



Starting Strong

Engaging Young Children

**LESSONS FROM RESEARCH ABOUT QUALITY IN EARLY
CHILDHOOD EDUCATION AND CARE**



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Foreword

The first years of life lay the foundations for an individual's future skills development and learning. As the *Starting Strong* reports of the Organisation for Economic Development and Co-operation (OECD) and other research has demonstrated, investments in high-quality early childhood education and care pay dividends in terms of children's short- and long-term learning and development.

Many OECD countries recognise this and have increased public spending on ECEC, particularly to expand its access. In consequence, universal or quasi-universal access to at least one year of pre-primary education is now a reality in most countries, which constitutes significant progress towards the Sustainable Development Goals education targets. A growing body of research suggests that only high-quality early childhood education and care is associated with children's development and learning, with especially strong evidence in the case of disadvantaged children. But raising quality can be a daunting task when public budgets are being tightened.

As a result, policy makers face complex decisions in spending, evaluating trade-offs between structural investments and investments that improve the quality of the interactions taking place in early childhood settings, for instance between staff and children. The nature of these demands imply that policy makers need to be informed of the evidence base and then examine how a variety of policy options apply to their context or jurisdiction.

This research report summarises the key findings from two background studies which were commissioned as part of initial desk-based research for the new OECD project "Policy Review: Quality beyond Regulations in Early Childhood Education and Care (ECEC)", focusing in particular on "process quality", to be conducted in 2017-2020. The report aims at supporting readers to understand different dimensions of quality in ECEC and the complexity of the provision of education and care for the early years. It also highlights significant quality issues in existing research and avenues for further research.

One of the two background studies is a literature review authored by Pauline Slot (University of Utrecht). It examines how structural and process aspects of ECEC quality are interrelated in the provisions of ECEC for children from birth to age 5, including family daycare. The review has an explicit cross-national focus, and includes the "grey" literature (i.e. national and international reports, unpublished studies, recent evidence).

To complement the literature review, a meta-analysis was authored by Antje von Suchodoletz (New York University Abu Dhabi), D. Susie Lee, Bharathy Premachandra and Hirokazu Yoshikawa (New York University). It explores how aspects of quality are associated with child development and learning. The meta-analysis also has an explicit cross-national focus, but was limited to centre-based settings for children aged 3 to 5. Both background studies were designed, implemented and concluded in 2017.

Based on the two research studies (literature review and meta-analysis), this report was written by the OECD ECEC team: Clara Barata (lead author), with contributions from Victoria Liberatore (e.g. introductions, OECD data charts, research assistance), Arno Engel and Miho Taguma (e.g. messaging, Chapters 1 and 5). Project support was provided by Mernie Graziotin. Guillaume Bousquet finalised the meta-analysis charts with guidance from Éric Charbonnier. Victoria Elliott provided the editorial support. Sophie Limoges and Rachel Linden provided support to the publication process.

Members of the OECD Network on Early Childhood Education and Care provided feedback on draft versions of the report, and helped guide the development of the research and publication (see Annex A).

Co-ordination was initially provided by Éric Charbonnier, and later Clara Barata, with overall guidance and support by Yuri Belfali, Miho Taguma and Arno Engel. Final review was provided by Andreas Schleicher, Noémie Le Donné, Elizabeth Shuey and Hannah Ulferts. The report also benefitted from conceptual discussions on process quality with the Questionnaire Expert Group and Consortium of the OECD Starting Strong Teaching and Learning International Survey

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Information on the OECD's work on Early Childhood Education and Care is available at: <http://www.oecd.org/education/school/earlychildhoodeducationandcare.htm>.

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List of abbreviations

BA	Bachelor's degree
CARE	Curriculum and Quality Analysis and Impact Review of European Early Childhood Education and Care
CIS	Caregiver Interaction Scales
CLASS	Classroom Assessment Scoring System
EACEA	Education, Audio-visual and Culture Executive Agency
EC	European Commission
ECE	Early childhood education
ECEC	Early childhood education and care
ECERS	Early Childhood Education Rating Scale
ELLCO	Early Literacy and Language Classroom Observation
ERS	Environment Rating Scales
EU	European Union
Eurydice Network	Education Information Network in Europe
FCCERS	Family Child Care Environment Rating Scale
ISCED	International Standard Classification of Education, including ISCED 01 for programmes designed for children aged 0-2 and ISCED 02 for programmes designed for children aged 3-5
ITERS	Infant and Toddler Environment Rating Scale
MDG	United Nations Millennium Development Goals
NICHD	National Institute of Child Health and Human Development
OECD	Organisation for Economic Co-operation and Development
ORCE	Observational Record of the Caregiving Environment
Pre-K	Pre-kindergarten
QRIS	Quality Monitoring and Rating Improvement Systems
SDG	United Nations Sustainable Development Goals
US	United States

Executive summary

The first years of life lay the foundations for a child's future development and learning. Reflecting on the important role of early childhood education and care (ECEC) services in providing all children with the skills they need to be successful in school and in helping disadvantaged children to catch up, many countries have increased their financial support for early childhood provision in recent years. More recently, the focus of debate has been shifting from expanding access to affordable early childhood education and care to enhancing its quality. This is because a growing body of research suggests that the magnitude of the benefits for children will depend on the level of quality of services.

In light of budgetary constraints, policy makers require the latest knowledge base of the quality dimensions that are the most important for ensuring children's development and early learning. Current research, however, is often narrow in focus or limited to programme-level or national-level conclusions. To take stock of and to expand the knowledge base on this topic, the OECD has commissioned a cross-national literature review and meta-analysis of the relationship between structure and process quality in early childhood education and care and links of quality to child development and early learning, conducted in 2017. Structural characteristics are conceptualised as more distal indicators of quality that refer to the infrastructure, whereas process quality concerns the more proximal processes of children's everyday experiences.

Results are organised into three thematic policy levers that build on the Starting Strong III Quality Toolbox and later the European Union (EU) Proposal for key principles of a Quality Framework for Early Childhood Education and Care. The report then concludes with an overview of key insights and avenues for further research.

Overview: Promoting early childhood education and care quality, child development and learning (Chapter 1). As early years provision has expanded, a better understanding of quality has become a priority. This chapter explains why process quality matters, introduces the methods and scope of this report and provides a brief overview on access. It then moves on to describe the importance of defining and analysing quality for different age groups and types of ECEC settings. It highlights key findings and explains their linkages to the policy levers that guide the structure of the report.

Standards and governance (Chapter 2). Child-staff ratios and group sizes are the two most commonly used and studied early childhood education and care quality regulations. Lower ratios and, to a lesser degree, smaller group size were found to be consistently supportive of staff-child relationships across different types of settings. However, the evidence for the relationship between smaller ratios and emerging academic skills, such as early literacy and early numeracy, was unclear. Children in class- or playrooms with a larger share of immigrant or bilingual children seemed to experience lower quality staff-child interactions, as well as present lower language and literacy skills. Other dimensions considered, such as the physical location of the setting, intensity of daily services and

licensing, were based on fewer studies or inconsistent evidence for their association with staff-child interactions.

