacts.</p>	<p><u>Objective 1</u> Define the exposure to water stress. Examine the characteristics of the water stress associated with delayed early childhood development.</p>
<p><u>Research Question 2</u> How does growing up in communities with water stress predict children’s risks for delayed early childhood development?</p>	<p>Establish a composite summary measurement using aggregated data to estimate child water stress and vulnerability</p>	<p>Identify locally relevant experiences of water stress within a multidimensional perspective.</p>	<p><u>Objective 2</u> Define Child Water Stress Examine the combined effect of exposure and determinants to early childhood development (Child Water Stress)</p>

Table 4.1: Method Framework, Cont.			
Research Questions	Quantitative	Qualitative	Objectives
<p><u>Research Question 3</u> How do exposure to household water stress and the intermediate factors of wealth and parental support establish risks of delayed early childhood development?</p>	<p>Establish a mediation model to examine the mechanisms and interactions related to child water stress and between the exposure, wealth level and child care</p>	<p>Assess views, perceptions, and experiences from caregivers on how water stress interacts with micro contextual factors, especially wealth level, and influences their proximal processes</p>	<p><u>Objective 3</u> Explain the Interactions Explain the interactions between the variables related to exposure and determinants of early childhood development, and their association increased risk of delayed early childhood development</p>
<p><u>Research Question 4</u> How does child water stress influence the effectiveness of services meant to support children in achieving their developmental potential?</p>	<p>Quantify the effectiveness of select early childhood services to measure their effectiveness in supporting children to reach positive development outcomes while considering water stress and related interactions with contextual factors</p>	<p>Identify factors that influence the design and implementation of services and perceptions of caregivers on how services and policies support their ability to be a protective buffer to children</p>	<p><u>Objective 4</u> Examine the Implications for Childhood Services Examine the gap between childhood services and children’s context and how child water stress influences the effectiveness of the services in supporting children achieve their positive outcomes.</p>

4.4 Data

Table 4.2 presents the list of data utilized by the current research. The quantitative data were different sets of secondary data purposefully selected to serve each research question. The data were refined, compiled, and reviewed by the author. Household level data were utilized to examine trends and correlations. Population data were combined with household data aggregated by the author to develop an ecological data set for 52 communities in Palestine. To examine the implications for services, data collected from organizations providing services to children were used as case studies to present an explanation of the services and suggest recommendations.

The qualitative method produced primary data collected by the author through four focus group discussions with 38 parents, and semi-structured interviews with 11 programme managers working in the field of child health and education. This inductive research was used to gain an in-depth understanding of how caregivers experience water stress, including its adverse life impacts and interaction with their context, and how the household's continuous experience with water stress influences their children. It aimed at implementing a systematic and rigorous form of inquiry based on four themes related to the research questions to supplement and provide in-depth humanistic views of the results obtained through the quantitative approaches.

Table 4.2: Data, Objectives, Sources, and Utilization

Objectives	Data Type	Survey Name	Analysis Steps
Define the exposure to water stress Define the exposure. Examine the characteristics of the water stress associated with delayed early childhood development.	Quantitative	Household environmental survey	1- Descriptive analysis of the physical main elements of the exposure 2- Descriptive analysis of the common features of water stressors
		Multiple indicator cluster survey (2014)	3- Examine the correlation between exposure to water stress and determinants to early childhood development 4- Establish association between water stress and delayed early childhood development
		Multiple indicator cluster survey (2010)	5- Compare frequencies of water stress elements in 2010 and 2014 to examine chronicity of water stress
	Qualitative	Four focus group discussions	6- Content analysis of perceptions and views to capture in depth understanding of water stress and its adverse consequences
Define Child Water Stress Examine the combined effect of exposure and determinants to early childhood development (Child Water Stress)	Quantitative	Multiple indicator cluster survey (2014-2015)	1- Establish ecological data set of 30 variables (7 variables representing water stress and 23 variables represent children living conditions) in 52 Palestinian communities. 2- Standardize the data of the 30 variables to be comparable 3- Establish composite summary measure for water stress (7 water stress variables)
		National census 2017	
		Poverty Map 2016-2016	
		Household Environmental Survey 2013	

			<p>4- Establish composite summary measure of child water stress (30 variables)</p> <p>5- Establish child water stress features controllability, adaptability and predictability</p> <p>6- Examine correlation between child water stress and risk for delayed early childhood development</p> <p>7- Estimate vulnerability</p> <p>8- Create prediction model using vulnerability as predictor to percentages of children not on track in the selected communities</p>
	Qualitative	Four Focus group discussions, the primary focus of focus group discussion number 2	9- Investigate the stress features of water stress and how parents experience the combined burden of child water stress and its association with children vulnerability
<p>Explain the Interactions Explain the interactions between the variables related to exposure and determinants to early childhood development, and their association increased risk of delayed early childhood development</p>	Quantitative	Multiple indicator cluster survey (2014)	1- Establish mediation model to estimate the total effect, direct effect, and indirect mediated/supressed effect of wealth and child care
	Qualitative	Four Focus group discussions, the primary focus of focus groups discussion 3	2- Examine how water stress influences the family's dynamics and relationships and contribute to children vulnerability and risks

<p>Examine the Implications for Childhood Services Examine the gap between childhood services and children’s context and how child water stress influences the effectiveness of the services in supporting children achieve their positive outcomes.</p>	Quantitative	Data from 56 preschools collected in 2012 and repeated in 2015 used as case study	<p>1- Provide descriptive analysis of the childhood services using case study of 56 pre-primary schools</p> <p>2- Examine the effectiveness of the services provided to children with respect to the conventional activities addressing children cognition and supplementary activities addressing children’s living conditions.</p>
		Four Focus group discussions. The primary focus of focus group discussion 4	<p>3- Views and perceptions from caregivers of how ECD services support them to be effective buffers</p>
	Qualitative	Semi-structured interviews	<p>4- Views and perceptions from caregivers of gap between educational and health services and children home and community context.</p>

4.4.1 Quantitative Data

As detailed in the table above, the present research utilized secondary data to examine trends and features of exposure to water stress, establish an ecological data set to develop a composite scale of child water stress and vulnerability at the community level, quantify the interactions, and examine the effectiveness of the childhood services. Considering the contextual and ecological features related to water stress and early childhood development, national demographic, environmental, health, and population surveys conducted by credible institutions according to well-established processes were utilized. The data were offered to the author in a raw format. The author reviewed the design, collection, reliability, and validity of the data before use and analysis. Shortfalls and Limitations of the data are also addressed.

4.4.1.1 Multiple Indicators Cluster Surveys

Table 4.2.1 indicates extensive use of the Multiple Indicators Cluster Surveys (MICS), especially under the first three objectives. In addition to its representation, coverage of the different geopolitical settings, household-based data, and consecutiveness, the MICS surveys addressed the main aspects included in the research question: water stress and determinants of early childhood development, including the level of wealth, proximal processes such as child care and support, health, and nutrition, as well as personal characteristics, and early childhood development.

The Palestinian Central Bureau (PCBS), a highly credible national statistical institute operating in the West Bank and Gaza Strip, implements these surveys in Palestine as part of a global programme led by United Nations Children Fund UNICEF. Since

1995, when this global programme was started by UNICEF,¹⁷ until the end of 2017, five series of global MICS surveys were carried out. Palestine joined this programme in 2010, implementing MICS series 4 (MICS 4), followed series 5 (MICS 5) in 2014.

Using representative samples of 3,280 children, covering all districts and geographical clusters in Palestine, data were collected from households by field workers, employed and trained by PCBS using standard questionnaires during interviews with members of the households, especially parents, mostly mothers providing caregiving to children. Starting from series 4, the MICS programme added a specific module for measuring the proportion of children who were “not on track,” or were delayed in their early childhood development. During the household interview, the field workers (data collectors) requested permission to assess children aged 36-59 months for 10 benchmarks that children are expected to have reached in this age range in four domains:

- Social-emotional: Developmentally on track if at least two out of three benchmarks are true: The child gets along well with other children, does not kick, bite or hit other children, and does not get distracted easily.
- Approaches to Learning: Developmentally on track if at least one of the following is true: The child follows simple directions on how to do something correctly, and when given something to do, is able to do it independently.
- Physical: Developmentally on track if the child picks up a small object with two fingers, like a stick or a rock from the ground, and or is not sometimes too sick to play.

¹⁷ UNICEF, Multiple Indicator Cluster Survey (MICS), Background Information about this global programme available at; https://www.unicef.org/statistics/index_24302.html

- Numeracy/literacy: Developmentally on track if at least two of the following are true: The child can identify/name at least ten letters of the alphabet, the child can read at least four simple, popular words, and knows the name and recognizes the symbol of all numbers from 1 to 10.

Children are determined on track in three out of the four domains are considered to be on track in their development. Noting the holistic interest of the present research and the chronicity and multidimensionality of water stress, early childhood development was considered as the dependant variable of interest.

The data obtained from PCBS were in the form of different SPSS packages. Each package included data for a specific module, namely women's health, household conditions, and child health. Variables relating to child health were separated from the variables related to household conditions. Thus, and to be able to correlate aspects related to children with those related to their housing and social economic status, data from different modules of the same survey were merged, with the aged children 36-59 months as the primary unit. Children's national identity card numbers were used for coding.

Both MICS 4, implemented in 2010, and MICS 5, implemented in 2014, included similar questions on types of drinking-water sources and sanitation facilities, using two main indicators:

- Proportion of the population using an improved source for drinking and other purposes such as cooking and handwashing
- Proportion of the population using improved sanitation facilities

Both indicators were originally set in line with the definition from the WHO/UNICEF joint monitoring programme for water supply sanitation and hygiene (JMP), a global

programme to monitor progress towards Goal Number 7 of the Millennium Development Goals (MDGs).¹⁸

Improved water supply indicates safe quality, larger quantity, and lower cost by being connected to a piped water supply through a dwelling, yard, public tap, protected dug well, protected spring, protected rainwater collection, and bottled water if the secondary source used by the household is improved. Unimproved water supplies include unimproved dug wells, unprotected springs, vendor-provided water, a cart with a small tank, and bottled water if the secondary source used by the household is not improved.

The questionnaires of both surveys also included questions on the location of household the water source in the dwelling, yard, or elsewhere, as well as the time it takes to get water and come back. Questions regarding who usually goes to the water source were also included in the questionnaire, whether the person was an adult female or male, or female or male child, and if households treat water before use by boiling, or refining water using bleach strain with clothes, or using a water filter. Regarding sanitation facilities, the questionnaire included a question on the kind of toilet available: a flush toilet to the public sewer, flush to septic tank, flush to pit, or flush somewhere else, and if the toilet is shared with other households or not.

In addition to data related to water stress and early childhood development, this survey included data on the wealth level based on the families' possessions and assets. Based

¹⁸ Millennium Development Goals (MDGs), adopted by the United Nations in 2000 and ending in 2015, aimed to achieve eight measurable development goals related to poverty, hunger, education, gender equality, child mortality, maternal health, combatting HIV/AIDS, environment, sustainability, and global partnership for development. In 2015, the Sustainable Development Goals (SDGs) were adopted with 17 goals, including water and sanitation under goal number six.

on the assets and possessions. The families were divided into five groups; Poorest, second, middle, fourth, and rich.

It also included data on parental development support as parents were asked if they provide support to children to support their children's development through interaction and stimulation. These practices include reading books, singing songs with the child, and playing with the child.

MICS surveys have many shortfalls which were considered and noted by the current research. This type of survey is designed for international comparability and monitoring progress towards fulfilling international targets under the MDGs and SDGs.

The unique context for countries such as Palestine requires a high level of flexibility in setting definitions, especially for complex aspects such as water stress. Water and sanitation indicators focus on the main source of water for drinking or other domestic uses if improved or not. Specific reference to water-stress elements including affordability, poor quality, quantity, and reliability is missing. The surveys also lack adequate emphasis on the stressful features and life experiences that help determine how households can predict, control, and adapt to these failures.

The assessment of child development, if it is on track or not, is a remarkable development and contribution towards mainstreaming holistic perspectives in children's outcomes. It is a quick and simple test that can be used as an indicative measure whether or not certain benchmarks have been reached in the main developmental domains. However, it cannot replace the full and detailed assessment required to provide a comprehensive assessment and status of the developmental challenges. The results of this assessment indicate a dichotomous conclusion (if the

child is on track or not), based on the data generated by the test if the child passed three out of four tests. This indicates that children that have met a minimum of six benchmarks are on track, while the rest are included under one category as not on track. The author argues that a numeric variable with the number of benchmarks that children passed would generate more precise measurements and include differential variation among children who achieved less than six benchmarks.

The field collectors were trained to establish an atmosphere of trust and comfort between herself and the caregivers. However, the observations and reports from caregivers and children's behaviour may be altered or biased during the household interviews, resulting in biased data.

Finally, being a cross-sectional non-experimental, and non-longitudinal survey, such a survey is weak for establishing causations and inference, especially while using progressive time-related outcomes. Accordingly, the links and relationships generated by this data reflect associations and possible correlations. The data was considered by this research to establish a risk assessment. The author addressed this as a major limitation (See section 4.6.3) and recommended using longitudinal studies to link specific water stressors with delayed early childhood development.

4.4.1.2 Household Environmental Survey

The household environmental survey was used by the current research primarily as supplementary data for MICS 5, under steps 1 and 2, and to elaborate on the description of the water stress. This cross-sectional survey was conducted by PCBS in 2013 with a representative sample of 3,184 respondents, and included household environmental indicators such as household type, water consumption cost, reliability/discontinuity, and average quantity of domestic water used. The survey was based on household

members' recall and reporting on different aspects of household water, sanitation, and environmental conditions. The water-related variables were addressed in more detail than in the MICS surveys. In addition to questions on the type of water connections in the dwellings, it included a question on the average consumption of water for household use based on the amount of water purchased according to type of water sources, the cost of water use during last month, and the frequency of water interruption. Water quality was measured by the perception of the household based on smell, colour, and taste. Water-related questions in this survey did not include aspects related to adaptive and coping strategies for water stress such as boiling or storing water.

4.4.1.3 National Census 2017

The census is a national effort implemented by the PCBS. Due to its emphasis on the macro-context and its contribution to water stress in Palestine, data from the national census were obtained for the present study. The census was primarily utilized in step 2, using data on the populations of select communities, availability of child-based services including health clinics, child care services, and geopolitical conditions. Data collected address establishments, population growth and distribution, and characteristics of communities. The census is conducted every 10 years with continuous updates and projections every year. The first Palestinian census was done in 1997, the second in 2007, and is the most recent in 2017. To ensure homogeneity of data, the census information obtained for the present research was data based on 2014 projections and verified by the 2017 census, conducted only three years after the MICS 5 in 2014.

4.4.1.4 Poverty Map for the Palestinian Territory 2016-2017

Aggregated data on poverty levels in the communities selected by this research, specifically for answering research question number 2, was obtained from the Palestinian Central Bureau of Statistics. The data were collected in 2016 and 2017 and based on the small area estimation (SAE) approach, which was implemented using a household expenditure survey combined with census data. Using this method, PCBS estimated headcounts of families of limited economic capacities based on expenditure, consumption, and income from samples representing communities included in the census.

Unlike the wealth levels measured by MICS 5, which is based mainly on assets' possession, this data is with broader scope reflecting each community's economic capacities.

This measure was used specifically for answering research question two as part of aggregated data to estimate predictability, controllability, and adaptability of water stress in each of the selected communities. These capacities include the families' ability to purchase water supply from alternative sources when facing water stress due to unreliable public networks. It also reflects their ability to buffer their children from water stress and interrelated socio-economic conditions. Parents with sufficient expenditure power are more likely to afford life commodities, including food, support children development by enrolment in pre-primary schools, seeking health services, in addition to buying books and stories

4.4.1.5 Services Data; Preschools' Survey

Secondary data collected from 56 preschools that provide services to 7,000 children under five years of age in the West Bank and Gaza Strip. The preschools are registered

and licenced establishments run mainly by non-profit organizations in Palestine and serve children mainly age 3-5 years old. The services offered by these schools are mainly to develop the cognition, learning and social skills. These schools offer other services, with different extents, to alleviate the disparities children experience including limited wealth, discount fees, health interventions and parent awareness. The data were collected as part of two consecutive surveys that took place in 2012 and 2015. The surveys were conducted by the Welfare Association, a leading Palestinian non-governmental relief and development agency that supports initiatives to improve the education and wellbeing of Palestinians.¹⁹ The two surveys were intended to describe the scope and coverage of services in the West Bank and the Gaza Strip. The 56 preschools included in the present research were selected randomly from list of 450 preschools operating in West Bank and Gaza Strip and registered at the Palestinian Ministry of Education. The selection of the 56 preschools in the study was based on selection criteria including being licensed and registered by the relevant authorities, enrol children under five years old.

Out of a roaster of 450 preschools, 56 schools serving about 7,000 children in the West Bank and Gaza Strip were randomly selected to be included in the study. The selection considered balanced geographical coverage among all of the 16 districts in Palestine. The preschools were categorized according to the districts, then selected randomly from each district with an average of four preschools from each district, initially for a total of 64 preschools. Ten preschools were dropped from the list due to significant missing data. An additional two preschools were randomly selected from Gaza Strip,

¹⁹ More information on Welfare Association available at: <https://www.taawon.org/>

and the other one from West bank, bringing the final total to 56 preschools. Twenty-six preschools were found to be operating in Gaza Strip. The data included information on the services that each preschool offers to children, as well as the physical status, age group, and percentage of children developmentally on track, as reported by each preschool.

The data provides a comprehensive view of the type of services provided to children. It also includes aspects related to the physical status of the facilities of the preschool such as the class rooms, yards, and toilets. All preschools offer services to support children's learning and cognition. Supplementary interventions that support children's health, protection, hygiene awareness, and economic support vary among the preschools. Some of the preschools implement additional interventions to ameliorate the social, health, and environmental risk factors, including the disparities resulting from the causal pathways of the link between water shortage and ECD.

The data were offered to the author of the present research to be utilized as secondary data for research purposes only, based on a bilateral agreement signed and passed with the ethical assurance of London School of Hygiene and Tropical Medicine.

The present study considered this data as a case study, due to its geographical coverage and diverse interventions reflecting the practices of the national programmes and policies addressing the early childhood sector in Palestine. The data were collected using structured interviews and an observational check list to report on the main services provided by the preschools. The author of the present research refined, cleaned, and analysed the data using an SPSS package with the preschool as the prime data unit. The author recorded several shortfalls in this data;

- This survey was not implemented specifically for this research. This survey focused mainly on services and activities and related needs and challenges. Many variables relevant to this research, such as hygiene behaviour, parental support, and community context, were lacking.
- The data collectors of this survey did not assess children's development, practices, and behaviour. In this regard, the data collectors relied on the data included in child reports filled by preschool educators.
- The data collected are based on recalls and reports from the service providers. The data could be subject to the bias of positive reporting to reflect good services.

However, the author has ensured the proper data collection method and validation when received the raw data. Data were then organized and cleaned by the author and used to describe the scope of services provided.

4.4.2 Qualitative Data

The context analysis, features of water stress, and ECD indicate that exposure to water stress may not be fully understood without real-life stories and experiences shared by parents and practitioners, who can enrich numerical data with a human perspective. The participants echoed sincere and honest views, concerns, and challenges related to water as a life commodity they desire and an essential right of livelihood and wellbeing to be fulfilled.

4.4.2.1 Focus Group Discussions (FGDs)

The planning, organizing, and reporting of the data collected during the focus group discussions followed the guidance of the Consolidated Criteria for Reporting Qualitative Studies (COREQ) (Booth et al. 2014), which includes a 32-item checklist that was developed by reviewing and identifying items from other tools and checklists for qualitative studies.

Focus Group Discussions (FGDs) were selected by the present research as a permissive, non-threatening tool to discuss sensitive issues, encouraged by group dynamics and interactions (Krueger and Casey, 2002). It simulates a more natural environment as the participants are influenced by each other, as they are in real life context. During the group discussions, ideas and views emerge in a more natural setting and lead to shared meanings, collective and in-depth individual views, and perceptions beyond the ability of a structured questionnaire to reveal (Finch and Lewis 2003). Nyumba et al., (2018) suggested the use of different FGDs especially when addressing complex topics as the use of one FGD may exhausts the participants especially by just conducting one group discussion

Both water stress and early childhood development are highly influenced by context. Therefore, as recommended by Nyumba et al. (2018), Wong (2008), when it is desirable to obtain data from different groups, a general recommendation is to conduct a series of focus groups using the same participants each time.

The focus groups were designed taking into consideration the scope of water stress and early childhood development, the diversity of the people influenced and exposed to water stress, and the differences that reflect geopolitical, social, and economic diversity.

Table 4.3: Brief Description of the Focus Group Discussions

	Number of Participants	Location	Description of Community
Focus Group 1	7 females 4 males	North Gaza	Politically sensitive area considered a hot spot that witnesses different clashes
Focus Group 2	6 females 4 males	Middle Gaza	Urban setting with high population density; majority of population registered refugees
Focus Group 3	8 females	Nablus	An urban setting in the northern West Bank with a moderate economic situation and relatively stable political conditions
Focus Group 4	6 females 3 males	Jordan Valley	Rural setting with limited access of the population to land for infrastructure and development

The author planned these focus group discussions and set the scope, guiding questions, and analysis framework, and participated in the facilitation of each group.

To maintain the quality of conversation and dialogue, the number of participants was between 8-11 individuals, which falls within the range recommended by the literature (Nyumba et al. 2018; Wong, 2008; Hollis et al. 2002).

Invitations were distributed to 50 families requesting the participation of both males and females. A total of 38 participants older than 18, 27 females and 11 males, accepted the invitation and participated. Out of the 38 participants, seven couples participated, while 22 women and two men came without their spouses.

Participants were purposefully selected from a random sample of beneficiaries of community health programmes in North Gaza, Middle Gaza, and a food security programme in Nablus and the Jordan Valley. Each group was homogenous in terms of

the community they were from, water-related conditions they faced, role as a parent or caregiver for children under the age of five, and education level of secondary high school diploma and above. However, they were different in age, social characteristics, and family income. Three focus group discussions included both genders with more females than males.

The author developed a guide with a list of questions for each theme to guide the discussions. The average time taken for each focus group discussion was about 2.5-3 hours, including a coffee break and a quick lunch. All participants were advised that they can leave at any time if they feel late, or feel they need to leave for any other reason. However, no participant left before the end of the FGDs.

Due to cultural and security considerations, the gender of the facilitators was balanced (one male and one female from Gaza, and one male and one female from the West Bank). The facilitators were skilled community health workers with considerable experience in community public health work and group discussions and assessments, and were familiar with the context. In addition to data collection and guiding the discussions, the facilitators established an atmosphere of trust and confidence among the participants to share experiences and express opinions openly on relevant topics.

No interviews were tape-recorded due to political and cultural sensitivity, and in the interest of preserving an atmosphere of trust, keeping in mind that participants may object or feel uncomfortable regarding the recording of the interviews. However, and to avoid misinterpretations, miswording, and to assure transparency, all notes were written by both one of the facilitators and the author of the present research. At the end of the discussion on each theme, the author and co-facilitators provided a summary and conclusion of the discussion for all participants.

The organization of the focus group discussions were implemented in partnership with the Palestinian Central Bureau of Statistics and other institutions including Gaza Community Mental Health Programme.

Data were analysed using an inductive approach to analysis. This approach is a data reduction process that allows research findings to emerge from the frequent, dominant, or significant themes included in the raw data (Thomas, 2006).

Focus groups 1, 2, and 4 included a mix of female and male participants. Three couples participated in the first group, three in the second, and one in the fourth. The group discussion was mixed most of the time, except one part when males and females are divided to discuss aspects with gender-sensitivity, especially self-hygiene, domestic violence, and gendered burden.

During all focus group discussions, participants discussed the four themes addressed by the four research questions:

- 1- **Views, experiences, and perceptions of exposure.** Participants were requested to reflect on their general perception of water and their life. They were then asked to share their views on individual and common characteristics of the main elements of water stress (affordability, quality, quantity, and reliability) and their interactions with the determinants to early childhood development.
- 2- **Perspectives on water stress as a holistic stress and their capabilities predict, control and adapt to water stress.** Participants provided their views on the collective and macro-perspective of water stress and how they perceive it as part of their life, as well as their perceptions regarding their capacity to

predict, control, and adapt to water stress. They were also requested to reflect on how these features contribute to the feeling of vulnerability.

3- **Water-related experience at home.** Participants were requested to reflect on water-related experiences inside their homes, how water stress interacts with their economic capacities, and how they feel it impacts their dynamics and relationships.

4- **Childhood services.** Participants were requested to share experiences and views with respect to childhood services and related gaps, specifically focusing on how compatible childhood services are with children's context at homes and in their communities.

All focus group discussions were implemented after participants were briefed about the research project and had given their consent to the interviewers. Participants were not required to answer questions if they didn't feel comfortable doing so, and were allowed to leave at any time. Secured transportation and lunch were provided.

Some of the quotes included in the findings were shared with the participants by phone around one week after the focus group discussions, to assure proper meaning.

Participant responses were read several times by the author and the co facilitators to identify a list of sub-themes or categories which were coded using a simple framework. Quotes which were written differently by the facilitators and the author, suggesting different meaning were either dropped or checked by a follow up phone call with the participant.

Responses with the same content were condensed into summaries or segments. While reading and reviewing, new sub-themes emerged and were added to the diagram.

Finally, guided by the research questions, a model was developed for each theme with the underlying structure of experiences or processes generated from the text to produce conclusions or findings. Similarities and differences across sub-variables and sub-themes were also explored. Some of the quotations were found to be valid or relevant to more than one code. These quotations were divided into two or more parts and each part was given a relevant code.

The author experienced several challenges and limitations related to inability to tape record the interviews, social and cultural barriers, and sensitivity of the data collected, More description on the limitations of this method are discussed in 4.6.7

4.4.2.2 Semi-Structured Interview

Semi-structured interviews were conducted with key informants working in early childhood development services, water and the environment, mental, and public health and primary health care services.

Table 4.4: Brief Description of the Semi Structured Interviews

Sector	Number of key informants
Early childhood development services	3
Mental health	1
Development projects addressing children	1
Public Health	3
Water and environment	3

The selection of the key informants was purposeful. It was based on thorough search of candidates who work in the management of services and development interventions with technical and managerial functions. This method is an open and flexible technique used by small-scale research and case studies (Longhurst, 2003). The semi-structured

interviews entailed listening to participants and being open and non-judgmental while creating a comfortable environment that still allowed for systematic interviewing.

The author of the present research structured the interviews in advance regarding that main questions to be asked during the interviews, aiming to obtain an in-depth understanding of the effectiveness of the services provided to children and their consideration of water stress and contextual factors on children. Being semi structured, the persons interviewed enjoy considerable degree of flexibility with respect time and way they talk, present and express their views.

Data were collected using a form guided by the research questions. All participants were briefed about the research project before the start of the interview, and consent was requested based on a previously arranged appointment. The recording was not made. Confidentiality related to quotes, feedback, and titles was guaranteed, and all quotes were recorded on a special form. The filled forms were shared before ending the interview. Data were analysed using an inductive approach to analysis. The questions that guided the discussion reflected the main themes of the data. Quotations were coded according to the relevant theme. Quotations with the same code were condensed and summarized. During this method, the main shortfall was related to building trust with the interviewees to provide insightful nonbiased feedback without fears or sensitivity. The other shortfall was biased reporting, as many interviewees were hesitant to provide balanced perspectives that address the advantages and disadvantages related to the services they provide.

The author conducted all of the interviews. Most of the data collected was broad and elaborated. The data coding and content analysis was subject to inadequate or wrong interpretations of the meanings. However, the author called three interviewees around

one week of the interviews to check for or clarify issues not clear or missed by the author.

The author structured the semi-structured interviews in four parts. The first part addressed the impact of water stress on their long terms strategies and policies. The second part tackled their short-term outcomes, specifically how they believe water stress at homes and community of children impacts their ability to achieve effective supporting children's positive developmental outcomes. The third part addressed how children's context influences their products and services to achieve the effects and impacts. The last part discussed the impact of child context, including water stress on their inputs, which included professional and financial resources needed to implement the activities. To set child-focused boundaries of the discussion, the bioecological development concept guided the discussions under each part, especially by addressing children's macro, micro context, children's characteristics, and parents' involvement and support.

4.5 Data Analysis

The data analysis is organized to four sections that logically correspond to the four research questions. Each section included quantitative and qualitative analysis. To assure integrity of the analysis, the qualitative part under each section was included as part of the logical steps of the analysis.

4.5.1 Water Stress: The Exposure

The main objective of this section is to analyse the quantitative data explained in sections 4.4.1.1, and 4.4.1.2, and the qualitative data explained in section 4.4.2.1 to answer research question No 1.

What are the characteristics and features of household water stress associated with risks for delayed early childhood development?

The findings of this section are presented in Chapter five. The quantitative and qualitative analysis examined water stress as an early life stress that can influence children development.

The quantitative analysis was aimed at examining the features of the exposure, correlating exposure with the determinants of early childhood development, and determining the association with delayed early childhood development. Demographic and health data to understand the physical features of the main elements of exposure to water stress (quantity, quality, cost, and reliability) and explore its possible interactions with the determinants of early childhood development. The qualitative analysis aimed at generating in depth views of water stress and its adverse consequences. Table 4.4 shows the analysis framework, through five steps.

Table 4.5: The Analysis Framework of Water Stress: The Exposure

Aspect Investigated	Analysis	Data Source
Step 1. Examine the individual features of exposure		
Individual characteristics of water stress elements: Cost, consumption, frequency of water services without interruption, and percentage of households with perception to quality	Percentages, frequency, and means	Household environmental survey and MICS 5
Step 2. Examine the common features of exposure		
The interrelated effect	Correlation analysis among water stressors	Household environmental survey and MICS 5
The use of unimproved water sources and main source of drinking water examined as indicator of interrelated effect	Correlation analysis between use of unimproved water sources and main source of drinking water and water stressors	
Chronicity of water stress	The proportion of Palestinian households accessing unimproved water supplies as the main source did not significantly change over 5 years	MICS 4 and MICS 5
Step 3. Examine the correlation between exposure with determinants of early childhood development		
Interaction with geopolitical conditions	Cross tabulation between water stressors and type of community and region	Household environmental survey
Interaction with family wealth and water stress represented by unimproved water supply, contextual factors (such as wealth level, geopolitical characteristics)	Correlation and Cross tabulation between wealth and use of unimproved water supply as main source of drinking and family wealth	MICS 5
Interaction between water stress and parental support	Correlation between wealth and use of unimproved water supply as main source of drinking Linear regression and child care	MICS 5

Interaction between water stress and child's personal characteristics	Binary regression model to detect association between unimproved water supply as main source of drinking Linear regression and children age, sex.	MICS5
Examine the association between water stress and gender of persons collecting water	Binary regression to examine the association between water stress represented by the use of unimproved water supply and gender of persons collecting water	MICS5
Examine the association between water stress and Child Health	Binary Regression analysis between water stress represented by the use of unimproved water supply and diarrhoea and stunting	MICS 5
Step 4. Establish an association between water stress early childhood development		
Association with delayed early childhood development	Binary regression model between the use of unimproved water supply and children not on track in their development Linear regression model between the use of unimproved water supply and scale variable indicating the developmental status of children.	Mics 5, repeated with MICS 4
Step 5. Examine perceptions, experiences, and real-life realities related to the features and characteristics of water stressors (Qualitative analysis)		
General perception towards water stress	Content analysis of views, experiences and perceptions	Focus group discussion
General perception towards Interactions between water stress elements and the determinants of early childhood development	Content analysis of views, experiences and perceptions	Focus group discussion
General perception towards water stress and child development	Content analysis of views, experiences and perceptions	Focus group discussion

4.5.1.1. Individual Features of Exposure

This section provided a descriptive analysis of water stressors' physical characteristics, including cost, consumption, frequency of water services without interruption, and households' percentage of positive water quality perceptions. The analysis focused on the rate of coverage of the public water network, the percentage of households benefitting from a continuous and steady water supply, the average number and perceptions of families who had a negative perception of quality, and the rate of families using improved water sources as the primary source of drinking water.

4.5.1.2 The Common Features of Exposure

1. The Interrelated Effect

A multivariate regression analysis was used to examine the correlation between quantity, affordability, reliability, adequacy, and quality, hypothesizing that the occurrence of one feature may lead to the occurrence other physical features. Cross tabulation between type of water service and average cost and consumption was also used to examine the financial burden that each family pays per type of water service. The combined effect is based on the concept that the occurrence of one stressor is likely to lead or co-occur with the occurrence of other stressors.

The use of unimproved water supply as main source of drinking was examined as an indicator of interrelated and combined effect. Correlation analysis between use of unimproved water sources and main source of drinking water and water stressors was conducted.

2. Chronicity

Continuous and steady exposure to household water stress indicated by the use of unimproved water supply as main source of drinking, was measured for a period of five years to reflect the chronic and steady exposure of Palestinian children to water stress-related variables. The main reason for conducting this analysis was to overcome the absence of the factor of time in cross-sectional studies, which examines aspects only at a specific point in time and fails to capture the steady exposure needed to make associations.

4.5.1.3 Interaction with Determinants of Early Childhood Development

The following lists the steps followed for examining the relationship between water stress and the main determinants of early childhood development.

1. Interaction with the Macro-Context

Considering the bioecological development model that highlighted the macro context as a significant sphere of influence, and considering the macro context of water stress in Palestine, especially geopolitical conditions, this section examined the interaction between water stress and children's macro context. The Macro-context variables include the type of community and location if it is within a politically sensitive area, for example, if households are in Gaza, where people face volatile political and military conditions, or in the West Bank.

2. Interaction with Family Wealth

Cross tabulation was conducted between the main source of drinking water and wealth level was indicated by the wealth status of the family. Establishing the association was

intended to serve the research hypothesis that the wealth level is considered as mediator between water stress and early childhood development.

3. Association with the Parenting Practices

The literature review indicated that proximal processes are repeated, sustained, and continuous interactions between family members, especially caregivers and children. These interactions include reading books, supporting learning, language use, and playing with the child (Kline 2013). This also includes practices that caregivers do to ensure a safe and supporting environment for children, such as healthcare-seeking behaviour and feeding practices. Water-related practices include behaviours that ensure safe and adequate water needed for children's dietary, drinking, and hygiene needs, including collection, storage, and boiling of water.

4. Water Stress and Age and Gender

The analysis under this section examined if water stress interferes with the normal age-development processes. The analysis compared children 36-47 months and 48-59 months, respectively, concerning water stress and early childhood development status. The analysis made a similar comparison between boys and girls relating to their early development as girls are better than boys in developing their social and language skills (Bourke et al. 2011). In this respect, the analysis explored if the normal difference between boys and girls who live with water stress is different from the difference between boys and girls living less water stress.

5. Gender and Water Collection Person

The international literature emphasized on the water collecting persons being most likely females. In this respect, the analysis examined this trend in Palestine, considering the unique social and cultural context. The analysis examined the gender and age of the main collecting person.

6. Water Stress and Child Health

The international and local literature emphasized on child health as a commonly used indicator for water stressors. The child health referred to this research is mainly diarrhoea, stunting, and anaemia. The health outcomes are considered determinants of optimal early childhood development, as children with frequent diarrhoea are less likely to achieve optimal physical growth and development. Stunting on the other hand, indicates the cumulative effects of undernutrition and infections, including water-related diseases such as diarrhoea.

4.5.1.4 Association between water stress and Delayed ECD

This step builds on the previous two steps which highlighted the relationship between water stress and the determinants of early childhood development. To examine the direct relationship between water stress and delayed early childhood development, the following steps were followed:

Cross tabulation was conducted first to study the relationship between the two dichotomous variables. A chi-square test was done to check if the relationship was significant or not.

Binary Logistic Regression with Singular Variable This regression was conducted between the dichotomous variables—the use of unimproved water supply as main

source of drinking, and children “not on track” in their early development. The data used is from the Multiple Indicator Cluster Survey Series MICS 5 stratified by age, sex and mother education. Significance with p value less than 0.05 and odd ratio were calculated. The odd ratio was utilized to measure the predicted probability of children living in households with unimproved drinking water sources falling into the target group of delayed early childhood development. The coefficients resulting from the binary regression were utilized to predict change in the log odds for every one-unit increase in the predicted variables.

Linear regression was conducted between the use of unimproved water supply and a scale variable for early childhood development based on the number of positive tests children passed while being assessed for their development.

4.5.1.5 Qualitative Analysis; In Depth Views of Water Stress Features

The analysis made under this section is related to the first research question addressed during the four focus group discussions. The discussions sought general perceptions and views related to water stress features that facilitated detailed discussions about the other three research questions' specific aspects. The following includes the main sub-themes that constructed the argument associated with the first research question. More details related to the analysis of the focus group discussion is available in section 4.4.2.1.

1. Water Stress as Viewed by Parents

The first theme sought general perspectives regarding exposure to water stress. The content analysis considered caregivers' perceptions towards water stress being perceived positively as a factor of convenience and well-being, and negatively being perceived as a burden and source of disparity.

The general view obtained from the participants addressed individual characteristics included failures and deficiencies related to each dimension (affordability, reliability, quality, and quantity).

Common features addressed interrelationships among water stressors and how the occurrence of one stressor may lead to the occurrence of other stressors. Chronicity of water stressors was also raised by the participants as a common feature they experience.

2. Relationship with the Macro and Micro Contextual Factors

The second theme sought general feedback on the interactions between exposure and macro and micro risk and protective factors suggested by the participants. Special focus was paid to how they perceive the role of political conditions and limited wealth in intensifying the influence of water stress and undermining their ability to predict, control, and adapt to features of water stress.

4.5.2 Child Water Stress: A Community Perspective

This section addresses the link between water stress and risks for delayed early childhood development as a continuous and co-occurring processes of interactions between water stressors and micro- and macro-factors referred to as the as the main determinants of early childhood development including geopolitics, community features, family features, and children characteristics. The combined exposure of water stress and the determinants of early childhood development is referred to by the present research as Child Water Stress. Chapter 6 presents the findings of this analysis. This section addresses the second research question.

How does growing up in communities with water stress combined with stagnated socio-economic conditions predicts risks for delayed early childhood?

No.	Step	Description
1	Identify variables and domains	Ecological data set was developed for 52 communities in Palestine. For each community, data of seven variables related to water stress, and 23 variables related to children's living conditions were gathered as ecological data set. The 23 variables were grouped into six domains; Geopolitics, Community features, Families' economic conditions, families' features and children characteristics
2	Standardization of data	Data of the exposure and child wellbeing were standardized to enable comparability and grouping.
3	Estimate water stress index	The average of the standardised scores of the seven variables of the exposure were estimated to reflect the water stress in each community

4	Estimate Child water Stress Index	For each community, weighted average of the standardized scores of the exposure and wellbeing variables was estimated. The score reflected the stress related to combined water stress and wellbeing. The
5	Examine the stress features of predictability, controllability and adaptability	Group the domains and variables according to the stress features
6	Estimate the Relative Risk	To examine possible correlation between stress and delayed early childhood development, the relative risk calculated as the percentage of children not on track in their development in the most ten stressed communities (considered as most exposed to child water stress exposure) divided by the percentage of children not on track in the least exposed communities.
7	Estimate vulnerability	Estimate vulnerability as a function of exposure, adaptive and control capacities, and sensitivity of the system
8	Establish prediction model	Use linear regression to examine correlation between vulnerability score and likelihood of delayed early childhood and create a prediction model for expected percentages of children not on track
9	Examine the impacts and adverse consequences of Child Water Stress and home environment, (Qualitative analysis).	Assess views and perceptions of parents regarding the collective perspective of child water stress and how they experience situations when their children experience vulnerability

As summarized by Table 4.5 the methods under this section includes both quantitative and qualitative analyses. The quantitative method suggested a summary metric of water stress to measure physical dimensions using a model focused on the combined effect of water exposure-related variables and macro and micro contextual factors in 52 communities in Palestine. The summery metric is an integrational measure that assesses the holistic status of children by addressing different aspects that matter children's wellbeing. As explained in section 2.5.4 page 73, this approach follows a right based highlighting the need to treat child as a human being who needs integrated support for healthy and safe start, protection and development. As defined by the previous section, water stress, with its multiple dimensions and contexts, reflects the chronic interaction between water insecurity factors (affordability, quality, quantity, and reliability) with the determinants of early childhood development, namely the macro and micro contextual factors, especially the geopolitical, economic, social, and personal characteristics. This interaction occurs simultaneously and collectively, and intensifies water stress features including uncontrollability, unpredictability, and inadaptability. It is critical to reiterate that the index is a relative proxy measure of the water stress that children and their families experience. It also serves as an indicator of vulnerability to risks of delayed ECD. It does not reflect causality or inference, but is conditioned by the variables and indicators included in the index. Community-aggregated data was obtained from demographic, environmental, and health surveys. The surveys examined water-related characteristics, as well as socio-demographic, geopolitical, and community features.

The qualitative method was implemented using focus group discussions and gathering views, perceptions, and experiences related to the combined effect of water stress and

the factors that shape its stressful features: controllability, susceptibility, predictability, and adaptability. The consequences on children were examined in particular.

4.5.2.1 Components, Variables, and Related Stress Features

Table 4.6 includes 30 variables categorized within six components that have been used by the current research. The selection of the variables included in the index followed human development theories; specifically, the bio-ecological development model put forward by Bronfenbrenner and Morris (2007) and constitutes Person, Process, Time, and Context. The selection of the variables was also based on data availability, relevance to water stress and children living conditions, and reliability of data as assured by the author.

The 30 variables constitute a multidimensional ecological data set for 52 communities with a total population of 2,644,000 acquired from different sources, including the MICS 5 (2014), household environmental survey (2013), population census, and Poverty Map. The data set was used primarily to establish composite indices for water stress, child water stress (water stress and child wellbeing variables), and vulnerability indices. The data set includes 7 variables that indicate the exposure to water stress, 23 variables that reflect children's wellbeing and living conditions. The 23 variables were selected and categorized according to five main domains: geopolitical conditions, community characteristics, economic conditions, family features, and child characteristics. The data set also includes three indicators for early childhood development collected in cooperation with PCBS, indicating the percentage of children in each community who were assessed as developmentally on track. These indicators serve as child outcomes and are not merged with the data set.