Workforce development and working conditions (Chapter 3). Higher-quality staff-child interactions and exposure to developmental and educational activities were found to be linked to higher levels of children's emerging literacy and numeracy skills, as well as better behavioural and social skills. These associations were similar for groups of children from predominately disadvantaged backgrounds and more mixed groups. Both higher pre-service qualifications and in-service training (or professional development) were found to be related to higher-quality staff-child interactions, but only staff in-service training was related to children's emerging academic, behavioural or social skills. Positive associations were found between working conditions, the organisational climate in settings, and staff-child interactions, but the number of studies that have included these aspects is limited. The association of staff years of work experience with positive staff-child interactions appeared to be inconsistent across types of settings.

Data and monitoring (Chapter 4). Data and monitoring can be a powerful lever to encourage quality in early childhood education and care by establishing facts, trends and evidence to inform measures for improvements. The implementation of quality monitoring and rating improvement systems was associated with higher-quality staff-child interactions, in particular for centres for children aged 3 to 5 and for children aged 0 to 2. The associations are more uncertain for family daycare. Monitoring and quality rating systems provide only rough indicators of process quality.

Key insights and avenues for further research (Chapter 5). This report offers a set of key insights. Children can develop their skills more effectively when staff provide high-quality interactions, but relationships between structural characteristics, such as child-staff ratios and pre-service qualification, and children's development may be indirect. In contrast, participation in ECEC-specific professional development is associated with both higher-quality interactions and better child development. Associations between group size and staff-child interactions are less clear, but more positive relations were found for the youngest children. Monitoring systems can also inform quality improvements. Emerging evidence on other mechanisms, such as staff collaboration, working conditions, well-being, physical location of centres and child group composition, also indicates a relationship to better staff-child interactions, but the evidence for them is limited.

This report also identifies important avenues for future research. More evidence is necessary on the relationship between the combined or mediated effects of structural features and process quality. Child development domains, such as well-being and critical skills, need to be examined more broadly in studies of early childhood education and care quality. How structural characteristics relate to child peer experiences is ill-understood, as well as the interactions staff establish with other staff, the children's parents/guardians and the broader community. More and more fine-grained evidence on curriculum and monitoring would provide important insights. Finally, further studies of quality for the youngest are necessary across indicators to inform research and policy.

Chapter 1. Overview: Promoting quality early childhood education and care, child development and learning

Research shows that quality early childhood education and care (ECEC) affects children's development and learning. There is consensus that process quality, such as the quality of staff-child interactions and developmental activities, is the primary driver of gains in children's development through ECEC. This report builds on a cross-national literature review examining the relations between structural indicators, such as child-staff ratios, and process quality in settings for children aged 3 to 5, aged 0 to 2, including family daycare settings. It also provides insights from a new meta-analysis of the linkages between quality and child learning and development. This overview chapter describes how ECEC provision has expanded and emphasises the importance of better understanding and defining ECEC quality. It highlights key findings and explains their linkages to policy levers such as standards and governance; workforce development and working conditions; data and monitoring.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

Introduction

The effects of quality early childhood education and care (ECEC) on children's development and learning have been well established in the literature, and there is a general consensus that process quality is the primary driver of children's development in ECEC (Melhuish et al., 2015^[1]). The OECD *Starting Strong* reports (Organisation for Economic Co-operation and Development (OECD, 2001^[2]; 2006^[3]; 2011^[4]; 2015^[5]; 2017b^[6]) and other international research point out that high-quality ECEC is beneficial for children's early development and their subsequent school performance in various domains, such as language use and emerging academic skills, early literacy and numeracy, and socio-emotional skills (Burchinal, 2016^[7]; Cappella, Aber and Kim, 2016^[8]; Melhuish et al., 2015^[1]; Yoshikawa and Kabay, 2015^[9]). The OECD's Programme for International Student Assessment (PISA) study suggests that 15-year-old students who attended early childhood education for less than one year are 3.1 times more likely than students who attended for one year or more to perform below the baseline level of proficiency in science (this decreases to 2.3 times after accounting for socio-economic status), see Figure 1.1 (OECD, 2017a^[10]).

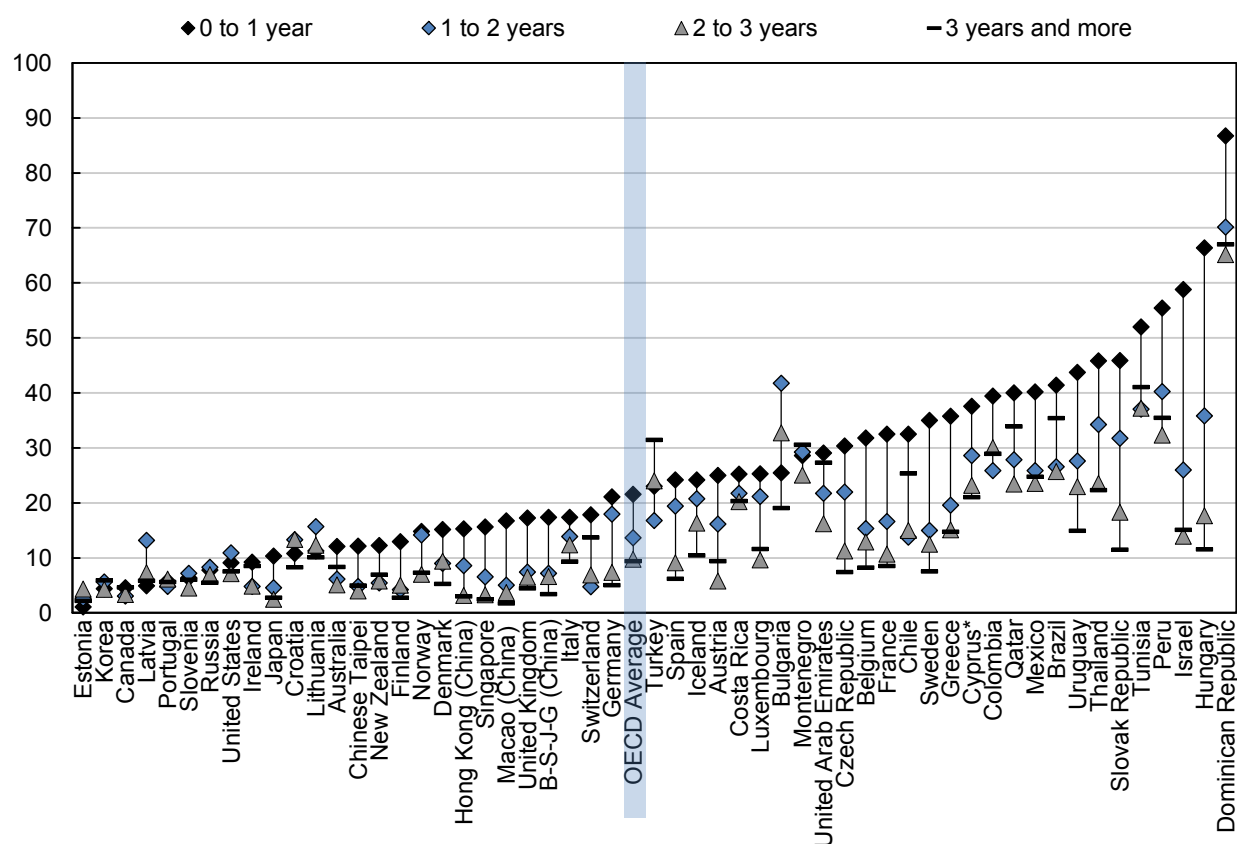
Benefits of high-quality ECEC also extend to health and well-being, for example by helping instil healthy habits of eating and physical activity (OECD, 2014^[11]). Evidence is growing that high-quality ECEC services also help support children's outcomes later in life, including in labour market participation, reduction of poverty, increased inter-generational social mobility and social integration (Sammons et al., 2008^[12]; Sylva et al., 2004^[13]).

An early learning environment that provides young children with opportunities to engage in developmentally appropriate, stimulating, and language-rich activities and social interactions can compensate for the risks for children from disadvantaged backgrounds of falling behind or not reaching their full developmental potential (Arnold and Doctoroff, 2003^[14]; Heckman, 2006^[15]). Such research highlights the long-term benefits of investments in ECEC programmes.

Policy makers face complex decisions in spending on ECEC, and need to consider trade-offs between structural investments and investments that improve the quality of the interactions between ECEC staff and children. Such demands require that policy makers be informed of the evidence base so that they can examine how a variety of policy options apply to their context or jurisdiction.

However, the focus of current research is often too narrow, examining only one aspect of quality, or being limited to programme- or national-level conclusions. These two aspects have received considerable criticism from the research and policy-making community. Prior research on structural characteristics of ECEC settings has been dominated by a focus on the so-called "iron triangle" characteristics (i.e. child-staff ratio, group size and teachers' pre-service qualifications; (Slot, 2017^[16]). To date, the vast majority of studies investigating associations between structural characteristics and process quality focused on only one indicator of process quality: the quality of teacher-child interactions. The research has also largely overlooked many other aspects of process quality, such as child-to-child (peer) interactions.

Figure 1.1. Proportion of low performers among 15-year-old pupils according to the numbers of years spent in early childhood education (PISA 2015)



Notes: Countries and economies are ranked in ascending order of the percentage of low-performing students who did not attend early childhood education (ISCED 0) or attended for “less than one year”. Low performers may be able to use basic or everyday scientific knowledge to recognise or identify aspects of familiar or simple scientific phenomena. However, they also often confuse key features of a scientific investigation, apply incorrect scientific information and mix personal beliefs with scientific facts in support of a decision.

* Note by Turkey: The information in this document with reference to “Cyprus” relates to the southern part of the island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of the United Nations, Turkey shall preserve its position concerning the “Cyprus issue”.

Note by all the European Union Member States of the OECD and the European Union: The Republic of Cyprus is recognised by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.

Source: (OECD, 2017a_[10])

Researchers have also pointed out that examining quality in a programme or a country gives an incomplete picture of the wide scope of quality experiences and indicators. Arguably, most countries have quality regulations and monitoring systems that limit the potential diversity in staff and structure characteristics, and the range of staff practices.

An additional limitation of the literature available is that it relies predominantly on studies conducted in the United States, and examines mostly centre-based settings for children aged 3 to 5, whereas systematic research on indicators of quality in ECEC across types of settings and with a global focus is still very limited.

Process quality matters

This report confirms that process quality is a powerful predictor of children's development and learning. The evidence shows that children have higher levels of emerging literacy and numeracy skills, as well as better behavioural and social skills, in ECEC settings with more positive staff-child interactions, or staff providing higher quality or more exposure to developmental and educational activities. Better outcomes for children are also observed when there are fewer negative staff-child interactions. Associations between staff-child interactions and children's development and learning did not differ significantly for children from predominantly disadvantaged backgrounds, compared to a more mixed or balanced group of children.

The report also shows that a few common structural quality indicators, such as child-staff ratios, pre-service qualifications, staff participation in in-service training, and the existence of quality monitoring and rating improvement systems all influence staff-child interactions (see Table 1.1). The evidence is less clear for group sizes and the years of work experience of staff.

Finally, the report documents very limited direct effects of such structural indicators on children's development and learning in the studies available. There is evidence for the benefits of in-service training for child development and learning, but the links of other structural characteristics to child development and learning are unclear or have not been examined in the literature. This means, for example, that despite changes in staff-child interactions linked to structural quality changes, no relationship was detected between child-staff ratios and children's early literacy and numeracy.

A possible reason for these apparently inconsistent findings could be that structural characteristics of ECEC provision are primarily *indirectly* related to child development and learning, influencing child development through process quality. Since many other factors, such as the children's home-learning environment, also affect children's early development, direct effects may not be likely in some cases.

Measurement may also play a role. For instance, the strongest linkages between staff-child interactions and child development are found in examining staff practices geared to specific developmental domains (e.g. emergent literacy and numeracy) and evaluations of children's development in precisely those areas. Indeed, research on curricula and their linkages to staff practices and child development is unbalanced and insufficient.

Another explanation is that structural features are interrelated, and that only by looking at combinations of structural indicators can we better understand how structural features promote development and learning. Contextual factors also need to be taken into consideration to increase understanding of the mechanisms at play between structure, process and child development. Finally, there may be optimal combinations or levels at which some of the most commonly utilised structural levers, such as qualifications, ratios and group size, have an impact on process quality and children's development, but the research is still focused on estimating the benefits on a one-to-one relationship.

Table 1.1 summarises the indicators for which a considerable number of studies are available, with ample geographic representation, and combined analysis from the

literature review and meta-analysis, where available. The results of this report suggest that policy makers can leverage structural regulations to encourage high-quality staff-child interactions. For instance, staff should be well-trained to encourage children's development, and should enjoy good working conditions. Monitoring systems can be harnessed for quality improvements.

Table 1.1. Influence of structural characteristics on staff-child interactions and child development and learning for well-documented policy levers

Structural characteristics	Association with	
	Staff-child interactions	Child development and learning
Lower child-staff ratio	Positive	Evidence unclear
Smaller group size	Evidence unclear	m
Higher pre-service qualifications	Positive	Evidence unclear
Participation in in-service training/ professional development	Positive	Positive
Years of work experience	Evidence unclear	m
Presence of accountability/Quality monitoring and rating improvement systems (QRIS)	Positive/neutral	Evidence unclear

Note: "m" signifies missing, i.e. indicating that sufficiently reliable evidence is not available.