Major Component	Bio-ecological Model	Variable	Data Source
Water Stress	Exposure	1- Percentage of families experiencing an interruption in water supply at least one day a week	Household Environmental Survey
		2- Relative adequacy: The difference between the average monthly consumption for each community and the highest value of the average consumption	
		3- Percentage of families that provided a “bad” perception of water quality based on its state, colour, and appearance	
		4- Average monthly family expenditure, water networks	
		5- Average monthly family expenditure, water tankers	
		6- Percentage of households with the public network as the primary source of drinking water	
		7- Percentage of families with improved wastewater network	
Geopolitical conditions	Macro-Context	1- Percentage of households with 3 km proximity to checkpoints, established by the Israeli army, on main roads limiting and restricting the movement of Palestinian people and goods to other towns and districts	Population and Establishment Census
		2- Percentage of households with 3 km proximity to Israeli settlements established on Palestinian land	
		3- Percentage of households with 3 km proximity to a separation wall established by Israel inside Palestinian land or 1967 borders	

		4- Percentage of households partially or wholly surrounded by a separation wall, requiring the Palestinians to get permission from the Israeli authorities to leave or enter and move to other Palestinian districts	
Major Component	Bio-ecological Model	Variable	Data Source
Community Demography	Macro-Context	1- Population of community per number of public health clinics	Population and Establishment Census
		2- Population of community per number of basic schools	
		3- Population of community per number of preschools	
		4- Population of community	
		5- Percentage of households registered by the United Nations as refugees among population	
Household Capacities	Micro-Context	1- Percentage of households with poor wealth level	Poverty Map
		2- Unemployment rate among females participating in the labour force (15 years and above)	
		3- Unemployment rate among males participating in the labour force (15 years and above)	
		4- Dependency rate	

Major Component	Bio-ecological Model	Variable	Data Source
Family Characteristics	Proximal Processes	1- Percentage of women head of households	MICS 5
		2- Average members of household	
		3- Mean number of activities with adult household members	
		4- Percentage of individuals suffering chronic diseases out of total population	
		5- Percentage of female individuals 21+ who do not have above secondary education, from total female population 21+	
		6- Percentage of male individuals 21+ who did not complete secondary education, from total male population 21+	
Child Characteristics	Person	1- Percentage of children under 5 not attending preschool	MICS5
		2- Percentage of children under 5 who reported with diarrhoea	
		3- Percentage of children under 5 who fall below two standard deviations of the median height for age of the WHO standard	
		4- Percentage of children age 5 and above out of school or preschool	
Child Outcomes	Developmental Status	1- Percentage of children 36-59 months not on track - Physical	MICS5
		2- Percentage of children 36-59 months not on track - Social	
		3- Percentage of children 36-59 months CDI not on track	

The concept of the Human Development Index:²⁰ is the overarching principles for selecting the factors included in the data set. Focusing on ECD, the human development concept was narrowed down to variables related to the detriments to early childhood development: family processes, personal characteristics, and macro- and micro-context. The selection of variables was also based on the availability and reliability of the data, consultation with a wide range of service providers and stakeholders including PCBS, and consultations with caregivers who participated in the focus group discussions.

Geopolitics: The first domain addresses stress related to geopolitical conditions reflecting the unique macro-context of Palestinian communities. The author used four indicators based on the UN's description of the main geopolitical conditions in Palestine (United Nations Development Assistance Framework State of Palestine UNDAF, 2018). These variables indicate long-term "facts on the ground" established as conflict-related changes in or around the Palestinian communities:

Community features A higher population in the community results in more demand and pressure on the water service providers, which impacts both continuity and reliability. Since the concept of this paper is child-focused, the second component reflected the pressure on vital community services provided to children, specifically the population per number of primary health clinics, number of basic schools, and number of preschools in the village. This component also included the percentage of population registered by the United Nations as refugees. The presence of refugees reflects additional social and

²⁰ The Human Development Index is a scale developed by United Nations Development Programme (UNDP) for countries to report data for annual human development reports. Available at www.hrd.undp.org/eng/content/human-development-index-hdi

economic burdens on the community having been displaced from their original areas and being reliant on the support of the United Nations Relief and Works Agency (UNRWA).

Household capacities: These variables indicate the economic and social capacities of the household. They address the general wealth level of the family and the economic contribution of males and females. The wealth level is based on the availability of assets, male and female unemployment rates, and dependency rates. The female unemployment rate was included in the index to provide a gender perspective of the data, and to highlight the traditional role of females beyond child care and household responsibilities.

The fourth variable reflects the economic burden implied by household members. It specifically refers to individuals under 15 and over 65 years old who are more likely to be dependent on others for purchasing and fulfilling their essential needs and commodities.

Household characteristics provided a micro-perspective of the risks and challenges related to the social environment of the households. This sub-index included six variables:

The percentage of women who are heads of households indicates significant economic, and to a larger extent, social burdens. This variable was selected noting the role of mothers in caregiving and household duties. The number of household members impacts the severity of social and economic burdens, as well as the amount of household duties and responsibilities. Higher numbers of household members indicate the need for more resources and assets, larger financial burdens, and more household responsibilities.

Variables related to the number of support and care activities that parents provide for their children were generated by the MICS survey that includes 10 activities that male or

female parents perform. These activities include singing with the child, playing with the child, reading books, and leaving the child alone.

The percentage of individuals suffering from chronic diseases in the community indicates the health, social, and economic burdens on the family. The third variable under this component is the level of care provided to children based on reporting by caregivers.

The fifth and sixth variables reflect the available knowledge and social capacities indicated by the percentage of females and males age 21+ who have achieved an education level above high school.

Child characteristics include four variables related to children in the communities selected for this study. Attending preschool reflects the additional support and proximal processes provided to a child, in addition to the support provided by parents and families. These factors reflect the ability of the families and communities to control, predict, and adapt to water stress, as well as their vulnerability to risks for delayed early childhood development.

4.5.2.2 Standardization of Data

The methodology used for creating this index was adapted from the Human Development Index and other indices developed to measure vulnerabilities in communities in the developing world (Hahn et al 2009; Tewari and Bhowmick 2014; and Etwire et al. 2013). Each component (water, geopolitical, economic, social and personal characteristics, community characteristics and adaptive processes, and child outcomes) is made up of several variables or sub-domains that are measured on different scales. The variables under each component were treated equally for its contribution to each components.

To calculate the standardised index score of each variable, the value of each domain was standardized using Equation 1:

$$\text{Variable index score} = \frac{\text{Actual observed amount for each locality} - \text{minimum amount}}{\text{Maximum amount} - \text{minimum value}}$$

$$\text{Equation 1: Variable Index Score} = \frac{Si - Smin}{Smax - Smin}$$

Where Si is the observed amount for community I , $Smin$ is the minimum value among the communities for the same variable, while $Smax$ is the maximum value.

4.5.2.3 Estimation of Water Stress Index, the Exposure

To calculate the index for water stress (water sub-index), the standardized values of water variables were averaged using Equation 2:

$$\text{Equation 2: } M = \frac{\sum_{i=1}^n \text{Variable index scores}}{n}$$

Where M is the average standardized value of water stressors, and n refers to the number of variables under each domain.

4.5.2.4. Estimation of Child Water Stress Index

To estimate the overall child water stress index (CWSI) score, the average scores of sub-indices were calculated using Equation 3:

$$\text{Equation 3: CWSI} = \frac{\sum_{i=1}^6 (Wmi Mri)}{\sum_{i=1}^7 Wmi}$$

The exposure determined in the previous section was merged with the indices generated for the intermediate factors that reflect children's living conditions. Accordingly, the

CWSI is the weighted average of the six components (the exposure, geographical conditions, community features, families' economic conditions, family features, and children characteristics). Different methodologies can determine the weighted average. However, to avoid misjudgement in weighting, the method followed by Hahn et al., Etwire et al. (2013), and Sullivan et al. (2003) who determined the weighting of each domain based on the number of variables that form this domain (Wmi). The weighted average takes into account the varying degrees of strength and importance.

To utilize this approach in calculating the child wellbeing index which indicates the living conditions and communities' capacities of the communities experiencing the exposure, the same formula above was used but without the exposure.

The weights of each major component, " Wmi " were determined by the number of sub-components that make up each major component and are included to ensure that all sub-components contribute equally to the overall index.

4.5.2.5 Water Stress of Features: Predictability, Controllability, and Adaptability

The wellbeing variables were grouped into stress features, including exposure, predictability, controllability, and adaptability. The categorization of the 30 variables into the four features was challenging, especially that many variables can be related to more than one feature. However, this research based the categorization of each variable on the relevance of the major feature it can be related to. Categorization was also based on the outcomes of the focus group discussions, specifically question number 2. The determinants of early childhood were categorized according to their impact on the predictability, controllability, and adaptability of water stress.

Adaptability: The stress score of adaptability refers primarily to the available social and personal capacities of the families to adapt and cope with water stress. It is mostly based on the strength of the personal characteristics alone and as a group to adapt and cope with water stress. This feature was formed by merging the variables related to the family and child characteristics to resist, adjust, absorb, adapt, and cope with water stress:

- 1- Dependency rate
- 2- Percentage of women as heads of households
- 3- Mean number of activities with adult household members
- 4- Percentage of individuals suffering from chronic diseases from the total population
- 5- Percentage of children under 5 not attending preschool
- 6- Percentage prevalence diarrhoea
- 7- Percentage prevalence stunting
- 8- Percentage of children out of kindergarten, excluding those in first grade, among children 5 years old

Predictability: Predictability refers primarily to the uncertainty resulting from the instability of the macro-conditions, including the conflict-related facts on the ground, which imply fluctuations and changes that impact families and children. These impacts include the interruption of water services and delivery; limited movement of people, goods, and services; and likelihood of acute instability and violent civil and military confrontations.

- 1- Percentage of people with restrictions on movement to other towns (buildings 3 km away from Israeli army checkpoints, not including the closure/border crossing in the Gaza Strip)
- 2- Percentage of people with close proximity to settlements
- 3- Percentage of people close to the separation wall or 1967 borders (buildings 3 km away from the separation wall or 1967 borders)

- 4- Percentage of people completely enclaved by the separation wall, requiring a permit from the Israeli authorities to pass through

Controllability: Controllability was formed by the variables that refer primarily to the socio-economic capabilities that help families reduce, prevent, and minimize the impact of exposure. These variables include employment, education, and population-related pressure on social services. However, these capabilities are not only economic. They also include knowledge that enables families to plan, explore, and judge, as well as demographic features such as social and economic burdens on refugee communities, and male and female unemployment rates. High scores under the controllability component reflect the risk of being helpless and unable to control and mitigate water exposure-related challenges.

- 1- Population per number of public health clinics
- 2- Population per number of basic schools
- 3- Population per number of preschools
- 4- Total Population of each community
- 5- Percentage of refugees among population
- 6- Poverty, measured by consumption and expenditure capacities
- 7- Adult female unemployment rate
- 8- Adult male unemployment rate
- 9- Average number of members in a household
- 10- Percentage of female individuals 21+ who do not have above secondary education, from total female population 21+
- 11- Percentage of male individuals 21+ who did not complete secondary education, from total population 21+

4.5.2.6 Estimation of Relative Risk

To estimate the probability of not being on track in the stressed communities, the most stressed communities were compared with the least stressed communities with respect to the stress scores of predictability, controllability, adaptability, and wellbeing domains, as well as the child water stress score and children outcomes.

Using the relative risk concept, the most stressed community were considered the exposed group, and the least stressed community was a the least exposed group. The relative risks are calculated as follows:

$$\text{Relative risk} = \frac{\text{Percentage of children not on track in the exposed group}}{\text{Percentage of children not on track in less exposed group}}$$

4.5.2.7 Estimation of Vulnerability

The calculation of vulnerability based on concept developed by IPCC (2007) was developed by Enwire et al. (2013) and Tewari et al. (2014). Vulnerability refers to susceptibility to exposure, sensitivity of the system, and capacities to adapt and control exposure. Accordingly, the main concept used for estimating vulnerability is the difference between the stress score of the exposure and the stress scores of the adaptive and control capacities. For each community, vulnerability was calculated as follows:

$$\text{Livelihood vulnerability index} = (e-a)*s$$

Where e is the exposure score, a is the adaptive and controlling capacities score, and s refers to the sensitivity of the system. Following Enwire et al. (2013) and Tewari et al. (2014), the sensitivity refers to the level of the susceptibility of the context, therefore, this research used the average score of the macro geopolitical and community scores to indicate the sensitivity of the context. The communities with exposure stress scores higher

than the adaptive and control capacities stress score means that children living in these communities are more vulnerable.

4.5.2.8 Vulnerability and delayed ECD; Establishing a Prediction Model

A prediction model was created using a linear regression equation for testing the relationship between the vulnerability score and percentage of children with delayed early childhood development:

$$Y = \text{constant} + \text{slope} * X$$

To estimate the predicted value for percentage of children not on track in their development (Y), the constant value refers to the intercept of the regression line, while the coefficient refers to the slope of the line. Y is the dependent value that represents the percentages of children with delayed early childhood development, and X is the independent variable that represents the vulnerability index value. This formula can facilitate the establishment of a prediction model for the most vulnerable communities to indicate the estimate percentages of children not on track in these communities. The table includes two sig values: the significance value related to the constant when it is less than .05, interpreted by the ability to reject the null hypothesis that the constant does not equal zero; and the significant value of vulnerability indicates that the slope does not equal zero.

4.5.2.9 In-depth views Towards Child Water Stress. Qualitative Analysis

The qualitative analysis conducted under this section was based on the data collected from the focus group discussions, and sought to identify locally-relevant experiences of water stress within a multidimensional perspective with specific focus on situations when water stress is uncontrollable, unpredictable, and inadapttable, and how these situations influence children's vulnerability to adverse risks and outcomes. The analysis under this section was related to research question number two and presented in section 6.6.

The present research argued that being unable to control, predict, and adapt to stress cause adverse life impacts for caregivers, including disruption of family-child relationships, quality of care, and family/caregiver support to children.

1. General View of Child Water Stress. The Combined Effect

Caregivers were asked to express in general how the collective effect of water stress impacts them. Their perceptions included that they feel weak, helpless, and isolated; that it disrupts their relationships with their spouses and their children; that they use less water, and feel that they and their family members are thirsty, unclean, and that they need to bathe, cook, and clean the house, but can't. They were then asked how they feel this impacts their relationship with their children, and how the children are impacted themselves. This included adverse contextual factors (micro and macro) and how they interact with aspects of water stress (political intensity and wealth level) that limit the ability of households to predict, control, and adapt to water stress and prevent its consequences on their children.

2. Predictability

Caregivers were asked about their experiences when they feel uncertain and unable to predict conditions and development due to developments related to the macro- and micro-conditions. They were requested to share their own experiences and times when they feel unable to predict water stressors, as well as what factors contribute to the ability of households to foresee changes regarding to water stress. Responses, including the uncertainties, emergency conditions, internal household dynamics and relations, were recorded. Participants were then asked about outcomes unpredictability creates on caregivers' practices and behaviour in their relationship with their children, including being uncertain, anxious, or nervous.

3. Controllability

Caregivers were asked to what extent they can tolerate and control water stress combined with other factors, and when they feel helpless. They were also asked what factors add to water stress and make them feel helpless and unable to do anything to control the situation they live in. Responses included that they feel helpless, that they cannot do anything more, and that they need to wait and see. Participants were also asked to define instances when caregivers feel helpless, what factors contribute to uncontrollability of water stress, and what impact this has on the child-family relationship.

4. Adaptability

The third feature addressed by the focus group discussions was adaptability and instances when caregivers felt unable to adapt to water stress. They were also requested to match factors that interact with water stress and disrupt the ability of caregivers to adapt to the uncontrollability of water stress and how it impacts the child-family relationship.

5. Vulnerability

The last feature discussed in focus groups was vulnerability, measured by the perception of caregivers regarding unpredictable, uncontrollable, and inadaptable exposure. This feature examined the situations when children are exposed to water stress and how they feel helpless, unable to predict and adapt to the exposures. This feature also addressed the main contextual factors that families and children experience in addition to water stress and how the general macro-situation impacts their children.

4.5.3 Child Water Stress: A Micro-Perspective

This section utilized secondary data generated from the Multiple Indicator Cluster Survey, Series 5. The method of data collection, related variable, and limitations of this survey are explained in section 4.4.1.1. The analysis is guided by the adapted model for the combined effects of the exposure, risks and protective factors visualized in Figure 2.3 page 55 . The analysis are presented in chapter 7.

How do exposure to household water stress and the intermediate factors of wealth and childcare interact and establish risks of delayed early childhood development?

Considering the complex features and characteristics of water stress and early childhood development, it is hypothesized that exposure influences children directly, but also, and to a larger extent, indirectly through factors considered to be determinants of ECD.

This concept invited the consideration of analysis methods that stimulate real-life routines. Children live and interact while exposed to co-occurring factors. Accordingly,

the statistical methods went beyond causality and conventional risk-outcome-confounder variables to mediation/suppression models to examine interactions among the variables.

The qualitative methods sought to supplement the statistical analysis with means to better understand these interactions based on life experience. Special focus was placed on how water stress adds to contextual burdens that households experience and how this additive influence affects their adaptive strategies, as well as the care and support they provide to their children.

4.5.3.1 The Mediation Model

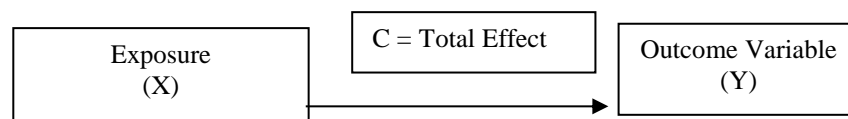
The mediation model is a process that examines the relation between at least three variables. It examines the role of hypothesized intermediate variables in the relationship between the independent and dependant variables. This process is based on the concept that the independent variables establishes a total effect on the dependant variable. This effect is decomposed or partitioned into a combination of a direct effect and an indirect effect, transmitted through intermediate variables. The hypothesized relationship between the exposure and outcome variable is explained by Figure 4.1.

Figure 4.1.a demonstrates the hypothesized total link between the independent and dependant variable. This link is linear and is determined or predicted using the corresponding values of both variables, with a coefficient that represents the slope of the regression line, and consists of the predicted score on the outcome variable for each possible value of the independent variable. The value of the coefficient represents the total effect of the exposure on the outcome variable. The null hypothesis to be rejected can be stated as no association between the exposure and outcome variable. This hypothesis can be presented as if the exposure has no effect on the outcome variable, $C=0$.

Figure 4.1.b demonstrates that the hypothesized total effect is decomposed to direct and indirect effects. The null hypothesis to be rejected is stated as if the total effect C does not equal zero, meaning there is no indirect mediating effect with a null hypothesis to reject $ab=0$.

Figure 4.1: Hypothesized Causal Mediation Effect

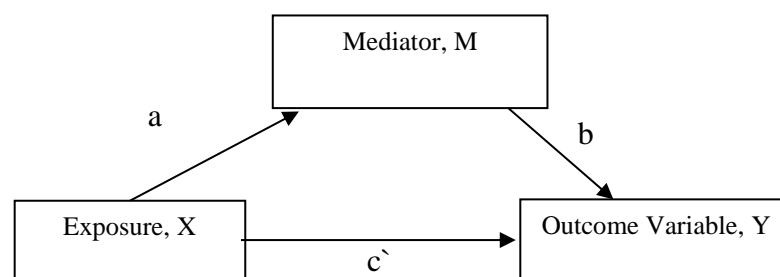
Figure 4.1.a: The Effect of Water Stress on ECD without Considering Mediation



Null Hypothesis 1.1: $H_0: C=0$

C is the total effect of the exposure on the outcome variable

Figure 4.1.b: The Effect of Exposure on the Outcome Variable including the Mediating Effect of M



Hypothesis 1.2: $H_0: ab=0$

- a is the effect of the exposure on the mediator; b is the effect of the mediator on the outcome variable; and c' is the direct effect of the exposure on the outcome variable
- ab represents the indirect effect
- The total effect $C =$ The direct effect $c' +$ the indirect effect ab $C = c' + ab$
- The product of ab estimates the strengths of the mediation path
- a , b , and c are estimated based on the values of the regression model

To statistically examine this hypothesis, the present research followed the structural sequential method, following MacKinnon and Dwyer (1993), Kenny (2004), and VanderWeele (2016). This method is a multi-step regression testing model to estimate the total, and the direct and indirect effects.

Model 1: The independent variable (exposure) significantly affects the dependant outcome variable. For scale and continuous variables, this relation was computed using the linear regression equation

$$Y = B_1 + cX + \varepsilon$$

Where, Y is the outcome variable, X is the independent variable (predictor), ε is error, c is the coefficient or the total effect, and B is the intercept of the Y axis. The outcome of this computation is to estimate c, corresponding to the total effect.

Model 2: The independent variable predicts the mediator (X) and the predictor predicts the mediator (M) using the equation:

$$M = B_2 + aX + \varepsilon_2$$

Where M is the mediator, X is the predictor, ε is error, a is the slope of the regression line between X and M, and B_2 is the intercept of the effect of X on M. The outcome of this computation is required to estimate the indirect effect.

Model 3: This stage is a multi-regression model that includes two independent predictors (the exposure and the mediator) and the dependant variable. It was performed by two stages: The mediator was tested as a predictor of the dependant variables, then the independent variable was tested as a predictor for the dependant variable with the addition

of the mediator. This is referred to in the model as X still predicts Y when M is in the model:

$$Y = B_3 + c'X + bM + \varepsilon_3$$

Where c' is the direct effect, b is the effect of the mediator on the outcome variable, and ε_3 is the error. Models 2 and 3 yield the direct effect c' and well as the indirect effect ab . The summation of these two effects is equal to the total effect $c = c'+ab$. This value should be equal to the value of C in Model 1. The addition of the mediator decomposed the relationship and explained part of the relationship through the indirect relationship between the independent and dependent variables.

4.5.3.2 The Variables of Interest

The use of mediation analysis aims to explain the relationship between the variables related to exposure to water stress, and outcome variables related to delayed early childhood development, while considering variables related to determinants of early childhood development. The following variables were examined by the mediation model.

The Independent Variables

The use of unimproved water sources as the main sources of drinking water

This variable is the independent variable representing water stress. This variable was examined as a variable that reflects multiple water insecurity factors, especially poor quality, poor reliability, additional financial burden, and inadequate quantity.

Outcome Variable

Children 3-5 years old on “On Track or Delayed” in the early development is the outcome variable. The MICS 5 survey provides final output of dichotomous variable of child being on track or not in his or her development.

To provide more strength to the variables, the present research developed a scale variable for early childhood development status. The estimation of indirect effect on dichotomous outcomes is difficult to estimate, mainly due to the violation of linearity and normality that feature in linear regressions. Instead of the dichotomous feature of delayed early childhood development, the present research established a scale variable indicating children’s status in their early development. The scale variable is composed of the number of items or benchmarks included in the child development index that children have achieved. The scale is composed of ten developmental categories including social-emotional, literacy and numeracy, physical and learning. The scale provides a more accurate assessment of children rather than a dichotomous “yes, no” evaluation. Childhood developmental status is a series of complex, progressive processes that reflect the cumulative effect of the main determinants of early childhood development, especially the proximal processes that children experience in their close environment. Accordingly, a scale variable may provide a more comprehensive assessment of the child. However, as previously indicated, the ten-item scale is an initial assessment. In case children identified as not on track according to the dichotomous variable, or a low number of positive items using the scale, children require in-depth analysis using more specialized tools by a specialist in the field.

Mediator Variable 1: Wealth Level

The wealth index is a categorical variable included in the MICS 5 survey. The wealth index is a composite indicator of wealth computed using information on the ownership and possession of consumer goods, dwelling characteristics, water, and sanitation. The quantiles of the wealth score divided the households into five levels: poorest, second, middle, fourth and richest. MacKinnon et al. (2000) indicated that mediational analysis adjusts for a third. This adjustment reduces the magnitude of the direct relationship between the independent and dependent as part of the influence passes through the third variable through indirect pathway.

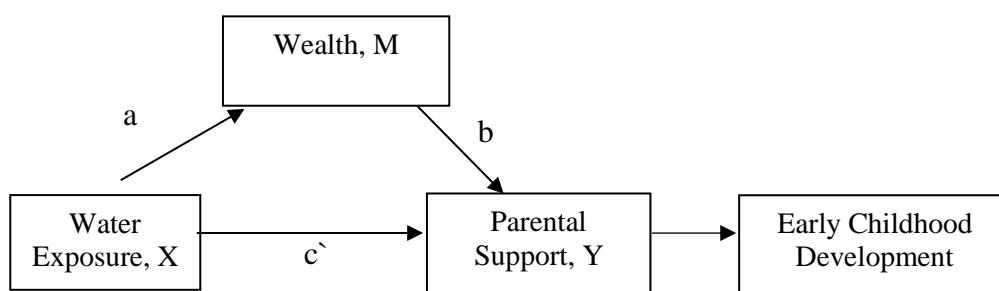
Mediators Variable 2: Parental Support

The MICS survey included ten practices performed by both parents. The present research established a scale of all practices that parents reported they do for or with their child.

The literature review indicated that the proximal processes which include variables related to family care and support provided to children are considered as the most proximal detriment to optimal early childhood development. The present research argues that weak proximal processes are mediator factors as deteriorated social environment, and disrupted family system are more likely to be enhanced by water stress.

Being the most proximal children's spheres of influence, the parental support are more likely to be influenced by wealth levels, which means that proximal processes can mediate the combined influence of wealth levels and intensity of water stress on children. This may imply dual roles for these variables. It can act as a mediator of the link between water stress and early childhood development, or an outcome of the effect of water stress, wealth level, and a predictor of delayed early childhood development.

Figure 4.2: Mediation Model. Water Stress, Wealth level, and Parental Support



4.5.3.3 Suppressors Effect: Family Wealth, Parent Support, and Education

Related to the previous chapter, the effect of the intermediate factors is not necessarily towards risks and harm. Suppressors of risks are hypothesized to be factors that help control or reduce the effects of water stress on children. Statistically, it is defined as an intermediate variable. When added to the regression model established for the independent predictor and the outcome variable, its predictability independent variable to the outcome variable increases while the intermediate factor does not predict the outcome variables. The main variables addressed as controllability of stress are the financial capacities, quality child care and education of the parents.

To detect the suppressor role of proximal processes represented by the child care variables, the same process was undertaken. However, in Steps 3 and 4 the suppressor effect is opposite to the mediator effect. As indicated by the structural equation model, adding the mediator to the model reduces the magnitude of the direct relationship between the independent and dependent variables. The suppressor effect, on the other hand, increases the strength of the direct association, indicating less likelihood of decomposing the total effect to direct and indirect effects, and the magnitude of the indirect relationship

between an independent variable and a dependent variable becomes weaker, while the direct relationship became stronger.

4.5.3.4 Moderators Effect: Child and Parents Characteristics

The moderator variable is a variable that alters the strength of the effect or the relationship between the independent and dependent variable. For water stress, the present research hypothesized that the effect of water stress on children varies according to age, sex, type of community and region, and mother being the head of the household.

These types of variables are crucial to understanding how the features of certain variables alter the effect of the stress on children and their families. This may be of great advantage not only in water stress management planning and intervention design, but also to knowing the roles of these variables in the stress. The moderator analysis is measured using the linear regression between independent and outcome variables.

Measurement of Moderation

Most of the literature computed moderators using the regression formula below:

$$Y = A + aX + bM + cXM + E$$

Where A is the intercept, X is the independent variable, M is the moderator, a is the coefficient of the effect of X on Y, b is the coefficient of the effect of the mediator on Y, and c is the coefficient of the moderation effect.

Since both the independent variable and moderators of interest are dichotomous variables, while the outcome variable is scale, and to apply the linear regression formula, the independent and moderator variables were standardized to be continuous.

Different software introduced electronic help kits to compute moderation, notably “PROCESS”, developed by Hayes (2017).²¹ However, following Aiken and West (1991), the present research intended to define the role of the variable (moderation or not) rather than computing its precise effect. Accordingly, the independent variable and moderators of interest were standardized using SPSS software. Then, an interaction variable was created yielded from the duplication of the two standardized variables. The two standardized variables and the interaction variables were then incorporated into the linear regression model. The model summary was checked for a significant change in the value of R- squared score which indicates change in the variabilities of the values, showing a potentially significant moderation effect. R-squared reflects the proportion of variance in the outcome variable which can be predicted from the independent variables. After adding the moderator, the change in R-squared is detected to reflect if the proportion of the variance changed due to the addition of moderator. No significant change in R-squared score indicated no moderation effect.

4.5.3.5. Confounders

Based on the literature review, many variables may confound the link between the independent and dependent variable. Confounding factors are considered independent risk factors that wholly or partially account for the observed effects and outcomes that might change the relationship between the independent and dependent variables, and do influence its outcomes (Woodward 1999, p. 146). While establishing an association between two variables, confounders are usually controlled for. The presence of confounders in the mediation analysis is more challenging. The mediation analysis is

²¹ The PROCESS is a path analysis modelling tool. It openly accessed on line at <https://www.processmacro.org/index.html>

concerned with interaction between three variables. Therefore, controlling for such interaction requires careful attention. Richiardi et al. (2013) and VanderWeele (2016) discussed this concern and highlighted the need for strong assumptions of the relationships between the three variables. They suggested three main sources of potential bias related to confounders to control for (i) mediator-outcome confounding, (ii) exposure-mediator interaction, and (iii) mediator-outcome affected by the exposure.

The second challenge is to select the confounding variables that might meet the criteria of confounding. Woodward (1999) suggested simple criteria for what confounders are necessary to control for:

- Be related to risk factor but not a consequence of the risk factor
- Be related to the outcome but not a consequence of the outcome

LaMorte (2016) provided guidance to determine whether a given risk factor caused confounding by comparing the estimated measure of association before and after adjusting for confounding. The present research considered age, sex, and education as confounder. Older children have more developed brains, and water use may be different among age groups. Females, at early ages, are more developed than males and the social context may influence the use and consumption based on the child being male or female. Educated mothers may cope and adapt to water at the same more likely to be employed and purchase more water and provide more care to children. Considering the mediation analysis, the confounding effects were considered according to the following:

- Mediator-outcome confounding variables includes mother education, and if a female is the head of the household. Less education and female heads of

households are more likely to be poor and less likely to be able to provide quality support and care to their children.

- Exposure-mediator interaction factors include mother education, as educated mothers may be less likely to be poor and have more opportunities to access greater quantities and safer water, and type of community as rural communities may have less water resources and lower wealth levels.
- Mediator-outcome, affected by exposure, includes the number of children in the house which may lead to an increased burden on the financial capacity of the family and more water needs. At the same time, caregivers may provide less time and quality care to their children.
- Direct effect, including gender, is a possible confounder as variation between males and females in terms of ECD was highlighted by the literature. Due to social and cultural factors, variation between males and females in water use and access may occur. For instance, girls may not go out and play and may need less water for bathing and handwashing. Mother education may also act as a confounder as educated mothers have more opportunities for work and accordingly may contribute to purchasing water. Educated mothers may also be more aware and knowledgeable of the aspects related to ECD.
- The reason for using the structural sequential method is to obtain more clarity regarding the pathways through which the unimproved water supply affects ECD within a logical and stepwise sequence, enabling understanding of the mechanisms and facilitating evaluations and interventions.

4.5.3.6 Examining Possible Bias,

A mediation model was suggested by the present research as an appropriate model for examining the interactions. This model examines the relationship between the independent and dependant variables while accounting for intermediate variables that mediate, suppress, or moderate the link. The literature highlighted increasing popularity of the mediation model as a useful tool to look beyond single stressor single outcome approaches. As a conceptual model, it presents a conceptual perspective that can simulate the interactions happening in children lives. However, this model has considerable critiques, especially in terms of bias, considering confounders, and estimations of precision. The present research favoured using this model, noting its disadvantages and implementing many measures to reduce bias and consider confounders.

Policy objectives were also considered in selecting the model for this study. The conceptual perspective considers multidimensionality and interactions among factors of different disciplines that affect children, and highlights concerns of water stress, considering them independently of determinants of ECD.

To produce rigorous outcomes, this research used two approaches, as detailed below:

The mediation model has the advantage of being structured and conceptual, enabling an estimation of the total, direct, and indirect effects. This model became a popular approach in social fields, including psychology as it is associated with multiple perspectives involving different factors (Agler and De Boeck 2017). However, this model is a statistical process that addresses various perspectives with no single unified way of mediation, and may not capture all aspects of the hypothesized relationships.

The following are some of the considerations captured through the literature review:

- This model requires clear prior hypotheses with a global idea related to the total effect and specific perspective that derive the regression analyses to compute the total, direct, and indirect effects. For the purpose of the present research, the investigation was theory-derived mediation hypothesis, and variables were selected to allow testing of the null hypothesis of no mediation.
- The use of non-experimental observational data may be of significant weakness. Being non-experimental and non-randomized, it will be weak in capturing the cause-effect relationship. However, the main goal of the research is not to identify a cause-effect relationship. The variables selected were already known for this effect. For instance, water-related failures and deficiencies such as poor quality and inadequacy were tested by other literature for their relationship with illness, malnutrition, and undermined care and support provided by caregivers.
- The present research made sure of the goals of using the mediation model, seeking an explanation of a possible mode of interactions among multiple variables. The model presented a conceptual model of interactions among different variables that may lead to an increase in the likelihood of risks that undermine optimal ECD.
- This model can test ways and processes to change the level of the dependent variable and help in building prediction models to use the independent and mediation variables to predict the value of the outcome. This can facilitate practical improvements with better predictions and estimates of the prediction model provided in the previous chapter by adding mediator factors to the water-related vulnerability.

- Confusion may occur between the direct and total effects. This highlights the need to estimate the total effect while the emphasis is on estimating the hypothesized mediating effect. This required a clear theoretical goal concerning the total, direct, and indirect effects. Mediation can be helpful when there is a role of suppressor variable.
- These processes have different stages that may imply different confounders at each stage. It is always necessary to control for confounders for the main two stages (the independent effect on the mediator and the mediator effect on the outcomes indicator).
- When using observational data that lacks clear temporal precedence establish assumptions of unmeasured confounders that bias the estimates and necessitate examining parameter sensitivity (Agler and De Boeck 2017) .

The literature proposed different approaches to minimize the parameter bias and sensitivity, including those put forward by Sobel (2008); VanderWeele (2016); and MacKinnon et al. (2000).

1- Test for Fitness and Strength of the Association

Under the regression analysis, the Hosmer and Lemeshow test available in SPSS package, is considered to estimate R-squared and the goodness of fit. R-squared is a statistical measure of how close the data are to the fitted regression line. It is also known as the coefficient of determination, or the coefficient of multiple determination for multiple regression. The highest score (100%) indicates that the model used can explain all of the variability of the outcomes data around its mean. Lowest score (0%) on the other hand,

indicates that the model used explains none of the variability of the response data around its mean.

While R-squared provides an estimate of the strength of the relationship between the model and the response variable, it does not provide a formal test for the hypothesis and the relationship between the two variables.

2- Sobel Test

The Sobel test²² was used to double-check significance of the presence of total and indirect effects between water supply and ECD. The Sobel test verifies if the mediating factor carries the influence of the independent variable on the dependent variable.

The test is based on the idea that when the mediator is added to a regression analysis model with the independent variable, a reduction in the effect of the independent variable is recorded while the effect of the mediator remains significant (Sobel 1982). Therefore, based on this theory, the estimates of paths a and b are independent,

$$H_0: ab=0 / H_0:c-c'=0.$$

The Sobel test provides an approximate estimate of the standard error of

$$ab = \sqrt{(b^2 \times sa^2 + a^2 \times sb^2)}$$

²² Sobel Test is available online (<http://quantpsy.org/sobel/sobel.htm>). It was developed by Preacher and Hayes (2008). This software measures the indirect mediating effects within structural equation modelling programmes.

Whereby a is the regression coefficient of water supply on wealth level, se is the standard error of a , b is the regression coefficient of wealth level on the outcome early childhood, and sb is the standard error.

The Sobel test examines if indirect effect is significant given the values of the indirect pathway represented by the values of the coefficients (ab). To test of the indirect effect if exists or not, the Sobel test estimates Z indicating the standard deviations from the mean. (i.e., larger than 1.96 in absolute value is significant at the .05 level). The P value of the Sobel test below 0.05 proves that the indirect effect does not equal zero, rejecting the null hypothesis that the indirect pathway ab equals 0.

It is crucial to note that the Sobel test is done with caution as it has low power, mainly because the sampling distribution of ab is likely to be skewed (MacKinnon and Dwyer, 1993). It is argued that if ab is positive, there is positive skew with many small estimates of ab and few very large ones. It uses a normal approximation presuming a symmetric distribution, which might lead to false symmetry.

3- Bootstrapping

Bootstrapping is a method used for testing indirect effects, especially in situations where there might be violations of statistical assumptions (Bollen and Stine, 1992). It is a non-parametric method of resampling with replacements done many times (i.e. 1000 times). Since the data is not randomised, bootstrapping can serve as a means to reorganize the data and establish a sampling distribution similar to randomized data. During replacements and resampling of the data, a sampling distribution is generated and the indirect effect is computed. Correction of the bias is usually made because the mean computed from the bootstrapped distribution does not exactly equal the indirect effect with a confidence interval, and the p value. If the confidence interval does not equal zero, it can be concluded that the indirect effect does not equal zero and exists. Bootstrapped data of water stress indicator and wealth level were correlated. Bootstrapped data of water supply and ECD with the presence of a mediator (wealth level) were correlated.

Many models that tackle mediation were suggested and all encountered critiques. While the author acknowledges the shortfalls, his position towards this model is based on the concept of mediation and the logic of addressing multiple variables that simulate real-life conditions that children and their families live and experience. Many electronic statistical models and software are available and can compute the total, direct, and indirect effects in a very short period of time. However, this process is not a form of data manipulation. It is intended to be a product of mindful and critical thinking, and consultative process of the roles of the variables.

Therefore, the present research argues that establishing conclusions for such complex social and ecological problems and related interactions may not be explained by only statistical and theoretical criteria. Regardless of its mathematical power, such complex

social and environmental aspects need supplementary approaches based on views, perceptions, and experiences, as well as the general point of view of a researcher.

4.5.3.7 Qualitative Analysis

This method is intended to supplement the quantitative analysis for answering the third research question, specifically the mediation model with in-depth views. This aspect was the subject of discussion during the third part of all FGDs. All groups were requested to provide their own views and experiences on how water stress interacts with their wealth and influences their children indirectly through the changes occurring in family dynamics and the quality of care and support they provide to their children. Each participant was requested to use simple check lists with 14 items to indicate aspects related to household insecurity based on personal experiences and views. The checklist included adversities they face from living with water stress. The respondents were supported by the facilitators to fill both check lists. The first list included responses that were adapted from the Water Insecurity Scale (WIS) developed by (Shrestha et al. 2018) and (Wutich, 2009). The WIS examines caregiver's views and experiences of the characteristics related to themselves and their children.

1. Water Stressors and Related Interactions

At the beginning of this section, a quick discussion was conducted to present the concept of interactions between water stress and factors related to lifestyle, as well as socio-economic and political conditions. The participants were asked to share adverse life experiences they encountered in the last three months while they are experiencing situations related to part or all of the following water stressors: inadequate water supply

for their household needs; poor quality; frequent disconnections of public water supply; high cost for water purchased.

2. Water Stress and Wealth

The second part of the discussion was conducted after incorporating the wealth capacities into the discussion to have a joint understanding of the concept of wealth capacities as a broader concept to only financial income. All participants were requested to present their views based on their own assessment of their wealth, including the possession of assets such as storage facilities, the type of dwelling, possession of the house, steady family income, and financial support they receive from others.

3. Water, Wealth Stressors, and parent support

The third part of the discussion incorporated parental support into the discussion, including how it is influenced by water stressors and how it is influenced if water stressors and limited wealth are combined together. This section followed the logical sequence of the combined mediation model as the direct link between water stressors and child care was discussed first.

4.5.4 Bridging the Theory-Practice Gap and Implications for Practice

Considering the practice and policy objective of the present research, this section explained the method to assess the gap between the practices of the children services and the concept of child water stress that children experience, primarily in their households.

The present research employed a case study approach to obtain an in-depth appreciation of the gap between the practices of child services and the multidimensional perspective of water stress children experience in their households and communities. Chapter 8 presents the findings of this section. The investigation was guided by research question number four:

How does child water stress influence the effectiveness of services meant to support children in achieving their developmental potential?

Considering children under five as the primary focus of the research, early childhood services were used as a case study to serve as an example of children services. Preschools are officially licensed institutions that provide child care, learning, and cognition support services to children, mainly from ages three to five years old. The specific aim of the case study is to examine the extent to which the child-based services consider the complex socio-economic and environmental stresses in which children live. Noting the findings of the previous sections, the present research argues that holistic interventions addressing socio-economic and environmental stressors are more effective in supporting children to achieve their developmental potential.

Secondary data collected from the 56 preschools was used to describe in detail the type and scope of services, geographic coverage, and differential effectiveness of different services based on positive childhood development outcomes. Primary qualitative data

using semi-structured interviews with practitioners and stakeholders, and focus group discussions with caregivers were used to explore professional attitudes, knowledge, opportunities, and challenges related to the extent to which early childhood services consider the water stressors and other macro- and micro-factors children are exposed to during the design and implementation of their services and interventions.

4.5.4.1 Quantitative Analysis; Descriptive Analysis of Services

1. Analytical Description of the Services

Secondary quantitative data were utilized to provide an analytical description of the services offered by early childhood services. Data on the services were not originally collected for the benefit of this study. The data were gathered using structured interviews and an observational check list of activities offered to children regarding the availability of resources and physical capacities. Access to the children's files was requested to obtain data on their physical, social, and emotional development. Once the author received this data, the following factors were considered:

- 1- Data were collected by qualified, neutral field researchers (recruited for this action)
- 2- The methodology, scope, and geographical focus were clear
- 3- The purpose of the assessment was clear for the participants
- 4- Data were entered by qualified data collectors
- 5- Consents were obtained
- 6- Confidentiality was assured in writing

The author then refined, cleaned, and analysed the data using the SPSS package. No personal data, titles, or names were obtained. Confidentiality, copyrights, and use of data

only for research purposes was assured. The data with its features and shortfalls is explained in section 4.4.1.5. More description of the limitations of this data explained in section 4.6.6.

Step 2. Estimating Effectiveness of the Services

The effect size approach was used to measure the effectiveness of each preschool in supporting children to achieve their developmental potential based on the difference in the percentage of children with positive child outcomes during two consecutive periods. The effect size is a simple statistical method for comparing outcomes from different sectors that are ordinarily difficult to compare. The effect size score for proportions can be calculated following the work of Cohen (1988).

The effect size of proportions was calculated as follows:

$$h = \varphi_1 - \varphi_0, \text{ where}$$

$$h \text{ is effect size,}$$

$$\varphi = 2 \arcsine(\sqrt{p})^*$$

To measure the z score:

$$z = \frac{\varphi_1 - \varphi_0}{\sqrt{((N_1 + N_2) / (2N_1N_2))}}$$

*The arcsine was calculated using excel software specifically using function ASIN (www.excelfunctions.com)

Cohen's method suggests the categorization of the effect size to be small ($h = .2$ or less), medium ($h = .5$), and large ($h = .8$).

If the variables are recorded using means of proportions, the effect size is calculated according to the Effect Size Calculator for T-Test for effect size of means using the following formula:

$$d = \frac{M_1 - M_0}{\sigma \text{ pooled}}$$

where d is the effect size, M is the mean, and σ is the pooled standard deviation, according to the following formula:

$$\sigma_{\text{pooled}} = \sqrt{((SD_1)^2 + SD_2^2)/2}$$

where SD_1 is the standard deviation of the mean before interventions and SD_2 is the standard deviation of the mean after interventions (Cohen 1988).

The descriptive analysis yielded differential comparisons among the preschools with respect to its effectiveness. Comparisons were made regarding the effectiveness and scope of services, specifically by comparing the effectiveness of preschools with holistic approaches and preschools focusing on learning and cognition.

The effect size reflects the effectiveness of services in making a change or difference represented by positive child development outcomes. The value of the effect size of these services was incorporated with the aggregated data used for measuring water stress in the communities addressed in the previous section, to examine compatibility with the intensity of water stress in these selected communities. The effect size scores will be matched with the vulnerability scores generated in the previous section. The effect size score for each preschool was combined with the standardized data for the community where each preschool is operating. The analysis aims to reject the hypothesis that ECD services achieved positive effect size. A mediation analysis was conducted between water stress and children outcomes with the effect size of the services as an intermediate factor hypothesizing that it acts in a suppressor role, intercepting or limiting the indirect pathways between water stress and ECD.

4.5.4.2 Qualitative Analysis: The Gap, as Viewed by Parents

The fourth part of the focus group discussions sought to identify locally relevant experiences of parents regarding services provided to children with specific focus on supporting children facing water stress. The discussions were guided by research question number four. It sought insights on how the parents believe the services are supporting children to address water stress and improve their ability to control, predict, and adapt to it. The discussion examined how caregivers perceive the role of child-based services in respect to their role in supporting children to achieve their optimal development.

It sought parents' views of the gap between the activities and interventions targeting children and their home environment. It addressed how parents experienced events or situations when the services do not follow or consider the challenges in the social and physical surrounding and macro-environment of children including water stress, limited wealth, crowding, and challenging macro geopolitical instability. The discussion addressed views, perceptions, and experiences related to how the caregivers perceive integration among the services offered by the education institutions and health services. Do they complete each other and what impacts does the gap have on them and their children?

The caregivers' views and perceptions of the role of child-based services in preventing and controlling water stress at the household level were discussed during the four focus group sessions.

4.5.4.3 Qualitative Analysis: The Gap, as Viewed by Practitioners

Eleven semi-structured interviews were conducted with four officers working in ECD, four officers working water, and three health workers working in primary health care services. These interviews aimed to obtain an in-depth understanding of the effectiveness of the services provided to children and their consideration of water stress and contextual factors on children. The analysis under this section followed a logical framework with the intention of articulating the current theory of change for services. Similarities and differences in the responses were reported. This method resulted mainly in lessons learned, gaps, and perceptions. Once finalized, data were shared with the programme stakeholders for review and comments.

1- Perception of service providers on water stress

The first questions sought opinions related to water stress, and answers were coded if the emphasis was on physical aspects or stress features. The key informants were requested to express their views of water stress in Palestine and how they perceive it as a threat on their activities and beneficiaries.

2- Perceptions and practices related to ECD

The second set of questions gathered opinions related to practices and experiences with ECD processes with respect to the continuity of support provided to children during their development, and also in respect to the integration between the services and the water sector.

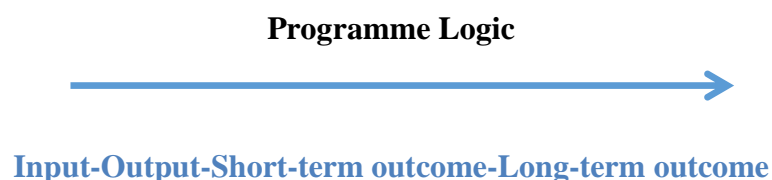
This section focused on two aspects highlighted by the literature. The first aspect pertained to how child services accompany and follow the development processes of children, and if there is an age-specific service gap between the neonatal phase and the

ages of three to five. The second aspect is related to the integration of the health, education, and water sectors in respect to children's needs and risks.

3- Water stress and the design and development of services and initiatives

The last section evaluated the theory of change that early childhood services follow in designing their interventions, specifically if the link between water stress and ECD services is considered during the main stages of programme development. These questions also addressed the opportunities and challenges services face while supporting families and children in predicting, controlling, and adapting to water stress.

The challenges and opportunities of incorporating the concept of child water stress with practice were presented in accordance to programme logic, which includes the long-term goals, outcomes, and activities. In doing so, it is possible to detect which interventions in the pathway were successful in producing the outcomes and/or which interventions are missing that made the work unsuccessful (Taplin 2013). This theme evaluates the current theory of change of the programme logic and proposes a new theory of change which is referred to as the change that should happen within the current programme logic (ibid; Marielle Riché 2014). In accordance with the programme's causal pathways (project management cycles) it is important to determine what strategies can be gained from the present research to prevent the influence of the possible adverse consequences and vulnerabilities on delays in ECD. It was necessary to evaluate the effectiveness of the current interventions implemented by the ECD programmes and propose additional interventions to ameliorate the impacts of water stress.



- **Impact:** Generally oriented objective reflecting the contribution to enhancing the strategies and efforts to reduce risks related to delayed developmental status of the children.
- **Effect:** Change in the practice, skills, and knowledge of the parents and service providers.
- **Outputs:** Products and services put in place to achieve the effects and impacts.
- **Activities:** Operational and technical tasks needed to produce the outputs.
- **Inputs:** professional and financial resources needed to implement the activities.

This process resembles the empirical causal mediation model used in the current research to assess causal pathways that may create disparities among children. For example, training educators in skills (intervention/cause) to improve the cognitive and social abilities of the children in the preschools (outcome/effect).

4.6 Methodological Limitations

The following section addressed methodological implications that were taken into account during the development of the analysis.

4.6.1 Defining Water Stress

Defining water stress was challenging due to the different terminologies and concepts that are often used. Water stress, water scarcity, and water insecurity have been used interchangeably among the literature and imply different interpretations based on different contexts and cultures. The main challenge is to combine stressors and physical features based on interactions among different variables from different disciplines. The selection of the variables was bounded by the availability of data, relevance, and applicability. However, other factors related to socio-economic conditions, water stress, and geopolitical conditions may be overlooked. This highlights the need to consider this research as a risk and vulnerability assessment rather than a cause-effect method.

The chronicity of water stress reflects chronic exposure during children's development process, however, and since a cohort or longitudinal observations were not implemented, the chronicity was based on population measures and comparisons of two consecutive MICS surveys. However, changes may have happened during the two surveys, meaning sharp or acute variations were not captured.

4.6.2 Early Childhood Development

The assessment of child development, if on track or not, may imply significant shortfalls. The 10-item assessment is a quick, easy, and simple test that may be used as an indicative measure for reaching or not reaching certain benchmarks in the main developmental domains. However, this assessment cannot replace a full and detailed assessment required

to report on the mental and physical status of a child. The field collectors were trained to establish an atmosphere of trust and comfort between them and the caregivers, however, the observations, caregivers' reporting, and children's behaviour may be altered or biased during the household visit, leading to biased data.

Thus, the present research reassures that the child development index used by MICS is a valid variable that indicates increased risks and vulnerability but not as a definitive assessment of a child's developmental status. However, and the dichotomous result of child being on "track or not" may provide a sharp conclusion for a lengthy and holistic processes. Shortfalls in and bias might occurred during the data collection are likely to happen. Children might altered their behaviours due to the presence of stranger (data collected) in the house. Mothers may also provide biased reporting to provide different status to the reality. The data collectors are subject to mistakes in measurements and reporting. Being secondary data, all of these shortfalls, and others, were not mitigated by the author of this research.

4.6.3 The Cross Sectional Data

The quantitative method used extensively quantitative data generated from cross-sectional demographic, environmental, and health surveys. It is important to note that the quantitative data were secondary data not designed nor implemented for this research. Accordingly, many possible associations of research interest were not done. These associations include the relationship between specific water stressors not adequately addressed by MICS survey and children outcomes (as explained by section 4.4.1.1).

This research highlighted the importance of the available demographic and health data to be efficiently and adequately utilized to describe the main relations of the research's

interest, and to more effectively serve policy and programme formulation. However, the following limitations were considered:

- 1- The cross-sectional surveys do not allow for an analysis of the changes and effects that occur over time at both the macro aggregate and micro household or individual levels. These surveys provide information only at the time the surveys were conducted (when data was collected).
- 2- The cross-sectional surveys do not allow for examination of causations and inference as the time factor is not considered. This could imply fluctuations in the values or features of variables. The literature indicated that ECD is a time-varying variable. Therefore, cross-sectional studies may not provide adequate insights into related social and behavioural changes among children. Rafferty et al. (2015) recommended the use of repeated cross-sectional studies to minimize the impacts of the above shortfalls on the validity of the results and to show that the patterns of water stress did not change over time. Accordingly, the present research used both MICS 4 and MICS5 to examine the continuation of the exposure to water stress-related variables while examining the chronicity and steadiness of the exposure on children in Palestinian communities. However, while the sampling frame and communities covered by both surveys are similar, the respondents of each survey are different. The changes in the proportion of households accessing unimproved water supplies may indicate the chronicity of the water stress on the Palestinian household. Therefore, the present research compared the water-related variables from 2010 and 2014. The definitions of those related to water stress and early childhood did not change, and the questionnaires used were very similar. Rafferty et al. (2015) indicated that age (which reflects the time between birth to

date of observation) may substitute for the maturation or physical and cognitive development process. The period of observation may be referred to as period of effect, but still may reflect the latest development that occurred with respect to the phenomena.

- 3- The multiple indicator cluster survey does not adequately emphasize the uniqueness of the local context. The globally unified mode of such an approach may be useful for comparison and monitoring progress in different aspects to fulfil international monitoring mechanisms such as MDGs and SDGs, however, countries with unique contexts, such as Palestine, require a high level of flexibility in setting definitions such as water stress, and in examining trends, mechanisms and approaches. For instance, the water and sanitation module does not address aspects identified as the main elements of water insecurity and stress in Palestine (affordability, poor quality, quantity, and reliability).
- 4- This shortfall limited the ability to capture the full picture of water stress and undermined possibilities for examining associations with social and health outcomes. There is also inadequate data to indicate relevance or adaptation to the local Palestinian context. In addition to reliability and affordability, the surveys lack adequate data on how households control, predict, and adapt to water stress, and how it influences their practices and child care.

4.6.4 The Aggregated Data

Ecological inference is often subject to bias and imprecision as it focuses on community-level information. This shortfall underscores the ecological fallacy, which implies bias when making inferences using aggregated community data as it is often subject to bias and imprecision due to the lack of individual-level information. Accordingly, the

aggregate data in this investigation was not used for establishing inference, but to show trends, likelihoods and community based predictions.

Selecting variables that reflect quality of life is challenging. Many indices were found in the literature, such as: The Human Development Index, Child Wellbeing Index (Save the Children 2017), Child Wellbeing Index (Bradshaw et al. 2003), Water Poverty Index (Sullivan et al. 2003), and the Child Wellbeing Index for Rich Countries (UNICEF 2013). Noting the unique socio-economic conditions in Palestine, indices adapted to the local context are needed. The selection of domains and variables by the present research was based on their relevance to the local context, reflection of the quality of life available for young children, and also based on the availability of data. Based on the above criteria, 23 variables were included, which could be enough to reflect the quality of life in the selected communities. However, the model is flexible and more domains and variables can be added in case additional data is made available.

The present research presented the Water-Child Wellbeing Index to reflect a summary measure of the interaction between water supply and child wellbeing. The index is a single summary measure for reporting priorities, needs, and rights of the communities using a non-research language that can be easily understood by policy makers. However, such indices have some disadvantages, being relative concept confined the analysis to the data and communities included in the index. Other major shortfalls are related to oversimplifying complex issues which might be misleading to policy makers, the challenge of selecting the relevant domains and indicators, and the availability of data.

4.6.5 Mediation Analysis

The present research acknowledges the likelihood of the presence of unknown confounders that might not have been considered. It argues that while striving for rigorous data, the logic and concept of the mediation effect would be an asset for programmes and policies to consider during needs assessments and evaluation by considering not only the direct pathways but also the indirect pathways.

This method is augmented by measures to control for confounding variables and tests to decrease bias. The structural sequential approach, which is based on conventional exogeneity assumptions alone, is insufficient for identification of causal mechanisms, and randomization alone is unable to provide the mechanism. The approach might fail to recognize the key assumption behind mediation analysis, and may ignore important confounders that alter the results and conclusions.

However, the present study preferred to select the structural equation approach for the following reasons:

- 1- The structural equation model provides a robust platform for creating standardized assessment tools to understand wealth level by programs and interventions . Such a tool would be helpful in the next chapter, which focuses on the programme design and evaluation.
- 2- The structural equation model can help generate a deeper understanding of the pathways under this link.

4.6.6 Services Data

This data could be subject to serious bias, including reporting bias. This data was generated by interviewing service providers who have an interest in providing a positive image of their services' quality. This data collection was not implemented to serve research purposes, and therefore could have been subject to shortfalls in its rigor and quality for the feedback reported. The services' data utilized in this investigation are clearly not representative of the total population.

However, incorporating this data intended to enrich the research scope to reflect the implications of the findings for practice. This data were generated during the project formulation, needs assessment, and implementation stages. The author did not assure rigorous data collection and analysis during the survey, as the data were not initially intended for research purposes. More details on the limitations of this data is explained under section 4.4.1.5.

4.6.7 Qualitative Methods

The qualitative measures have strengths and advantages that allow for in-depth exploration, broad and open-ended inquiry, and facilitate understanding of opinions, perceptions, and behaviours based on a set of values, beliefs, and assumptions. However, this approach has certain limitations. Qualitative research is not generalizable to the population as the sample is usually not statistically representative to the community. Choy et al. (2014) listed certain shortfalls in qualitative research including that it is not easy to validate data trends and significance, or associations with no objectively verifiable result. The data are largely influenced by the skills and personality of the interviewers who can intentionally or unintentionally guide the discussion towards his or her preferences, opinions, experiences, and thoughts. Data collection is consuming during the interview

process and intensive categorization process. And finally, the in-depth feedback provided by participants is important, however, the interpretation of results is subjective and can be biased.

The author experienced several methodological and logistical challenges while implementing the focus group discussion. In addition to the common shortfall of the qualitative methods being not generalizable, the author wanted to document the following main shortfalls and challenges that influenced the quality of the data collected;

- 1- The inability to tape-record the interviews implied a huge challenge to capture in writing all aspects, primarily when the participants exchange ideas and experiences through direct conversations. This required more effort to guide the discussions, which could have influenced the participants' flexibility and space to express their opinions. It also implied additional effort to call the participants to assure their quotes, and its meanings were reflected probably.
- 2- The social and cultural barriers among the participants were significant. The participants selected for these interviews met together for the first time. The author observed sense of reservations to express their opinions and ideas, especially at the beginning of the interviews. The mixed-gender in three focus group discussions implied that females were hesitant to share their own household experiences, especially at the beginning of the research. This implied extensive efforts to break the ice, spread trust and comfort among the participants, and ensure the research objectives.
- 3- The different social and cultural contexts challenged the data analysis among the four districts' participants. Different meanings specifically challenge it for similar

terms. This implied extensive additional efforts from the facilitators to follow up with the participants for more elaboration. The fact that the facilitators are from the same regions where the FGDs implemented helped in mitigating this shortfall.

The semi structured interviews was also challenging.

- 1- Using semi-opened questions provides more flexibility for the interviewees to elaborate and sometimes deviate from the question's subject. This created a challenge to guide the conversation and later during the analysis.
- 2- Conflict of interest was a real concern as participants were defensive for their organizations and their service.
- 3- The data coding and content analysis were subject to inadequate or wrong interpretations of the meanings.

The author strived to minimize these shortfalls by providing an extensive explanation of the research's purpose and significance, shared with the participants, at the beginning of the interviews, the main questions to guide the conversation, and finally assured confidentiality.

Chapter Five | Exposure

Rethinking Water Stress beyond Physical Measures

5.1 Introduction

This chapter's underlying goal is to present water stress as an early life stress for children, and associated with their early development risks. This chapter presents the findings of a descriptive analysis of secondary data obtained from demographic and health surveys, supplemented by primary qualitative data collected during four focus group discussions. Research question number 1 (below) guided the qualitative and quantitative analysis:

What are the characteristics and features of household water stress associated with risks for delayed early childhood development?

5.2 Individual Features of Water Stressors

Table 5.1 presents trends in exposure to water stressors that families and children in Palestine experience..

Table 5.1: Brief Descriptive Summary of Water Stressors in Palestine

Indicator	Status
Percentage of households connected to an improved water network	96%
Percentage of households receiving water from the improved network on a continuous basis	23%
Percentage of households who expressed a positive perception towards water quality	49%
Average monthly consumption of water for domestic use in cubic meters	22
Average cost of water per cubic meter from public network (NIS*)	2.8
Average cost of water per cubic meter from unimproved water tankers (NIS*)	30
Percentage of households with unimproved water source as the main source of drinking water	44.9%

* New Israeli Shekel: Currency in Israel, around .29 USD

The majority of the households (96%) are connected to improved piped water networks, managed and maintained by public authorities, including village councils and municipalities. While network coverage is high, only 23% of households receive a continuous and steady water supply with no interruptions. Only 49% of respondents indicated a positive perception of quality based on the smell, colour, and taste of the water accessed through public networks. As a result, households use alternative and supplementary unimproved sources, such as bottled water and vehicular tankers as the primary source of drinking water. This trend is common as 44.9% of households use unimproved water supply as main source of drinking.

Alternative sources have considerable disadvantages. The cost of water purchased from private vehicular tankers, classified by WHO as an unimproved source (Howard, Bartram, and Water, 2003), is about ten times higher than the cost of the public network. With an average of 22 cubic meters reported by the households per month on average, each family may access an average of 0.7 cubic metre per day for all uses for all family members including; pathing, flushing toilets, household production, hand washing, house cleaning and self-washing.

These findings provide an overview of the status of water stress among many Palestinian households, including unreliable availability, poor quality, inadequacy, and unaffordable cost. The results show strong policy emphasis on infrastructure by high coverage of public water network. However, the findings also show that having an improved water network does not necessarily mean having continuous, reliable, affordable, and adequate access to water.

5.3. The Common Features of the Exposure

5.3.1 The Interrelated Effect

The interrelated concept is based on the idea that a family that faces a problem due to one stressor is more likely to experience problems due to other stressors. An regression analysis was performed between water quality as a dependent variable, and cost, reliability, and quantity as predicting variables.

The output of the regression analysis demonstrated in Table 5.2 shows a significant association, with a significant value less than 0.05 of cost, reliability, and quantity with water quality.

These results suggest that families who have access to acceptable quality water are more likely to be experiencing a reliable supplies The negative coefficients related to the cost and demand for water tankers, indicates an inverse relationship between good quality water, cost and unimproved water supplies. Water from unimproved water tankers is often more expensive and is usually of poor quality. The public network is generally cheaper and of safer quality than water accessed through vehicular tankers.

Table 5.2: Interrelations between Water Stress Dimensions and Water Quality

Dimension	Coefficient Estimate	Std. Error	Sig	95% Confidence Interval	
				Lower Bound	Upper Bound
Cost in NIS	-.041	.000	.000	-.041	-.041
Service with continuous supply	3.217	.018	.000	3.181	3.253
Use and consumption of tanker water	-.634	.007	.000	-.645	-.623

Notes

- **Sig:** The significance value with less than 0.05 means the relationship is significant, indicating less than 5% probability that the null hypothesis of no association is correct.
- **Coefficient** indicates a relationship between the independent and dependant variables. It represents the change in the values of the dependant variable given the values of the independent variable. It is indicated by the slope of the regression fitted line. The negative sign indicates an adverse relationship.
- **CI** is the confidence interval of the coefficient.

Table 5.3 indicates that the quantity of water purchased from unimproved sources is much less than the public network. Except for bottled water, which has acceptable quality, regulatory authorities do not control the variety of unimproved water supplies in Palestine (World Bank, 2018).

Table 5.3: Water Source, Consumption, and Related Cost

Type of Water Service	Average monthly consumption (m3)	Cost per m3 (NIS)	Family pay (NIS)
Public network	20	2.8	56
Tankers	1.1	30	33
Bottled water	0.09	1255	113
Other sources including wells and streams	0.72	80	56

The average consumption of water correlates with water service type. On a monthly basis, for all domestic uses, and during all seasons, Palestinian households consume around 20 cubic meters from improved water supplies and about two cubic meters from unimproved water sources.

If a family uses up to 22 cubic meters of water from the different services mentioned above, they pay an average total of 258 NIS (about 80 USD). This implies a significant financial burden, especially for low-income families with the poorest wealth level. It is even more challenging for families under the poorest wealth level, with a monthly income threshold estimated by the Palestinian Central Bureau of Statistics of 1,974 NIS (PCBS 2017) for a household of five individuals (two adults and three children). These results indicate that poor families are more likely to access and consume water less than the average consumptions of the Palestinian families.

The information above indicates that stressors influence each other, with the occurrence of one stressor is more likely to lead to a state of water stress. The use of unimproved water sources as the main source of drinking water is indicative of interrelated influence

and combined effect with the likelihood of using poor quality water received from unimproved sources, weak reliability of the public network, and high cost.

5.3.2. Chronicity

The literature review and context analysis provided evidence that Palestinian families experience lengthy and chronic water stress accompanied by chronically challenging geopolitical, social, and economic conditions. The chronicity of the exposure is of significant importance, given children’s need for regular and constant care and support for optimal development. Table 5.4 supports the evidence drawn from the literature review and indicates that a significant portion of the Palestinian community experiences continuous exposure, including children who experience exposure during periods of growth and development, and especially the poor and vulnerable. The table compares the water-related variables in the MICS 4 survey in 2010 and MICS 5 in 2014, indicating that for about five years, around half of Palestinian children were living in households with unimproved sources as the primary source of drinking water.

Table 5.4: Access to Improved Networks (Comparison of data from 2010 and 2014)

Indicator	2010	2014
Percentage of households connected to a public network	81.5	96
Percentage of households with improved public network as the main source of drinking water	50.1	55.1

The above table indicates a slight improvement in the access of households to improved water networks. However, the percentage increase in the coverage of the improved water

networks (from 81.5% to 96%) does not match the percentage increase of the households who use improved water networks as the primary source of drinking water (50.1% to 55.1%). This difference shows an imbalance between physical infrastructural improvements, and improvements sensed by families in their homes who desire more access to good quality, adequate quantity, and affordable cost.

A word of caution in this respect is that children included MICS 4 were not the same children involved in MICS 5, and therefore, the above analysis does not necessarily indicate that each child experienced a steady and continuous exposure. This analysis does indicate exposure to water stress at the aggregate demographic level. The country's level of exposure is constant and did not significantly improve.

5.4 Interactions with Determinants of Early Childhood Development

This section utilizes secondary quantitative data to examine the association between water stress and the detriments to early childhood development to obtain a child-oriented perspective. The detriments are a combination of risk and protective factors that interact simultaneously with elements of water stress. The selection of the variables followed the bio ecological development model concept, as well as the macro- and micro-context, proximal processes, and personal characteristics.

5.4.1 Interactions with the Macro Geopolitical Conditions

Geopolitical conditions account for geographical and political features that shape the Palestinian community and household macro contextual conditions. The areas include rural, urban, and refugee areas, which imply different elements, including population, location, and administrative status. These factors are used by policymakers, scholars, and service providers for public planning, decisions, and strategies. Refugee camps are a politically-oriented category. They are densely populated areas with residents officially registered by the United Nations as refugees. Rural areas are less dense but are located inside or nearby politically sensitive areas, including the borders with Israel, and Israeli settlements established on the outskirts of Palestinian cities and in the vicinity of rural communities. The proximity to disputed areas indicates the likelihood of tense confrontations and restrictions on movement.

The analysis includes the two main regions of Palestine: The West Bank and Gaza Strip. The West Bank is separated from the Gaza Strip; where people live under severe humanitarian conditions and experience tense political situations, strictly controlled movement of goods and services in and out of Gaza, and tense military confrontations between Palestinians and Israelis. Table 5.5 shows the variation among the types of areas regarding average expenditure on water from public networks, perception towards water quality, average consumption for all uses, and reliability.

Table 5.5: Differential Comparison among Community Type

Community Type	Average Cost for water from improved network	Percentage of households that expressed good perception of Quality	Average monthly consumption in m3	Percentage of households with access to improved network with continuous supply
	Mean cost in NIS	Quality	Quantity	Reliability
Rural	55	46.8%	22.9	23.4%
Urban	65	73.1%	19.5	48.2%
Camp	48	23%	21.5	19.1%

Average water expenditure is higher in urban settings and lower in refugee camps. These camps are featured with crowding, deteriorated, and stagnated socio-economic conditions. An apparent variation in water quality is evident, with better quality in urban settings and the poorest quality in the refugee camps. Average consumption is higher in rural communities that consume more water for domestic agricultural production activities and have less population pressure. The service reliability indicated by the percentage of households with water on a continuous basis is lowest in the camps. The above table indicates that water stress is sensed more in refugee camps with deteriorated socio-economic and political conditions, and displaced residents living within densely populated areas with limited employment and limited wealth levels.

Comparing water stress among the two main regions, only 5.8% of Gazans provided a positive perception of the quality of water received from public water networks, while 94.2% provided either partially (52%) or completely (42%) negative feedback.

Meanwhile, 89.2% of Gazans indicated that they use unimproved water sources as the primary source for drinking. The difference indicates severe water stress in the Gaza Strip, whereby families do not trust the public water network for its quality and reliability.

5.4.2 Interactions with Family Wealth

Table 5.6 shows that improvements are less likely to favour households of limited wealth levels. Households of the poorest level are connected to a public network, but their primary source of drinking water is an unimproved source. Only 1% of the households who use improved water source as main source of drinking are impoverished families, indicating weak access by the most vulnerable and marginalized poor communities.

Table 5.6: Access to Improved Networks and Wealth Level (Comparison of data from 2010 and 2014)

Indicator	2010	2014
Percentage of households of the poorest wealth level, out of total percentage of households with a public network as the main source of drinking water	13.6	1
Percentage of households from the second poorest wealth level, out of total percentage of households with a public network as the main source of drinking water	17.7	8.7

Comparing these results with data from 2010 shows that the improvement in access was concentrated in areas with better wealth and kept poor people more reliant on unimproved sources.

The households with the poorest wealth level, mainly in the Gaza Strip, primarily use unimproved water sources. Table 5.7 indicates that 50.5% of the households who use unimproved water sources for drinking are from the most impoverished families. The use of unimproved water supplies declined with increased wealth levels.

Table 5.7: Wealth Levels and Main Source of Drinking Water

Main source of drinking water	Wealth Index Quintile					
	Poorest	Second	Middle	Fourth	Richest	Total
Not improved	50.5%	34.3 %	9.2%	3.1%	2.9%	100%
Improved	1%	8.7%	29.4%	33%	27.9%	100%

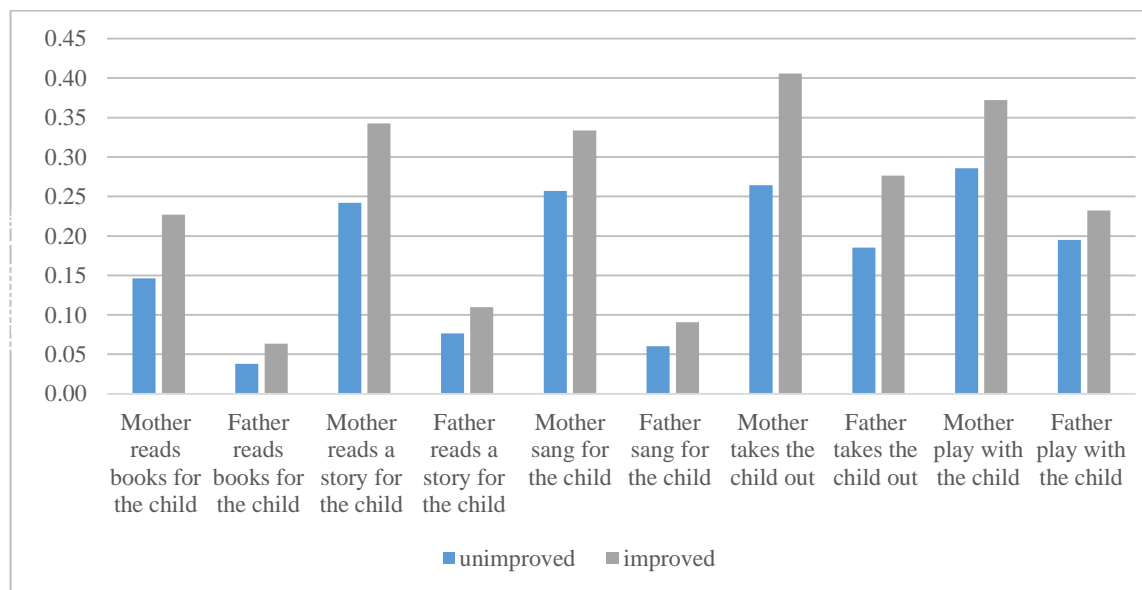
The results shown in Table 5.7 support the findings outlined in Table 5.5, which showed that the most impoverished families experience the most continued exposure and benefit the least from service improvements.

The findings indicate different contexts as unimproved water supplies with high costs are more likely to be used by low-income families with limited capacity to pay. The limited access of the poorest families may be attributed to inadequate infrastructure, challenging geography, and remote access. However, these findings highlight the need to examine the relationships between water stress and wealth status from a different angle.

5.4.3 Water Stress and Parenting Practices

The MCIS survey included questions on selected positive parenting practices related to children development enhancing social interactions, stimulation, motor and cognitive development. Practices such as playing, singing, and reading books and stories with the child are highlighted by the literature as necessary for optimal early childhood development. The data indicate that positive parental practices are mostly provided by mothers. Fathers still perform these practices, but with more frequency in certain physical activities such as taking their children out, and playing with their children. Out of five practices, children benefit from an average of 2.87 practices offered by mothers comparing to only 1.32 practices offered by fathers. Figure 5.1 presents a visualized comparison between children from households with improved water sources and unimproved water sources with respect to the average number of parental practices. The visual represented by Figure 5.1 shows that children from households with unimproved water sources as main source of drinking are less likely to enjoy these practices.

Figure 5.1: Comparison between Children Provided with Parental Support Practices with Respect to Type of Water Service



A word of caution in the analysis is that this demonstration is descriptive and the relationship could be liable to many other variables that influence this relationship, including the wealth level and mother’s education.

To examine the association between the use of unimproved water sources as main source of drinking and parenting support, the author developed a new variable for parenting practices that considers the difference between mothers and fathers with respect to the frequency of parenting practices.

Using the average number of practices offered by all mothers and fathers as weights, the average parenting practices for each child, was represented as the weighted mean of the parenting practice offered by mothers and fathers. The data with higher weight for mothers reflected more contribution to the mean than the data elements of fathers of low weight.

A linear regression was performed between the use of unimproved water supply and the weighted average of parenting practices. The regression analysis indicated significant association with adverse relationship between the use of unimproved water supply as main source of drinking and the weighted mean of positive parenting practices. The significance remained after adjusting for age and sex of the child, and mother education.

To measure the strength of the relationship, R square test²³ was used. The analysis yielded a low R square of about 2%, showing that only small part of the value of the dependant variable (parent support) is predicted by the independent variable, indicating the presence of other environmental, social, and economic variables that would contribute to this relationship.

The linear regression model also showed positive relationship between wealth levels and positive parenting care indicating that children from families of higher wealth levels are more likely to benefit from positive parenting practices.

The results do not necessarily indicate water stress induces less care or love for their children. It suggests that they are less likely to provide child development practices with their children. Less developmental practices could be attributed to water-related activities, such as boiling and collecting water. However, the previous section indicated that mothers, the primary caregivers, are less likely to be burdened by water collection. Thus, fewer practices may be attributed to other related factors, including parents' social and emotional status, being stressed by the adverse social and economic consequences of water stress. It may be also attributed to fewer capabilities of the families of limited

²³R-squared is a statistical indicator that measures how close data are to the fitted regression line between the values of the independent and dependant variable. It shows the value of the outcome variable being predicted

wealth who are more probably influenced by water stress. The relationship between water stress, wealth level, parental support and early childhood development is examined in more detail in Chapter 7.

A word of caution is that data related to parenting care may be subject to certain reporting bias, as parents may find it difficult to recall all practices, noting that the interviews were performed with one parent only. Another source of bias might have happened due to possible over emphasis, by parents, on showing positive practices so that they are not perceived less caring for their children.

5.4.4 Water Stress, Age, and Gender

Table 5.8 presents a comparative analysis between two age intervals: 36-47 months and 48-59 months. The findings indicate realist difference between the percentage of older children on track in their development being higher than younger children, regardless of water stress. Interestingly, the same table indicates that the difference between older and younger children who access unimproved water sources is 4%, while the difference between older and younger children who access improved water sources is 9%. This difference indicates that water stress is more likely to influence the normal age specific growth and development process.

Table 5.8: Cross Tabulation between Type of Water Source and Child Development with Respect to Age and Gender of the Child

Water Source	Child Development	Percentage of children on track by age in months			Percentage of children on track by gender		
		36-47	48-59	Difference	Male	Female	Difference
Unimproved	Developed	48%	52%	4%	48%	52%	4%
Improved	Developed	45%	54%	9%	49%	51%	3%

The age-related difference indicates more exposure to situations and experiences that undermine the curve of children's development. The same trend was identified between females and males. Generally, girls are better than boys in developing their social and language skills (Bourke et al. 2011). The above tables showed that girls from both water stress categories, improved and unimproved sources, are more developed than boys. However, the difference between females and males on track, with respect to access to water sources is only 1%. This difference indicates that water stress is less likely to influence gender-based difference during their normal growth and development process.

5.4.5 Gender and Water Collection

Table 5.9 shows that 90% of water collecting persons are aged 15 years and above, compared to 10% of water collecting persons under the age of 15. Unlike much of the international literature, which suggested that mainly females perform water collection, in Palestine, adult males (92%) are more likely to collect water than adult females (8%). Regarding age, the percentage of female children collecting water to the total percentage of children collecting water is (27%), much higher than the rate of adult females to the total percentage of water collecting adults (10%). This difference indicates a social trend related to adult females having less movement and access to water sources outside their homes. The relationship between water collection, gender, and wealth level are indicated by the increased percentage of women and female children collecting water among the poorest categories.

Table 5.9: Water Collection: Gender and Age Differences in Each Wealth Level

Age and Gender		Wealth Level					General	
		Poorest	Second	Middle	Fourth	Richest	Sub Total	Total
Adult	Female (age 15+ years)	10%	6%	5%	0%	0%	8%	90%
	Male (age 15+ years)	90%	94%	95%	100%	100%	92%	
Children	Female (under 15)	29%	19%	25%	0%	0%	27%	10%
	Male (under 15)	71%	81%	75%	0%	0%	73%	

Using the Pearson correlation test, the wealth level is significantly associated with more females assuming this task from the poorest category. Differentiated factors related to other water-related practices, and related social burden are not addressed by the quantitative data, but addressed by the qualitative data related to life experiences.

5.4.6 Water Stress and Child Health

As indicated by the literature review, most of the international research examined the impacts of water stress on children's health and survival, mainly diarrhoea, stunting, and anaemia. These outcomes are also determinants of delayed early childhood development, as children with frequent diarrhoea are less likely to achieve optimal physical growth and development. Stunting indicates the cumulative effects of undernutrition and infections, including water-related diseases such as diarrhoea.

On the other hand, Anaemia is attributed to iron-deficiency due to the nutritional quality of foods and practices, as well as water-related intestinal parasites, such as hookworm

and schistosomiasis (Sumbele et al. 2015). It is a long-term child outcome interrelated with socio economic conditions with long-term health impacts with social consequences.

Referring to Table 5.10, the data shows that the prevalence of diarrhoea,²⁴ stunting,²⁵ and anaemia²⁶ is higher among children from households with unimproved water sources.

Table 5.10: Water Stress and Child Health Outcomes

	Percentage Prevalence	Unimproved Water Supply	Improved Water Supply
Anaemia	10%	12.6%	7.3 %
Stunting	6%	6.4 %	5.3 %
Diarrhoea	7.2%	8.4%	6.7 %

Table 5.10 indicates that children living in households with unimproved water supply as main source of drinking are more likely to suffer from Anaemia, Diarrhoea and Stunting. Using regression analysis, diarrhoea, stunting and anaemia were found to be significantly associated with the use of unimproved water supply as main source of drinking. Table 5.11 presents significant association between the three health outcomes and the use unimproved water sources as main source of drinking. As indicated in the previous sections, the use of unimproved water sources as main source of drinking indicates more likelihood of using alternative water sources with less quantity and poor quality. The data

²⁴ Diarrhoea: 14-day recall of children had diarrhoea with more than three diarrhoea episodes/day

²⁵ Stunting: Reflects the cumulative effects of undernutrition and infections since and even before birth. This measure can therefore be interpreted as an indication of poor environmental conditions or long-term restriction of a child's growth potential. Stunting indicates the measure of height for age <-2 SD of the WHO Child Growth Standards median. (WHO 2010. Nutrition Landscape Information System)

²⁶ Anaemia: Inadequate oxygen carrying capacity of blood cells caused mainly by iron deficiency resulting from illness, infection, inflammation and malnutrition; mainly related to eating and feeding practices.

shows that there is 64%, 59%, and 57% probabilities that children with anaemia, stunting and diarrhoea respectively, are from households using unimproved water sources. All findings in Table 5.11 were controlled for age, sex and mother education as possible confounders.

Table 5.11: Association Between the Use of Unimproved Water Sources and Health Outcomes

	Sig	Coef	S. error	Odd	Probability	R-Square
Anaemia	.01	.585	.182	1.795	64%	.008
Stunting	.01	.393	.149	1.482	59%	.002
Diarrhoea	.022	.309	.135	1.362	57%	.006

While the association was identified, the strength of the relationship, as indicated by R-Square results, shows that water stress predicts only a small part of the occurrence of anaemia, stunting, and diarrhoea. R-Squared results indicate, realistically, that other factors not related to water stressors contribute to the prediction of these outcomes, including feeding practices, socioeconomic conditions, type of food intakes, physical characteristics, and other social and cultural.

5.5 Exposure and Delayed ECD

Table 5.12 shows that children living in households with unimproved water supply are more likely not be on track in their development. The data shows consistent trend among all of the domains of early childhood development.

Table 5.12 Breakdown of children developmentally on track and water supply

Developmental	Unimproved water supply	Improved water supply
Literacy	32.50%	67.50%
Social-Emotional	46.50%	53.50%
Physical	47.50%	52.50%
Learning	46.60%	53.40%

To further test the association between children being not on track in their development and water stress represented by the use of unimproved water supply as main source of drinking, a logistic regressions was performed between the dichotomous forms of the variables and indicated in Table 5.13

Table 5.13: Test for Association between Unimproved Water Supply and ECD, using Dichotomous Variables

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
WS1(1)	.368	.078	22.046	1	.000	1.445	1.239	1.685
Constant	-1.134	.055	428.370	1	.000	.322		

The result shows that the Sig values is less than 0.05, and an odd ratio the same as calculated using the chi-square (1,445). The odd ratio of 1,445 means that there is 59%

probability²⁷ that children from households using unimproved water sources as the main source of drinking water are more likely to be delayed in their development.

To avoid misleading conclusions, the R-squared score was calculated using SPSS software to estimate the strength of the relationship between the model and the response variable. The value of R-square is 0.7-1%, which indicates that the predictor variable, water stress, can predict only 0.7-1% of the dependent values, reflecting weak relationship, even if the association is significant.

When more variables are added, R-squared values typically increase, indicating other variables' roles in the relationship. This argument was supported by the inclusion of the wealth level in the model, which reduced the associations' significance, indicating that the wealth index influences the relationship. Based on this result, the author hypothesized that the direct influence of water stress on children's development is minimal, while the more considerable influence occurs through interactions with other variables through indirect social and economic effects.

The author also argued that the dichotomous classification of the dependant variable might provide a simplified association. To perform a more stringent measurement, the author developed a scale variable of early childhood development based on the number of developmental assessment tests that children passed during the MICS survey. The scale variable is based on the number of positive scores that children achieved for each of the ten items included in the early childhood development index. The scale variable provides an assessment of the status based on the cumulative results rather than a “yes/no” conclusion. It is based on a score from 0-10 according to childhood development

²⁷ The odd ratio was converted to probability using the equation $\text{probability} = \frac{\text{odd ratio}}{1 + \text{odd ratio}}$.

benchmarks. Noting that older children and females are more likely to be developed than younger children, the analysis was adjusted for age and sex. The output of the linear regression indicated in Table 5.14 yielded an insignificant association as the sig value is more than the significance thresholds (0.05).

Table 5.14. Coefficients Table of the Relationship between Unimproved Water Source as Main Source of Drinking and Scale Variable of ECD

Model	Unstandardized Coefficients		Standardized Coefficients	t	P value Sig
	B	Std. Error	Beta		
(Constant)	5.511	.039		140.588	.000
Unimproved Water Source	.011	.059	.003	.182	.855

a. Dependent Variable: Total number of positive ECD tests

This analysis suggests no association between water stress, represented by the use of unimproved water sources, and early childhood development, represented by the level of positive development benchmarks. These findings also suggest that the hypothesis that water stress is not associated with delayed ECD cannot be rejected. The literature review and context analysis indicate that such a conclusion is realistic, noting that ECD includes multiple macro- and micro-spheres that interact with water stress and related factors that prevent its influence (protective factors) or mediate its influence (risks factors). A word of caution explained in the data limitation is that Child Development Index is an initial assessment of the child's developmental status. More comprehensive and detailed assessments are available, which require much more time, observations, and tools used with the children to provide better estimates judgment of his or her developmental status. The score utilized by MICS 5 and used in this research is an indicative tool.

5.6 An In-depth View: In depth Views of Water Stress Features

5.6.1 Executive Summary

This report is based on the findings from four focus group discussions held in four districts in the West Bank and Gaza Strip, specifically reporting on the first question raised in the discussions. Humanistic and real-life views, life stories, and experiences were used to supplement the quantitative analysis findings addressing the characteristics and features of exposure to water stress. The analysis relates to the method section No 4.5.1.5.