Looking at geographical differences, several patterns can be observed. Links between staff-child ratios and interactions between staff and children were not found to vary according to the geographical location. But while US studies showed negative associations between staff-child interactions and children's behavioural skills, those linkages were overall positive in studies conducted outside the United States.

Other mechanisms, such as the funding of provisions or staff salaries, are also examined in this report, but the evidence for them is limited by the number of available studies and/or country representation. The report shows that children can develop literacy, numeracy, behavioural and social skills more effectively when staff engage in quality developmental activities with children. In turn, these staff practices and engagement with children may depend on team collaboration, and benefit from improved working conditions and well-being. Licensing for family day care, when regulated with pre-service qualifications, can be a tool to ensure better interactions for children. Separate class- or playrooms for disadvantaged, immigrant or bilingual children are associated with risks for equity and quality in ECEC. Lastly, the location of ECEC centres within schools may be associated with differences in staff's engagement with children.

This chapter first introduces the methods and scope of this report, provides a brief overview on access to ECEC, then moves on to describe the importance of definition of quality, including arguments for analysing the quality of centres for children aged 0 to 2, and for family daycare settings. It ends by explaining the policy levers guiding the structure of this report.

Scope and evidence base of this report

The overarching goal of this report is to review the current cross-national conceptual and empirical knowledge base of the relationship between ECEC structure and process quality, and links between quality and child development, learning and well-being.

The report summarises the conclusions of a literature review that examines how the structural and process aspects of ECEC quality are interrelated in settings for children aged 0 to 5, with a distinction between centres for younger children (under 3 years old), centres for older children (3 to 5 years old), and family daycare settings when appropriate (Slot, 2017_[16]). The review had an explicit cross-national focus, and includes a review of the “grey” literature (i.e. national and international reports, unpublished studies, recent evidence).

The literature review also looks at the preliminary evidence from two more recent approaches to the research on ECEC quality, which partially overcome the limitations of prior research that examine only one aspect of quality (Slot, 2017_[16]). The first approach explores how structural characteristics may be *indirectly* related to child development and learning, influencing child development through process quality. The evidence from this new approach has so far only taken into consideration staff-child ratios, staff qualifications and group, class- or playroom composition. The second approach looks at models of policy implementation, to examine how different structural features jointly influence staff-child interactions. This approach illustrates better the policy context of these associations, where decisions are made in tandem and/or respect previous policy. The available evidence looking at these approaches is summarised in this report, but is limited mostly to the United States, and involves only a small number of studies.

Further details of the literature review method are available in Annex B.

To complement the literature review, a meta-analysis of the association between aspects of quality, with a specific focus on studies examining process quality, and associations with child development and learning, provides an updated empirical evidence base for the conceptual knowledge (von Suchodoletz et al., 2017_[17]). The meta-analysis examines two additional aspects: *i*) the differential effects of ECEC quality for children from disadvantaged families, compared to more diverse groups of children; *ii*) the geographical differences in associations (US versus non-US). This piece of research was limited to centre-based settings for children ages 3 to 5 to allow for the analysis to be conducted in less than a year.

The meta-analysis included the full coding of 44 studies. Twenty-one of the studies reported research from the United States. Of the remaining studies, 16 reported research from different European countries (Germany [6], Netherlands [2], Portugal [3] and 1 study each from Flemish Community of Belgium, Finland, Ireland, Spain, and the United Kingdom) and 7 research studies from other countries (Australia [3], Chile [2], China [1] and Tanzania [1]).

Of the independent samples included in the meta-analysis (i.e. excluding overlapping datasets by retaining only the largest sample size), the total sample size of the studies coded was 3 110 ECEC staff (i.e. lead teachers) and 16 386 children, from 1 977 ECEC centres. Sample sizes ranged from 92 to 2 938 children, and from 16 to 694 ECEC staff. When reported ($n=26$), the samples were representative at the state/regional level, where the data was collected for most studies ($n=22$). Additional studies reported that the study population was representative at the national level ($n=1$) (Slot, Boom, et al., 2017) or at the local level ($n=3$) (Bowne et al., 2016a; Cadima et al., 2016; Phillips et al., 2009). All of the studies that included child data had similar numbers of boys and girls (43% to 53% girls). The children’s age was, on average, 66 months (ranging from 37 months to 180 months; $SD=36.9$). Where this was reported, the majority of ECEC staff was female (95% to 100%) and, on average, 37 years old ($SD=4.80$).

Further details of the meta-analysis method are available in Annex C.

Across the two studies, very limited literature was found on aspects of child well-being which limited the scope of examined child outcomes to development and learning.

Most OECD countries now offer universal access to at least a year of early childhood education and care, but its quality remains a concern

Reflecting on the important role of ECEC services in providing all children with the skills they need to be successful in school, and helping disadvantaged children to catch up, many countries have increased their financial support for ECEC programmes in recent years (OECD, 2017a_[10]; Vargas-Barón, 2015_[18]). This may either imply the expansion of universal provision for all children or reflect targeted measures that may specifically seek to enrol children from disadvantaged backgrounds – or a combination of both. Such approaches will also influence the composition of group, class- or playrooms.

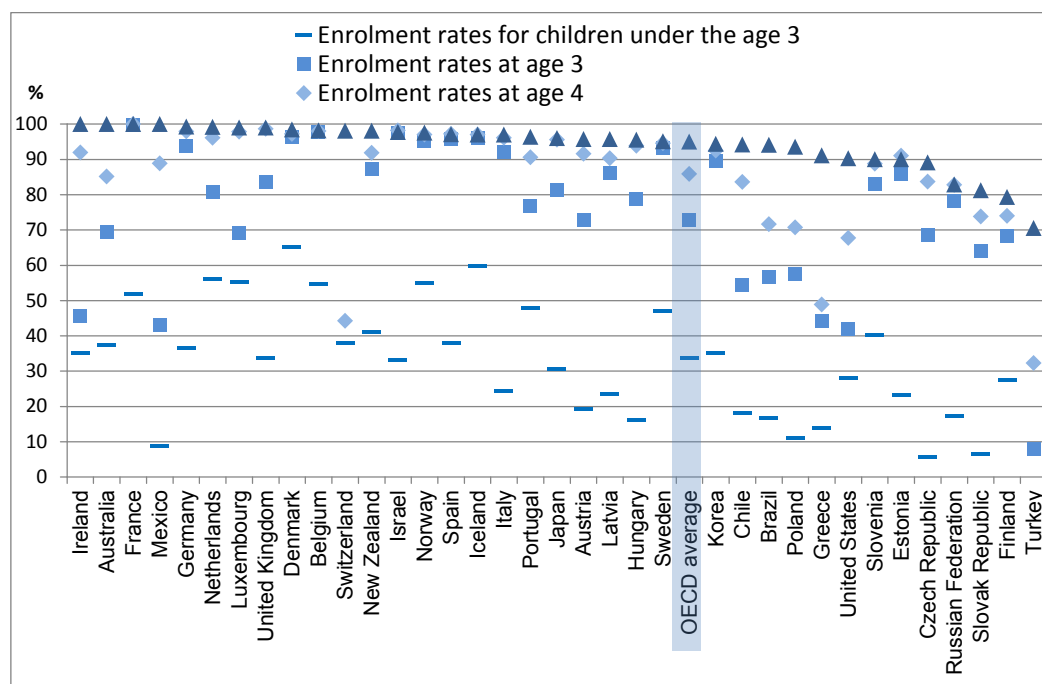
In consequence, universal or quasi-universal access to at least one year of ECEC is now a reality in most countries (Figure 1.2), which constitutes significant progress towards the Sustainable Development Goals education targets. In most countries, more than 90% of children are already enrolled in pre-primary education (or in primary education in some countries) at age 5. These countries are already close or have reached the SDGs target recommendation for universal participation in organised learning one year before official primary-school entry age. High enrolment rates are also observed for lower age groups. Among 4-year-olds, 90% or more are already enrolled in pre-primary (or primary education) in two-thirds of the 37 countries where data are available (OECD, 2017).