Negative perceptions were overwhelming. Exposure to water stressors is constant and ongoing, characterized by water supply discontinuity, poor quality, inadequate clean water, and high costs. All focus groups shared the same main elements of stress, though with different intensity. However, the uniqueness of the local context influenced the discussion of each focus group. The participants reflected on the chronicity of water stress, including time and duration. They did not count days, but rather emphasized when their physical and social capacities were exhausted. Participants also reflected on water stress as a contributor to other disparities and stresses related to instability, as well as geopolitical and microeconomic conditions. Participants believe water stress may influence their children, but interestingly, they find that children will not be negatively influenced until parents and caregivers are physically, economically, and socially helpless and exhausted.

5.6.2 Key Findings

The following findings summarize the feedback, quotes, and discussions expressed by participants of the four focus groups concerning the first research question. The discussions, coding, and analysis were guided and organized by three objectives:

- General perception towards exposure to water stress, including water failures and deficiencies
- Relationship between exposure and family features, capacities, dynamics, and relationships
- Adverse life consequences and challenges that influence children

This discussion's guiding principle was that water stress is a reality interacting with the essential aspects that matter to children and their families.

5.6.2.1 Water Stress as Viewed by Parents

“Water is precious. We strive to access and keep it, but at the expense of my dignity.”

Female participant from Gaza.

The above quote from a 26-year-old married female from Gaza presents a general perception regarding water as an essential life commodity. She did not indicate concerns related to access, volume, time of collection, or consumption. Rather, she reflected on water stress with humanistic and social perspectives related to dignity, self-esteem, and respect.

The majority of the participants reflected on water stress as a constant challenge characterized by unrest, frustration, and deprivation, combined with risks and consequences to their livelihood and wellbeing. The following are quotes and segments of the discussions related to the general description of water stress exposure:

- Water stress is part of the complex conditions under which we live.
- It is all about politics.
- Water stress, especially the discontinuity of services, is used by politicians as punishment.

- Water is vital not only for drinking and washing, but also for our wellbeing and sense of security.
- We have tap water, but it's undrinkable.
- We always feel short of water for all uses.
- We feel short of water for drinking and food preparations.
- The cost of water tankers is high and becomes extremely high during the summer.

The participants echoed negative perceptions of water stressors. They shared experiences related to high cost, poor quality, unreliable services, and inadequate quantity. The qualitative description of the stressors added a humanistic touch to the physical features. With each stressor, participants reflected on how impactful and stressful it is on their lives and livelihood.

A female participant from the Jordan Valley said:

We buy tanker water but I am not happy about its quality. It looks strange with a greenish colour. I know if my kids drink it, they will be sick. I boil small amount for drinking, but I feel hesitant to take a bath using dirty water, and I cannot boil it all to have a bath or wash.

Reflecting on cost, a female (28 years old) from Gaza said:

We receive water through the network connected to our house, but it is very bad quality and is salty. So, we purchase bottled water for drinking and cooking and we even pay extra money in winter, and it never improves.

Regarding reliability, a 38-year-old man from Gaza said:

When the public electricity is cut, water pumps stop working, and consequently we face a combined problem of less water and difficult sewage disposal. Even if we have tap water, it is not drinkable, so we buy bottled water for drinking and cooking. When we have a disconnection, we purchase water from water tankers for other uses at a higher price, and less quantity to live with.

Reflecting on adequacy, a female, 23 years old, from the North Gaza Strip said:

I always feel short of clean water, uncertain, and insecure. During conflict conditions, the thing we worry about most is water. I think water cuts are the most severe punishment. We were displaced and lived with our relatives in more safe places and felt the burden we put on them many times.

All participants of all focus group discussions shared common negative perceptions. However, they always combined their description of water stress with examples and stories explaining the challenges they face, combined with their feelings and emotions.

A general observation from all focus groups was the influence of the local context's social, cultural, and political uniqueness on the discussions. Gaza's focus group discussions related the water stress with the macro geopolitical conditions being an essential part of the conflict. The focus group discussion in the Jordan Valley addressed water stress as part of their livelihood and economic sustainability as a Bedouin community and needing water for their sheep and goats, as well as water for their household. The Nablus group's water stress was perceived as a failure in the public system and influenced their self-esteem and well-being.

5.6.2.2 Interrelationships

The participants shared concerns regarding the situations with combined and interrelated influence. The most severe situations were expressed with joint stress:

- Because of bad quality water we buy bottled water.
- Water disconnection forces us to purchase vehicular tanker water.
- During high demand, water tankers are very expensive.
- Bad quality water is good business for vendors selling bottled and tanker water.
- Attacks on Gaza followed by disconnection of water and electricity is the real disparity.

The content above indicates interrelationships among the water stress dimensions. Poor quality is interrelated with weak reliability; high cost is interrelated with weak reliability by purchasing from alternative sources; and inadequate quantity may increase the demand and prices. The qualitative method also provided a different perspective related to the economic burden. Conventionally, water is perceived as a commodity with costs that burden families.

Participants merged their stories with fears, uncertainty, and senses of insecurity, unhappiness, and inconvenience. The stories reflected water as a source of income related to productive activities indicating that interrelated exposure may stress families beyond cleanliness and hygiene to their general quality of life and wellbeing. Participants indicated that they do not wash, or feel hesitant to wash or bathe using water they perceive to be of bad quality. The reliability of water supply represented by continuity of service is influenced by the electricity supply, which is affected by political uncertainty and geopolitical conditions.

5.6.2.3 Chronicity

The quantitative method examined chronicity at the general demographic level based on two surveys conducted four to five years apart from each other. All participants agreed that water stress posed a constant challenge. Participants indicated that water stress is a continuous and unpleasant dynamic process. They reflected on how the chronicity of water stress leads to exhaustion of assets and resources, as well as feelings of helplessness and frustration:

- Water stress is a constant problem.
- There is a continuous state of “ups and downs” in service provision.
- Water stress is due to chronic weak public management and internal disputes.
- The chronicity of water stress is associated with the chronicity of the conflict.
- Chronicity leads to exhaustion of resources and assets.

The intensity of the dimensions varies according to natural factors combined with macro geopolitical conditions and micro-factors, especially family economic capabilities.

“It never ends. Discontinuity continues. It is fluctuating and uncertain. We adapt by storing and saving water, but it never ends.” Female participant from North Gaza.

Many quotes attributed continuity of water services to the continuity of the current situation, especially with respect to macro instability and underactivity.

“We are living a bad general situation socially, economically, and politically. Water is part of this construct.” Male participant from Gaza.

5.6.2.4 Interactions between Exposure and the Determinants of Early Childhood

Development

A 40-year-old male from North Gaza said:

It is all about the politics. Gaza is undergoing a closure and restrictions on movement for more than 10 years. We consumed everything and now we have no more water.

The following includes aspects collected from the participants, and indicate relationships between water stress and the main determinants of early children development:

- Adequate financial resources can enable purchasing more water to fulfil family and children needs, especially drinking, cooking, and washing.
- More water means improved hygiene and healthy space for children to play and interact.
- More clean water is linked with better food and nutrition.
- More water is connected with less disruption in family relationships and dynamics.
- Water stress is a source of frustration and distress among the family.
- Parents perceive water stress with more risks for young and sick children.
- Parents reflected on strong passion and love towards their children with sense of over protection during stress.
- Parents focus on the essential needs of their children, respond when they observe health problems, but less likely to read books, play and sing with children during water stress.
- The public services provided to children especially pre-primary schools and public health clinics are not adequately considering children's home context.

The participants discussed how water stress interacts (influence and being influenced) with macro- and micro-context of children. Most of the concerns highlighted by households included lacking enough water, facing unemployment, and having limited and expensive alternative sources, all of which established serious challenges. This concern emphasizes not only the holistic construct of water stressors, but the holistic construct of a family's wellbeing and livelihood of which water stress is a major part. The data shows that the macro-factors establish realities beyond the control of households. It also shows other risk factors that influence their ability to control, predict, and adapt.

While the macro-factors are out of their control, micro contextual factors can increase or decrease the intensity of water stress. The discussion merged the description of water stress with challenges related to children's living conditions related to capabilities of the families to predict, control, and adapt water stress and prevent its consequences on their children.

5.7 Conclusion

This chapter presented the characteristics and features of exposure to water stress that families and children in Palestine experience. The analysis described trends related to affordability, reliability, adequacy, and quality. It also presented common features of chronicity, interrelated, and combined influence. This chapter explored the association between exposure and determinants of ECD, including macro and micro contextual factors. Finally, this chapter explored the association with delayed ECD being to the main variables addressed by the study. The quantitative and qualitative analyses examined exposure as a dynamic and interrelated construct of stressors, mainly described as high and unaffordable cost, inadequate quantity for domestic use, poor quality, and weak or unreliable services. The main findings can be summarized as follows.

5.7.1 Quantitative Analysis

The main findings can be summarized as follows:

- The physical elements of unreliable water supplies including high cost, inadequate quantity, and unaffordable cost are associated.
- Palestinian households enjoy high coverage through a public water network, but the majority do not receive water on a continuous and steady basis.
- Water quality is perceived as a dominant stress, but with variations between the Gaza Strip and West Bank.
- Total average consumption is at an acceptable level. However, the level of consumption is moderated by wealth, with poor families more likely to access less water.
- The cost of alternative and supplementary sources is high and may create a significant burden for poor families.

- Water stress is a chronic as sensed at the macro-level.
- Water stress, represented by the use of unimproved water supply, is associated family wealth with less access by poorest families.
- Water stress and early childhood development are influenced by age and sex.
- The use of unimproved water supply as main source of drinking was found significantly associated with the occurrence of diarrhoea, stunting, and Anaemia.
- Water stress is associated with less positive parenting practices related to stimulation and interactions with children.
- Water stress interacts with the main determinants of early childhood development, however, it is the data suggest no significant association of water stress with children not being on track in their development.

The analysis indicated that water stress is a combined, holistic, and complex construct that interacts with other stresses. The use of unimproved water supply as the main drinking source was established as a suitable physical indicator that reflects the holistic perspective of water stress. Households use unimproved water sources as an alternative to unreliable sources of poor quality and inadequate quantity. It is also an indicator of the high cost, compared to the water accessed by public water networks.

This chapter showed that water stress does not influence children and their families through isolated intermediate macro and micro contextual factors. The exposure's individual and shared characteristics indicate that the failures are combined, interrelated, and chronic, leading to a disruption of the surrounding environment and causing direct influence, mainly represented by health outcomes.

The quantitative analysis failed to establish strong association water stress represented by the use of unimproved water supply as main source of drinking, and delayed early

childhood development. While this finding failed to prove the present research's central hypothesis, results indicated that water stress primarily influences children by influencing positive penetrating the shields and spheres set to protect and develop children.

5.7.2 Qualitative Analysis

The discussions supported the findings of the quantitative analysis with in-depth perspectives. The main findings generated through the discussions are presented below:

- Water stress is part of larger construct of complex factors that influence the intensity of water stress.
- Water stresses vary by time and context, while the feeling of stress and insecurity is a common chronic feature.
- A sense of helplessness, distress and frustration is a predominant perception collected from the participants.
- The scope and intensity of water stress is influenced by the uniqueness of the local context and related political, social, and cultural differences.
- The duration of stress as perceived by households varies according to the severity of stress (based on the number and characteristics of stressors) and family's capabilities to control and mitigate the stressors.
- Most severe stress occurs when water stress is combined with disrupted family relationships and dynamics.
- Families believe that children may be influenced by water stress mainly when family members, especially parents, feel financially and emotionally exhausted, vulnerable, and helpless. These findings are compatible with the quantitative analysis but with a broader concept related to chronicity, intensity, and duration. Parents believe their children are less likely to be influenced by water stress until

they themselves become helpless and exhausted with weak capacities to buffer their children.

5.7.3 Integrative Remarks

Both the qualitative and quantitative analyses examined the exposure to water stress as a chronic, constant state of stress that may vary in intensity according to the families' local context and capacities. Water stress is more likely to influence children based on the intensity of exposure and the families' protective and supportive mechanisms. The influence of water stress on children may not occur directly, but mainly when the family is not buffering water stress.

Concluding from the above, and noting the limitations of the quantitative data being cross-sectional with weak inference power, and the un-generalizability of the qualitative data, the analysis presented in this chapter provides adequate evidence that the exposure to water stress establishes early life stress for children that contribute to risks undermining the optimal early development of children. The influence of the exposure deprives children, especially the undermined wealth, from a safe and healthy environment. It also influences children by disrupting the family economic and social environment, implying more burden on the parents, and increasing the likelihood of decreased parenting processes referred to as children's engines. This conclusion is an indicative finding that children from households with water stress may influence the growing and development process of children. While the findings indicate possible risks, being based on cross sectional data, this survey is weak in establishing inference between water stress and age-development progression, inviting further research using other methodologies with more stringent cause-effect methods such as longitudinal studies.

Chapter Six | Child Water Stress: The Combined Effect

6.1 Introduction

The previous chapter established evidence that exposure to water stress is composed of four main stressors: inadequate quantity, poor quality, unreliable services, and high cost. Exposure is chronic, combined, and interacts with factors related to the macro- and micro-contexts of children.

This chapter 's main purpose is to present the concept of Child Water Stress as a combined effect of the exposure to water stress and determinants of early childhood development including; the macro and micro contextual factors, personal characteristics, and family features interact with exposure and establish a combined influence on children. This concept follows a community approach as an overarching context of co-occurring and combined interactions. The analysis was guided by research question number two and followed the adapted model visualized in Figure 2.3 page 55.

How does growing up in communities with water stress predict children's risks for delayed early childhood development?

This chapter includes an analysis to measure child water stress in selected communities. It also examines communities' stress features related to water stress' controllability, predictability, and adaptability, and their relationship with children's vulnerability to risks for delayed early childhood development.

The findings are based on quantitative and qualitative analyses. The quantitative analysis was conducted on an ecological data set developed by the author for 52 communities in Palestine. The data set includes aggregated community-based demographic and population data addressing macro-factors including the geopolitical situation, and

community features integrated with data on families' wealth conditions and capabilities, child support, and children characteristics. As indicated by the method chapter,

6.2 General Overview: The Communities

Using multidisciplinary secondary data from national demographic, environmental, and health surveys, the author developed an aggregated ecological data set for 52 communities in Palestine. As listed in Table 6.1, the population for the selected communities is about 2.6 million, or 55% of the total population of the West Bank and Gaza Strip. All of these communities experience significant variations in water stress and interrelated geopolitical, socio-economic, and community features.

The communities were specifically selected to ensure a geographical balance between all governorates in Palestine (16 districts), balanced geographical location (North, South, East and West), different religions (Christian and Muslim), different weather conditions (hot climate of the Jordan Valley, mountainous regions, and coastal areas), geopolitical sensitivity (proximity to politically volatile and disputed areas), region (Gaza Strip and West Bank), population type (refugee, rural, and urban), and wealth levels.

Table 6.1: General Overview: Communities Included in the Index

No	Locality	Poulation	Type	Region
1	Attil	10,227	Rural	West Bank
2	Al Masqufa	294	Rural	West Bank
3	Tulkarm	58,050	Urban	West Bank
4	Beit Lid	5,651	Rural	West Bank
5	Jenin	46,139	Urban	West Bank
6	Jenin Camp	12,268	Refugee	West Bank
7	Qabatiya	22,709	Urban	West Bank
8	Jaba'	10,046	Rural	West Bank
9	Azmut	3,078	Rural	West Bank
10	Nablus	146,493	Urban	West Bank
11	Aqraba	9,500	Rural	West Bank
12	Qalqiliya	49,441	Urban	West Bank
13	Habla	7,126	Rural	West Bank
14	Marda	2,313	Rural	West Bank
15	Biddya	9,365	Rural	West Bank
16	Salfit	10,215	Urban	West Bank
17	Al Bireh	46,212	Urban	West Bank
18	Beituniya	23,904	Urban	West Bank
19	Jericho	22,006	Urban	West Bank
20	Ar Ram	22,969	Urban	West Bank
21	Jerusalem	200100	Urban	West Bank
22	Al 'Eizariya	19,863	Urban	West Bank
23	Abu Dis	12,164	Urban	West Bank
24	Sur Bahir	10000	Urban	West Bank
25	Beit Sahur	14,770	Urban	West Bank
26	Al Khadr	11,673	Urban	West Bank
27	Beit Fajjar	13,142	Urban	West Bank
28	Al 'Arrub Camp	9,841	Refugee	West Bank
29	Beit Ummar	16,789	Rural	West Bank
30	Tarqumiya	17,791	Rural	West Bank
31	Hebron	202,172	Urban	West Bank
32	Bani Na'im	24,888	Rural	West Bank
33	Dura	35,030	Rural	West Bank
34	Yatta	60,315	Rural	West Bank
35	Adh Dhahiriya	35,659	Rural	West Bank
36	As Samu'	24,349	Rural	West Bank
37	Tubas	20,129	Urban	West Bank
38	El Far'a Camp	7,117	Refugee	West Bank
39	Tammun	13,451	Rural	West Bank
40	Beit Hanun	49,107	Rural	Gaza Strip
41	Jabalya Camp	54,123	Refugee	Gaza Strip
42	Jabalya	158,754	Rural	Gaza Strip
43	Gaza	549,070	Urban	Gaza Strip
44	An Nuseirat Camp	34,950	Refugee	Gaza Strip
45	Al Bureij Camp	29,867	Refugee	Gaza Strip
46	Az Zawayda	21,074	Rural	Gaza Strip
47	Deir al Balah	67,727	Urban	Gaza Strip
48	Al Qarara	24,149	Rural	Gaza Strip
49	Khan Yunis	174,240	Urban	Gaza Strip
50	Bani Suheila	38,727	Rural	Gaza Strip
51	Abasan al Kabira	22,493	Rural	Gaza Strip
52	Rafah	152,950	Urban	Gaza Strip

As summarized in Table 6.2, the index included 13 communities from the Gaza Strip and 39 from the West Bank. Nine communities were included with populations less than 10,000 people, 32 with populations of 10,000-50,000 people, four communities with populations of 50,000-100,000 people, and seven with populations over 100,000 people. The population of each community was obtained from the Palestinian Central Bureau of Statistics (PCBS) based on 2017 projections. The communities varied in type: 25 communities were rural, 18 were urban areas (including all of the cities in Palestine), and 9 communities were refugee camps.

Table 6.2: Summary of Communities' Statistics

Characteristics	Category	Communities Included in the Index
Region	Gaza Strip	13
	West Bank	39
Type of community	Rural	25
	Urban	18
	Refugee Camps	9
Population	Less than 10,000	9
	10,000-50,000	32
	50,000-100,000	4
	100,000 and above	7

6.3 Water Stress Index (The Exposure)

The Water Stress Index includes seven variables reflecting the four main elements of water stress that influence household security: quality, quantity, reliability, and affordability. These seven variables are outlined below:

- 1- Percentage of families experiencing an interruption of water supply at least one day a week

- 2- Relative adequacy indicated by the difference between the average monthly consumption in each community and the optimal quantity recommended by WHO
- 3- Percentage of families that provided “bad” perceptions of water quality based on its taste, colour, and appearance
- 4- Average monthly family expenditure, water networks
- 5- Average monthly family expenditure, water tankers
- 6- Percentage of households using the public network as the primary source of drinking water
- 7- Percentage of families with improved wastewater network

The Water Stress Index focuses on quality, quantity, reliability, and affordability. Reliability was measured by the frequency that households experience water supply disconnections. Adequacy was estimated as a relative concept measured by the difference between average monthly consumption in each community and the optimal quantity recommended by WHO. In their report commissioned by WHO, Howard, Bartram, and Water, (2003) suggested that when the majority of households are connected to the public piped network, average consumption is more likely to be above 100 l/c/d and may be up to 300 l/c/d. Since Jerusalem had the highest consumption rate among the communities included in the index at 125 l/c/d, this value was used as a reference value as it is within the optimal consumption range.

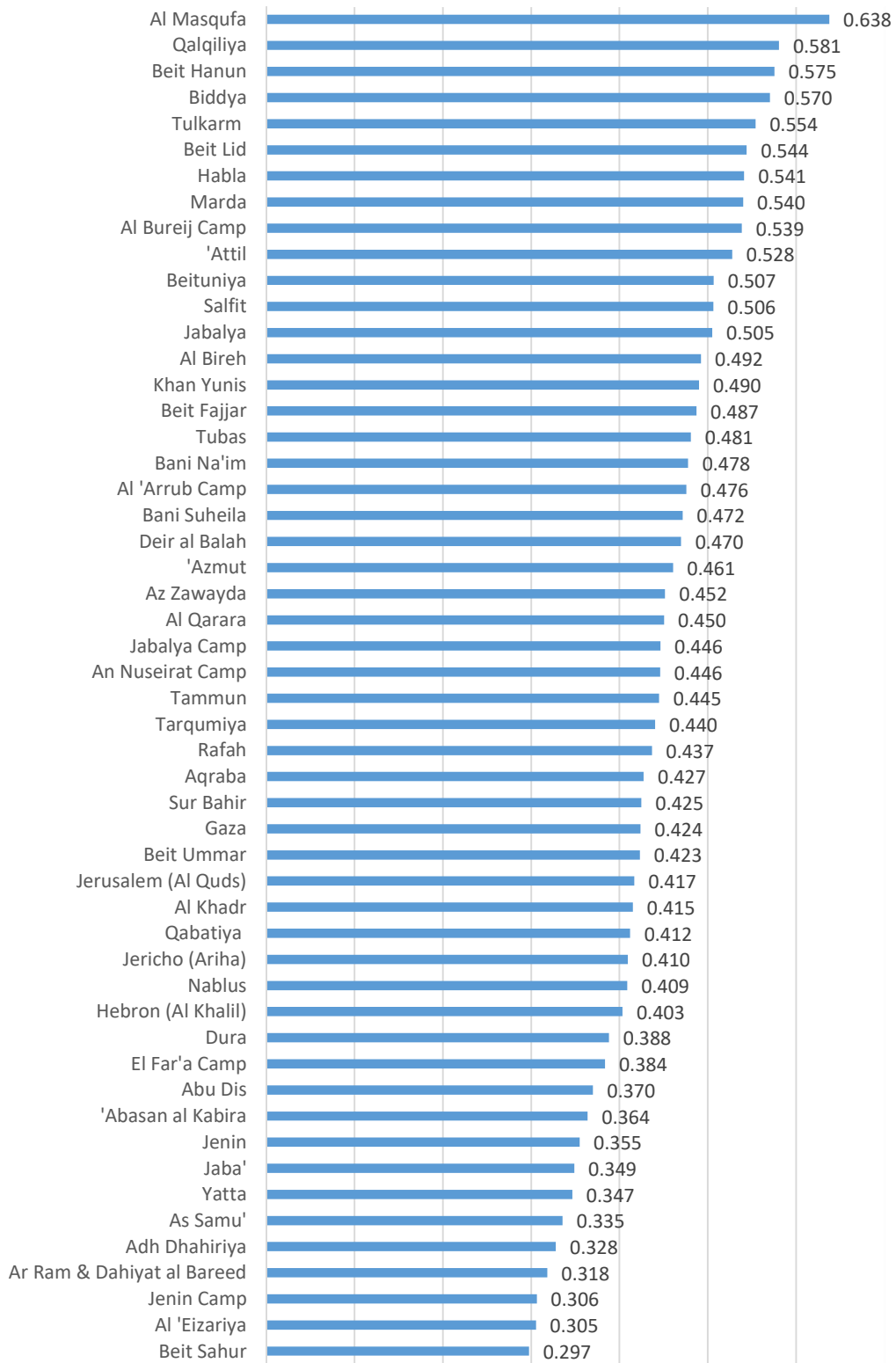
Poor quality was indicated by reported percentages of bad perceptions related to taste, colour, and smell. Affordability was indicated by two variables: average expenditure on water from networks, and expenditure on water purchased from tanker vendors. The use of unimproved water sources as the primary source of water for drinking reflected the combined features of poor quality, weak reliability, untrusted quality, and additional cost as households explore alternatives or other sources with higher prices.

The final variable is use of the improved network for wastewater disposal. This variable was included in the index as both wastewater and domestic water are linked. More water use and consumption results in more sewage. Unsafe disposal may harm the surrounding environment, pollute underground resources, and contribute to the hazardous surrounding environment with odour and risk of oral-faecal contamination.

Figure 6.1 presents the results of the standardized values of water stress variables among the 52 communities. The index shows clear variations among the communities, ranging from the least stressed (.297) scored by Beit Sahour, an urban community in the West Bank, and most stressed (0.638) scored by Al-Masqufa, a small rural community in the West Bank.

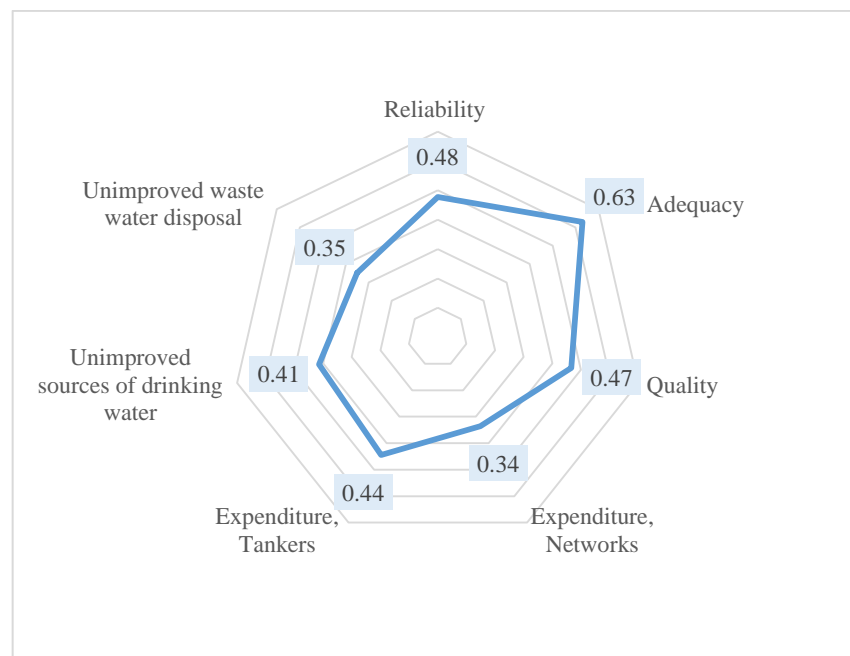
Referring to the community data, about 65% of the households in Al-Masqufa receive water through interrupted services. The households' average monthly consumption is about 44 litres per capita per day. About 70% of the families had bad perceptions of water quality, and pay around 25 USD a month in additional costs for water they purchase from alternative unimproved sources. The second most stressed community is Qalqilia, an urban community in the West Bank, where around 50% of households experience water discontinuity. On average, they use about 64 litres per capita per day. About 74% of the families indicated bad perceptions regarding water quality, and pay around 40 USD every month to purchase water from unimproved sources.

Figure 6.1: Standardized Scores of Water Stress Index in Selected Palestinian Communities



Of the ten communities with the highest water stress, only two are in the Gaza Strip (Al Bureij Camp and Beit Hanun). Although they reported high level of ‘bad perception towards water quality’, Gaza communities seem to receive water from the public network with higher frequency than the communities in the West Bank. Accordingly, households in Gaza pay less than communities in the West Bank, primarily because they rely less on alternative, high cost sources. Figure 6.2 visualizes a comparison among the water stress variables reported for all communities included in the index.

Figure 6.2: Comparisons; Standardized Scores of Water Stress Variables



Water adequacy is measured as the difference between the average consumption of each community and a value around the optimal consumption level recommended by WHO reached by only one community (Jerusalem and Beit Sahour, with consumption of 125 litres per capita per day). This confirms the findings of several examples from the literature which indicated that quantity and access to water in Palestine are inadequate.

The total average quantity of water consumed by families in the selected communities was about 71 litres per capita per day.

With around 43% of households experiencing water cuts at least once a week, water service reliability was the second most stressed variable. This stressor reflects failures and shortfalls in the system and indicates the combined burden of inadequate quantity and high cost of purchasing water from alternative sources.

The third most stressed variable was water quality. Data showed that about 50% of households provided a “bad” perception of water quality, particularly among communities in the Gaza Strip (around 95%). The high frequency of water service interruptions and cuts combined with bad perceptions towards quality are interrelated. The discontinuity of the water supply encourages households to look for alternative water sources, which could be of poor quality. Simultaneously, communities in the Gaza Strip receive water on a more regular basis, with 98% of households reporting poor quality for drinking.

6.4 Child Water Stress Index

As early childhood development is the focus of this thesis, the present research expanded the dimensions water stress to include variables related to detriments to ECD that correspond to the bio-ecological development model: context, proximal processes, and personal characteristics. The primary purpose of this section is to present a workable definition of child water stress as a combined influence of the exposure and intermediate factors related to the detriments to early childhood. This index is practically a combination of water stress index estimated above, and the child wellbeing factors related to determinants of optimal childhood development.

6.4.1 Child Wellbeing; the Intermediate Factors

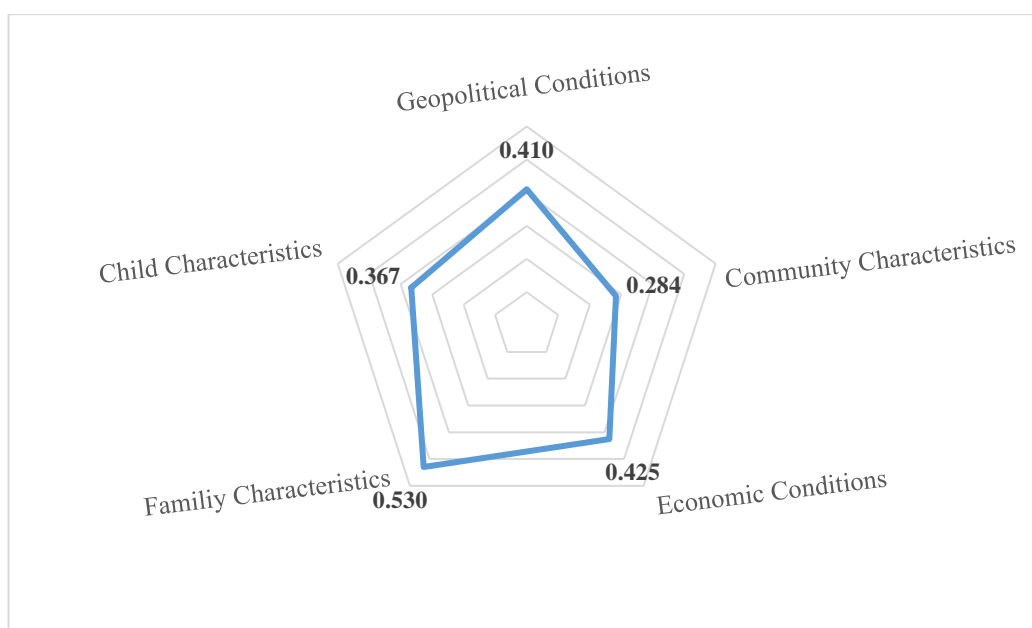
Referring to table 4.6 in the method child' wellbeing is reflected by data set of 23 intermediate factors namely the geopolitical conditions, community features, economic conditions, family characteristics, and child characteristics.

By looking at the status of the child considering these factors, Figure 6.3, the micro contextual factors, especially family characteristics and economic conditions, were scored as the most stressed major components.

The scores of both components indicate undermined capacities to access adequate resources, including food and water, as well as the inability to control and predict risks and stresses, including water stress,

As expected, all the communities in Gaza scored the highest level of economic stress. This confirms several international reports on the deteriorated economic conditions in the Gaza Strip. For instance, the community of Bani Suhaila has an unemployment rate of 52%, 54% of the population is under the poor wealth level, and 72% of females are unemployed. Khanyounes in Gaza has 40% unemployment, 49% of the population is under the poor wealth level, and 68.5% of females are unemployed.

Figure 6.3: Standardized Scores of Intermediate Variables of Child Wellbeing



Geopolitical conditions are the third most stressed component, demonstrating how the unique macro political conditions and related facts on the ground influence the course of life for Palestinian families and children.

Out of the 52 communities included in the index, 26 are near checkpoints established by the Israeli army that restrict their movement.

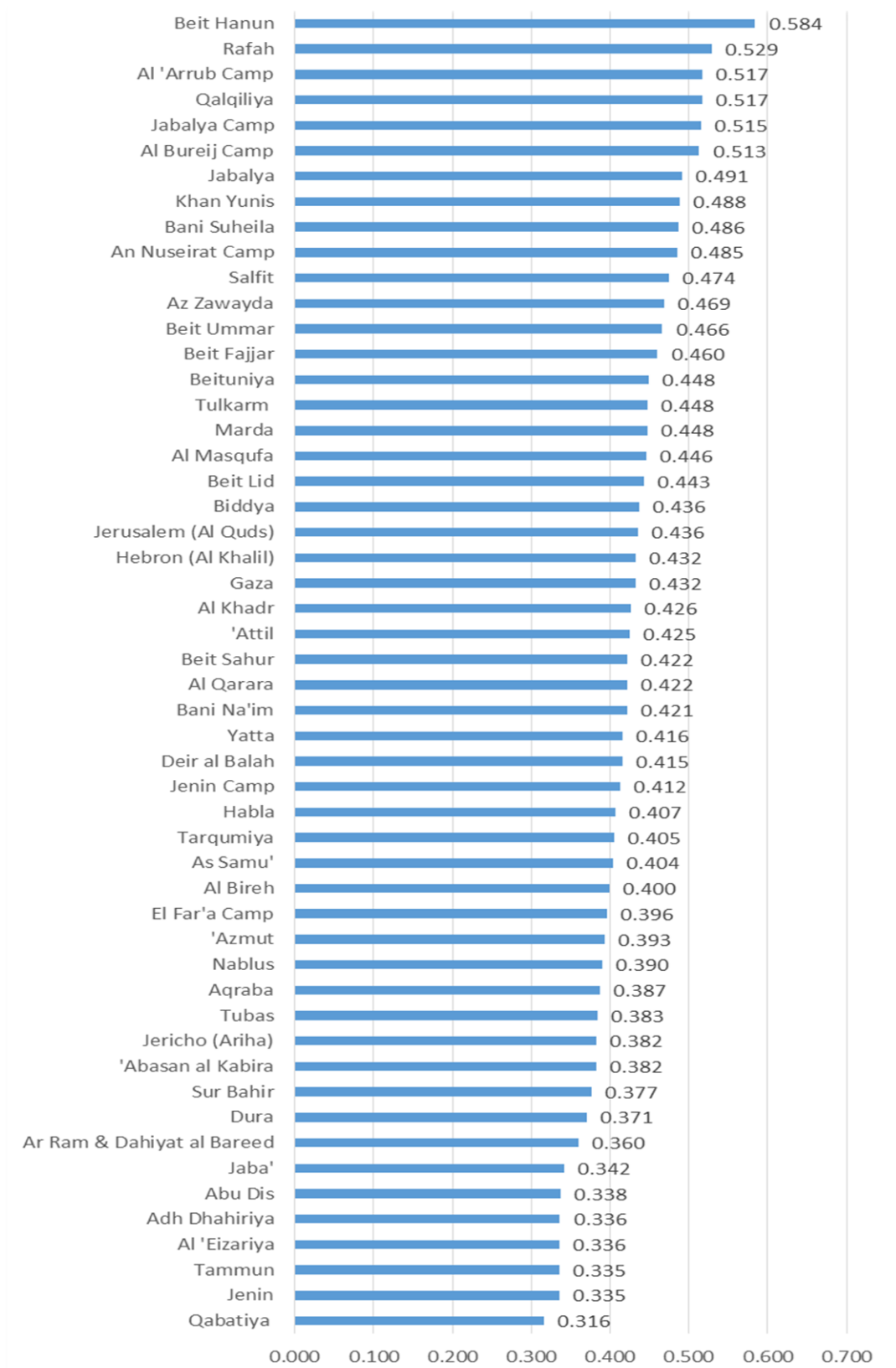
Additionally, 23 communities are close to Israeli settlements built on disputed land, 14 communities reported their lands partially enclaved by the separation wall, and 100% of the communities in the Gaza Strip and Jerusalem are completely surrounded by separation walls, disconnected from other Palestinian areas. Palestinians from the other districts must obtain special permissions from the Israeli army to travel to and from these areas.

6.4.2 The exposure and Intermediate Factors. Child Water Stress

Child water stress represents the total weighted average of the standardized values of 30 variables: 7 variables related to the exposure, referred to as water insecurity elements, and 23 variables grouped under five major dimensions. These dimensions include geopolitical conditions, community features, family economic conditions, family features, and child characteristics.

Figure 6.4 shows the weighted average of the standardized values of the water stress domain combined with scores of the child wellbeing domains. This scale is a relative metric that assesses and differentiates among the communities based on the same categorization and interactions between the risk and protective factors.

Figure 6.4: Child Water Stress Index

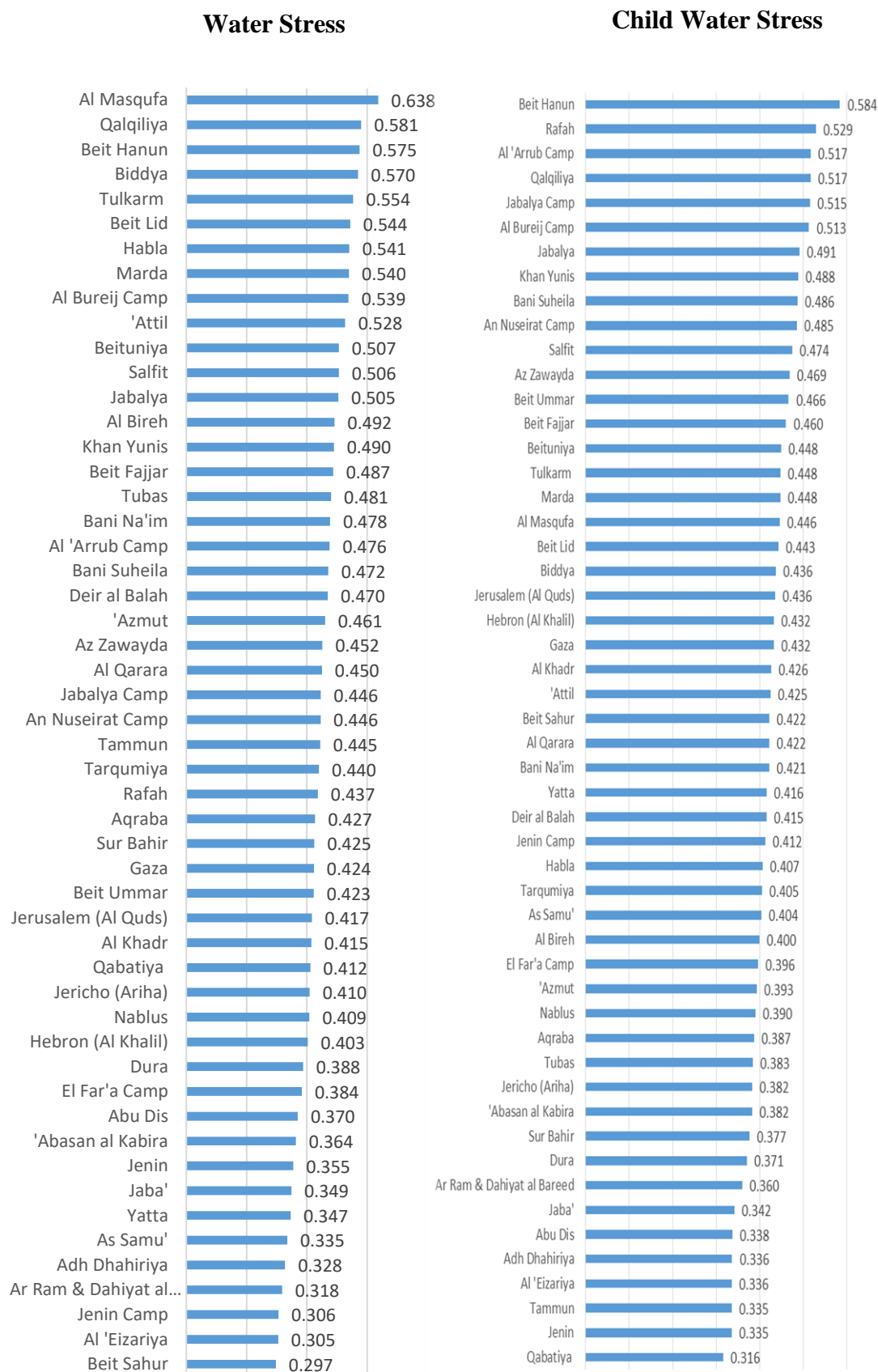


The lowest value in the index was .316, scored by Qabatia in the West Bank. According to this relative scale, it was the least stressed community. Qabatia is a rural agricultural community in the West Bank with relatively calm geopolitical conditions, nearby industrial zones, a low value of water stress, and relatively low rates of unemployment and limited wealth. Beit Hanoun, a community in the Gaza Strip, had the highest stress score. Beit Hanoun scored relatively high in terms of water stress, and 100% of its households are located in areas near the northern border of the Gaza Strip where they experience extremely high tension with Israel. This area has experienced war conditions several times in recent years, 39% of its households are within poor wealth level, and unemployment rates among males and females are around 51% and 69% respectively. Of the top ten most stressed communities, eight are located in the Gaza Strip. This confirms many reports that indicate the stagnated socio-economic and political conditions in the region.

Figure 6.5 clearly indicates that the ranking of the communities according to the water insecurity index changed after incorporating the living standard variables. The Child Water Stress Index provided a more holistic perspective of the risks and hazards that children face in these areas, merging water stress with other basic life commodities.

The Child Water Stress Index does not undermine the findings of the Water Stress Index. Rather, it highlights the level of risks and stresses that children face growing up in communities with water insecurity combined with stressful socio-economic conditions. This index does not overlook the conditions related to water insecurity, but highlights the need for a holistic and multidimensional perspective that guides the prioritization of humanitarian and development assistance.

Figure 6.5: Visualization of Water Stress vs Child Water Stress, Community Ranking



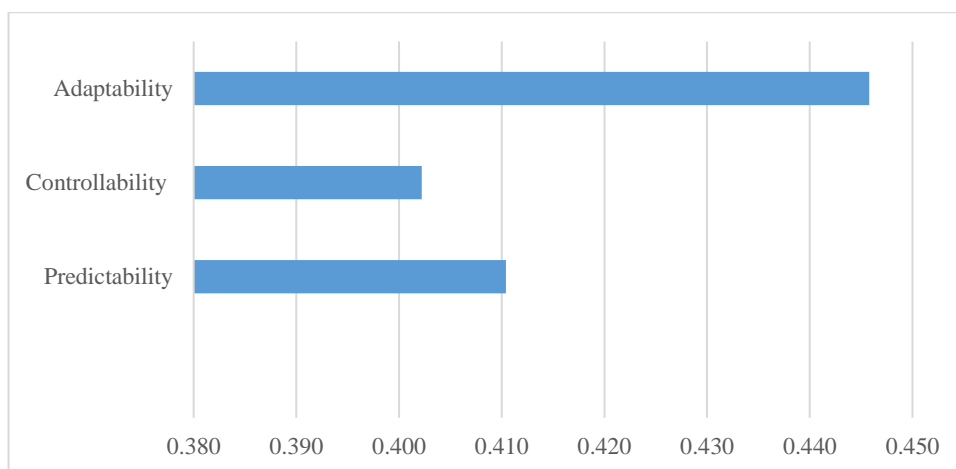
The index above reflects a macro-perspective of the living conditions that children experience in Palestine. Since the index includes variables related to the main detriments to early childhood development, especially the macro- and micro-context, family capacities, and child characteristics, this index can serve as prediction tool for risks for delayed early childhood development. It is hypothesized that children living in households and communities with water stress combined with stressful living conditions are more likely to be at risk of delayed early childhood development.

6.4.3 Child Water Stress Features

The child wellbeing variables listed in section 6.4.1 and in table 4.6, were regrouped into three stress features: predictability, controllability, and adaptability of water exposure. The categorization of the 23 wellbeing features was challenging, especially that many variables can be related to more than one feature. However, this research based the categorization of each variable on the relevance of the major feature it can be related to. The categorization was also supported by the outcomes of the focus group discussions, specifically research question number two, where the detriments to early childhood development were categorized according to their impact on the predictability, controllability, and adaptability of water stress (See section 6.6).

Figure 6.6 indicates that the exposure to stress is higher than the stress related to the capacities to adapt, control, and predict water stress.

Figure 6.6: Standardized Score of Child Water Stress Features



The most stressful feature highlighted by Figure 6.6 is adaptability, which refers to family and child characteristics, features, and related relationships and dynamics. It highlights the socio-economic pressure and demand by those who experience water stress to fulfil their needs and ensure acceptable levels of livelihood and wellbeing.

Figure 6.6 also highlights pressures families face when experiencing water stress. It reflects the capabilities with socio-economic challenges, such as a high economic dependency rate among children and the elderly on the head of the household, and larger numbers of household members, creating social, childcare, and economic challenges. It also includes more challenges related to certain family and child characteristics that require additional efforts, including ill children, and children not enrolled in school. The second most stressful feature is predictability, reflecting undermined capabilities to predict, prevent and or alter the exposure in order to prevent and alleviate its influence on children. Controllability was the least stressful feature, indicating more impacts of the macro-level conditions being a common and overarching challenge that all communities face.

6.4.4 Relative Risk

To link the Child Water Stress Index score with early childhood outcomes, Table 6.5 compares the ten most and least stressed communities included in the scale with respect to water stress, the wellbeing domains (predictability, controllability, and adaptability), and the percentage of children not on track in their development.

Table 6.4: Comparison Between Most and Least Stressed Communities

Aspect	Average Index Score Least Stressed communities	Average Index Score Most Stressed communities
Water Stress Index	0.369	0.50
Geopolitical Community	0.183	0.48
Community	0.192	0.51
Household Economic Indicators	0.263	0.73
Family Characteristics	0.577	0.57
Child Characteristics	0.386	0.27
Predictability	0.183	0.48
Controllability	0.333	0.57
Adaptability	0.419	0.47
Child Water Stress Index	0.345	0.51
Percentage of children 36-59 months not on track In the physical domain	0.16	0.19
Percentage of children 36-59 months not on track in the social- emotional domain	0.40	0.48
Percentage of children 36-59 months not on track in their development	0.36	0.4

Using the relative risk concept, the author estimated the amount of risk due to an exposure to child water stress. The author treated the ten most stressed communities as the most exposed group, and the ten least stressed communities as the least exposed.

- Relative risk percentage of children 36-59 months not on track in their development was $34/36 = 1.1$
- Relative risk of children 36-59 months not on track in the social-emotional development domain was $48/40 = 1.2$
- Percentage of children 36-59 months not on track in physical development domain was $19/16 = 1.2$

These results show that children from the most stressed communities are 1.1 times more likely to not be on track in their development and 1.2 times more likely to be underdeveloped emotionally and physically. This indicates increased likelihood and risks among the most stressed communities. The relative risk can be estimated according to certain features or domains, however, the Child Water Stress Index and rate of early childhood development not on track reflect the holistic perspectives that child water stress results from combined action, and that early childhood development is a synthetic outcome of interactions between the child and his or her surrounding environment.

6.5 Child Vulnerability Index

The Child Water Stress Index reflected the extent to which children and their families are challenged by the combined interaction between exposure to water stress elements and capabilities to predict, control, and adapt to water stress. The previous section estimated child water stress as a holistic measure according to sub-holistic measures related to controllability, predictability, and adaptability of stress.

As concluded from the literature review (section 2.5.2) vulnerability, which serves as one of the main features of child water stress, narrows down the concept of stress as a function

of exposure, sensitivity of the context, and susceptibility to threats, risks, and harm. It is based on the concept that higher exposure and limited capabilities to control and adapt to stress within a sensitive and fragile system keep children exposed to risks that may influence the early development process. These risks include frequent illness, disrupted family dynamics and relations, reduced care, distressed families, and unsafe physical surrounding environments.

6.5.1 Child-Water Vulnerability in Palestinian Communities

Noting the relevance of water stress as an ecological feature, the estimation of vulnerability followed the concept developed by the Intergovernmental Panel on Climate Change IPCC (2007), which examines the vulnerability of communities to the risks of climate change. This concept considers vulnerability as a function of exposure, the available adaptive and control capacities, and sensitivity of the system or the context of the stress. High vulnerability scores reflect high exposure values, undermined capacities to adapt and control exposure, and sensitive and fragile contexts leading to higher susceptibility to adverse effects on children.

Considering the concept of early childhood development, the undermined capacities refer to detriments to early childhood development including families' social and economic capacities to provide support and care. Continuous vulnerability means that children are constantly exposed to water stress while living in undermined family and community systems that fail to prevent or buffer the exposure.

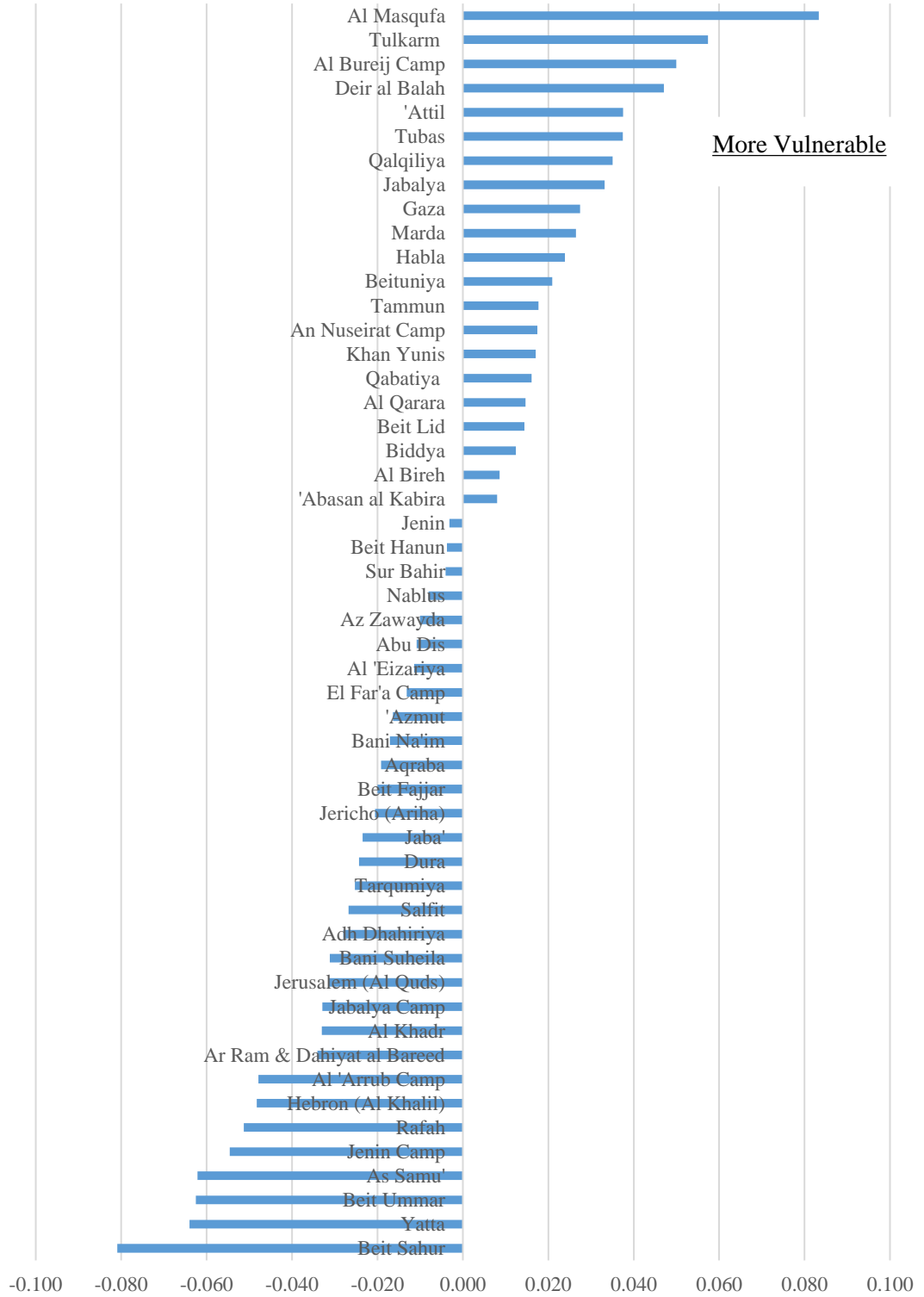
As indicated in the method chapter, vulnerability was estimated according to the IPCC as a function of the difference between exposure and adaptive and control capacities, multiplied by the sensitivity of the context. The adaptive and control capacities score was estimated as the average of the adaptability and controllability scores. Sensitivity referred

to how fragile the context is, based on macro geopolitical features, which indicate the instability and uncertainty.

Figure 6.7 demonstrates the ranking of the communities included in the index according to the calculated vulnerability scores. This concept provided a new relative ranking between the communities based on the hypothesized arrangement between the stress features that shows high exposure, limited capabilities, and sensitive context.

Figure 6.7 indicates that children from Al-Musqufa and Tulkarem in the West Bank, followed by Bureij and Der Al-Balah in Gaza are the most vulnerable to water-stress. Al-Musqufa and Tulkarem were identified by the Water Stress Index as the most water-stressed communities, which signifies the role of the exposure in this arrangement. However, this index ranked communities with undermined and deprived capabilities to control and adapt to water stress, including high unemployment and dependency rates for larger numbers of family members. This ranking provides another perspective by considering the emphasis on the capacities to control and adapt to water stress and their relationship with exposure. It also signifies the sensitivity of the context as a major factor in this relationship.

Figure 6.7: Standardized Scores of Vulnerability Index (Exposure, Adaptive capacities, and Sensitivity)



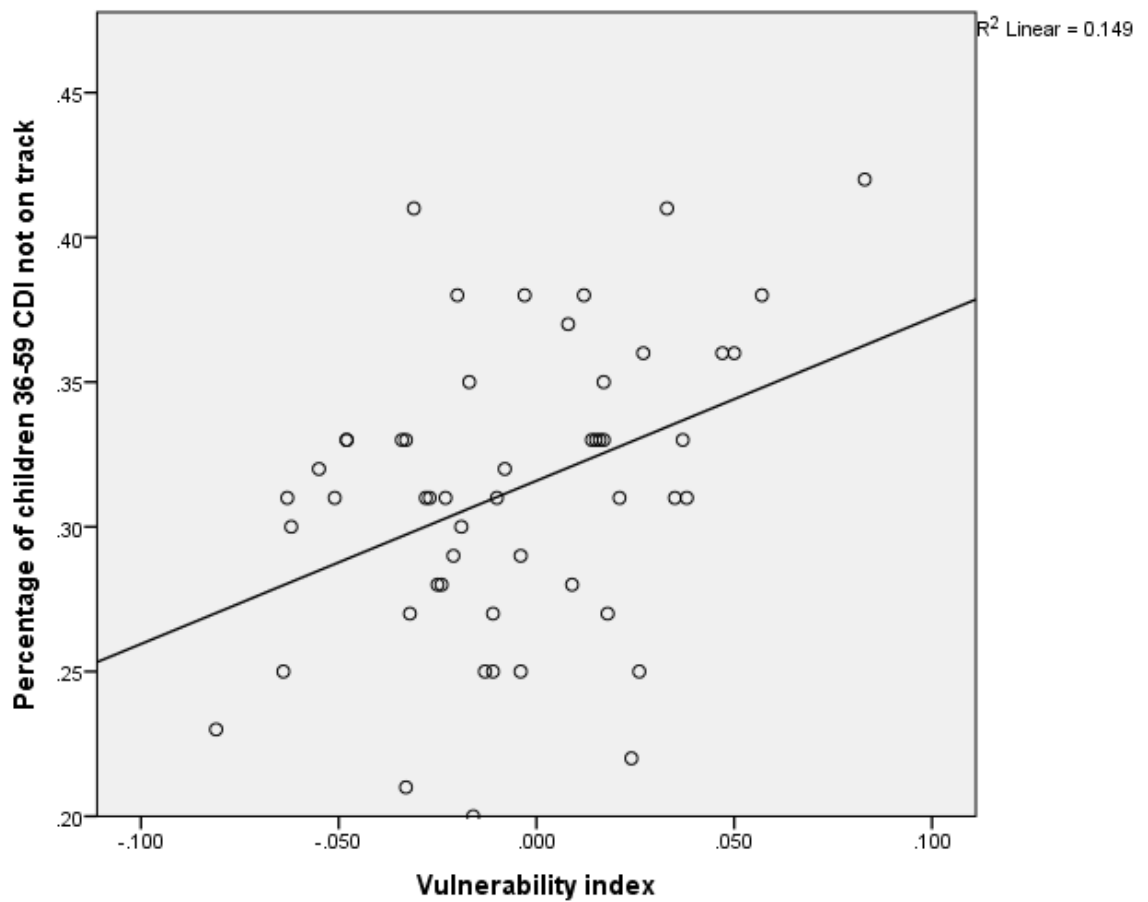
As indicated previously, this index is a relative method whereby the community data was related to data from the index. The variables were treated according to the same standards, variable definitions, and domains. The categorization of the variables into the main vulnerability features is a key detrimental factor to the structure and results of the indices. While the categorization requires clear criteria, equal treatment of variables, and a standardized method of estimating the index, this index may present considerable challenges.

6.5.2 Child-Water Vulnerability and Delayed Early Childhood Development

By performing a linear regression analysis between the vulnerability index scores and the percentage of children with delayed early childhood development, the SPSS output in Figure 6.8 below shows a fitted line for the values, indicating the relationship between both variables.

This fitted line shows a positive slope, indicating a positive relationship with the majority of the values around the line. This does not imply a cause-effect relationship. Rather, it indicates an increased likelihood among the communities of higher vulnerability scores to have more children not on track in their development than communities with lower vulnerability scores.

Figure 6.8: Linear Regression Fitted Line between Vulnerability Index and Percentage of Children Not on Track in the Selected Communities



However, this relationship can be used to assess the differential variations among the communities with respect to children. Table 6.8 indicates the positive direction of the hypothesis that the increased vulnerability values can predict higher risks of delayed early childhood development. Based on the significance value, the null hypothesis that there is no association between the independent variable (vulnerability) and the dependent variable (percentage of children not on track in their early development) was rejected, indicating positive relationships between both variables.

Table 6.5: SPSS Output Coefficient Table of the Linear Regression Analysis, indicating the Association between Vulnerability and Delayed Early Childhood Development

	Unstandardized Coefficients		Standardized Coefficients	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta		Lower Bound	Upper Bound
Vulnerability Index Coefficient	.576	.179	.414	.002	.216	.936

Note: Dependent Variable: Percentage of children 36-59 CDI not on track

This relationship rejects the hypothesis about a possible association between the vulnerability index and delayed early childhood development. It can be used as a proxy predictor of children’s vulnerability to delayed early childhood development to create forecasts and identify the most vulnerable communities with increased likelihood of risks. This information can be used to facilitate effective programming and prioritizing based on holistic needs beyond water-related exposure.

The prediction model is based on the following regression formula generated from the table above:

$$Y = \text{constant} + \text{slope} * X$$

In estimating the predicted percentage of children in each community not on track in their development (Y), the constant value refers to the intercept of the regression line, while the coefficient refers to the slope of the line. Y is the dependent value, represented by the percentages of children with delayed early childhood development, and X is the independent variable, represented by the vulnerability index value. This formula can

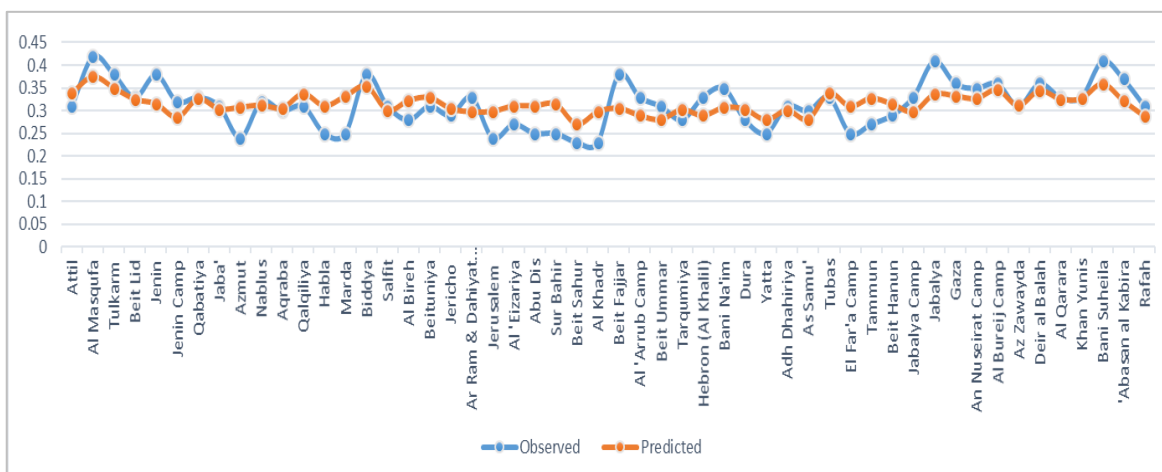
facilitate the establishment of a prediction model for the most vulnerable communities to indicate the estimated percentage of children not on track in each community. The table includes two sig values: the significance value related to the constant when it is less than .05, interpreted by the ability to reject the null hypothesis that the constant does not equal zero; and the significant value of vulnerability, which indicates that the slope does not equal zero. Accordingly, the prediction is based on the regression model using the linear formula generated from the above table:

$$Y = .317+.576X$$

Where Y is the predicted estimate of the percentage of children with delayed early childhood development; X is the vulnerability index value computed from the function of exposure, adaptive capacities, and sensitivity; 0.317, which is the value of the constant; and 0.576, the slope.

Using the estimated regression model above and the data from the vulnerability index, the predicted percentages of delayed early childhood development were computed for each community. Figure 6.9 presents the data of both the observed and vulnerability-based predicted percentages of children with delayed early childhood development. The blue dots indicate the percentages of children with delayed early childhood development as reported by the data included in the ecological data set, and the brown dots indicate the predicted percentages of children with delayed early childhood development.

Figure 6.9: Actual vs. Predicted Values of Percentages of Children with Delayed Early Childhood Development



Note: The above diagram used the observed data obtained from the ecological data set based on the percentages of children not on track in their development using MICS 5 survey. The predicted values are based on the linear regression model between the vulnerability score and percentage of children not on track.

With a confidence interval for the predicted values of 0.27-0.36, the above graph visualizes proximity and synergy between the observed data reported by the ecological data set and values generated by the prediction model for each community. The average difference between the observed and predicted values is about 0.001. Simply, the above figure shows that aggregated community data, once analysed and compiled using standard measures, can indicate the risk and vulnerability that children experience, and the percentage of children at risk of delayed ECD. This data relates to their quality of life and increasing or decreasing deprivation. It can be also utilized for advocacy by leveraging the scientific tool to indicate the likelihood of inequalities among communities accompanied by risks for delayed early childhood development.

However, the interpretation of the association needs to be considered with caution. Vulnerability is a proxy indicator encompassing a wide variety of variables and implies several intermediate factors. The index is highly influenced by the different definitions related to the stress and vulnerability domains, as well as different social and political factors. Accordingly, one may not overstate these relationships using cause-effect language, which would imply that vulnerability is an underlying cause of delayed early childhood development. This relationship should not be ignored, but rather stated by using the language of vulnerability and risks, indicating that vulnerability may increase the risks of delayed ECD.

6.6 In-depth views Towards Child Water Stress. Qualitative Analysis

6.6.1 Executive Summary

The quantitative data presented a model for examining stress features and predictability, controllability, and adaptability. It linked water stress and delayed ECD as a continuous state of vulnerability, established as the difference between exposure and adaptive capacities. The quantitative data did not capture how families and children are challenged by child water stress as a holistic unit. Additionally, the data did not address when and in what situations families perceive water stress as unpredictable, uncontrollable, and unadaptable, and what impacts these conditions have on families and children.

This section is the second report prepared based on the findings from four focus group discussions held in four districts in the West Bank and Gaza Strip. This report is explicitly based on the discussions related to the second research question, which guided the focus group discussions:

How does growing up in communities with water stress predict children’s risks for delayed early childhood development?

To guide the discussions and to answer the research question, three sub-questions were raised:

- How do you perceive the combined effect of water stressors and macro and micro contextual factors within a holistic construct?
- Under what conditions do you perceive water stress to be:
 - Unpredictable
 - Uncontrollable
 - Unadaptable
- When do you feel your children become vulnerable and exposed?

6.6.2 Key Findings

6.6.2.1 The Combined Effect

We live in Oja.²⁸ We receive no support from either the Palestinian or the Israeli government. We purchase water for the family and for the cattle. We need water to process milk, make cheese, and sell our products in Jericho City. We buy water from vendors, but we are always uncertain about cost and delivery. If we have no water, then we can’t make cheese. We deserve more water. My husband does his best, but our income is limited, and we can’t order a water tanker every day. Female participant from the Jordan Valley.

It is all about the politics. Gaza has faced closure and restrictions on movement for more than 10 years. When military attacks occur, the networks will be destroyed and we will have limited electricity and water. Water we receive is of

²⁸ Oja is a community located in the Jordan Valley.

bad quality and we always need to pay a lot for drinking water. At the same time, my husband is occasionally employed. Female participant from Gaza.

The above quotes from study participants and many others reflected water stress from a macro-perspective. Interestingly, when water stress is mentioned, the participants mix it with social, economic, and political challenges. The challenges mentioned by respondents were mostly related to aspects beyond their control, such as geopolitical developments amid an atmosphere of uncertainty. However, the variations and differences were noticeable.

Focus groups in Gaza often combined water stress with other stresses, mainly poor electricity, household crowding and congestion, weak public services, and limited wealth and economic opportunities. They also identified water stress as a social and political stress, adding to the stresses caused by the political developments that Palestinian communities in Gaza experience.

The focus group in the Jordan Valley integrated water stress with cultural challenges, mostly mothers who mixed household and productive duties. The participants also mixed water stress with poor housing, utilization of land for agriculture and development, and weak public services including health and education. General feedback obtained from this group included the stress of water related to income generation and wealth level. Much of the emphasis was on how to sustain healthy cattle as the main source of income for the families. This income is mostly generated through milk processing and selling sheep during feasts.

The focus group in the urban community of Nablus mixed water stress, especially the discontinuity of the public water supply, with household wellbeing and being unable to

perform adequate household duties, as well as disrupted relations with other families and neighbours. The discussion about the neighbours was mixed with inequality and being related to the weak pressure of water supply, as many are living in multi-floor buildings in which water flow during the summer is weak and does not reach the storage tankers on the roof.

6.6.2.2 Predictability

All participants indicated difficulties in anticipating water-related conditions. The main aspects mentioned were the price of water tankers, the frequency of water cuts, and the timely delivery of water tankers. Participants from the Gaza Strip indicated that they were certain of the bad quality of water they receive through the public water network. The focus group in Nablus indicated that the quality of services and frequency of the distribution system were the most unpredictable aspects.

The participants from all of the groups attributed unpredictability to macro-conditions. The focus group in Gaza attributed unpredictability to the general political conditions that the Gaza Strip is experiencing. The focus group in the Jordan Valley attributed unpredictability to the unique context of the area, having limited governmental support and inadequate control of their own resources. The consequences of unpredictability varied. Interestingly, participants from the Gaza Strip indicated that they were able to adapt to the state of unpredictability. A female from Beit Hanoun in the Gaza Strip said, “We got used to the unexpected. We got used to shocks and surprises and make it part of our life routine.”

However, all participants linked the adverse consequences with the intensity and duration of water-related failures and deficiencies.

Another female participant from Gaza said:

When we experience electricity cuts, all water pumps stop. We know for sure water will be disconnected. When the electricity and water cut extends for days, then we start to become distressed and worried.

Unpredictability limits caregivers and makes families and children uncertain about current and future childhood development. It also undermines their abilities to be prepared and prevent the intensity of the exposure and its consequences. Unpredictability makes households uncertain of what will happen next, and causes them to feel some level of anxiety in preparation for something unexpected to occur. All participants indicated that predictability can help them modulate their own attitudes and responses to the exposure.

6.6.2.3 Controllability

Controllability of water stress was addressed by all focus groups as the capacity to reduce, minimize, and prevent water stress. Most of the responses referred to people's exhausted capacities due to high cost, lengthy exposure, and intensity of the exposure. They also reflected on their financial capacities as the biggest factor that can help in changing exposure.

A male from the Jordan Valley said:

If I have money, I can get more water. If I have money, I can buy storage tankers. However, when we experience water shortages for a long time, my family keeps demanding water, my cattle need water, and I can't do more, I feel helpless.

Opinions that address other factors were also captured. Steady and positive emotional and social family relationships can help in reducing or minimizing the impacts of stress, particularly between spouses. However, this factor has its limits also. Female participants

indicated that they feel depressed and frustrated, and many are “unable to keep a smile on [their] face” while they have no water.

When asked if they feel unable to act as a buffer for their children, all indicated that when they feel emotionally and financially exhausted, they feel unable to continue providing adequate support and care for their children. Many said this experience is very traumatic, and that they feel predisposed to psychiatric disorders, primarily anger, distress, and frustration.

6.6.2.4 Adaptability

Participants addressed the types of coping strategies they use, as well as factors that undermine their ability to cope and adapt to water stress. Many strategies were mentioned such as storing water, saving water, and efficient use. Water related strategies were related to organizing household duties according to the water schedule, prioritization of water use, and limiting household and yard cleaning.

With respect to coping with water stress while maintaining adequate parental support. Most of participants indicated social and economic stressors along with water stress. The family members relationships, specially, among the parents, and between parents and their children were considered as vital for adapting.

6.6.2.5 Vulnerability

We do not know what to expect. We are always stressed by water. Sometimes we manage, but we always feel threatened. Female participant from the Jordan Valley.

I do my best to protect my children. I keep everything tidy and clean, but when we have little water for more than three days, what can I do? Female participant from the Jordan Valley.

When my husband tells me he has no money to purchase water, what can I say to my children? Female participant in Gaza.

The participants varied in their capabilities to buffer their children from the combined stresses and the level of vulnerability to risks and harm. Their experiences and views indicated that when water stress occurs at the same time as other stresses, their buffering capabilities are undermined. The two main co-occurring stresses addressed by the participants were economic capacities and social environment.

Most of the responses and feedback referred to limited economic capacities as the main stress when combined with water stress that significantly influenced the ability of parents to buffer their children. These factors also expose children directly to water stressors, especially unsafe quality and inadequate quantity needed for essential hygiene practices. Female participants stressed that family characteristics are one of the main stressors that, when combined with water stress, contributes to children's vulnerability and risks. The main variable participants mentioned was the number of family members in the household. Participants stressed the challenges of living with extended family members, including parents, children, and other relatives such as grand parents, uncles, and cousins. Extended families generate more pressure with respect to personal demand co-occurring with other demands related to food and essential needs. It also reflects crowding, and complex social relationships and dynamics.

The participants indicated that household duties and the complex social relations and dynamics among extended families provide less childcare support and time spent with children. Two male participants indicated that the stress would be intolerable when combined with challenging economic and macro-political conditions.

When you face all these stresses at one time, I become distressed, frustrated, socially pressured, and angry. Male participant from Gaza.

Geopolitical conditions were mentioned as cross-cutting, common features that all people experience to different degrees, but not as a specific stress that interacts directly with household needs. This contradicts with the findings of the quantitative analysis, specifically Figure 6.6, which indicated that predictability attributed to geopolitical conditions was the second highest stress feature.

A common observation is that vulnerability was a feature highlighted as a consequence of predictability, controllability, and adaptability. When the stress is not controlled and people do not adapt, children remain under living conditions that are characterized by inadequate access to water for washing and cleaning, and often ingest contaminated water. They also do not enjoy recreational or leisure activities that require water, such as swimming, or other sport activities that will make them dirty.

6.7 Conclusion

This chapter provided a simulation of children's lives in communities living under water stress and challenging socio-economic and geopolitical conditions. It was based on the concept that early childhood development is a synthesis of interactions between children and their close and remote surrounding environment. The factors are mainly related to the detriments to early childhood development and reflect the spheres of influence that, depending on their directionality, protect or undermine children's surrounding environment, influencing the predictability, controllability, and adaptability to water stress and the vulnerability of children to risks of delayed early childhood development.

6.7.1 Quantitative Analysis

The Child Water Stress Index provided an overview of the stress communities in Palestine experience. This index capitalized on the combined influence of water stressors as explained in the previous chapter. The Water Stress Index provided an overview of the variations among Palestinian communities indicating that water adequacy and reliability are the elements with the highest stress scores.

Both adequacy and reliability are interrelated with other stressors. Inadequate quantity seemed to be the most significant stress, being a tangible variable that families experience while conducting household duties, washing, drinking, and cooking. Poor reliability of services is interrelated with adequacy, poor quality, and high cost when families search for alternative unimproved sources.

The explicit water data shows that many communities in the West Bank are more stressed than communities in Gaza. This finding may provide false perceptions that the communities in the Gaza Strip are less stressed, and lead to interventions and support

being directed elsewhere. Communities who had lower stress scores on the Water Stress Index may have higher stress scores in terms of their quality of life, which could limit their ability to control and adapt to water stress-related exposure. On the other hand, families with higher capacities and quality of life may be better able to control and mitigate water stress, and can ensure a safe and steady family system and environment that protects their children.

From this perspective, the research presented the term “child water stress,” integrating exposure with variables related to the capabilities to predict, control, and adapt to water stressors. Once integrated with the water data, the ranking of the communities according to the Water Stress Index changed. A new ranking was for communities by water stress as well as living conditions and wellbeing.

The analysis showed that the most stressful feature is family adaptability, which integrates the family and child features and reflects their physical, social, and personal capacities to adapt to water stress. Based on comparisons between the ten most and least-stressed communities, the relative risk measures indicated that children are 1.2 times more likely to not be on track when living in households facing child water stress.

Following the definition of the IPCC (2007), vulnerability was measured as a function of exposure, adaptive capacities, and sensitivity of the system. The data showed a strong association between vulnerability and the likelihood that children are not track among communities facing higher levels of child water stress. Using the linear regression equation generated from the relationship, a prediction model was generated, whereby the vulnerability score generated from the ecological data set can predict an estimation of the percentage of children not on track in each community.

The quantitative data and analysis under this section are relative to the variables and communities included in the indices. While the model is replicable, other contexts may require different variables and selection criteria for grouping to domains and stress features. Stress outcome effects were not intended to be established. Rather, the models simulated real-life conditions of families experiencing different factors at the same time. It was also intended to provide adequate considerations to the uniqueness of the local context.

6.7.2 Qualitative Analysis

The qualitative data enabled an in-depth understanding of how parents are stressed by the combined interactions of water exposure and macro and micro contextual factors. The participants expressed that water-related challenges and failures, as well as the macro- and micro-context, and social and economic burdens act simultaneously.

Participants reflected on predictability as a hectic challenge of living under geopolitical uncertainty and conditions out of their control, and the continuous state of anticipation that “bad things will happen.” While all communities face common water stress and stagnated socio-economic conditions, discussions signified the uniqueness of the local context of each community. The local context with respect to its social, economic, and cultural uniqueness was presented as a significant factor influencing water stress and its features. The participants also reflected on their feelings of helplessness, especially when water stress is combined with challenges related to their wealth. Significant emphasis was paid to the role of a steady and supporting environment in controlling water stress and its consequences.

6.7.3 Integrative Conclusion

Our life is alike a swing, it moves up and down. Sometimes it is quick, sometimes it is slow. It is hectic and exhausting for us. We may hold on for a while, but our children can't. Female participant from North Gaza.

This quote from a female participant from North Gaza summarized the general feeling of participants. She did not refer to water-related stressors or socio-economic or political factors. Rather, she reflected, with a negative feeling, her wellbeing from an integrated perspective based on what she has felt, perceived, and experienced. She reflected on her life with a high level of uncertainty, indicating that it is hard to predict and difficult to control, like the movement and speed of the swing. She referred to her children as the most vulnerable, and that they may not be able to take action, but bear the majority of the burden. Water stress was presented not only as an exposure, but as part of a larger construct and contributes to negative consequences within a holistic pattern.

The macro- and micro-contexts provided an integrative approach for assessing the state of children in the country in general and in the community in particular. However, the uniqueness of the local context with its social and economic features is significant.

The findings suggest the following:

- Adequacy and reliability are the water failures that stress communities the most
- While exposure is essential to assess, social and economic macro- and micro-factors shape the controllability, adaptability, and predictability of water stress and influence its effect on children.
- Aspects related to family characteristics and capabilities had the highest levels of stress among the child wellbeing domains

- Children facing water stress combined with intermediate factors of undermined child characteristics, family social and economic capabilities, and challenging macro socio-economic and geopolitical conditions are at higher risk of being susceptible to adverse consequences of water exposure.
- Parents view child water stress from a holistic perspective as a combined effect on undermined wellbeing.
- Intermediate factors shape capabilities to adapt and control exposure.
- Exposure, the intermediate factors related to predictability, controllability, and adaptability of the exposure, and sensitivity of the context influence the level of vulnerability of children to risks that harms the process of early childhood development.

Noting the above findings, and considering the limitations of the methods used (being relative and nongeneralizable), this chapter responded to the research question that children facing water stress combined with undermined capabilities are vulnerable to increased risks for delayed early childhood development. Exposure is lengthy and chronic; however, the negative impacts may not occur until the families and communities are unable to control, reduce, cope, and mitigate the exposure.

This chapter confirmed that exposure is essential to assess, but its interactions with intermediate factors related to the child's living conditions, and the available capabilities to predict, control, and adapt to water stress are equally important. The next chapter examines the mechanisms and directionality of these interactions, exploring the intermediate factors that carry and enhance its effect on children.

Chapter Seven | The Link in the Household Domain

7.1 Introduction

The previous chapter presented child water stress as a combined exposure of water stress and intermediate factors within an overarching perspective of micro and macro physical and social factors. This chapter's main objective is to explore mechanisms that explain interactions between exposure to water stress and intermediate variables at the micro household context. The findings of this chapter were guided by research question number three, and based on the analysis framework explained in method 4.5.3, page 170.

How do exposure to household water stress and the intermediate factors of wealth and parental support interact and establish risks of delayed early childhood development?

Figure 7.1 presents the hypothesized relationship between water stress indicated by the use of unimproved water supply as the main source of drinking water, and early childhood development status, mediated by wealth level and parental support. The null hypothesis to be rejected stated as no such relation exists.

The relationship was examined using quantitative data using data explained in section 4.4.1.1 page 124.

While it is a statistically sound and logical method, the mediation model has shortcomings and limitations related mainly to defining clear assumptions and controlling for confounders, noting the multiple hypothesized relationships, which are discussed in the method chapter. This research utilized this model to holistic thinking and a logical framework for assessing complex exposure like water stress that interacts with contextual factors that matter to children and their families.

Figure 7.1: The Mediation Model

Figure 7.1.a: The Total Effect

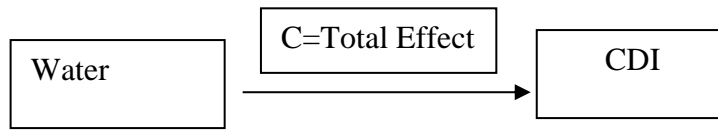
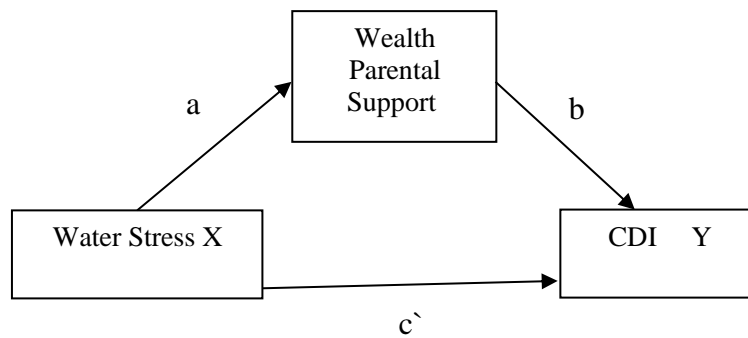


Figure 7.1.b indicates a hypothesized partition of the overall effect to direct effect (c'), and indirect mediation effects (ab).

Figure 7.1.b: The Direct and Indirect Effects



The total effect $C =$ the direct effect $c' +$ the indirect effect ab

$$C = c' + ab$$

Null hypothesis: $ab=0/C-c'=0$

- a is the effect of water supply on wealth level, b is the effect of wealth on the early childhood development index score, and c' is the direct effect of water supply on early childhood development
- Total Effect $C =$ The direct effect $c' +$ the indirect effect ab
- $C = c' + ab$, the product of ab estimates the strengths of the mediation path

Figure 7.1.a demonstrates the hypothesized total relationship with its total effect. If the null hypothesis of no relationship is rejected, then the relationship exists, and accordingly, the total effect can be dissociated to direct and indirect effect as indicated in figure 7.1.b.

Considering the features of water stress and ECD, aspects related to the link between both variables are influenced by relationships, social context, dynamics, and perceptions,

highlighted by the literature as substantial for optimal ECD. Thus, this chapter supplemented the statistical methods with a qualitative segment (section 7.5) that includes views and experiences of caregivers to obtain an in-depth understanding of household water stress, and its interaction with the child's micro context.

The qualitative analysis that supplemented the quantitative findings generated from the four focus group discussions specifically when the participants discussed the third research question mentioned above, with specific focus on views and experiences about the interactions between water stress, family wealth, parental support, and risks for delayed early childhood development.

7.2 The Main Variables

The main variables examined by the mediation model is water stress indicated by the use of unimproved water supply as main source of drinking, the family wealth level, parental support, and children health, which are all included in the Multiple Indicator Cluster Survey (MICS) series 5.

Other factors including mother's education, mother's age, child health, child age and sex, type of community, region, and type of dwelling were examined for confounding, suppression, and moderation effects.

- **Independent variable:** Exposure to water stress indicated by the use of unimproved water supply as the main source of drinking water
- **Intermediate variable 1 (mediating variable):** Wealth level, representing micro contextual factors and the economic capabilities of the family. Family wealth was measured based on the ownership of a list of goods and commodities reflecting

family's capabilities, such as possession of a car, computers and dwellings. The data were standardised and indexed, and each household in the total sample was assigned a wealth score categorizing the families under one of five categories: poorest, second poor, middle, fourth, and rich.

- **Intermediate variable 2:** Parental support representing proximal processes. These processes are in the form of stimulation and interaction practices that parents reported doing with children. MICS 5 surveys included 10 parenting practices offered by mothers and fathers such as reading books, playing with the child, singing, and going out with the child. The author developed a scale variable of the weighted mean of the practices with more weight to the parenting practices of mothers who reported more parenting developmental practices than fathers.
- **Dependent variable:** Scale variable of early childhood development status. Delayed early childhood development was indicated by the scale variable of the child development index based on a 10-item assessment for the child by the data collectors during the home visit.

7.3 Water Stress and Early Childhood Development

Table 7.1 demonstrates a finding already identified in Chapter 5 (table 5.14) examining the association between water stress and ECD.

Table 7.1 Coefficients Table of the Relationship between Unimproved Water Source as Main Source of Drinking and Scale Variable of ECD

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig
	B	Std. Error	Beta		
(Constant)	5.511	.039		140.588	.000
Unimproved Water Source	.011	.059	.003	.182	.855

- **Sig:** The significance value with less than 0.05 means the relationship is significant, indicating less than 5% probability that the null hypothesis of no association is correct.
- **Coefficient** indicates a relationship between the independent and dependant variables. It represents the change in the values of the dependant variable given the values of the independent variable. It is indicated by the slope of the regression fitted line. The negative sign indicates an adverse relationship.
- **CI** is the confidence interval of the coefficient.

With specific focus on the sig score for unimproved water source on its association with ECD, in Table 7.1, water stress represented by the use of water supply as main sources of drinking is not significantly associated with the child development status.

To apply this finding to the hypothesized mediation model, the null hypothesis demonstrated in figure 7.1 cannot be rejected, as there is no significant association between the water stress related variable, and early childhood development. Scholars (e.g. MacKinnon and Dwyer 1993; VanderWeele, 2016) stated that applying the mediation model requires establishing a significant association between the independent and dependant variables. The absence of an association suggests the impossibility of applying the mediation model to examine the mediation of water stress on early childhood development. The absence of the association suggests a distal indirect relationship

between both variables due to the existence of a wide variety of micro and macro contextual factors related to the main determinants of ECD including personal characteristics and parenting. This concept is explained by several scholars including Irwin, Siddiqi, and Hertzman (2007), and Tudge et al. (2017), who suggested that a child is sphered by different determinants related to her characteristics, family, and community features, indicating that contextual stresses such as water stress interacts with these detriments in its effects on children.