The increase in access has been made possible, in part, by the extension of legal entitlements of a place for younger children, and efforts to ensure free access for the older age group (e.g. aged 3 to 5). However, there are major differences across countries in the age groups covered by legal entitlements to a place in ECEC. For instance, some countries, such as Norway and Germany, cover ages 1 to 5, while others, such as the Czech Republic and Portugal, only guarantee children a place for one or two years before entering primary school.

Similarly, the time per week covered by the legal entitlements to a place in ECEC also differs greatly across countries and jurisdictions. For example, Norway grants universal access to 41 hours of ECEC, and French pre-primary schools provide 24 hours, Austria provides between 16 and 20 hours for the year before entering primary school, and Scotland (United Kingdom) provides only 16 hours for 3-4 year-olds (OECD, 2015_[5]).

The legal entitlement to a place in ECEC is not a guarantee of free access, especially for younger children. Both variables are independent. In pre-primary education (ISCED 02), most countries provide free access to ECEC to all children for at least the year before entering primary school. However, exceptions include Japan, Norway and Slovenia, where free access to the last year of ECEC is provided, but only on a needs basis. In Slovenia, around 3% of all children aged from 11 months to 5 years have free access to ECEC. In other countries, free access to ECEC is common, but the number of years and the number of hours covered varies significantly.

Figure 1.2. Enrolment rates in early childhood education and primary education, by age (2014)



Note: Children under the age of 3 are enrolled in formal childcare (ISCED 0 and other registered ECEC services); children at ages 4 and 5 can already be enrolled in primary education in a small group of countries. This figure combines data on formal childcare from the OECD Family Database, OECD, Paris, <http://www.oecd.org/els/family/database.htm> and on ECEC and primary settings covered by the ISCED classification from OECD (2016), *Education at a Glance 2016: OECD Indicators*, ensuring a consistent reference year. For more recent data on enrolment in ISCED 0 and ISCED 1 provision, please refer to OECD (2017), *Education at a Glance 2017: OECD Indicators*.

Source: (OECD, 2017^[19]; 2016^[20])

In many developmental areas, brain sensitivity peaks before the age of 3, including emotional control, social skills, language and numeracy (Gambaro, Stewart and Waldfogel, 2014^[21]; Naudeau et al., 2011^[22]). To support child development and equity, but also because of concerns about the obstacle to mothers' participation in the labour force, increasing effort has been made to provide places in ECEC to children well before the age of 3 in many countries. Data from the OECD Family Database shows that participation rates of children under the age of 3 have increased from 29% in 2006 to almost 35% in 2014 (OECD, 2017). This is also reflected in Figure 1.2.

Many countries also offer regulated family daycare, particularly in Europe (Eurydice Network, 2009^[23]; OECD, 2006^[24]). Family daycare settings refer to licensed home-based ECEC for children aged 0 to 2¹. Creating family daycare places can be a fast way to meet demands for more places with a relatively limited investment (as compared to the creation of new centres), and provide children with an environment more similar to their own home. These settings may or may not have an educational function or be part of the regular ECEC system.

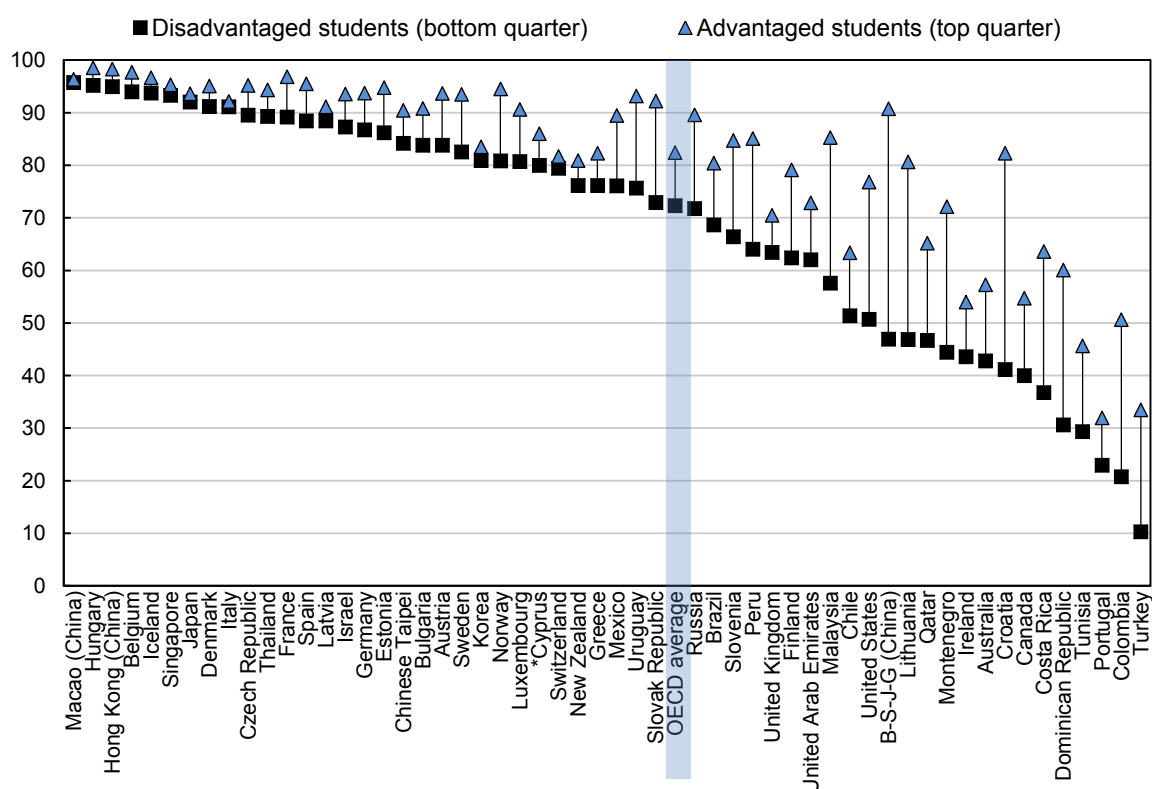
Coverage of family daycare settings varies considerably across countries. In Belgium, Denmark, Germany, France, Finland, the United Kingdom and Iceland regulated family daycare settings represent a significant proportion of ECEC, in particular for younger

children. In Denmark, around 40% of 1-year-olds are enrolled in regulated family daycare, whereas in France, the participation rates for the 0 to 3 age group apply to about 30% of children (European Commission, 2014^[25]). In Iceland, 31% of children under 2 years old are enrolled in family daycare. In the Netherlands, about 9% of 2 and 3 year-old children are enrolled in family daycare (OECD, 2016^[26]).

In addition to variations in types of provision, great disparities in enrolment persist. The children who need it the most are less likely to have access to ECEC (Eurydice Network, 2009^[23]; OECD, 2017a^[10]) (see Figure 1.3). Furthermore, children from disadvantaged socio-economic backgrounds have a higher chance of attending low-quality settings (Leu and Schelle, 2009^[27]; Stewart and Waldfogel, 2017^[28]; Vandenbroeck et al., 2018^[29]; Zachrisson et al., 2013^[30]).

The lower quality of settings with a large percentage of immigrant or bilingual children might reflect the barriers to access and the added risk experienced overall by disadvantaged families (Eurydice Network, 2009^[23]) and ethnic minority or multilingual families in specific locations (Stewart and Waldfogel, 2017^[28]). A further explanation that has been suggested is that working with disadvantaged children is more challenging and that additional resources might be needed to counteract these challenges to raise process quality (Pianta et al., 2005^[31]).

Figure 1.3. Percentage of 15-year-old students who attended early childhood education (ISCED 0) for two years and more, by socio-economic background (PISA 2015)



Note: Countries and economies are ranked in descending order of the percentage of socio-economically disadvantaged students who had attended early childhood school for two years and more.

Source: (OECD, 2017e^[32])

The importance and definition of quality

A growing body of research suggests that the magnitude of the benefits for children will depend on the level of quality of ECEC services, and that low-quality ECEC can be associated with no benefits or even with detrimental effects on children's development and learning (Britto, Yoshikawa and Boller, 2011^[33]; Howes et al., 2008^[34]). With mounting pressure to prepare ever more affordable places in ECEC, in a sector that is often highly decentralised, simultaneously raising quality can be a daunting task – particularly when public budgets are being tightened. However, even defining quality in ECEC remains a challenge for researchers and policy makers seeking to enhance quality (La Paro et al., 2012^[35]).

Definitions of ECEC quality often distinguish between structural characteristics and process quality (Howes et al., 2008^[34]; Pianta et al., 2005^[31]; Slot et al., 2017a^[36]; Sylva et al., 2006^[37]; Thomason and La Paro, 2009^[38]); for a review see (Slot et al., 2017a^[36]). “Quality standards” are often understood as “regulations”, while there is an emerging trend to extend the scope to more dimensions, such as process quality. Quality standards may also include “quality beyond regulations”. To inform and influence policy and the general public about the wider definition of the ECEC quality, the concept needs to be better understood and supported.

Structural characteristics are conceptualised as more distal indicators of ECEC quality that refer to the infrastructure, i.e. the available physical, human, and material resources. Structural characteristics are often aspects of the ECEC system that have traditionally been more easy to regulate, such as child-staff ratio, group size and staff training/education (Barros et al., 2016^[39]; Howes et al., 2008^[34]; Slot et al., 2015^[40]; Thomason and La Paro, 2009^[38]). Measurement of structural aspects can often be implemented with a survey or interview at the classroom, setting or system level.

Process quality concerns the more proximal processes of children's everyday experience and involves the social, emotional, physical and instructional aspects of their interactions with staff and other children (peer interactions) while being involved in play, activities or routines (Anders, 2015^[41]; Barros et al., 2016^[39]; Ghazvini and Mullis, 2010^[42]; Howes et al., 2008^[34]; Pianta et al., 2005^[31]; Slot et al., 2015^[40]).

Staff-child interactions in particular usually include the dimensions of:

- emotional climate, including physical and emotional care and support
- instructional quality or pedagogical practices, including the strategies and activities staff employ to engage children in learning and development, and how to scaffold children's learning
- organisation of group routines and management of children's behaviour (Hamre et al., 2014^[43]).

Additional aspects of process quality include the quality of children's interactions with space and materials (Hamre et al., 2014^[43]; Mashburn et al., 2008^[44]; Slot et al., 2017a^[36]; Slot, 2017^[16]). Interactions among children, among staff and with parents are also paramount in the environment for learning and well-being that children experience. Parental involvement in children's learning and development begins at birth, by providing guidance, developing habits, imparting values, supporting learning experiences and sharing expectations (OECD, 2017b^[6]). Children with involved parents tend to do better in reading and numeracy, have positive social and emotional social skills, and be more motivated to learn (OECD, 2017b^[6]). In addition, supportive relationships that generate

healthy attachments positively affect children's understanding and regulation of emotions, as well as their feelings of security and taste for exploration and learning (OECD, 2015^[5]).

The Programme for International Student Assessment (PISA) and many other studies show that children whose parents engage in activities such as reading, writing words, telling stories and singing songs not only tend to achieve better reading and numeracy skills, but are also more motivated to learn (Scottish Government, 2016^[45]; OECD, 2011^[4]; Sylva, Siraj-Blatchford and Taggart, 2003^[46]; van Voorhis et al., 2013^[47]). Differences in developmental outcomes by gender and socio-economic background begin early in life, before children start primary school (Bradbury et al., 2011^[48]; Feinstein, 2003^[49]; Sylva et al., 2004^[13]). The role of parents, ECEC staff and school teachers in identifying children's individual need for support is thus vital. However, these aspects are often under-researched, and in this report, the scope of process quality is limited by the available literature. The OECD's ongoing project on Quality beyond Regulations in ECEC, to which this report contributes, will extend the scope of analysis to those additional aspects of process quality.