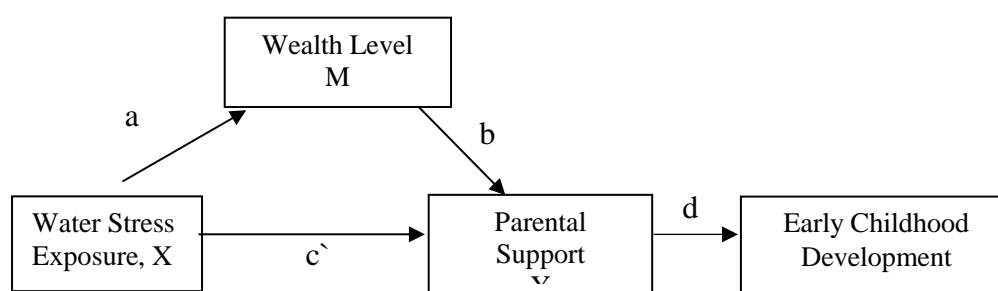
7.4 Water Stress and Parental Support

Based on the above finding, the author provided an adapted hypothesis by considering the parental support, which reflects a proximal determinant of child development, as an independent outcome variable of the mediation model, with water stress as an independent variable, and wealth level as mediator. The author hypothesized that parental support can serve as a significant predictor of early childhood development. The main motive of utilizing parental support in this model is to highlight the role of parents being stressed by water stress, and being suggested by Bronfenbrenner's bio-ecological theory as essential requirement for optimal early children development (Tudget et al. 2017).

7.4.1 The Meditating Role of Wealth Level

Figure 7.2 presents a hypothesized link adapted from Figure 7.1, with mediation model of the influence of water stress on parental support, mediated by wealth level, while parental support is predictor for ECD.

Figure 7.2: Mediation Model, Water Stress, Wealth Level, Parent Support, and ECD



Parental support was determined by the weighted mean of practices performed by mothers and fathers as reported by parents who participated in the MICS 5. It is related to interactions and stimulation practices provided to children by fathers and mothers including playing with the child, reading books, singing, and going out with the child.

The main findings are demonstrated in Table 7.2 below, presenting the six models that form the mediated analysis.

Table 7.2: Mediation Analysis, Water Stress, Wealth Level, and Parental Care

Models	Sig	Coefficient	CI Low	CI	R-Squared
1 Water Stress-Parental Support	.001	.066 (-)	-.072	0.083	.049
2 Water Stress- family Wealth level	.001	2.35	7.9	13.8*	.53
3 Poor Wealth Level-Parent Support	.001	.063 (-)	-.09	-.036	.053
4 Water Stress- family wealth- Parent Support	.773	.004 (-)	-.029	.022	.029
5 Water Stress-poorest family wealth- Parent Support	.0001	.043 (-)	-.064	-.022	.021
6 Parent Support-ECD	.001	1.336	1.13	1.54	.189

Notes:

- **Sig:** The significance value of less than 0.05 means the relationship is significant, indicating less than 5% probability that the null hypothesis of no association is correct.

- **Coefficient** indicates a relationship between the independent and dependent variables. It represents the change in the values of the dependent variable given the values of the independent variable. It is indicated by the slope of the regression fitted line. The negative sign indicates an adverse relationship.
- **CI** is the confidence interval of the coefficient.
- **R-Squared** is the proportion of the variance in the outcome variable predictable from the independent variable.

Model 1: Water Stress-Parental Support

The first model examined the relationship between the independent variable—unimproved water supply as the primary source of drinking water—and parental support. The linear regression analysis indicated a significance value of less than 0.05, marking a significant association between the use of unimproved water supply as the main source of drinking water, and the number of parental care practices provided. This finding indicates a significant association and allowed to proceed to the next models in the mediation analysis.

The negative coefficient indicates an adverse relationship between unimproved water sources and the number of proximal child care practices. This relation suggests that children of water-stressed households are more likely to enjoy less parental developmental support than children from families with improved water sources. Based on the mediation model concept, this step generates the total effect, which is the value of the coefficient of the relationship between water and child care (0.066).

Confounders used in this step included the type of water network, type of toilet, age of child, sex of the child, and maternal education. The confounders were selected based on

its assumed influence on both the independent and dependant variables. These included factors that may influence the quality of care including age and sex of the child, and water stress status and included type of toilet, and if the household is connected to a public network. Other confounders may still influence this relation but not accounted for due to lack of data such as the mother's reactivity, quality of the relationships between father and mother, relationship with and among other members of the family, and the geopolitical conditions during the time the interview was conducted.

Model 2: Water Stress-Family Wealth

This model examined the relationship between water stress and the mediating factor of wealth level. As addressed by the MICS survey, the wealth levels are five categories, poor, second, middle, fourth, and rich.

The result indicated by Model 2 in Table 7.2 shows clearly a positive and significant relationship, suggesting that parents with undermined wealth are burdened by water stress. This association suggests a vital role of wealth in water stress's interactions in its influence on children and their families. Although water stress implies financial burdens, this relationship does not necessarily mean that water stress decreased wealth level, but it adds to its already existing detrimental social, emotional, and cultural effects. Unfortunately, the quantitative cross-sectional data does not allow an in-depth understanding of water stress impacts on wealth status of the family beyond its financial consequences. The author raised this question during the focus group discussions with parents. Their answers are presented at the end of this chapter (section 7.5).

Model 3: Poor Wealth Level-Parent Support

This model explained the mediator's relationship, represented by wealth level, and the weighted mean of parenting practices. As indicated in model 3 in table 7.1, the association is adverse, indicating that parents with undermined wealth are less likely to offer child parental development practices to their children. The significant relationship remained after incorporating different assumed confounders related to this relationship, especially the child's age and sex, mother education, region and area indicating the geopolitical conditions, number of household members, which indicates more child care and economic burdens, and if the family owns the dwelling. This relationship, being independently examined from water stress, confirms the powerful and already existing influence of wealth level on parenting support and care. These influences may be attributed to reduced financial capabilities that families need to ensure a safe, steady, and social environment inside the household. It may also be attributed to deteriorate wealth, and challenging social, emotional, and cultural detriments on the family relationship, and undermined buffering abilities to control and prevent stresses.

Model 4: Water Stress-Wealth Level-Parental Support

This model examines the relationship between the use of improved water sources as main source of drinking and parental practices after incorporating the wealth level, the mediator, to the mediation model.

The findings indicated by model 4 in table 7.2 clearly shows that the “sig” value .001 for the association between water variable and parental support identified in Model 1 increased to .773 in Model 4, indicating that this relationship became insignificant as it exceeds the significance threshold of .05. As explained in the method chapter, the increase

in the value of sig after adding the mediator, means that the total effect was dissociated, and part of its influence became explained through indirect effect.

This finding proves a mediating indirect effect exists and, consequently, rejects the hypothesis of no indirect effect between water stress and parenting practices. It confirms that water stress influences parental “early development” support directly, and indirectly through the effect of wealth on the family.

According to the structural equation model, the linear regression formula of the fourth model can predict the value of the direct effect (c') which is the value of the coefficient of the independent variable X as indicated in the formula below:

$$Y = B + c'X + bM + \varepsilon$$

Where Y stands for the outcome variable, B stands for the intercept of the y-axis of the regression fitting line of the relationship between water stress and parent care, and c' represents the direct effect and equals the value of the coefficient (slope) of the fitted regression line between the independent and dependant variables. Referring to model 4 table 7.1, c' equals .004

Noting that model 1 estimated the total effect, the indirect effect is estimated as the difference between the values of the total effect (0.066) and the value of the direct effect c' (0.004), according to the following:

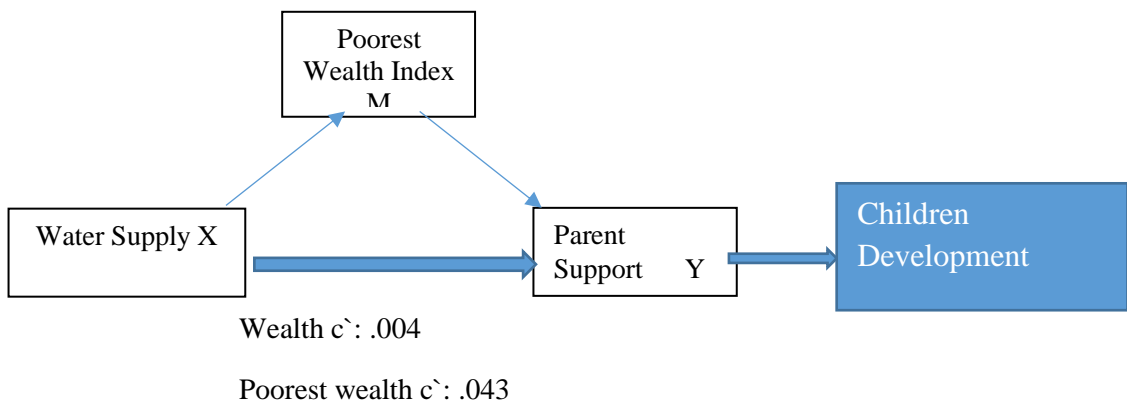
- Total effect = 0.066
- Indirect effect = total effect - direct effect
- Indirect effect = 0.066 - 0.004 = 0.062
- Percentage of indirect effect to total effect: $0.062/0.066 = 93\%$

This result indicates that the hypothesized indirect effect represents about 93% of the total effect of water stress on parental support. This finding suggests that most of the effect of water stress on parental support occurs through indirect influence transmitted in this relationship through the wealth level.

Model 5: The Intensity of the Mediator and the Direct Effect

This step is not part of the original mediation model. The author developed a new variable of the wealth level for the poorest wealth only (wealth level) to indicate intensified exposure of intermediate factor. The regression analysis yielded an increased values of the coefficient value that represent the direct effect(c') to .043 which increased the proportion of the direct effect to the total effect to about 67%. This indicates that the direct effect of water stress on parent support increased, suggesting that the magnitude of the intermediate factor made parents more exposed to the direct influences of exposure.

Figure 7.3: Increased Magnitude of the Direct Pathway with Increased risk of Intermediate Factors



This finding challenges the concept of setting a consistent hypothesis that most of the exposure's effect is made through indirect impact, especially among the poor. When they experience undermined capabilities to prevent and control water stress exposure, parents

become less likely to buffer themselves and their children, and become more vulnerable and susceptible to the exposure. This indicates another powerful aspect of the intermediate factors as it influences the intensity of the exposure to poor reliability, inadequate quantity needed for domestic needs, and poor quality for cooking and drinking.

Direct effects of water stress on parents may also include other social and emotional impacts, with parents being directly distressed socially and economically by water stress.

However, this finding needs to be examined with caution as the data are based on a cross-sectional and time-specific survey. Section 7.5 explored in-depth understanding of how parents become stressed, exhausted, and helpless while avoiding water stress (see section 7.5.2.3 and 7.5.2.4).

Model 6: Parent Support-ECD

This step is not part of the original mediation model, but suggested by the author as a workable explanation of the logical relationship between water stress and ECD. It suggests a statistically-significant positive relationship between parental support practices and early childhood development status suggesting the increase in parenting support is more likely to lead to improved opportunities of optimal ECD. Consequently, parental support, which acted as an outcome of water stress in the previous 5 models, can act as a predictors of risks on child's development.

The findings suggest that parents influenced by water stress and inadequate economic capacity are less likely to offer developmental practices that support children development, including learning, intellectual stimulation, and emotional support. The relationship was significant after adding to the model different confounders related to

children characteristics including diarrhoea, stunting, age and sex of the child, and mother education.

7.4.2 Suppressing Factors

While the focus is usually on risks and hazards, this section provides a balanced perspective for the role of protective factors.

Statistically, the suppressor is an intermediate variable that, when added to the regression model between the independent predictor and the outcome variable, increases the strength of the significance of relationship of the independent, mediator and outcome variables. This relationship is opposite to the concept of model 4 of the mediation model, that implies a reduction in the magnitude of the relationship (becomes insignificant) when the mediator is added to the model.

Referring to the sig value, table 7.3 indicates that the mother's education is a suppressor to the pathway of water stress- wealth level-parent support. This means that the mother's education suppresses the indirect effect of water stress and poor wealth as the significant relationship became with stronger than was true before adding the mother's education.

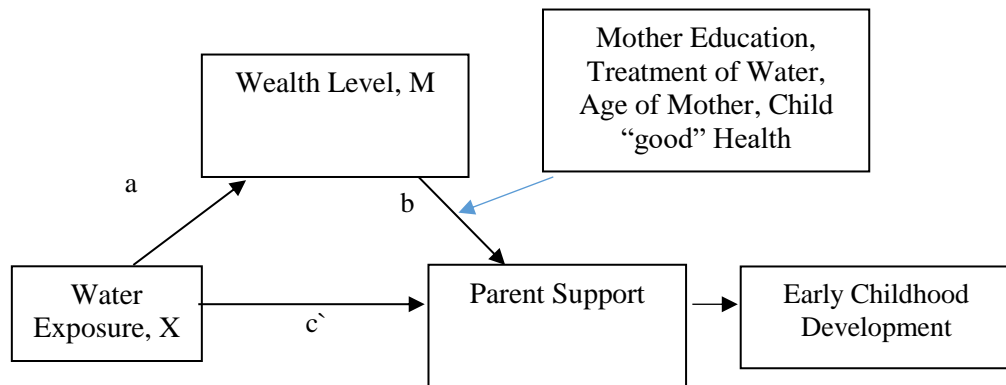
Table 7.3: Regression Analysis of Factors with Suppressing Effects

Model	Sig	Coefficient	R-Squared
Water Stress-wealth level- Parent support	.136	.015 (-)	.033
- Mother Education	.04	.02 (-)	.056
- Treat Water	.02	.012 (-)	.033
- Age of Mother	.03	.312 (-)	.055
- Not sick with Diarrhoea	.02	.310 (-)	.006
- Not sick with Stunting	.01	.393 (-)	.002
- Not sick with Anaemia	.01	.585 (-)	.008

Figure 7.4 presents suppression pathways, specifically addressing mother education (above high school), and treatment of water by boiling before use, and her age.

This result indicates a vital role of maternal education to act as a buffer, protecting their children from the indirect effects of water stress and possible other environmental, social, and physical stresses on children. Mother education reduces the influences of exposure made through the socio economic micro context of the child. This concept is based on the assumption that educated mothers have more knowledge and economic potential and capabilities to provide their children with care and support, and to control and adapt possible consequences of wealth level and water stress.

Figure 7.4: Visualization of the Mediating Role of Family Wealth and Suppressing factors Health and Mother Education and Age



Age is adversely associated with water stress as women of higher age seem to have more experience and probably a lower number of young children to care for. Boiling water is adversely associated with water stress, which is a realistic finding, indicating that parents can prevent the consequences of water stress through simple water-related practices given that water quality is a significant stressor in Palestine.

Child health was examined a child characteristics within a positive perspective. The analysis under this section considered the category of children not having diarrhoea

anaemia, and stunting as indicators of good health, and accordingly suppressors to the effect to the effect of water stress on risks for delayed early childhood development.

7.4.3 The Moderation Role of Refugee Communities

Moderation occurs when the relationship between two variables depends on the value of a third variable. Being a refugee is an ongoing and existing demographic and social life reality, and is addressed as a practical example for this model.

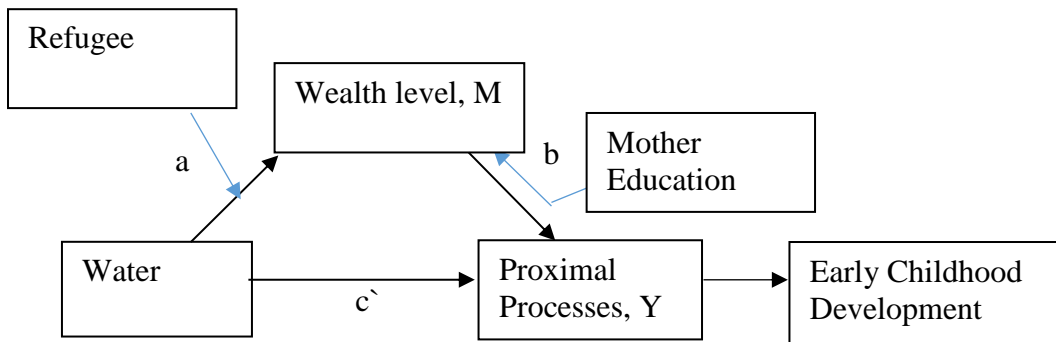
Type of community (rural, urban, or refugee) was found to be a moderator for the link between water stress and parent care. Statistically, as indicated in Table 7.5 and following the method explained in Chapter 4, when the variable of being a refugee was added to the model and compared to a dummy verifiable created for the same variable, the R-squared value changed, indicating that variance of the outcome variable changed according to the characteristics of the intermediate factors.

Table 7.4: SPSS Output Showing the Change in R-squared Value of Being a Refugee

Model	R-Square	Adjusted R-Square	Std. Error of the Estimate	Change Statistics				
				R-Square Change	F Changed	df1	df2	Sig.
1	.014	.014	.23316	.014	23.650	2	3257	.000
2	.016	.016	.23294	.002	7.162	1	3256	.007

From this finding, it can be interpreted that the effect of water stress on parents and children is higher if they are refugees. This result is not surprising as living in a refugee camp indicates a higher likelihood of facing complex disparities including high population density, high unemployment, deteriorated wealth rates, and sensitive geopolitical conditions. These conditions make the impacts of water stress on the ability of refugee families to care and support for children more challenging.

Figure 7.5: Visualization of the Moderation Effect of Being a Refugee



While the social and economic contexts of the refugees are evident, the influence of water stress being moderated by being a refugee has never been addressed in Palestine. It is crucial to understand how the living conditions of the refugees alter the effect of the stress on children and their families. This may be of great advantage, not only in water stress management planning and design of interventions, but also for policies and social, health, and economic services addressing children and their families.

7.4.4 The Mediation and Moderation Effects: The Vicious Cycle

As mentioned in the method chapter, moderation is a condition closely related to mediation, whereby the effect of the independent variable varies across the characteristics of an intermediate factor. This research highlighted that poor families are more likely to be influenced by the social and economic burden of water stress that undermines their social and economic capacities. At the same time, refugee communities moderate water stress, being more vulnerable and susceptible to the adverse consequences of water stress. From this respect, this research suggests a vicious cycle that combines mediation and moderation in these communities. By combining both mediation and moderation in Figure 7.6. c, water stress enhances the already existing social, economic and

environmental burden of poor wealth, while poor families at the same time, have limited capabilities to cope with and control water, and becoming increasingly less likely to be able to buffer and support their children.

Figure 7.6: Mediation and Moderation: The Cycle

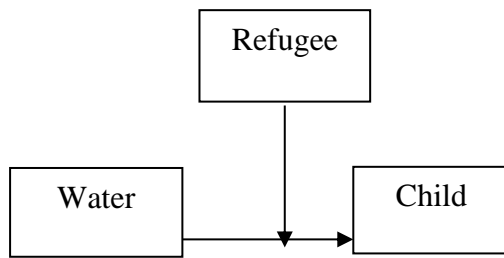


Figure 7.6.a. Moderation

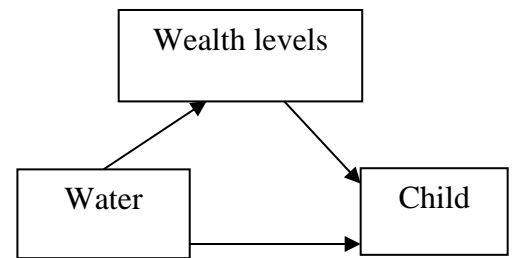
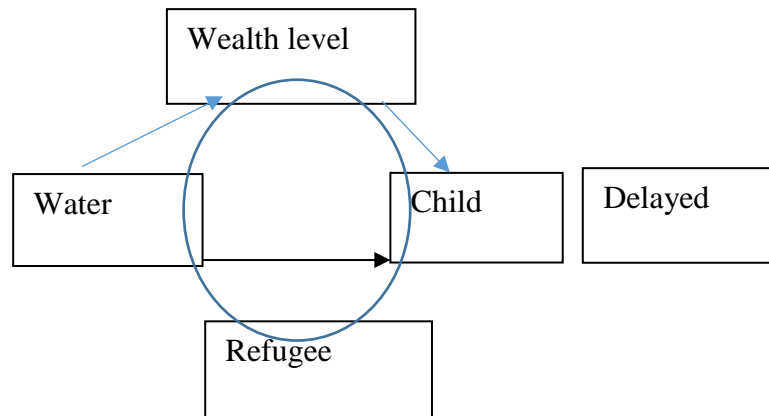


Figure 7.6.b Mediation

Figure 7.6.c. Mediation and Moderation



Such a situation continuously disrupts the family system and opportunities for improvement, increasing the gaps between the communities and families. The strength of the suppressor variables may break this cycle, but this depends on their values, intensity, and the position of these factors. The author believes the available data, being based on a cross-sectional method, did not capture many aspects that influence this cycle. The mediated-moderated interrelations involve social, relational, cultural, and political factors beyond the scope of the quantitative data.

7.5 Water Stress and Household Chaos: Qualitative View

7.5.1 Executive Summary

This section is the third report prepared based on the findings from four focus group discussions held in four districts in the West Bank and Gaza Strip. This report is explicitly based on the discussions related to the third research question raised during the focus group discussions:

How do exposure to household water stress and the intermediate factors of wealth and parental support interact and establish risks of delayed early childhood development?

The first qualitative report in Chapter 5 provided an in-depth description of water stress. The second report in Chapter 6 provided a holistic perspective of the effect of water stress within combined stress features. This report explains modes of interactions between water stress and household dynamics and living conditions, guided by the main steps of the mediation model.

The discussions followed the mediation model logic being structured according to the following objectives:

- Examine the indirect effect of water stress on parental capabilities, mediated by the family's wealth conditions
- Examine the direct influence of water stress on parental capabilities
- Examine Water Stress-Induced Household Chaos and Parental Capabilities
- Examine Water Stress-Induced Household Chaos and Children

This section addresses the influence of water stress on parental capabilities with a specific focus on how parents perceive water stress as a source of trouble, pressure, and disturbance for them as parents, influencing their ability to maintain regular and adequate parental care for their children. This focus is based on the concept of household chaos, which refers to aspects of family and community life that are troubling, disturbing, and undesirable for parents (Evans and Wachs 2010). The focus group discussions sought parents' experiences, views, and perceptions of when water stress contributed to the level of chaos already experienced by the households and how this contribution added to the sense of disturbances that parents feel while they are caring for their children.

The discussions addressed the indirect and direct effects of water stress on parents' sense of chaos. The indirect pathways addressed inadequate or disturbed care provided to children mediated by wealth capacities, leading to disturbances in parenting represented by less time, interaction, and being less responsive to children's needs.

The direct link was examined for its influence on their parental duties including failures and challenges related to the reliability of water services, inadequate quantity, perceived poor quality, and high cost. The consequences of a sense of chaos influenced by water stress were then discussed in terms of risks related to delayed early childhood development.

7.5.2 Main Findings

7.5.2.1 The Indirect Effect: Water Stress, Wealth Conditions, and Parental Capabilities

The participants discussed how this pathway influences their ability to preserve steady relations with family and neighbours, fulfil the vital needs of children, and maintain good health and an adequate sense of security with no intention of worry or threats.

The participants were not requested to disclose their wealth level, but to share their own experiences during situations when they experienced water stress and how they related to their wealth challenges. Most of the participants, especially in Gaza and the Jordan Valley, highlighted wealth and economic conditions as significant challenges that influences their parenting capabilities.

My husband is unemployed, and I know he may not be employed for the next few months. We receive occasional financial support from charitable agencies and the United Nations and have little money to buy only food and water. We do not know how long it will take. Female participant from Gaza.

The participants agreed that their economic challenges are continuous stressors with lengthy exposure, especially with limited financial income, unemployed parents, and increasing household demands. An interesting finding captured during all discussions, and not captured by the quantitative analysis, is that families usually adjust their household expenditures and assets to reach a certain level of adaptation.

Most parents especially in Gaza, addressed challenges related unemployment of the head of household, absence of steady income for the family, absence of constant assistance and support from the government and United Nations, lack of opportunities for marketing

their household products, and increased cost of living. The following water-economic challenges were collected from the participants:

- Burden of purchasing water from tanker vendors at high costs
- Had to borrow water from neighbours
- Could not produce homemade products for income generation
- Household income-generating activities disturbed
- Faced difficulties in purchasing water storage supplies
- Prioritized purchasing water at the expense of other commodities

When the family becomes exposed to water stress, the economic adaptation system they developed becomes disturbed. There was disagreement among the participants on the level of disruption that water stress constitutes to their economic capacities. The participants in Jordan Valley who use water for production activities highlighted this a major challenge.

The groups in the Gaza Strip shared a considerable absence of social and economic security, while the Nablus group focused on the livelihood and wellbeing inside the household.

The participants, especially males, expressed their concerns over the economic burden, explained as the total they pay for different related costs including payment to the regular water network, maintenance of the water network, storage and piping connections, and, most significantly, the financial burden of paying for water tankers with fluctuating prices.

7.5.2.2 The Direct Influence of Water Stress on Parents

Participants connected water stress with cleanliness and hygiene highlighting this aspect as the second priority after drinking and cooking. The focus group in the Jordan Valley connected water with the safety and quality of the dairy production, and with the safety of drinking water for their family members and their sheep. The participants indicated that water-related disturbances, especially inadequate water, unreliable and discontinued services, and poor quality are immediately sensed and cause social, emotional, and physical distress that multiplies with progression of the exposure. The following are summary observations collected from the participants:

- Clean the house less than needed
- Children bathe less than needed
- Cook less food
- Concerned from sewage and faecal waste disposal
- Feel water stress is a concern for the health of children
- Children are told not to play
- Purchase water from untrusted sources but with lower cost
- Feel distressed
- Feel insecure and worried
- Limited places for children to play
- Kitchen, toilets, and yard not clean
- Personal hygiene of mothers sacrificed for others

The participants referred to the direct influence by the absence of water-related practices they perform when they have water, such as bathing, washing, and cooking. They also feel the direct consequences due to the absence of water as an essential requirement for making a safe and healthy environment for them to live and interact. This includes clean toilets, kitchen, and house. It is also related to the cleanliness of the yard and house where children can play and develop their motor and physical skills.

All participants highlighted the time and length of the problem as a major detriment of water stressors. Participants indicated that they can manage for two days with the minimum quantity needed for cooking, drinking, handwashing, and toilet use. Others indicated their personal level of tolerance with respect to water disconnections and related uncertainty.

After two days, participants indicated they start making use of other sources of water, meaning they start utilizing their own wealth and capabilities. The stronger their capabilities, the more they can tolerate and adapt to the lengthy exposure. Several participants indicated that they start adaptation without making use of their financial capabilities by utilizing storage water, borrowing from neighbours, and using nearby public springs, especially in the Jordan Valley.

7.5.2.3 Water Stress-Induced Household Chaos and Parental Capabilities

The following includes quotes reflecting the sense of chaos that parents feel due to the direct and indirect effects of water stress. The feelings of chaos are related to the social, emotional, economic, and physical shocks that challenge their control and adaptation role as parents:

- *“When we have limited water, everything inside the house goes up and down.”* Male participant from the Jordan Valley.
- *“When we have no water, everybody is nervous and blames each other.”* Female participant from Nablus.
- *“My wife and my children pressure me to leave our house and go to another place.”* Male participant from Gaza.
- *“When I do not bring water bottles, everybody is angry at me. I cannot concentrate, I cannot focus.”* Male participant from Gaza.

- *“When you have no money, you stay at home to spare expenditures. When you have no water, staying at home is intolerable.”* Participants from Nablus.
- *“I can’t do laundry or bathe, which become my second priority. I can hold many stresses. I can hold having no money and no clothes but I can’t stand having no water.”* Female participant from Gaza.
- *“I prioritize drinking and food preparation. Then I give priority to children to have a bath, not me. Imagine you do not bathe for a week. I feel disgusted and dirty. I avoid my children and husband, and don’t leave my home.”* Female participant from the Jordan Valley.

The above quotes are examples of what parents are challenged by during times of water stress, including negative feelings, and disturbed relationships and dynamics with their children. The quotes indicated some variations among male and female participants. While it can’t be generalized as a public trend, male participants expressed their feelings with anger and nervousness, while most of the females indicated that they express their feelings with internal anger, isolation, and distress.

The lengthy exposure has two perspectives. While it exhausts already limited capacities and influence, lengthy exposure may enable certain adjustments and adaptation by families. Many of the parents’ worries and concerns were due to the unexpected shocks and disturbances that influenced their household processes and dynamics. The unexpected shocks were highlighted by the groups in Gaza due to electricity cuts, which stop water pumps and weakens the public water pressure. Others referred to conflict-related conditions including unexpected military confrontations, which affect the access and movement of people, and results in the displacement of communities living near the borders and disruption of productive economic processes.

Many participants highlighted that the influence of water stress on the quality of care they provide to their children happens mainly after the caregivers feel exhausted, helpless, and

unable to buffer their children from the adverse impacts of the exposure. The following are the main disrupted parental capabilities, according to the participants:

- Disrupted relationships
- Economic pressure
- Disputes with other family members, neighbours, and relatives
- Parents become less proactive in addressing other needs like clothes, books, toys and stories
- Family members become unhappy, nervous, less emotional, and less sincere
- Socializing with neighbours and relatives becomes inadequate
- Males face more economic pressure
- Females face more pressure in child care and household duties
- Males express their feelings with anger and nervousness
- Females express their feelings with isolation and distress
- Challenging tension related to household priorities
- Parents become over protective
- Feeling unhappy and not comfortable
- Self-isolation
- Consider changing community or neighbourhood

None of the participants indicated less love or passion toward their children; on the contrary, participants indicated they became more protective, sensitive, and responsive to their children's needs when the stress occurs. However, as shown above, the adverse consequences were related to the limited capacities that limit the caregivers' ability to interact with and support their children.

This perspective confirmed the sense of overprotection towards children at the expense of essential well-being and parents' quality of life. During stress, they prioritize their children with their own limited resources, capacities, and capabilities. However, participants indicated that while they become protective of their children during stress, they become more socially, emotionally, and economically pressured.

The combined and chronic exposure makes the effect collective and difficult to tolerate. For instance, when households in the Gaza Strip experience electricity cuts and demolished public water networks, demand for unimproved alternative supplies of water increases. However, this raises the cost, and therefore households purchase less water. Such complex conditions force families to face complex multidimensional stresses that may exhaust their capabilities.

7.5.2.4 Water Stress-Induced Household Chaos and Children

The discussions provided an interesting perspective that was not detected by quantitative data. They indicated that children feel the social and economic pressure that comes with water stress. Parents noted that their children feel the change in their parental support during water stress. This feeling intensifies when parents become unable to prevent and control stress.

When we live in a tense family situation, my children, four and two years old, are worried. They are not normal, they shout, play less, and become over-demanding.

My child is four years old. He is aware of all that happens around him. When we have no water, I do my best not to influence him. But I can't help being sensitive. When he plays and gets dirty, I become strict with him not to get dirty because we have no water. Female participant from Nablus.

The above quotes reflect that children, mainly those aged two to five years old, feel the stress and consequences of water failures, and related challenges. Parents do their best not to offer less water for drinking and washing. However, they offer limited space for their children to enjoy childhood activities, including playing and moving freely inside a clean and safe house. They primarily experience disturbances in the steady, safe, and supportive family atmosphere. They feel the change through abnormal relations between

family members, among parents, and in the absence of close relationships with their main caregivers that they are accustomed to.

Reflecting on parents' discussions, the change in the relationship with the caregiver has two main perspectives. Under the first perspective, children experience more sensitivity, more attention, and increased social and emotional support. This perspective was explained by being knowledgeable about the ongoing stress, implying an increased sense of insecurity, protection, fear, and worry.

I would do anything to protect my children. I use less water, less food, and less money to make things available for them. Female participant from Nablus.

Through this perspective, parents become over protective, prioritize their children's needs, and utilize other resources to maintain a safe and healthy environment. This group indicated that the over protection makes them, as parents, more nervous, worrisome, and even encourages them to provide strict guidance to their children not to play and get dirty.

The other perspective is reflected by undermined or inadequate care. Participants indicated that water stressors contribute to higher levels of anxiety, nervousness, uncertainty and anger. The impacts of the above challenges were primarily expressed with social and emotional distress, anger, and frustration. Interestingly, feelings and practices of isolation, distress, and insecurity were heard during all of the focus group discussions, particularly in the Gaza Strip.

The following are aspects captured from the participants on how children are influenced by the disturbances caused by water stress in the family system:

- Children are distressed themselves.
- The household and yard are not clean and they can't play outside.

- My children complain about their hygiene and sanitation and even cleanliness inside the house.
- I love my children, but I am not a happy mother.
- Children do not bathe adequately.
- I cook less food for the children because there is no water.
- I spend less time with the children.
- I pay less attention to the children's needs unless they are sick.
- I become nervous, and provide harsh directions to children.
- Children witness family disputes specially between the father and mother.
- I take children less to leisure places.

The above features clearly indicate the absence of safe, healthy, and supportive social and physical atmospheres for the child to have space to move and interact. Out of 14 parents who have children under the age of one, 11 indicated that water stress does not influence their essential caregiving motives. However, all indicated that they considered stopping breastfeeding their children when they are socially and physically stressed. Mothers indicated that the main reasons for stopping breastfeeding is the physiological and social stress they face when they have an inadequate quantity and poor-quality water, accompanied with increasing social demands from family members.

This trend has never been addressed in Palestine, and data from the qualitative analysis cannot establish evidence of the relationship between stopping breastfeeding and water stress. However, it indicates deep feelings and unpleasant experiences that deserve further researching.

7.6 Conclusion

7.6.1 The Quantitative Analysis

To provide a narrow scope at the household level, the role of the intermediate factors in influencing water stress was examined using family wealth and parental care as the main intermediate factors between water stress and early childhood development. The data utilized by the present research failed to establish a statistically significant relationship between the use of unimproved water supply as the main source of drinking water, which represented water stress, and early childhood development status represented by the Child Development Index. Moreover, the data did not show a significant relationship between water stress and other child outcomes, especially diarrhoea and stunting. The absence of association can be attributed to the fact that water stressors in Palestine, specifically water quantity and quality, are not severe in their physical intensity, and therefore do not establish significant effects on child outcomes.

The present research argued that early childhood development and children are sphered by essential determinants, particularly children's close environment, that interact with water stress and influence the intensity of its impact on children.

From this perspective, water stress was found to have significant association with the quality of parental support represented by the number of child development-related practices parents provide to their children. At the same time, child parenting was found to be significantly associated with optimal early childhood development, and deficient care as a predictor for delayed early childhood development. Water stress was found to establish direct effects on parent care, but to a much larger extent through indirect effects such as undermined wealth levels, indicting family wealth.

Following the path diagram in Figure 7.2, the conclusions can be summarized as follows:

- Parental care is a significant predictor of optimal early childhood development.
- Water stress influences parental support directly, but to a larger extent indirectly through intermediate factors of children's living conditions.
- Children from households with water stress are less likely to enjoy adequate parental support than children from households without water stress.
- Water stress induces the influence of poor wealth levels on the Palestinian households and children.
- Water stress influences parental support directly. The direct effect increases with the increased intensity of the intermediate risk factors, making children and their families more susceptible to water stress exposure.
- Maternal education can suppress the impacts of water stress on parental care and its consequent effect on childhood development.
- Being a moderator effect, children living in refugee communities are more likely to be influenced by the combined influence of water stress and undermined wealth level.
- Mediation and moderation can cause a vicious cycle that contributes to keeping poor people within the deteriorated wealth level. Under mediation, stress such as water enhances the influence of limited wealth on families, causing increased financial burden. Under moderation, poor families suffer the most from stresses such as water stress. This construct makes it difficult not only to escape the poorest wealth level, but also to escape or prevent other stresses.

7.6.2 The qualitative Analysis

The qualitative method provided an in-depth understanding of how water stress dissociates its effects on direct and indirect pathways. The direct pathways are not necessarily through the physical features of stressors, but also experiences and events caused by water stress.

Wealth and water stress have a reciprocal relationship. However, wealth-related challenges seem lengthy and steady, to which parents adjust and adapt themselves. Water stress, especially public water disconnections, establish occasional shocks that disturb their adapted routines. The combined influence of water stress and wealth-related challenges undermine their parenting capabilities as they are negatively influenced socially, emotionally, and physically.

Both the direct and indirect effects seem to merge and contribute to household chaos, whereby the parents (both males and females) perceive the tensions, disturbances, and troubles in their households. Parents become more protective and prioritize their children, but when things are about to be out of control, they become distressed, angry, and pressured.

The relationship between children and their physical and social environments, especially with the main caregiver, is undermined. Children (depending on their age) feel the change and detect an unhealthy family atmosphere. Some challenges influence children with tangible changes such as less ability to play and others with undermined capabilities, practices, and feelings among those around, especially mothers.

7.6.3 Integrative analysis

This research explored the interactions between exposure to water stress and intermediate factors related to children's living conditions. This chapter intended to explain the interactions of child water stress presented by Chapter 6 as the combined effect of exposure to water stress and factors related to children's living and wellbeing conditions. It primarily explained the role of intermediate factors in influencing the intensity of the exposure and its influence on children.

This chapter provided evidence that children are influenced by indirect pathways through which intermediate factors mediate the effect of water stress exposure and induce its influence. While the main focus of this research highlighted risks, it also addressed protective factors that suppress and reduce its intensity, and other intermediate factors that moderate the influence of water stress.

The qualitative analysis indicated that parents attempt to adapt to water stress, confirmed that they sense the risk on their children when they feel exhausted. Due to limited resources and higher stress, poorer families are less likely to provide enriching stimulation and care for their children.

The social construct of the Palestinian household is centred on the role of the mother as the caregiver to protect and meet the daily needs of their children, which includes the burden of collecting and storing water. However, the qualitative data showed that both parents are stressed by water failures and challenges as both feel the household's disturbances are enhanced by water stress.

A significant finding of this research is the social and emotional domain of early childhood development as the domain mostly influenced by water supply, family wealth

and early childhood development. The quantitative data showed more involvement of mothers in child care practices and less involvement of fathers. However, the qualitative data shows that both parents believe water stress adds to the disturbances, troubles, and challenges they encounter not only physically but also socially and emotionally. As revealed by the qualitative method, children feel the stress and detect an unhealthy family environment. Children are stressed by tangible changes such as less ability to play. They are also influenced by undermined parental capabilities, practices, and feelings.

While the relationship between wealth and water supply is not a new finding, the mechanism and the directionality of the pathways identified in this research increase the understanding of this problem to support the development of responsive and effective programmes.

Considering the methodological limitations, , the present research argues that the mediation model can serve as suitable logic for conducting assessments to help design and implement programmes addressing children's wellbeing and development. It also serves as a practical strategy and approach to better assess and serve children to meet their needs and rights.

Chapter Eight | Implications of Child Water Stress for Child Development Services and Practices

8.1 Introduction

The previous three chapters described the exposure to water stressors, defined a macro-perspective of child water stress, and explored mechanisms to explain related interactions at the micro household level.

This chapter examines the implications of the macro- and micro-perspectives of water stress on the effectiveness of childhood services provided to pre-primary school aged children. Childhood services refer to the services that support children to achieve their positive early developmental outcomes including learning, cognitive, and social skills. The ineffectiveness identified in this chapter indicates undermined ability of childhood services to achieve their desired objectives of supporting children to achieve their optimal developmental outcomes. Being relevant to the research objectives, ECD services and related policies served as a case study, presenting a pertinent example of other childhood services, including health and social support.

Considering the benefits for the children, families, and communities, international and national strategies are paying increased attention to ECD services. ECD services emphasize the development of cognitive, learning, and social skills. The present research argues that the context of poor, vulnerable, and marginalized children—including many children in Palestine—dictate a different paradigm for these vital services.

Many charitable community-based organizations in Palestine, supported by UN agencies such as UNICEF as well as the Ministry of Education, operate preschools offering services with relatively reduced fees and expenses. Preschools are relatively small educational establishments offering services to children primarily aged three to five years old.

Children go to preschools for learning and cognition development, to enhance their skills and knowledge, and to learn how to explore, think, and problem solve. Most importantly, children interact with peers, educators, and caregivers, and develop interpersonal, communication, social, and emotional skills.

Admission to preschools is not compulsory. The decision to enrol is subject to the interest, preferences, social beliefs, and the financial capacity of parents.

Within the context of Palestine, every morning, many children, most likely from poor households, come to preschool from homes where they may see, witness, interact, and suffer from situations related to water stress combined with stagnated social and economic conditions.

The present research argued that water stress and vulnerability that children experience at home and in their communities undermine the effectiveness of early childhood services in supporting children to achieve their development potential.

Guided by the outcomes of chapters five, six and seven, this chapter presents the findings of the quantitative and qualitative methods to examine the challenges and gaps between the macro- and micro-perspective of household water stress and early childhood services. To capture a comprehensive view, the research utilized secondary quantitative data from the communities and ECD services to explore the relevance of the services to children's macro-context. The research utilized primary qualitative data to obtain an in-depth understanding of the gaps between ECD services and the social and physical environment at the household level. Finally, the present research obtained views and experiences from the practice side regarding interactions between the macro- and micro-perspectives of water stress and the practice-based processes.

8.2 Relevance of ECD Services to the Macro-Context: Descriptive Analysis.

8.2.1 Types of Services and Related Effectiveness

Table 8.1 presents ECD services offered, to varying extents, by a sample of 56 preschools in the West Bank and Gaza Strip. The present research classified ECD services into two main groups. The first group includes activities and interventions primarily to support children's cognition and learning, which serve as core activities implemented by almost all preschools included in the sample. The second group encompasses four categories of supplementary services offered in parallel, and in addition to the core activities. These services address contextual aspects including water stress, socio-economic factors, health, and parent-child interactions.

The descriptive overview as presented in table 8.1 includes estimates of the effect size of each service. As indicated by the method chapter, the effect size quantifies the extent of change happened due to certain intervention or service. The estimation of the effect size followed Cohen's *d* methodology by calculating the mean difference of children on track in their development in 2012 and 2015 considering the services provided. To obtain standardized measures, the mean difference was divided by the pooled standard deviation of the mean percentages of children on track.

Table 8.1: Types of Early Childhood Services and Related Effectiveness

Type of ECD Service	Percentage of preschools implementing the service	Effect size on children on track in their social-emotional development	Effect size on children on track in their physical development
Learning and Cognition			
Extracurricular activities, arts, culture	69%	.29	.58
Learning skills	100%	.04	.10
Language skills	100%	.10	.10
Average learning and cognition	100%	.14	.25
Supplementary Services			
Interventions addressing water stress			
Assure continuous supply of water for drinking and washing at preschool	75%	.50	.90
Enhance children practices of washing hands	63%	.50	.53
Assure adequate, clean, and functioning toilets with clean running water for flushing and faecal disposal	73%	.47	.83
Average Water Stress		.49	.75
Interventions addressing children's socio-economic conditions			
Support for School uniformed	54%	.52	.66
Preschool fees partially covered	29%	.58	.9
Support for school bags and books	60%	.38	.81
Average socio-economic		.49	.82
Interventions addressing parents			
Awareness and knowledge of ECD	69%	.4	.49
Involvement of parents in volunteer activities	45%	.4	.78
Average parent activities		.4	.64
Interventions addressing children's health			
Percentage of children who bring food from home	70%	.36	.56
Children checked for their health once a year	77%	.37	.56
Average health interventions		.37	.56

Notes:

- 0.2 is low, 0.5 is moderate and 0.8 and above is high
- The percentage of preschools implementing the service was reported in 2015.