For this report, the meta-analysis composes three specific indicators of process quality. To capture two different features of staff-child interactions, it uses a global score of staff-child interactions, and an aggregate score of staff-child interactions, including the staff's positive emotional, instructional, and organisation interactions with children, generally based on a set of domain-specific scores reported in the studies. Process quality was operationalised as staff-child interactions in all but 7 studies, and most commonly assessed through observational measures (breakdown of measures per study coded are detailed in Appendix C). Of the 44 studies coded, in 23 studies, a global score of the measure was used to describe the quality of staff-child interactions. In addition, 18 studies focused on positive interactions (i.e. warmth, responsiveness, emotional climate), 4 studies on negative interactions (i.e. conflict, permissiveness, negative climate), 10 studies on instructional interactions (i.e. general instructional support and cognitive stimulation but not content-specific instruction), and 8 studies on organisation/management of routines/chaos.

It also uses an aggregate score of the exposure and/or quality of developmental and educational activities. Fifteen studies focused on developmental and educational activity indicators of process quality, which were assessed using observational ($n=13$) and self-report measures ($n=2$, see Appendix C for detailed breakdown of measures per study coded). Despite the variety of measures, all studies focused on educational activities, i.e. early literacy or early numeracy activities.

Most of the studies reported information regarding the reliability of the process quality measures included, and the reliability reported was acceptable to excellent for staff-child interactions and developmental and educational activities. Although peer interactions were considered a priority for the literature search in the literature review and meta-analysis, studies of peer interactions as an indicator of process quality were scarce, and often limited to findings from studies conducted in the United States (von Suchodoletz et al., 2017^[17]). Some more recent conceptualisations of ECEC quality may include parent and community engagement as potential structural and process mechanisms for quality, but these were considered beyond the scope of the literature review and meta-analysis, and thus of this report.

Measurement of process quality generally involves the use of a standardised observational protocol, and may also include an interview with staff and/or leaders. The protocol tends to be complex, time-intensive and require specialised training (Box 1.1).

Only a few of measures have been used consistently across jurisdictions and countries. The rigorous adaptation of measures to other countries allows for a more direct comparison of the level of process quality observed in different contexts. However, levels of quality reported in the studies cannot be considered as representative for the quality in each particular country or region.

Comprehensive process quality measures, such as the environmental rating scales, are the most commonly used observational instruments hence allowing for international comparison. A recent meta-analysis of 72 studies from 23 countries focusing on ECEC for children aged zero to five demonstrated that the average level of comprehensive process quality as measured by the environmental rating scales, was mediocre with a score of almost 4 on a 7-point rating scale (Vermeer et al., 2016_[50]). However, significant differences were found between studies, i.e. studies from Australia reported the highest average scores (i.e. at 5), while studies from Bangladesh, the Netherlands Antilles, and South Korea reported the lowest scores (i.e. below 3). Quality was generally observed to be higher in studies from North America than in studies from Europe, South America, and Asia, but the variation was also larger in North America compared to Europe and Asia.

More specific measures of process quality looking at staff-child interactions, such as the Classroom Assessment Scoring System (CLASS), are also increasingly being adapted to different countries and across different age ranges. A preliminary overview (see Annex Table 1.A.1) reveals a consistent pattern of mid-to-high range scores in the CLASS for emotionally and organisationally supportive classroom interactions, and low to lowest range scores for instructional support across all age ranges and types of provision (Slot, 2017_[16]).

Overall, the findings for the preschool age (with the CLASS Pre-K) show medium to medium-high quality for emotional support in studies from all countries. Instructional support, or support for learning, is in the low range and lowest for the majority of studies and only reported in the mid-range in studies from Finland, the Netherlands, and Portugal. Although the number of studies involving infant and toddler classrooms is rather limited, the results reveal a similar pattern as for the preschool age. However, for all subdomains of staff-child interactions (emotional, organisational and instructional support), the variation observed within countries is roughly equal to the variation between countries, indicating that the quality of staff-child interactions is only partially determined by country-wide characteristics or national policies.

Box 1.1. Commonly used measures to assess ECEC process quality.

Instruments that assess process quality are divided into global quality measures (e.g. Environment Rating Scales, or ERS), and instruments that focus explicitly or exclusively on the quality of interactions between staff and the children (e.g. the Classroom Assessment Scoring System, or CLASS). Most instruments are age-specific (Infant and Toddler Environment Rating Scale, or ITERS, for infant and toddler classrooms, versus Early Childhood Education Rating Scale, or ECERS, for preschool classrooms), and have had multiple reviews and adaptations to different contexts (e.g. ITERS versus ITERS-R). A few instruments distinguish between different subdomains of process quality (e.g. the CLASS distinguishes between emotional support, classroom management and instructional support).

Global quality measures

Environment Rating Scales (ERS): These observational tools evaluate the overall quality in ECEC, encompassing a wide range of quality aspects based on the following subscales: space and furnishing, personal care routines, language reasoning, activities, interaction, programme structure, and parents and staff.

Different versions have been developed for infant and toddler classrooms (ITERS-R; (Harms, Cryer and Clifford, 1990_[51])), preschool classrooms (ECERS-R; (Harms, Clifford and Cryer, 1998_[52])), family daycare (Family Child Care Environment Rating Scale, or FCCRS, or FCCERS-Revised; (Harms, Cryer and Clifford, 2007_[53])). In addition, an extension of the Early Child Care Environment Rating Scale (ECERS) was developed by (Sylva, Siraj and Taggart, 2003_[54]) ECERS-E) to capture aspects of the curriculum with a focus on literacy, math, science and diversity.

Quality of interactions

Caregiver Interaction Scales (CIS; (Arnett, 1989_[55])). The CIS measures teachers' sensitivity, harshness, detachment and permissiveness in the interactions with children.

Classroom Assessment Scoring System (CLASS). The CLASS evaluates emotional, behavioural and instructional aspects of the teacher's interactions with children and the way the teacher encourages interactions with materials and peers. There are several different age versions available for infant classrooms (CLASS Infant; (Hamre et al., 2014_[43])) for toddler classrooms (CLASS Toddler; (La Paro et al., 2012_[35])), and for preschool classrooms (CLASS Pre-K; (Pianta, La Paro and Hamre, 2008_[56])).

Observational Record of the Caregiving Environment (ORCE); (NICHD Early Child Care Research Network, 1996_[57]). The ORCE measures caregiver-child interactions, with a few items addressing language and cognition.

Early Literacy and Language Classroom Observation (ELLCO; (Smith, Dickinson and Sangeorge, 2002_[58])). The ELLCO measure focuses on classroom interactions, but also has a more domain-specific focus on emerging literacy activities.