Cohen (1988) suggested that an effect size score of 0.2 is low, 0.5 is moderate and 0.8 and above is high. The findings are relative to the sample used by the present research, and therefore, they may not be generalized to all populations. However, the information, still, presents an essential view of the types of services provided, variability among services, feasibility of the interventions, and comparability concerning effectiveness and results.

The descriptive overview indicates that the primary focus of early childhood services is learning and cognition as the preschools' routine programmes. This emphasis reflects an ideal objective for supporting children to acquire literacy, numeracy, and language skills, and to enhance readiness for primary school.

Supplementary services addressing aspects related to water stress and contextual conditions vary among preschools. Obviously, ECD services do not have much to do with improving household water security. However, they may reduce its adverse consequences by ensuring appropriate access to a continuous supply of water at the preschool.

75% of preschools assure a continuous and running water supply and waste disposal facilities inside the preschool, 63% engage in awareness and hygiene practices of handwashing, and 73% have toilets with running water for flushing waste. With the absence of a national baseline, the present research cannot confirm if these water-related values are high or low. However, ideal coverage of such services should be close to 100% as continuous and safe water and sanitation facilities are basic fundamental rights for each child.

The effect sizes of water-related interventions are relatively large, especially assuring continuous supply of water for drinking and washing at preschool which scored effect

size of physical development outcome of 0.9, and assuring adequate, clean, and functioning toilets with clean running water for flushing and faecal disposal of effect size of physical development outcome of .083.

The high effect size indicates continuous and steady access to a supply of drinking water and faecal disposal allows children to enjoy a more reliable and convenient environment to interact, communicate, learn, and play.

The activities contributing to the alleviation of socio-economic burden showed high effect size, especially related to physical development outcome. These activities are of unique distinguishing importance due to limited wealth levels and the deteriorated socio-economic conditions in the country. The data show that more than half of preschools responded to the deteriorated socio-economic conditions by providing discounted or free uniforms, school bags, and educational materials. However, fewer preschools provide financial aid to encourage low-income families to enrol their children. The latter intervention scored a relatively higher effect size. Although it results in high effect size, only 29% of preschools offer this. Preschool fees partially covered. This may not indicate a lack of interest, but rather limited financial capacities and resources among these organizations.

With less than half of preschools actively running joint interventions with parents, the data show a service gap with low to moderate percentage parental involvement and moderate effect size. However, the data indicates parental involvement in the preschool activities only. The data does not allow conclusions related to child parental interaction at home, where the majority of which occur. Still, the findings reflect an aspect of improvement specifically by increasing parents' involvement and interactions at

preschools. Further research seems needed with respect to how the increased involvement of parents at preschool is reflected on the quality of support and interactions at home.

The interventions addressing children's health raise additional concerns. Despite being a basic right for each child, full coverage of health responses among early childhood services is deficient. This shortfall was indicated by 70% of preschools complying with regular health screening for malnutrition, dental health, and disabilities. The effect size is moderate, mainly because many of the listed health interventions are in the form of initial screening and assessment rather than regular and continuous health activities incorporated in the preschools' routine. Other reasons may be due to institutional arrangements between education and health facilities that dictate that children's health is the responsibility of the health facilities. Therefore, the preschools only run initial or surface screening for children.

A general observation of the data indicates that learning and cognition interventions are offered on a routine and steady basis by most of ECD services. Because there are no increases or decreases, the effect size does not significantly change. If the quality and mode of learning and cognition are assumed similar among the preschools, then the supplementary services can make a difference. The supplemental interventions seem to be the window of opportunity for children to alleviate or reduce the impacts of complex stresses.

To further support this argument, a linear regression analysis showed a significant association between the average number of supplementary activities and overall effect size of preschools. This relationship remained significant after incorporating possible confounding variables, especially the values of vulnerability and stress for the regions in which these preschools are operating.

The statistical association may be weak especially that the sample size is only 56 preschools. More data related weaknesses may be attributed to not incorporating many factors related to the quality of care and services offered by each preschool, professional and technical capacities inside each school, the system and curricula preschools follow, and the geopolitical conditions. Most importantly, the number of activities may provide a misleading conclusion that the larger number of activities, the higher the effectiveness. The next section addresses an opposite path whereby the context itself may undermine the effectiveness of these services.

8.2.2 Relevance of Services to Stress and Vulnerability

Table 8.2 presents a comparison between the West Bank and Gaza Strip. The two regions vary in water security, politics, and economy, and related stress and vulnerability. The comparison used data related to the effectiveness of services, and the community-based data for the same regions obtained from the ecological data set of Chapter 6.

The following table presents a macro-perspective, relating the relevance of early childhood services to the local context. It compares the two regions in terms of the relative effectiveness of services, intensity of child water stress, vulnerability, economic stress, and socio-economic index. The data clearly shows that stress levels in the Gaza Strip related to high levels of water insecurity, undermined wealth, challenging geopolitical conditions, and challenging community features are relatively higher than in the West Bank.

The same data shows that the effectiveness of childhood services in the Gaza Strip is lower than in the West Bank. The average number of supplementary activities implemented by West Bank preschools is more than in the Gaza Strip (7.6 compared to 6.5, respectively).

Table 8.2: Comparison Between West Bank and Gaza Strip with Respect to the Standardized Scores of Stress Features and Effect Size of Early Childhood Services

Description		West Bank	Gaza Strip
<i>The Context</i>	Standardized values of stress features		
	Vulnerability score	-.01	.01
	Child water stress score	.41	.48
	Water stress score	.44	.47
	Average economic stress	.25	.92
	Child characteristics	.38	.23
	Standardized score of predictability of water stress	.42	.39
	Standardized score of controllability of water stress	.36	.54
Standardized score of adaptability of water stress	.45	.44	
Average stress		.34	.44
<hr/>			
<i>The Services</i>	Standardized values of the effect size of early childhood services		
	Interventions addressing water stressors	.72	.31
	Economic conditions	.80	.18
	Learning and cognition	.23	.16
	Parents	.61	.17
Health	.56	.27	
Average effectiveness		.58	.22
Average number of supplementary interventions without learning and cognition		7.6	6.5

- Higher standardized values of stress features indicate higher intensity
- Larger effect size indicates the ability to achieve higher difference between two periods

The limited effectiveness of early childhood services in Gaza suggested two possible gaps that require further explanation: The relevance of the core and supplementary services to children's context, especially the home environment. On the other hand, the higher stress and vulnerability among Gazan communities result in higher demand and more pressure

on services and activities, suggesting an undermined ability to develop and design supplementary services.

The findings suggest that the severity and magnitude of stress and vulnerability may establish a suppression path to the ECD services and undermines its effectiveness in supporting children achieve their positive outcomes. The next section provides perceptions and experiences of caregivers related to ECD services with specific focus on its relevance to children's context.

8.3 A Micro-Perspective: Childhood Services and the Home Environment

This section presents an analysis the views, perceptions, and experiences of caregivers (mostly parents) regarding the gaps between early childhood services and the home environment gathered through focus group discussions. The home environment refers to the natural physical and social environment that supports the growth and wellbeing of children. An optimal home environment is where children live and interact with parents, caregivers, and siblings in an atmosphere of happiness, love, and understanding, with adequate opportunities to play, explore, and discover, where they are supported by the presence of developmentally-appropriate tools and objects such as books and toys. The objectives of this discussion followed two tracks:

- Advantages and disadvantages of early childhood services
- Gaps between ECD services and home environment reflecting the following:
 - Inadequate consideration of child water stress and associated factors
 - Continuity of childhood services across age groups

8.3.1 Advantages and Disadvantages of Early Childhood Services

Among caregivers who participated in the focus group discussions, 55% had their children enrolled in preschool, 45% did not have a child in preschool, and 40% of all participants had another child below the age of three.

Generally, parents expressed positive perceptions and views towards early childhood development services. The following list of benefits was generated from the opinions and thoughts expressed by caregivers and parents:

- Learning how to read and write
- Interact and express themselves
- A place where children can stay because both parents are working or engaged in other duties
- Enhance their social skills and character (interacting with adults and children)
- Play, enjoy, and have fun
- Enhance their social skills and character
- Interact with adults and children
- Learn new things (e.g. new songs)

The main common benefit, as expressed by parents, was learning how to read and write. This finding highlights the dominant perceived role of preschools as an educational establishment for learning and education. The quotes translated from the Arabic language generally reflected two words: reading and writing. The caregivers provided simple examples of improved skills related to reading and writing as becoming able to read and write simple letters, words, and numbers.

The second main benefit expressed by parents was the perception of preschools as places where children can stay while they are engaged in work or productive household duties. This benefit does not reflect the social and cognitive impact on children, but rather a trusted place where children can stay while parents are busy. Parents are less worried about their children while they are at work, saving the trouble of keeping their children alone or with relatives. This response was mostly heard from the Nablus group, an urban setting with more women employed or engaged in small businesses.

Fewer quotes reflected benefits regarding children's social character, communication skills, and interactions with others. None of the participants indicated the harmful impacts of early childhood services. However, participants expressed several reasons for not enrolling or dropping children from preschools.

Why would I enrol my child in a preschool while I am at home, not working? Even if I would like to, my husband may argue with me, and my in-laws would criticize me! Female participant from Nablus.

The following aspects were demonstrated as an overview of the feedback received on why parents were not interested in enrolling children in preschool:

- Home environment safer and more convenient
- Mother is not working
- Cost and expenses
- No preschool nearby
- Social and cultural reasons
- Risk of leaving home
- Risk of diseases and infections
- Risks of gaining negative attitudes

- Kids resisted and refused going to preschool

Although most of the participants come from conservative backgrounds, few expressed a preference to enrol or not enrol their child based their gender. The four most common reasons for not admitting or dropping children from preschools were cost and expenses, risk and uncertainty, unemployed mothers staying at home, and the belief that the home environment is a safer place for children.

My child walks to preschool with his older brother. I am always concerned because our area is near the borders and things may explode. The preschool is good, but I feel he is safer with me at home. Female participant from North Gaza

Although most preschools belong to charitable organizations and charge reduced fees, cost and related expenses reflected significant barriers towards enrolling children. The majority, including the employed participants, indicated that cost and associated expenses pose a significant economic burden. Expenses include fees, clothes, books, toys, food, trips, and transportation. The facilitators asked parents to rank the enrolment of children in preschool among other household priorities. They prioritized essential expenses such as food, water, health, clothes, and house rents above preschool. If they secure these essential items, enrolment in preschool comes next. Parents also expressed their concerns of health risks related to early childhood transmission of diseases, especially skin infections, lice, and respiratory tract infections.

8.3.2 Gaps between ECD Services and Home Environment

The following factors were highlighted as the main gaps between preschool and home environments:

8.3.2.1 Inadequate Consideration of Child Water Stress and Associated Factors

Participants shared experiences and events (summarized in Table 8.5) indicating that early childhood services do not adequately consider children's home contexts, especially water stress and related stressors. The caregivers' main views on the relevance of ECD services to home context are outlined below:

- Preschools do not adjust their activities when families are experiencing severe disconnection of water supply (i.e. health screening and social support).
- ECD services do not educate parents on adverse consequences of water stress on children and possible mitigation measures.
- Child handwashing and hygiene awareness is part of the ongoing programme, but is not intensified during severe water stress.
- Fees are set without considering the financial situation at home.
- Geopolitical aspects related to the community, especially political intensity, are not considered.
- Preschools do not serve food to children.
- Preschools do not address children who do not have access to ECD services.

Last month (October 2019), the water supply was cut for more than three consecutive days. My child went to school wearing dirty clothes because we did

not have enough water. I was ashamed, and I am not sure if the pre-schoolers' caregivers were understanding, but I was almost sure all children from the same neighbourhood had dirty clothes. Ironically, while we had no adequate water even for drinking, the caregivers at the preschool taught our children not only to wash their hands regularly but also to take a bath every day. Female participant from North Gaza.

Last month (October 2019), my child was just enrolled in preschool. It was hot, and we had minimal water for more than four days. The preschool sent me a note asking that my child have a water bottle with him when he goes to school. I was amazed because they do not have water while we also had minimal water. Female participant from the Jordan Valley.

The above quotes reflect household experiences and the extent to which preschools adjust to certain levels of water stress. Parents assume ECD services face less stress being supported by different organizations and having a better financial status. Accordingly, parents expect preschools to be ready to adjust their activities when the community and households face water-related challenges. Adaptation, as viewed by parents, may include more health screening, intensified hygiene awareness, enhanced interactions with parents, and more considerations to the socio-economic conditions the families are passing through.

The preschool asked parents to pay about 20 USD as a fee for a school journey. At that time, we had water shortages and my husband had intermittent employment. The majority of the families did not pay because we had other priorities. So, the journey was cancelled and our children did not go. My child, who is five years old, knew about it and became so sad. Female participant from the Jordan Valley.

Parents indicated that preschools precondition the enrolment of children with the paying of fees. Bearing in mind the deteriorated wealth levels, all parents stated that reducing prices of uniforms, educational materials, and fees would lead to positive impacts among

the parents and encourage them to keep their children enrolled in preschools. The following summarize the main reasons why ECD services do not adequately consider household water stress, as perceived by parents:

- Inadequate parent-service interactions and coordination
- Limited financial conditions of the establishment
- Management and administration considerations
- Geopolitical conditions

The primary reason according to parents and caregivers was the limited interaction between preschools and parents. The weak interactions were explained as inadequate coordination, consultations, and engagement of parents with the preschools' activities. It was also referred to as inadequate data collected by the preschool on the physical and social environment of children's homes. Accordingly, preschools may design and invest in supplementary services irrelevant to the home and community context, while parents may lose unique opportunities to work together with preschool educators to effectively serve their children.

Parents stressed the need for strong processes and interactions among family members, caregivers, and parents inside homes and preschools to establish a powerful buffer from the challenges rooted in the macro- and exo-systems. They highlighted the proximal processes in homes as a higher priority than preschools, specially that many poor children do not have access to early childhood service.

Parents indicated that early childhood services are offered mainly to children enrolled in these preschools. While access to preschools is not mandatory, but rather associated with interest, motive, and cost, families indicated that simple outreach activities can be offered

as a form of inclusion and community-based services. Educators could use innovative tools such as mobile texting, social media, and conventional media to enhance awareness and knowledge in this regard.

8.3.2.2 Continuity of Childhood Services across Age Groups

Table 8.3 presents the age-service gap based on feedback from caregivers in the four focus group discussions.

Table 8.3: Age-Service Gap

Age	Type of Care	Mode	Organization
0-3 months	Neonatal care	Mandatory	Ministry of Health
	Immunization programme	Mandatory	Ministry of Health
	Mother and child clinics	Mandatory	Ministry of Health
	Day care centre	Optional	Ministry of Social Affairs
3-18 months	Immunization programme	Mandatory, structured	Ministry of Health
	Mother and child clinics	Mandatory, programmed	Ministry of Health
	Day care centre	Optional, unstructured	Ministry of Social Affairs
36-60 months	Preschool	Optional, programmed	Ministry of Education
60- above	Basic education	Mandatory	Ministry of Education

The above timeline indicates the majority of services are offered during the first year of life, and are provided mainly through mandatory health interventions set by the government that families must comply with. The services include immunization according to a schedule prepared for children by the Public Health Department of the Ministry of Health. During the first year, all mothers are requested to go to clinics for check-ups for their children. This service is offered by Mother and Child Health services when parents bring their children for immunization.

The table above demonstrates the existence of certain gaps and lost opportunities. From birth to age 18 months, children benefit from health interventions with little or no emphasis on aspects related to optimal ECD. At 18 months, the mandatory health programme ends. At 36 months children can start preschool.

For of children under age of 18 months, the time line indicates emphasis on health aspects with inadequate early childhood services targeting parents' awareness with respect to child development practices, noting that this age is of the highest rate of children's brain development. The findings also indicate that children between the ages of 18 and 36 months do not benefit from any type of steady and organized services. Children may be admitted to health services when they get sick, or go to the day care centre if their mothers are working, but they do not benefit from any structured service with programmed activities.

I started learning about child development only when my child joined preschool, at the age of three and a half years old. I wish I learned about ECD practices before. For example, they raised my awareness not to allow my child to watch TV for a long time, but I used to keep him watching TV to give me time to do housekeeping. Female participant from Nablus.

During this period, children and families may lose significant opportunities being unaware of many aspects related to childhood development for children aged 0-36 months. Parents indicated that the health care clinics can serve as a suitable place to offer awareness and education related to aspects that families can consider beyond health, diarrhoea, and malnutrition. The health facility can also address the social and emotional impacts of environmental stress and consider its impacts on the proximal processes.

8.4 Impacts on Practices: Practitioner Views and Experiences

This section presents an overview of the analysis of semi-structured interviews conducted with 11 carefully selected officers working in childhood services. The selection of the participants was based on the role of the organization, geography (Gaza Strip and West Bank), gender, management role, and involvement in service provision.

The focus of the interviews was to obtain in-depth practical perspectives from service providers of how child water stress (exposure to water stressors combined with macro and micro contextual factors) affects childhood services, and undermines their effectiveness in supporting children to achieve their optimal early childhood development.

To outline how child water stress and its contextual depth influences the effectiveness of the services in supporting children to achieve optimal early development, the interviews were guided by a logical framework that explained the impact of child context on the planning of interventions, initiatives, and projects. Several local and international organizations, including (European commission EC) and the United States Agency for International Development (USAID), use logical frameworks for planning interventions and services to achieve the desired effects and results. This framework consists of a matrix of four rows (the inputs, outputs, short-term outcomes, and long-term impacts), as key planning elements of the interventions and initiatives combined as a development pathway to achieve the desired objective.

Programme Logic

—————→
Input-Output-Short-term Outcome-Long-term Outcome

- **Long-term outcomes:** Generally oriented objective reflecting the contribution to enhancing the strategies and efforts to reduce the risks related to the delayed developmental status of children.
- **Short-term outcomes:** Change in the practice, skills, and knowledge of parents and service providers
- **Outputs:** Products and services put in place to achieve the effects and impacts
- **Inputs:** Professional and financial resources needed to implement the activities

The columns of the matrix were adapted to provide an in-depth ecological analysis of how the features of the exposure and interactions with the detriments to optimal early childhood development (macro-system, exo-system, micro and meso, and individual) influence the operating processes and environment within the critical elements of the interventions' logical plans (input-output-short-term outcome-long-term outcome). The macro-system represents societal norms and culture. The exo-system represents community services and features. The meso- and micro-systems reflect the relationships and proximal processes in the close environment including the home, preschools, and other places where child interactions take place.

The logical framework, Table 8.4, facilitated the development of topic guides used during the interview, including the sequence of the major questions relevant to the main elements of the logical framework. It combined practice-based terminologies with in-depth ecological factors that matter to children.

8.4.1 Summary Findings

Table 8.4 demonstrates an ecological analysis of the challenges and constraints that child water stress, which includes water stressors combined with challenging socio economic conditions, has on the operating processes and environment of childhood services as

summarized from the feedback received from the key informants. The breadth of this analysis tackles the main components of the logical framework of these services with respect to their long term, short term outcomes, outputs and inputs.

The participants explained how they interact with the macro and micro context of children they are serving. They indicated the challenges in setting holistic, and long-term strategies and policies that lead to sustainable changes and impacts. In terms of short-term outcomes, the participants addressed how childhood services are influenced by the unpredictability and uncontrollability of water stress, which undermines proactive and steady programmes and interventions synergic with the community needs and mobilized role of parents. With respect to the outputs and inputs, the discussions addressed gaps in providing services to children from marginalized and vulnerable communities, and inadequate coordination, sector-specific services.

By looking at the matrix vertically from an ecological perspective, the interactions from the macro-perspective implied constraints related to uncertainty, unpredictability, consistent with inadequate national strategies, sustainable for holistic and proactive interventions and plans. At the community level, it highlights a gap in multidimensional efforts that reduce vulnerabilities, inadequate consideration of marginalized and vulnerable communities, and inadequate community participation to secure adequate resources and inputs. At the micro- and meso-levels, the matrix highlighted the absence of strong and clear policies related to parent-child interactions, and the influence of family wealth on the utilization of services.

Table 8.4: Ecological Logical Framework of the Main Findings of the Impacts of Child Context on the Effectiveness of the Childhood Services

	Macro, Societal	Exo, Community	Micro and Meso, Parents and Children
Long-term Outcomes	Geopolitical conditions and challenging socio lead to a high level of uncertainty and limit the ability of service providers to set long term strategies and policies	Water authorities, municipal and village councils do not adequately consult with childhood services on water stress matters. Minimal funding and support received from the community groups and organizations.	The chronic and prolonged water stress among the families establishes pressure on childhood services as children are more likely to be at risk of illness. Challenging socio-economic conditions among the families makes it difficult for childhood services to establish strong partnerships with parents in setting their strategies.
Short-term Outcomes	The limited controllability and predictability of water stress undermine proactive strategies while addressing improvements at the national level.	Stagnated and Unpredictable socio-economic conditions combined with water stress pressure the service providers, especially health and education, to focus on short term outcomes with less emphasis on achieving long results among children.	The limited financial capacities and inadequate funding make it for childhood services to mobilize social and hygiene interventions to raise parents' awareness of child health and protection.

<p>Outputs</p>	<p>Absence of national regulations and guidance on holistic approaches with inter-, multi-sector approaches. The service providers lack clear national strategies for holistic child interventions. The services limit provision of services within its specific sector</p> <p>Inadequate awareness at the national level for the strategic benefits of early childhood services</p>	<p>The high political uncertainty among the communities, combined with limited financial resources, limits the services' ability to provide supplementary extracurricular interventions.</p> <p>Children from vulnerable and marginalized families have limited access to childhood services limiting the effectiveness of childhood services in making change at the community level.</p>	<p>The limited capacities of the services limit their ability to provide services and activities targeting parents at home.</p> <p>The limited capacities and resources of health and education services limit their capacities to reach children from marginalized and vulnerable communities, especially children with higher risk, mostly for children aged 18-36 months, most likely deprived of essential services.</p>
<p>Inputs</p>	<p>Limited income made by the services combined with limited funds from the government and civil society</p> <p>Significant focus on the physical needs of childhood services rather than proximal with less emphasis on children's needs and rights.</p>	<p>The services themselves suffer from water stress especially poor reliability of water than makes it difficult to sustain continuous water supply to children and parents inside the clinics and preschools.</p>	<p>Fewer families able to pay fees, more patients and more people in need of social support</p>

8.4.2 Impacts on Long-term Outcomes

All participants perceive water stress as a chronic natural and conflict-related problem that influences social, health, and economic development. They generally described water stress as an issue related to limited natural resources, weak infrastructure, weak national management systems, and geopolitics. At the societal level, participants viewed water stress as an aspect related to culture, whereby water is considered as a national resource to preserve and protect, and a factor that contributes to quality of life, wellbeing, production, and domestic needs.

Water-related geopolitical aspects mainly reflected the ongoing conflict in general, and, in particular, the conflict over water resources with Israel was considered an underlying cause of high level of uncertainty on the ground. The geopolitical uncertainty is also attributed to the internal political disputes, especially the division between the two main Palestinian parties, and related realities on the ground. Highlighted in particular were the institutional incoherence and lack of integrity of services between the West Bank, controlled by Fatah, and the Gaza Strip, controlled by Hamas.

We experience uncertainty during our work, at home, and in the community. We have long-term endeavours, but our plans always change. We tried to establish a transparent and unified tariff system to assure equity and equality of water distribution among all communities. However, some communities witness severe emergency conditions that make it challenging to implement. Male representative from the water sector.

We are uncertain about the political developments in the near future. Therefore, we cannot set plans for more than three years. Most of the donors fund projects no longer than one year, and a few of them no longer than three years. Male participant from the health sector.

Uncertainty was considered one of the main reasons why childhood services do not set steady and long-term strategies, programmes, and related policies.

At the community level, the participants related water stress with community vulnerability. Participants indicated that the vulnerability of children is caused mainly by the high level of uncertainty at the macro-level, and therefore they are forced to develop reactive plans and strategies rather than structured and proactive interventions. All participants suggested that they are aware of the trends, challenges, and risks at the exo-systemic or community level. However, they highlighted the role of the national policies in dividing the sectors as another challenge.

Early childhood development is a stem under education. The Ministry of Education manages it. It may be sensitive for the health clinic to start doing interventions in this regard. Female participant from the health sector.

The divisions among the community services according to sectors separated technically and organizationally was noted as causing difficulty in implementing multisector and holistic activities that address children.

This situation undermines the role of the communities in developing national policies that can be adapted to the local context. Participants from the health sector indicated that most of the public health clinics belong to the Ministry of Health, and they set their own strategies based on the national indicators reflected at the macro-level. However, they have limited capacities to adapt their operations in accordance with the context of each community. Though guided by general regulations from the Ministry of Education, the participant from the early childhood services indicated that early childhood services are decentralized, and do not belong to one public system. Therefore, they are more flexible in localizing their plans in accordance with the context at the exo-systemic level, mainly

because they are small organizations with limited coverage, serving children from their own community.

With respect to the micro family context, participants discussed social and cultural challenges.

We set our priorities based on our assessment of the preschool's physical and professional needs. We also consider the developments and cultural norms in the community, especially if it has a conservative background regarding women's participation and the refugee community, etc. But we can't assess what happens inside the households. We invite parents to the preschool but few of them come. Female representative from early childhood services in the West Bank.

Mothers bring their children to the clinic only when they are sick. Few of them participate in our educational workshops. Female participant from the health sector.

The two quotes above present examples of the gap between parents and childhood services. The gap appears to stem from both directions. Parents do not participate in activities, and childhood services do not engage parents in planning and strategizing. The net result is weak strategies and lost opportunities related to one of the main determinants of optimal ECD: enhanced proximal processes, including appropriate stimulation and responsiveness through adequate interaction between caregivers and children, guided or advised by early childhood experts.

At the level of individuals, the health and education representatives stressed the utilization of international child-based indicators such as infant mortality rate, immunization rate, under five mortality rate, infectious diseases, malnutrition and diarrhoea, percentage of children enrolled in school, under education, and percentage of families with access to improved water networks. They stressed the fact that it may be difficult to set community-

specific indicators, but agreed on the need for adequate considerations of the local context.

In conclusion, the interaction between the macro-perspectives of water stress and the ability of childhood services to achieve long-term outcomes indicated that water stress in Palestine is a unique environmental challenge viewed as a combined stress, and a factor of vulnerability mixed with geopolitical, social, and organizational challenges. This construct influences their own organizational strategies and limits opportunities to develop coordinated efforts to implement multidimensional strategies at the meso- and micro-system levels focused on children outcomes and characteristics.

8.4.3 Short-Term Outcomes

The short-term outcomes reflect changes in practice, skills, and knowledge. Considering the high uncertainty, socio-economic challenges, and cultural norms, it is hard for childhood services to change practices at the macro- and exo-levels, and even more challenging at the household level. Participants indicated that this might explain why they pay more attention to improving the service-specific technical, professional, and physical capacities.

Participants shared many examples of when they failed and succeeded to make changes at the community and household levels. They indicated that they continue their routine programme, addressing their core mission. They are unable to implement supplementary activities addressing children's needs at the household and community levels, such as supporting children from families with limited economic capacities with reduced fees. This suggests that financial and technical capacities mediate the influence of childhood services on children through supplementary activities, implying the need to sustain adequate income and funds to achieve core and supplementary outcomes.

Reducing depreciation and limited wealth is the responsibility of the Ministry of Social Affairs and the Ministry of Finance. We know we receive poor children at our preschool. We offer them reduced fees when we can, but we can't do more. Female participant from early childhood services.

Many participants indicated that supplementary outcomes, such as providing social and psychological support to vulnerable children in communities with tense geopolitical conditions are needed by children. However, they may prefer to stay within their own comfort zone, offering the core programme focusing on earning and cognition. Supplementary outcomes need additional efforts in fund raising, project development, design, and monitoring, and may be subject to a high level of uncertainty due to the conflict.

If we plan to implement development interventions in the Gaza Strip, we act according to a hit and run approach. To avoid unexpected uncertain conditions, we design projects quickly, implement, and then look forward at different stages or different communities. Male representative of education from Gaza.

Participants suggested that limited controllability and predictability of water stress undermines their ability to develop proactive outcomes. Participants agreed that working within a scope of reactive and responsive services provides a safe pathway. Accordingly, the planned outcomes mostly address ad hoc needs of beneficiaries and services while dimensions of children vulnerability at the community level are not adequately considered. At the individual child level, the participants indicated that their efforts in making changes in childhood development are suppressed by the levels of limited wealth among the families. Much of the development initiatives that aim at supporting children's emotional and physical development, such as summer camps, trips, and other activities

receive little attention from poor families, especially those activities that require minor financial contributions.

8.4.4 Outputs

Outputs are mostly related to the services and activities provided and implemented by the childhood services. Participants indicated that the decisions related to the types of services provided to children are subject to many factors including the organizational mandate, specialization, needs, and demand, and the available financial funds. In this regard, the interviews identified two main gaps: -

- Participants confirmed the existence of multiple service gaps. Children 0-18 months follow a steady and mandatory health programme. ECD services are programmed for children 36-60 months. Children 18-36 months face a service gap without any type of service provided to them, except unorganized day care centres, which only provide day care services for children under three years old, mostly for working mothers who want a place to put their children while they are at work.
- Access to services is limited for children from marginalized and vulnerable communities. This aspect was addressed through two opposite dimensions. Participants indicated that their own core programme and limited financial capacities limit their ability to improve the access of children in vulnerable and remote communities to their core or supplementary services.

Participants indicated that accessing vulnerable and marginalized communities is mixed with a high level of uncertainty, difficulty in terms of access, possible limited community participation, and more community pressure and demand than what they can respond to.

They highlighted that reducing the vulnerability of these communities is subject to changes at the macro-level and the relevant authorities must set special policies and services that are appropriate and relevant to their context.

8.4.5 Inputs

Inputs refer to the professional and financial resources needed to implement activities intended to achieve the desired outcomes. Participants indicated that childhood services require technical resources, specialized staff working in service provision, management and planning, operational systems, and adherence to ethical international and organizational working principles. They also need financial resources generated as income from the services, and, to a larger extent, from donors and community groups, to assure the continuation of the core and supplementary services.

We always have ideal plans. However, many of the plans are not doable because we lack adequate financial resources. Female participant from the health sector.

During situations of child water stress, especially disconnection of household water supply, participants from the health sector indicated that they may be pressured by the increased demands. They indicated that regardless of their limited resources they can accommodate this pressure and intensify their services to respond to the increased demand.

Based on their previous experiences, the participants listed situations that limited technical and financial resources and undermined their ability to accommodate the pressure of water stress:

- Percentage of families with poor wealth in the community
- Severe emergency and geopolitical conditions

- Social and cultural challenges (e.g. religious, gender, type of community)
- Organizational and leadership problems
- Inadequate coordination and cooperation by different service providers

Interestingly, the two main reasons expressed by the participants were related to organizational leadership management and inadequate coordination and cooperation among services providers. While the previous chapters highlighted limited wealth and emergency conditions as major mediators of water stress on the proximal processes needed for optimal development, the participants explained that challenging socio and emergency conditions establish significant pressure, reflected by increased uncertainty, needs, and demands. However, they also indicated that these conditions are considered part of the Palestinian life routine. Accordingly, organizations with strong strategies and leadership can manage cost-effective services, generate income, manage fundraising, and sustain proper core and supplementary services.

Everybody blames the conflict and internal political disputes for depleting our resources. But these conditions are not a surprise to us. Routine work may not be the best solution. We lack an innovative, proactive, flexible programme of work. We are competing but not completing each other. Male participant from the water sector.

These quotes reflect that organizations need each other. Due to the multidimensional aspects of child-related stresses, joint technical and operational coordination and engagement might save resources and secure complementary services to children. It also highlighted that they are not adequately working with community groups and parents, which influenced the sense of ownership and resulted in less participation and contribution to activities. This ranking is insightful as it explains the variability of the

effectiveness among different service providers who operate within the same social and political environment.

8.5 Conclusion

This chapter demonstrated a practice-based perspective on the link between water stress and early childhood development. In simple terms, childhood services, particularly health and education are considered a vital sphere of influence and part of a child's close environment whereby children benefit from services, interact, and are exposed to experiences different from their home environment.

8.5.1 The quantitative analysis

The present research utilized early childhood services as a case study for childhood services. An overview of the activities provided by this sector indicated that early childhood services provide similar activities to support children in learning, language, and numeracy which are considered the core programme. The service providers implement several activities to support children, aiming to alleviate complex stresses such as water and limited wealth. The scope and coverage vary among service providers, however, if the quality of services was assumed to be the same among all service providers, then supplementary activities make the difference in the effectiveness of early childhood services in supporting children to achieve optimal development outcomes.

However, the positive influence of the supplementary activities may be encountered by the influence of vulnerability and susceptibility of children to the combined effects of water stress combined with other risks such as limited wealth and challenging geopolitical conditions. The effects of the latter may exceed the impact of supplementary activities of the opposite direction and keep children at risk. This finding indicates that the scope and

size of services does not necessarily mean stronger effectiveness. It indicates that the risks and vulnerabilities among children and their families may undermine the effectiveness, and therefore service providers need to consider the balance between the scope of their service and needs and risks in the communities they are serving.

8.5.2 The Qualitative Analysis

Caregivers, mostly parents, helped explain the tension between early childhood services and vulnerability and risks among the community and households. The discussions indicated that generally the level of vulnerability is high and subject to a wide variety of socio-economic and geopolitical considerations. They identified major gaps in early childhood services that may influence their effectiveness in improving children's opportunities towards optimal development.

Early childhood services do not adjust their activities when families are experiencing severe water supply disconnections. These services are age-specific, providing children aged 36-60 months with core and supplementary services. While children from 0-18 months benefit from a mandatory immunization programme combined with regular health services, children aged 18-36 are left without any type of structured or continuous health or education services. Because the health programme is free and mandatory, poor and marginalized children may benefit from this system until age of 18 months, but are then left without any type of service until the age of six years, when they are enrolled in basic education.

The semi-structured interviews uncovered different shortages and gaps at each part of the logical framework. The combination of these gaps undermines the ability of childhood services to support children in achieving their development potential. Evidently, water stress is viewed as a complex multidimensional construct. Water stressors are combined

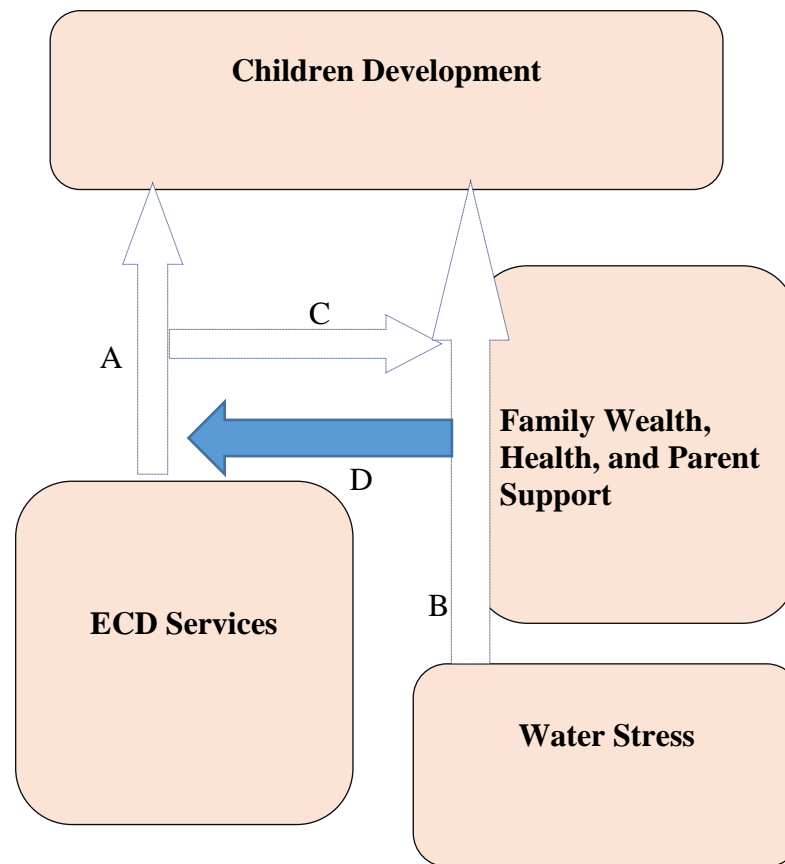
with risks related to the socio-economic and geological conditions and attributed to uncertainty and vulnerability.

Moving down the matrix, more specific issues emerged. The complex nature of stress and vulnerability require childhood services to look beyond the regular routine programme and explore additional aspects relevant to the local context. The supplementary activities that aim to respond to the local context, such as hygiene awareness, social support, and wealth level alleviation may enhance the effectiveness of childhood services in supporting children to achieve their potential outcomes.

8.5.3 Integrative Analysis

The graphical representation in figure 8.1 shows a typical pathway of the interaction between water stress, childhood services, and early childhood development. Pathway A indicates the interventions addressing children's learning and cognition. Path (C) shows the supplementary interventions that intercept Path (B) of the combined exposure to water stressors and intermediate factors. The ideal role for early childhood services is to operate according to Paths A and C. However, the reality in the Gaza Strip suggests a different concept. Pathway D indicates the effect of vulnerability and stress. The strength of Pathway D exceeds the power of Pathway C and undermines the ability of childhood services to support children to achieve their development potential.

Figure 8.1: Graphical Representation of Pathways vs. Services Pathways

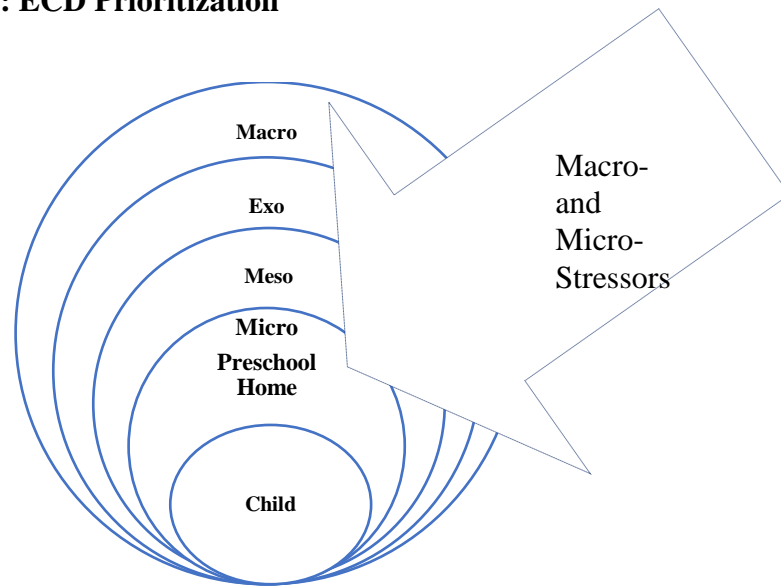


ECD and other childhood services need to create a balance between Pathways C and D with strength added to Pathway C. This can be achieved by not only the number of supplementary interventions but also the selection of the most relevant and suitable interventions that address vulnerability and stress.

The contextual levels presented by Tudge et al. (2017) demonstrate a simple analysis of this concept (Figure 8.2). It shows that preschools and homes positioned within the micro- and meso-systems can act as a buffer for children from the risks and stresses of the exo- and macro-systems. Inadequate consideration of Path D in figure 8.1 means continuous

exposure to hazards and risks in the macro- and exo-systems, keeping children vulnerable to risks of undermined health, growth, and development.

Figure 8.2: ECD Prioritization



The findings in this chapter indicate that the multidimensional perspective of child water stress which reflect children’s macro and micro context may influence childhood services directly and indirectly and undermine their effectiveness in supporting children to achieve Indicators that relate to combined and coordinated efforts seem inadequate. It their development potential.

A general observation collected is the emphasis of services on sector-specific objectives, such as increasing access of children to quality education, increasing access of children and mothers to mother and child health clinic services, improving the quality of education and care inside preschools, and reducing water interruption in certain communities.

Chapter Nine | Discussion

9.1 Introduction

The primary aim of this chapter is to discuss the research claims, critically examine, and homogenise the findings established in light with the problem statement and research questions. This chapter shares with the reader the new knowledge the author learned during this research, the new knowledge this work is contributing to related aspects.

A common observation derived from the previous chapters reflects a sense of disparity, inequality, and stress with respect to water access and availability. The communities in Palestine, especially in the Gaza Strip, had high levels of deprivation, indicating water stress is accompanied with poor quality of life.

Much of the literature provided evidence that early childhood development is an important period that shapes children's start of their lives, with benefits extending throughout their youth, and even into adulthood. The process of early childhood development is shaped by experiences and interactions of several risk and protective factors within children's macro and micro social, cultural, economic, and environmental factors.

The present research viewed the interactions and experiences between children and their surrounding environment through two main perspectives. It can be a source of risk that contributes to undermining the optimal development of the child. Conversely, it can be an opportunity to improve children's prospects for a better future. Within a real-life context, the two perspectives are not optional nor opposite alternatives. Both risk and protective factors co-occur and may act and interact simultaneously.

The main requirements of optimal early childhood development are similar for all children in the world. Universally, children require quality and adequate services, safe

and supporting physical and social environments, adequate and continuous interactions and stimulation, especially by parents, and responsiveness to children's needs and changes.

The present research highlighted the need for adequate considerations of the differences and uniqueness of children's contexts. While the core requirements are not different, the utilization of these requirements is more likely to be influenced by the local context, family capabilities, and children's characteristics.

The consideration of children's context is more vital for children living in countries such as Palestine, where the chronic, macro-factors of geopolitical instability and uncertainty, and challenging micro-contexts are common.

Derived by the above concept, the present research aimed to understand better how exposure to chronic stresses, such as water stress in Palestine, influences children's optimal development opportunities. The efforts made by the present research are based on a balanced perspective by linking the exposure to water stress with children's environmental context, proximal processes of interactions and stimulation, personal characteristics, and time-related to the duration of children's exposures and experiences.

During this inquiry journey, the author highlighted messages that shaped the knowledge created by the present research. The first message is that the current research data failed to develop evidence related to a direct association between water stressors and delayed early childhood development. The data showed that risks for delayed early development implied by water stress are more likely to occur by undermining one or all of the determinants of optimal early childhood development, especially proximal processes and children's characteristics and health. For instance, low-quality water increases the risks of delayed early childhood development by influencing children's health. Poor reliability,

inadequacy, and high cost may disrupt the family system and reduce the quality or frequency of the proximal processes. In other words, this research established evidence of proxy risks. Further research and other types of data, especially longitudinal studies, may be more appropriate for establishing inference and causality between water stressors and delayed children's developmental outcomes.

The significance of highlighting the influence of water stress on optimal early childhood development determinants stems from water stress being a living reality that influences children and their families, not isolated from other social, economic, and geopolitical factors. The link between water stress and ECD determinants reflects a continuous process of interactions between water stress elements and children's surrounding social, economic, environmental, and political factors.

A message highlighted is that water stress does not interact with risk factors only. It may interact with protective factors such as maternal education, improved health, and wealth that suppress its effects. The author was also captured by the direct impact carrying the smallest part of water stress on children, while most of the effects of water stress occur indirectly through several economic, social, and environmental factors. However, the data showed that when the family is under more extensive exposure related to their wealth (lowest wealth level), their capabilities to predict, control, and adapt to the direct effects of water stress become undermined, consequently, become at more risks of the direct impact of water stressors.

An additional message to highlight is to combine the statistical and quantitative methods with humanistic views and stories. The qualitative research did not allow generalized conclusions; however, 38 parents and 11 practitioners provided insightful and meaningful experiences and thoughts. Their views reflected a humanistic flavour with in-depth

knowledge that water stress is a living matter with social, cultural, and economic consequences. It reflected the tension between love and passion towards children and the sense of isolation, distress, and frustration when living water stress. Their views reflected adequate knowledge related to risks and hazards, they on their motives to adapt to water stress and conditioned when they feel unable to predict, control, and mitigate the consequences and impacts of water stress.

9.2 Early Childhood Development

This research presented early childhood development as a child outcome influenced by chronic stresses, such as water stress, in communities living chronic instabilities.

This research used ECD as a dependant variable, instead of the conventional health-related outcomes, especially diarrhoea and stunting, to highlight the characteristics of water stressors being with interrelated, lengthy, and interactive with children's social, emotional, health conditions along with undermining family's capabilities, dynamics and relations. All of which are considered as determinants of optimal ECD.

The interactions between water stress and determinants of optimal ECD, in both the domestic and public domains, provided evidence that delayed early childhood development is more likely to be enhanced by water stress. The outcomes of these interactions establish risks for children's translational processes that shape their social, emotional, and cognitive outcomes.

Scholars (e.g., Britto et al., 2013, Irwin et al., 2007) indicated that exposure to environmental stressors in the surrounding environment could influence children's neural and motor cells' genetic expression. While the direct influence of water stress on the genetic structure and expressions is beyond the scope of this study, exposure to water

stress with its lengthy and chronic features combined with its social, emotional, and physical consequences might pose risks for children's translational processes. The exposure with such effects may increase illness and reduce parental stimulation, responsiveness, and care which may delay certain functions in the neural system that need stimulations and interactions to grow optimally. The delayed neural and motor development is exhibited by fewer skills, weak physical, motor, and cognitive capabilities.

Another word of caution is that the data did not provide concrete evidence on how water stress reduces the growth and development of the neural and motor cells. It suggested risks based on the significant association established between water stress and the determinants of optimal early childhood development. Noting ECD and water stress's ecological considerations, the present research utilized the bio-ecological development model as a theoretical platform for better understanding how water stress contributes to risks for delayed early childhood development.

The analysis provided a balanced perspective between children's micro- and macro-contexts. Studying the water stress at the micro-context may not provide a full view without considering the macro social, economic, and geopolitical conditions, especially in countries living in political conflicts like Palestine. The time indicates that the type, the contextual level, and intensity of the exposure are influenced by time-related factors, including the duration of the exposure, age of children, occasions, and situations when the exposure affects children.

A word of caution is how the status of early development is examined, assessed, and indicated while considering the local context. The data used in this research are based on the child development index utilized by MICS surveys. This index is indicative to the

state of children development but does not provide detailed analysis of children's developmental status. More comprehensive assessments addressing children's social-emotional, physical and cognitive assessments can in-depth assessment of the child's developmental disabilities.

9.3 Water Stress

The present research supported the evidence that children in Palestine are more exposed to deficits and failures related to water quality, quantity, reliability of services, and affordability.

The local literature extensively emphasized the background of water stress, underlining the main causes of stress as being related to natural scarcity and limited resources. Much more emphasis was placed on the political considerations and conflict-related aspects being a concrete factor of the dispute between Israel and Palestine.

While securing more stable water resources, including equal distribution and control over water supplies, is dependent on a political solution between Israel and Palestine, the present research highlighted the need to better understanding the features and characteristics of the elements of water beyond engineering and volumetric characterizations. It is a real-life commodity that interacts with the social, emotional, cultural, and economic context of children and their families. Discontinuity and interruptions in the water supply, poor quality, inadequate quantity, and high cost are interrelated with combined effects that accompany children while they grow and evolve.

This research argues that international monitoring mechanisms, such as the WHO/UNICEF Joint Monitoring Program, as well as considerable water-related research use diarrhoea and malnutrition as child outcomes for water and sanitation challenges and

failures. While there are communities with severe and acute shortages accompanied by contamination, implying high risk of diarrhoea, the population-level data in Palestine showed that children scored acceptable levels in health outcomes compared to other countries. This research does not overrule the role of water stressors on child health outcomes, it highlights the need for holistic perspectives with outcomes such as ECD, that reflect the combined and synthetic environmental, social, physiological, emotional, and economic interactions.

The studies and surveys used for assessing water-related challenges and related child outcomes, face serious setbacks. For instance, the MICS survey includes questions related to the main type of water supply, but does not include questions that provide detailed and balanced perspectives between individual and common features of water stress.

Programmes and policies, on the other hand, have short-term goals, using physical health and survival as their primary child outcomes. Considering early childhood development as an outcome of chronic water stress would facilitate a more comprehensive view of challenges to childhood development and their rights to quality and multi-dimensional services beyond narrow or sector-specific perspectives.

9.4 Child-Water Stress: The Link

This research presented an extended concept of water stress. The physical standards of the poor quality, inadequacy, frequencies of supplies, and cost are important to assess the magnitude of the exposure, however, the capabilities of the family and its members to predict, control, and adapt to exposure shape the intensity of the exposure and its effects on the family and children.

All families and communities in Palestine are exposed to a certain levels of water stress. The micro household economic and social capacities, community and geopolitical conditions, and characteristics of individuals involved, especially parents and children, are intermediate factors that shape the intensity of the influence of the exposure on children. Depending on the magnitude, duration (lengthy or occasional) and directionality (risk or protective) the intermediate factors influence of the exposure on children being strengthened or reduced.

The concept of child water stress implies that the interaction between the exposure and children does not occur through straight lined stressor-child outcome pathways. It is presented as a real-life context whereby the exposure within the combined features of water stressors interact simultaneously with the intermediate factors within a continuous process of co-occurring interactions. From this perspective, a composite measure of Child Water Stress that combines the macro- and micro-interactions between the exposure and intermediate factors was presented.

Based on the combined approach, the data revealed differential estimates of stress features controllability, predictability, and adaptability among the communities included in the research. The data showed that children are at more risk with respect to adaptability of water stress. While it is a relative approach, the stress score of adaptability, which focused on the micro family level context and personal characteristics, and capabilities of children and their parents is at increased risk.

The concept of child water stress relates the interactions between the exposure and intermediate factors to children's vulnerability to risks of delayed ECD. The vulnerability concept is presented as a function of the exposure, adaptability, and controllability. This

concept reflects an increased intensity of exposure relevant to the sensitive context in addition to limited capabilities.

The concept of child water stress and vulnerability highlights the role of comprehensive and holistic monitoring systems that account not only for stressors, but also for the living conditions of children and their families. Usually, early childhood development is officially measured during MICS surveys every three to four years. From this perspective, the aggregated data at the community level collected on a routine basis can help estimate vulnerabilities and predict risks and deficits in quality of life, indicating risks to development.

The Child-Water Stress Index (CWSI) created in this study would enable policy makers and development assistance programme specialists to capture a collective measure and use it to prioritize and predict deprivation in the wellbeing of children within specific geographical and sectoral domains. The CWSI is intended to be adapted to the context, evidenced by the fact that child wellbeing and development are complex processes that interact with multiple socioeconomic, health, and environmental factors within the geopolitical reality of Palestine.

The research concluded that the child water stress represents the link as a continuous process of interactions between the exposure and intermediate factors that matter to children's social and physical environment. Understanding this is crucial for anatomizing the combined construct of child water stress.

However, the intensity of the exposure and intermediate risk factors shape the influence on children. The higher the magnitude of the exposure and undermined capacities to predict, control and adapt to water stress imply increased risk of delayed early childhood development.

This research argues that chronic water shortage in settings such as Palestine requires a different type of monitoring that captures the effects of factors beyond health and survival. Several drawbacks were identified in the national monitoring systems related to water and childhood development. While the CWSI created for this study could be used as a research tool to capture the multiple and combined effects, it also presents a simple and workable method for monitoring the progress and priorities related to children. Additionally, it can be used as a simple measure of the level of deprivation in communities that would help development agencies direct their support to communities experiencing the most need and the highest level of vulnerability. This research made use of the large amounts of data regularly collected through national demographic, health, and environmental surveys to be used for policy development and programme theory articulation and improvement. These efforts highlight the importance of utilizing data generated through assistance and development projects. Although programme data cannot be used for statistical generalization, it does enable better and deeper understanding of the indicators, variables, and associations generated from representative cross-sectional surveys. Collaborative and coordinated efforts from service providers in different sectors including the health, education, and social welfare are needed to complete this effort.

9.5 Understanding the Link

Noting the significance of the family context in adapting and controlling exposure to water stress, the data showed that the wealth level, parental care, and child characteristics were considered intermediate factors of the link between water stress and ECD in the micro-context. An interesting finding based on the data utilized by the present research, is that water stress, represented by the use of unimproved water sources for drinking water, was not associated with delayed ECD. While this finding did not allow the author to prove the main hypothesis that water stress is associated with delayed ECD, it provided a realistic conclusion that much of the influence of water stress affects children through indirect pathways through intermediate factors, especially family's wealth level and parental care.

The intermediate factors shape the exposure and its influence on children. Since the largest part of the effect of water stress occurs through indirect pathways, the directionality of the intermediate factor influences the intensity of the exposure on children. Accordingly, risk factors enhance these effects while protective factors suppress them.

The findings of Chapter 7 indicated that an increase in the intensity of the intermediate factors may enhance the direct pathways. For instance, changing the wealth level from poor to poorest, the direct pathway became larger. This means that the intensity of the poor wealth level made families more exposed to the direct influence of water stress. This finding indicates that the buffering capabilities of the families became weak, and the ability to predict, control, and adapt to water stress is undermined.

An interesting finding generated from the qualitative method is that the direct and indirect effects of water stress on parents, merge again and establish a significant effect on both

parents and children. The parents, being knowledgeable and aware of the direct and indirect effects of water stress, enhance the sense of household chaos that indicates social, emotional, and economic disturbances that generate pressure. This complex situation is more likely to influence the behaviour and attitudes of parents with those around them, including children. While this may not reduce the love and passion they have towards their children, and despite the fact that socially and economically pressured fathers and mothers may spare no effort to respond to the essential health and dietary needs of their children, they may not be able to provide adequate developmental care such as playing, reading books, and interacting.

9.6 Implications for the National Policies

Traditionally, early childhood services have focused on learning and teachers' capacity to alleviate the challenging socio economic conditions and water stress. This paradigm was confirmed by the data, which indicated a larger emphasis on learning and cognition and less on supplementary activities that help children alleviate contextual stresses including water stress.

The case study utilized by the research demonstrated that early childhood services currently operating in Palestine do not adequately address the indirect pathways of disparities in the lives of children. Rather, the ecological development model does not seem to be appropriately utilized, mainly due to the focus on in-school learning and cognition activities, with less attention to what is happening at the micro- and macro-levels in respect to the child's close environment (the family), and the surrounding environment (community), respectively. EDC services can be tailored according to children's needs and aspirations. In order to operationalize this idea, childhood

development should not be followed and monitored only through the education sector by the Ministry of Education.

Water stress in Palestine may take a long time to be resolved as it is connected to the complicated intricacies of the occupation. However, simple innovative measures with multispectral perspectives based on children's rights can make a change. The Palestinian National Strategy for Early Childhood Development and Intervention 2017-2022 highlighted the need for integrated and holistic approaches. The strategy addressed the need to reduce inequality in access to ECD services, the need mitigates the shortage of databases on child protection and disability programs, and inadequate awareness levels among families and communities. However, this strategy is limited to the objective level, lacking clear implementation mechanisms for assessment, interventions, and evaluations, specifically while addressing children at younger ages, primarily 0-3 years old.

The strategy called for integrated approaches coordinated and overseen by three regulatory bodies. The Ministry of Health supervises health screening and interventions, the Ministry of Social Affairs monitors social protection and licensing of nurseries that provide nursery services to children aged 0-4 years. The Ministry of Education is responsible for licensing and supervising the work of kindergartens (preschools) serving children aged 4-6 years old. Along with the distribution of responsibilities, many indicators were set, such as a 20% increase in the enrolment of children in preschools by 2022, 15% increase in number of preschools, 100% primary health care coverage, 15% reduction in anaemia, increased enrolment of children with disabilities, improved standards at preschools and nurseries, and development of an educational curriculum.

If implemented, the strategy would add significant improvements to the early childhood services in Palestine. However, there are still some observations that can be recorded noting the results of the present research:

- 1- Stresses such as water supply, violence, and conflict related emergencies, which feature prominently in Palestinian society, are not considered independent variables with causal mechanisms that need to be addressed.
- 2- While the strategy calls for an integrated approach, the indicators seems to be service-oriented and related to ongoing programmes and routines provided by each service provider.
- 3- The strategy calls for an increase in preschool enrolment, however interventions meant to support children who are enrolled have not been addressed.
- 4- The increase in enrolment of children in preschools mainly pertains to children 4-5 years old. Early childhood strategies for children under four years old are not clear. This contradicts the recommendations of the Lancet 2016 series, which calls for supporting early childhood at earlier stages, specifically children under four years old.
- 5- Community-based interventions that can be effective tools to reach children who are not enrolled in preschools and children at their homes, but have not been addressed.
- 6- It is obvious that the strategy aims to develop the services of preschools within the role of learning and cognition. Social protection programmes are considered the responsibility of the Palestinian Ministry of Social Affairs, which monitors nurseries in which minor activities related to ECD and learning are conducted.

- 7- ECD is considered a need but is addressed as a service that can be enhanced. While the research agrees with such a concept, ECD should be considered an indicator or a child outcome influenced by wellbeing and quality of life conditions.
- 8- Finally, the research argues that Palestinian children who live under unique conditions need appropriate monitoring systems that combine the spheres of influence and build on the interactions between the child's wellbeing status and quality of life.

The present research argues that Palestinian children need interventions that address aspects beyond those conventionally considered by international monitoring mechanisms such as the UNICEF/WHO Joint Monitoring Program. It also calls for nonconventional interventions in ECD programmes, beyond preschools, to households and communities integrated with other community-based high-coverage programmes and activities.

9.7 Implications for International Policy

ECD is increasingly recognised as a vital sector by the International community. This recognition is made clear by the designation of a special target within the Sustainable Development Goals (SDGs). Target 4.2 calls upon countries to, “Ensure that, by 2030, all children have access to quality early childhood development, care and pre-primary education to be ready for primary education.”²⁹

During the 2018 World Health Assembly, the UN Director General highlighted the need for special consideration of early childhood development, calling for investments in

²⁹ Target 4.2 is part of SDG 4 aims to “ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. Detailed description of SDGs available at <https://sdg4education2030.org/>

interventions that address children health and wellbeing and suggesting to strengthen data related to women, children, and adolescents. He also highlighted challenging economic conditions as the main risk factor for optimal development. In September 2015, the Global Strategy for Women's, Children's, and Adolescents' Health was adopted by the international community as part of Every Woman Every Child.³⁰ It acknowledged that women, children, and adolescent's worldwide still have limited access to quality basic services including health, education, clean water, and sanitation. It highlighted the need to respond to these rights and needs with equity. Shonkoff et al. (2016), highlighted the need for strengthening and increasing investments in ECD, and to widen the scope and actors working in the field through a rights-based approach, and called for an increase in the focus on children below four years old through health, nutrition, and 'nurturing care' provided by multi-sectoral interventions.

While the global strategies addressed inequality among countries, countries might fail to provide the means or adapt methods to generate evidence needed to set new policies to achieve global indicators. Global strategies called for reducing the inequalities among countries, while the present research addressed the inequalities within the country itself.

However, Palestine has special considerations, facing chronic conflict conditions and stress. Thus, monitoring systems and interventions applicable to the context should be adopted. The wellbeing index highlighted inequalities and adverse interactions among the stresses that children face. This index was developed as a model to determine how quality of life is influenced by chronic stresses and in turn, how this influences child

³⁰ *Every Woman Every Child* is a global movement established in 2010 to primarily mobilize international and national action by governments, multi-laterals, the private sector and civil society to address the major health challenges facing women, children and adolescents around the world. More information on this movement available at: <http://globalstrategy.everywomaneverychild.org/chapter1>.

development. Country-specific factor interaction data sets, if collected routinely, might be more informative for countries with unstable conditions than the conventional studies and surveys developed on an international scale such as the MICS surveys, which are implemented once every four years.

ECD programmes, on the other hand, can benefit from the international models, but should be adapted to the Palestinian context, taking into consideration the macro- and micro-environments and focusing specifically on children. This research argues that the integrational approach between micro- and macro-environments can be achieved if the interventions and programmes are designed based on children's status.

International agendas call for fighting poverty which reflects the limited wealth and capacities. The present research agrees with this concept, but argues that parents with challenging wealth capacities can still support their children. Such support can be enhanced by the ECD services through increased awareness and involvement. Addressing the community sphere of influence indicates the need for community-based approaches to make ECD awareness, knowledge, and services accessible to children who do not currently benefit from them.

The assessment conducted through this research also highlights the need for ECD services, particularly preschools, not only to address cognitive and learning objectives, but also to consider different approaches to ameliorate the impacts of water stress and related socio economic conditions. However, comparing international recommendations and guidelines to the country-level strategies is challenging.

By comparing Palestinian strategies and programmes with the recommendations set by the Lancet 2016 series, it seems there is a long way to go. While the Lancet 2016 series and UNICEF highlight the need for ECD to be community-oriented, grounded in a rights-

based approach, and utilize effective means for monitoring, the Palestinian strategy seems to be service-oriented, lack in-depth analysis of the interaction between the spheres of influence, now have clear mechanisms and intervention pathways.

Additionally, international guidance is set at the objective level and does not specify clear mechanisms to assess the needs and priorities at the country level, especially in countries that face complex conditions such as Palestine. The Lancet 2016 did not adequately provide means to clarify the interaction between quality of life, child wellbeing, and childhood development. This research argues that programmes need practical tools for assessment and interventions that consider the risks that affect children both directly and indirectly.

The concept of causal mediation process would help in setting assessments and interventions for more effective and responsive design and implementation. The Child Wellbeing Index can fulfil the need to monitor not only ECD, but also the quality of life and wellbeing reflecting the combined effects of the risk factors to deficits in early childhood development. Finally, services need to be evaluated based on positive changes made in respect to their effectiveness in intercepting the possible causal pathways. The effect size approach can serve as a real and effective method to assess the interventions' effectiveness and impact on children and measure the change that occurred based on real needs and priorities.

9.8 Contribution to the Original Knowledge

Throughout this research, the complexity of water stress and its interaction with child wellbeing and development has been investigated. It was assumed that understanding the exposure is not enough to create holistic, responsive interventions to support children to

achieve positive outcomes. The dynamic relationships between early childhood development and the child's surrounding environment is difficult to represent as a simple linear cause-effect pathway. This research addressed this interaction and provides evidence of increased risk among children living in communities and households living water stress.

While considerable research addresses the physical features of water stress and its related influence on child development outcomes using health and survival indicators (primarily parasitic infections, diarrhoea, and malnutrition), this research presents water stressors as a combined stress with features of chronicity, and combined interactions that occur in conjunction with other life aspects and conditions such as wealth, food, knowledge, and capabilities. It is intended to add to the international mechanisms such as the JMP approach for adapting aspects related to the local context.

Child development is presented as an appropriate outcome for long-term exposure to chronic water stress. This builds on previous efforts, specifically Bronfenbrenner and Morris (2007), Walker et al. (2011), Britto et al. (2013), and Tudeg et al. (2017) who provided ecological perspectives of early childhood development and related risks. This research attempted to utilize the bio-ecological development model in understanding how water stress influences children. It also built on the model suggested by Walker et al. (2011), who analysed the interactions between the risks and protective factors. The addition made by the present research is a combination of the exposure, and protective and risks factors as one combined entity (referred to in this thesis as Child Water Stress) that influences children collectively and continuously.

The current study expands the work conducted by Ngure et al. (2014), who examined the link between water stress and early childhood development through the health pathway.

This research calls upon water research experts, especially in countries like Palestine which suffers chronic water stress combined with social and economic disparities, to use the mediation model to not only identify the risk factors, but also measure their direct and indirect effects as the latter might have the worse adverse consequences despite not being adequately acknowledged.

The present research also contributes to the efforts made on the use of mediation modelling in setting logical analysis of influence of socio-economic conditions on children mediated by the changes occur in the family system. Engle and Black (2008) used the mediation model to relate limited wealth and financial capacities to childhood development. The present research estimated the mediated effect and indicated the possible interaction within the spheres of influence. This research added a qualitative analysis that provided in-depth knowledge, and humanistic positions and perceptions. An interesting addition to this model revealed mainly by the qualitative research is that while the effect of water stress on parental care dissociates to direct effect and indirect effects mediated by wealth level, both the direct and indirect merge again with a combined influence that contribute to the sense of “household chaos” that parents experience as a state of disturbances and troubles that burden them socially, emotionally and economically, and influence their relationship and family dynamics and relationship with their children. A word of caution here; this finding is based on non-generalizable conclusions, yet, interesting to note and further researched.

The present research aimed at contributing to the knowledge related to evaluating pathways of services and policies . Engle and Black (2008) identified risk factors and strategies for alleviating disparities. The present research demonstrates the relationships between the risk factors, including the interrelation between the primary factors in

Palestine (chronic water shortage, family wealth, stunting, and child care) within a logical approach.

The development of the Child Water Stress Index uses a multidimensional approach to understand the links and pathways through which family wealth level, family support, and child health are represented at the community level. Bradshaw et al. (2007) suggested a child wellbeing index based on a set of variables, but did not specify the dynamics between the variables in relation to water supply. Sullivan et al. (2013) developed an index referred to as water poverty index, but did not relate the index to children. The CWSI created by the present research adds the critical interaction between water supply and ECD. Development of an index that will assist researchers and policy makers to monitor the collective data points of water supply, child wellbeing, and development. These efforts indicated an evidence that the current indicators used for JMP might conceal the long-term impact of water supply on childhood development in countries with intermediate access to water supply.

This research is intended to present a contribution from a country in conflict, suggesting localization and adaptation of SDGs 4.2 which calls upon countries to, “Ensure that, by 2030, all children have access to quality early childhood development, care and pre-primary education to be ready for primary education.” It also responds to many recommendations stated in The Early Childhood Development 2016 titled: Advancing Early Childhood Development: From Science to Scale which highlighted that an optimal early childhood development period is a good start in life, a foundation for children’s future, and a unique opportunity for successful adulthood.

The intention of this research is to not only establish links and reject the null hypothesis. It also adds to previous efforts investigating the use of managerial and practice language

to present an in-depth analysis of current practices, and to propose a new theory of change that introduces workable solutions to better monitor children holistically, and implement interventions that are more effective in helping them achieve their early development potential. The results of the present study are critical to inform programme and policy makers that only looking at child health and survival as an outcome of reduced water supply is not adequate. Children are vulnerable to indirect effects of water supply, specifically through links with inadequate care and family wealth.

Finally, this research fulfils the demand for data and analysis for evidence-based policy planning and programming for early childhood survival and development in a holistic manner. Evidence-based practice is critical in countries like Palestine where water-related policies do not take into account the long-term and unobserved impact of water stress.

9.9 The Need for Further Research

There are many variables in these critical areas that are not addressed in this research and require further exploration, such as the reverse impact of child development on wellbeing, especially on economic and social aspects related to families.

The first aspect highlighted for further research is to establish a cause–effect relationship between all or part of water stressors and children not on track in their development. The data and methods used by this research did not allow establishing causation. Being a significant life condition that many Palestinian children live, a longitudinal study that tracks by time, how water stress influences the changes in children’s developmental outcomes.

The data showed intergenerational gaps as more emphasis is paid by early childhood services to children 3-5 years old. The intention is to continue in this line of research and

study the impact of water supply on children younger than 3 years, and older age addressing impacts of water stress on youth development.

Youth are more independently aware of their surrounding conditions. While the cross-sectional surveys provide adequate data on the household and community levels, cohort and longitudinal surveys that follow children's care over time would be a good tool to capture details of the relationship and stages of the effects.

The families' coping strategies and its role as mediator and moderator to the risk factors on children need to be considered. This would help the services and policies to develop practical tools to guide families, particularly caregivers on how to continue stimulating their children even when they face chronic or acute stresses.

Practice-based models based on bio-ecological development models require adaptation to children's context. There is a need for practice-based research to explore integrated approaches that incorporate health screening, psychosocial support, early childhood development screening, and child-based development plans. Such research can follow a logical sequence to identify relationships among the risks and vulnerabilities.

9.10 Dissemination Plan

The findings of this research were shared and disseminated at more than one level:

International and Local Research

- Chronic Water Shortage and Early Childhood Development in Palestine: Making the link and implications for policy and practice. Oral presentation. Lancet Public Health. Beirut, Lebanon. March 2015.

- Chronic Water Shortage and Early Childhood Development in Palestine: Making the link and implications for policy and practice. Oral presentation. Abstract accepted for oral presentation at the 5th Conference of the International Society for Child Indicators, University of Cape Town. September 2015.
- Oral presentation at the UNICEF World Bank Joint Conference: Investing in early years, early childhood development and disability, cross sectoral approaches to advocacy, policy and programming June 2018.
- Invitation to join an international expert group organized by UNICEF that will convene in New York to discuss improvements to CDI to be incorporated in MICS
- The findings of this research were shared and discussed with relevant organizations in Palestine, specifically the Palestinian National Institute for Public Health and the Palestine Child Institute.
- The author is currently exploring with Palestine Child Institute the use of the assessment tool and Child Water Stress Index in establishing a data system for identifying communities with the highest vulnerabilities that need urgent support. It also helped in creating evidence-based interventions through which community needs are addressed.
- The findings of this research were shared officially with the Palestinian Central Bureau of Statistics (PCBS) in order to introduce a new model in monitoring child status rather than the conventional surveys.
- Being the official body responsible for the data collection and information, PCBS needs to include multidimensional factors in its surveys. For example, the MICS

survey lacks questions about water-related factors such as the cost of water and average consumption.

- This research will be shared with the Palestinian Ministry of Planning to suggest a country-wide monitoring system for children and advocating for early childhood development as a national priority that impacts all areas of life and should therefore not be monitored by the Ministry of Education alone. It was also shared with the water authority who expressed interest in implement the WCWI as a holistic tool for predicting priorities moving forward.

Chapter Ten | Conclusion

10.1 Introduction

This research established evidence that children experiencing water stress are at more risk to not be on track in their early childhood development. The methods utilized by the present research failed to establish a significant direct link between water stress indicated by the use of unimproved water supply as main source of drinking and children not on track in their development.

However, the present research established an evidence of increased risk of delayed early childhood development being influenced by water stress, based on the analysis of characteristics of the exposure to water stress, its combined interaction with factors considered as the main determinants of optimal early childhood development. The above risks unfold while childhood services show inadequate considerations to children's "water stressed" home and community context.

Water stress was defined by the present research as the situation when the households and communities experience partly or all of the following challenges (stressors); unaffordable cost, unreliable and interrupted supply, poor quality, and inadequate quantity. The present research characterized the exposure to all of the part of the above stressors as chronic, interrelated influence as the occurrence of one stressors is more likely to lead to the occurrence of other stressors, co-occur with the children's living conditions, and establish combine effects on families and children.

The present research presented the concept of Child Water Stress as a continuous process of interactions between the exposure to water stressors and the main determinants of early childhood development; the macro geopolitical and community-related conditions, micro contextual factors including family wealth and capabilities, parental care and child characteristics.

The concept of child water stress suggests that the exposure only, does not necessarily reflect the influence of water stress on families and children. The main stress features; adaptability, controllability, and predictability shape the intensity of the exposure and children's vulnerability to its adverse consequences. The analysis showed that the most stressful feature is adaptability, which reflects the family and child capabilities to adapt, cope and mitigate water stress. The analysis presented children vulnerability to risks for delayed early childhood development as a function of the intensity of the exposure, the capabilities to control and adapt to water stress, and the sensitivity of the context. The higher vulnerability to water stress was found, associated with higher risks of delayed early childhood development in the selected communities. A word of caution related to water stress and vulnerability being relative concepts with conclusions established based on the data and communities covered by the present research.

To narrow down the scope of the study to the household level, the present research provided an explanation of the interactions occur between exposure to water stressors, the intermediate factors and early childhood development, specifically for their mediating, suppressing and moderation effects.

Noting the absence of direct association between water stress and delayed early childhood development, the present research identified an association between water stress and parental care which is identified as predictor of optimal early development. The effect of water stress on parental care was identified as occurring through direct effect of water stressors related to poor quality and quantity, reliability and affordability that burden parents with less water for cleaning, cooking and hygiene that influence their parenting role.

To a larger extent, the effect of water stress on parental care was found more detrimental through indirect effects mediated by poor wealth level. Parents testimonials and feedback during focus group discussions indicated that the direct and indirect effects burden them simultaneously and collectiveness that burden them socially, physically, emotionally and economically. Parents indicated that water stress contributes to the sense of troubles, disturbances and disruptions referred to as the household chaos. The sense of household chaos reflects disrupted parental system that influences family dynamics, and relationships with other members, perceived by parents as impactful on the level of stimulation and interactions with children.

Childhood services operate activities and services to support children develop their positive outcomes. Considering the data related to the case study utilized by the present research, these services focus on learning and cognition with inadequate considerations to the child's macro- and micro-context at their homes and communities. The effectiveness of the childhood services in supporting children achieve their positive outcomes are less among children living in water stress and vulnerability.

Based on the methods and data used by this research, water stress and delayed early childhood development are statistically not associated. However, the features and characteristics of water stressors, the vulnerability to the exposure and the main determinants of optimal early childhood development, the direct and indirect effects of the exposure on parents' support, and the gap between early childhood services and children context derive an increased risk for children not to achieve their optimal development.

10.2 The Hypothesis

In summary, the main research objectives and related hypothesis were met as follows:

The General Hypothesis:

Palestinian children who live in households and communities facing water-stress are more at risk of not developing optimally.

The quantitative and qualitative data demonstrated that children from households and communities facing water-stress are more at risk of not developing optimally. The evidence established by the findings chapters derived this conclusion. The descriptive analysis of the exposure suggested water stress being chronic, with interrelated influence, and combined effect that interact with the main determinants of optimal early childhood development, and establish direct and indirect effects on parental care considered as the main determinant of early childhood development, with services and policies not adequately matched with children context.

However, the analysis indicated that the influence of water stress on children is conditioned by the level of exposure, stress, and vulnerability that children experience with more likelihood among vulnerable communities and households featured with limited capabilities to predict, control, and adapt to water stress.

Hypothesis I

The main elements of water stress are characterized with chronicity, combined interactions, and interrelated influence that associate the exposure to water stress with the increased likelihood of delayed early childhood development.

The individual characteristics of the main elements of water stress indicated trends of unaffordable cost, high percentages of households indicated “bad” perception of quality, inadequate quantity accessed mainly by the families with limited wealth, and high frequency of water interruptions and discontinuity. Water stress at the macro-level is chronic stress being correlated at the macro-level with the natural water scarcity and challenging geopolitical conditions. The main water stressors interrelated being correlated with each other suggesting that the occurrence of one stressor is likely to lead to the occurrence of all or part of the others. The interrelated influence is perceived and experienced by households included in the qualitative methods as combined stress with adverse social economic and physical consequences.

Noting the above features, water stress represented by the use of unimproved water supply as main source of drinking was found associated with macro and micro contextual factors and processes considered as determinants of optimal early childhood development. Water stress is correlated with limited wealth level and conditioned by type of community and related vulnerability specially refugees communities. It was also correlated with reduced “child development” parental care practices whereby parents interact with their children and stimulate their neural and motor senses. Water stress was also found correlated with age related development whereby as the difference between older and younger children with respect to their early development is larger among children with less water stress. The same trend was found among females and males whereby the difference between females and males with respect to their development is higher among children with less water stress. While noting the associations indicated above between water stress and the main determinants of optimal early childhood development, childhood early development status and water stress were found not significantly associated.

Concluding from the above water stress may not establish a direct influence pathway with early childhood development, yet, it is more likely to undermines the main determinants of early childhood development.

Hypothesis II

Child Water Stress established, resulted from combined interactions between factors of exposure to water stress and children's macro and micro contextual factors, is a predictor of child vulnerability to risks for delayed early childhood development

The research provided evidence that water stress interacts with macro- and micro-factors of livelihood and living conditions of children and establish a combined effect. The present research introduced the concept of Child Water Stress as a combined (exposure-intermediate factors) a predictor of children vulnerability to the direct and indirect consequences of water stress. This concept highlighted that defining the exposure to water stress only is not adequate to understating its influence on children. The increased stress level is interrelated undermined capacities to predict, control and adapt to water stress which increases children vulnerability to risks for delayed early childhood development.

The water stress index, which is composed of water stress related variables, indicated differential variabilities among the communities selected in the study. It also indicated that adequacy is the prime stressor feature followed by reliability.

Noting the role of the intermediate factors and intensity of the exposure, the Child Water Stress index score revealed evident inequalities among the communities. It also revealed variations with respect to the wellbeing domains, of which, family characteristics scored as the most stressed wellbeing domain indicating the challenging situation at the family level.

The stress feature of family adaptability, being the wellbeing stress feature, which reflects undermined family and child's characteristics to cope and mitigate water stress, confirmed the challenging stress score at the family level.

The stress scores revealed higher relative risks of delayed early childhood development. Being a function of exposure, controllability and adaptability, and system sensitivity, the vulnerability of children to risks for delayed early childhood development identified as a predictor of increased likelihood of delayed early childhood development in the selected communities.

Hypothesis III

At the household level, water stress, indicated by the use of unimproved water supplies for drinking, influences children directly. However, children are influenced indirectly to a larger degree by inducing the effects of wealth level and parental care.

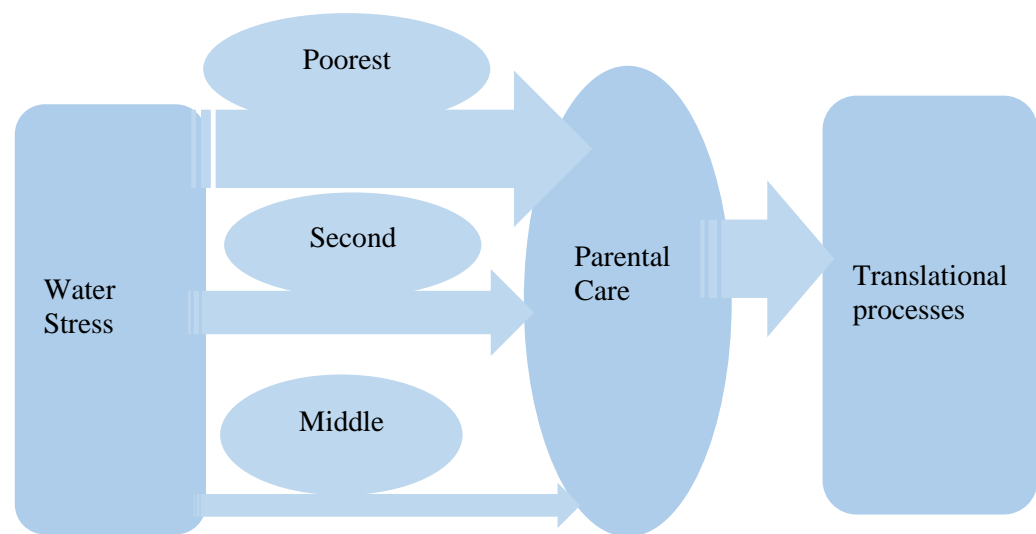
The inquiry of this hypothesis based demonstrated that water supply influences early childhood development through the mediated effects of limited wealth levels and parental care.

The mediation process was used to explain the directionality of the association between water stresses (represented by unimproved water supply) to early childhood development through wealth level and parental care.

The hypothetical pathway of water stress, wealth level, parental care and delayed ECD indicated larger part of the effect made through the indirect effect. The poorest wealth level is with limited capabilities to control the exposure, and therefore suffer from increased levels of exposure with more direct exposure. This conclusion confirmed the hypothesis that the larger extent of the exposure occurs through indirect pathways, yet,

this model added to the mediation models that the intensity of the direct exposure increases with the increased intensity of the intermediate factor. As concluded from Figure 10.1 the intensity of the direct effect increased when the intermediate factor changed from poor to poorest indicating undermined capabilities to control and exposure and therefore its direct effects were less likely to be prevented.

Figure 10.1: The Water Stress Pathway and Wealth Level



Noting its confounding related limitations, the mediation model is introduced as a method for investigating the outcomes of water stress on children by noting its effect on other factors. While health pathways are crucial in many settings, especially those with acute water stress, children context shapes its intensity and influence. Moreover, following and monitoring the water status within engineering perspectives might be misleading as they define factors more closely tied to access.

Hypothesis IV

Children's home context, including water stress and challenging socio-economic conditions, influences the effectiveness of early childhood development services in supporting children to achieve their development potential

A gap was identified between children's context especially with respect to water stress and services and policies addressing children early development. The effectiveness of childhood services in supporting children achieve their positive outcomes is less among services providing children from vulnerable communities.

The research demonstrated that the effectiveness of early childhood services could be enhanced by adding interventions that address the indirect pathways of stresses such as water. Early childhood programmes currently do not adequately address identified influences caused through indirect pathways. Early childhood services and policies address specific short-term needs of children (via educational goals), while the effect of water supply and the intermediate factors that influence the children through indirect pathways are overlooked.

The data suggests that monitoring systems and programmes addressing childhood development need to apply a holistic approach that addresses variables such as socioeconomic status and childcare. Within this context, identifying the mechanisms such as the mediation and wellbeing index, through which water shortage interacts with family wealth and influences the child development would be a significant step forward in mitigating its impact on the children in countries like Palestine.

Early childhood development can be used as a tool for measuring both long term and collective effect of water related disparities. In this respect, early childhood development

must be considered as an outcome for long term influence and should be added to the child indicators beyond the education sector. Such practice is sensed in Palestine as ECD services are followed by the Ministry of Education.

This research recommends the implementation of development assistance programmes that integrate interventions targeting water supply, early childhood development and child care. Operational recommendations for ECD programmes include enhancing teacher training on social environment factors, adding regular health screening, increasing the provision of free school uniforms and healthy food. These initiatives require strong working partnerships and cooperation between stakeholders offering services in more than one area such as the health and educational organizations.

Finally, and concluding from the above, the integrational approach considers all sphere of influence in terms of planning, design and interventions of programmes and policies. Unlike the current practices, which focus in their assessments on the capacities of the service providers, the findings indicate that the implementation of integrational approach should start with the children themselves. Integrated child assessments that consider the risks and needs at the school, household, and community levels would be the key for planning, design and intervention of programmes and policies. The integrated assessments and consideration of the child developmental status can indicate the outcomes of wellbeing of this child and the stresses imposed on her or him by the house, the school and the community. Based upon which strategies and interventions can be tailored and designed aiming at improving the child outcomes, and hopefully help children prevent and ameliorate the risks, and eventually meet the children's rights, needs, and aspirations, and contribute in reducing the prevalence of developmentally not on track, as indicated in Chapter 1.

10.3 Concluding Notes

The present research concluded the following messages:

The main concluding remark highlighted by the present research is water stress influences children beyond their health and survival. Viewing water stressors through physical and volumetric terms provides inadequate view of the possible impacts on children.

- 1- Water stress is chronic feature in Palestine. It is an ecological stress, yet, with social, geopolitical and economic dimensions that should not be neglected.
- 2- Water stress undermines the ecological determinants of optimal early childhood development
- 3- Water stress and poor wealth level, can form a vicious cycle whereby; poor are most likely to access unimproved water supply, unimproved water supply is with higher cost and harder to access, water stress makes more social and economic burden on the poor, the poor become less able to obtain water, have to pay more for obtaining water. Such cycle contributes to the stress factor that such families and their children live.
- 4- Family/parental care and support is inadequate, especially among the poor families. Female caretakers hold most of the task and burden of caring and nurturing. Water stress disrupts the level and frequency of care.
- 5- The outcomes of chronic water stress on children should be measured by social, emotional and economic variables not only health and survival.
- 6- Proxy community based aggregated data can predict risks and deficits in early childhood development

- 7- Poor children are the most influenced by stress and disparity, but the more likely not to receive ECD support.
- 8- Services and policies need to consider the indirect pathways of risks and disparities. Assessments, implementation and evaluation can consider such link and mitigate for.
- 9- Evident inequalities among communities in respect to the level of deprivation and risks highlighted.
- 10- It is recommended to maximize the use of the national and demographic surveys to examine inter connections between the variables that affect the lives of children. To present a clear and comprehensive analysis of water supply in demographic and health surveys, it is also recommended to incorporate more questions in the MICS surveys related to water shortage including cost, water interruption and possible coping strategies at the household level.

The basic tenant of this research is that it is a social and ethical obligation to measure and fulfil the needs and rights of children. This research argues that early childhood development is an important determinant in the lives of the children that is not given adequate attention in Palestine.

10.4 Closing Notes

In closing, I hope with this research I could contribute to the original knowledge related to children's wellbeing and development, aiming at effective assessment, monitoring, and interventions strategies in countries that witness chronic stresses as Palestine. This research aimed at presenting to the research, practice and policy communities with methods to contribute in understanding the status of quality of life and wellbeing of children. I hope that my contributions to the efforts to alleviate the suffering not only of the children of Palestinian, but all children living in similar settings, underscoring their rights, needs, and aspirations, to live equally as their peers in the other parts of the world. While deprivation and inequality highlighted, I look at the data through the window of hope and opportunity, for children to thrive, grow and develop, safely, optimally, and peacefully.

Ghassan

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