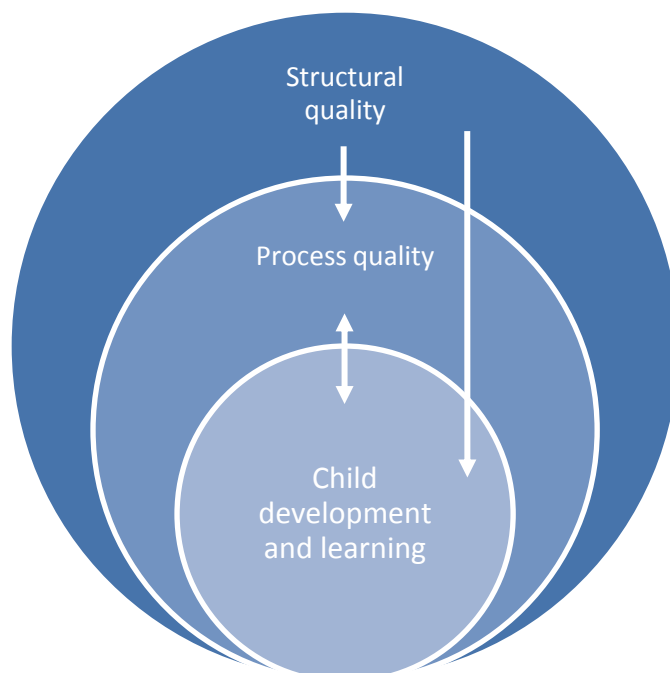
Student-Teacher-Relationship Scale (STRS; (Pianta, 2001_[59])). The STRS is self-report measure of closeness and conflict in student-teacher interactions for preschool and kindergarten classrooms.

Reflecting this trend, the (European Commission, 2014_[25]) describes quality as a multidimensional, complex construct that includes the structure of ECEC provision, processes and practices in ECEC settings, and outcomes from ECEC provision. Conceptualisations cover global aspects (such as a warm climate or child-appropriate behaviour) and domain-specific stimulation, in learning areas such as literacy, emerging mathematics and science (Anders, 2015_[41]). Essential to a multidimensional understanding of quality is the provision of a learning environment in which young children can engage in developmentally appropriate, stimulating and language-rich activities that offer opportunities for play and exploration, for use of language, for higher-order thinking and problem solving, and for social interactions (European Commission, 2014_[25]; OECD, 2017b_[6]). Consequently, to improve quality in ECEC, it is essential to define quality dimensions and their key indicators beyond the indicators that are traditionally regulated.

Processes and relationships in ECEC are crucial for quality

Structural features are considered to be important preconditions for process quality, and to some degree for child development and learning (Vandell et al., 2010_[60]). Despite the strong theoretical assumption that structural staff and classroom features affect children's development through process quality (see Figure 1.4), the empirical evidence supporting this notion is weak (Melhuish et al., 2015_[1]). For exceptions see: (Connor et al., 2005_[61]; Melhuish et al., 2015_[1]; NICHD Early Child Care Research Network, 2002_[62]; Slot et al., 2017b_[63]).

Figure 1.4. Conceptual and analytical model for the relationship between ECEC structural quality, process quality, and child development and learning



Source: Adapted from (Slot, 2017_[16])

Relations between structural and process quality in ECEC settings have been extensively studied, with mixed and inconsistent findings (Pianta et al., 2005^[31]). One explanation is that structural characteristics may be more indirectly related to child outcomes by providing the foundation for process quality as the primary mechanism for children's development and learning. However, studies directly testing indirect effects of structural quality on children's development and learning are limited and, so far, show a mixed pattern of associations (Anders, 2015^[41]).

Despite such findings, structural factors have been prioritised as a key strategy for improving the quality of ECEC programmes and ultimately children's development and learning (Early et al., 2007^[64]). For example, in many countries, raising staff qualification requirements is the quality improvement strategy of choice (Early et al., 2007^[64]). Structural standards are relatively easy to set and observe – both by inspectors and parents (e.g. space per child, number of adults in a class- or playroom). Regulating effective professional development, for instance, is a much more complex endeavour.

Linkages between structural and staff-child interactions also matter for the youngest children

Many countries have regulations to address the specificity of provision for children under the age of 3 (OECD, 2006^[24]). As a consequence, structural conditions for centres for children under the age of 3 differ in many respects from centre provisions for children aged 3 to 6. For example, group sizes or the child-to-staff ratio tend to be lower (Barros et al., 2016^[39]; Jamison et al., 2014^[65]; Slot et al., 2015^[40]; Vogel et al., 2015a^[66]; 2015b^[67]).

Despite these regulations, the quality of the interactions and of the environment provided in centres has been reported to be lower for infants and toddlers than for pre-schoolers (Fenech, Sweller and Harrison, 2010^[68]; Helmerhorst et al., 2014^[69]; Lahti et al., 2015^[70]; Fukkink et al., 2013^[71]). In particular, centres with mixed age groups serving children from birth until age 3 years appear to offer lower quality (Slot et al., 2017c^[72]).

There is also some evidence that the quality of the materials, activities, and environment may be lower in centres for infants as compared to those for toddlers (Hulpia et al., 2016^[73]), whereas basic safety and organisation and the quality of (language) interactions may be higher for infants than for toddlers (King et al., 2016^[74]). For example, research shows that support for children's development, well-being and learning is comparatively lower for infants (Fukkink et al., 2013^[71]), as well as emotionally supportive interactions (Helmerhorst et al., 2014^[69]).

These concerns also apply to family daycare settings, which are an important part of provision for the youngest children in many countries. The minimum requirements defined for licensed family daycare services vary widely across countries. Regulations usually require that providers meet minimum health, safety and nutrition standards, and also minimum educational requirements for caregivers. Some countries distinguish between registered family daycare providers, which often involve minimal to no monitoring or supervision, and licensed family daycare providers, which involve monitoring to a certain extent. In this report, family daycare settings refer only to the publicly regulated ECEC settings for children aged 0 to 2.

Family daycare settings differ in many respects from centres. Family daycare providers typically work alone (Porter et al., 2010b^[75]). Group sizes and child-staff ratios tend to be lower than in centres (e.g. (Burchinal, Howes and Kontos, 2002^[76]; Coley et al., 2016^[77];

Hulpia et al., 2016^[73]; OECD, 2006^[24]); but there is considerable variation across countries (Boogaard, Bollen and Dijkers, 2014^[78])

Staff educational qualifications also tend to be lower for family day care providers than for staff working in centres. Moreover, family daycare providers tend to have fewer opportunities for professional development (e.g. (Boogaard, Bollen and Dijkers, 2014^[78]; Fuligni et al., 2009^[79]). An overview by the OECD (2006) showed that the requirements for licensed family daycare care tend to be lower than for centre-based ECEC.

The quality of the interactions and of the environment provided in family daycare settings has generally been reported to be lower in comparison to centres. In a recent review, the environment in family daycare settings was described as varying from inadequate (Elicker et al., 2005^[80]; Fuller et al., 2004^[81]; Peisner-Feinberg et al., 2000^[82]) to good (Paulsell et al., 2008^[83]; Shivers, 2006^[84]), and overall quality in family daycare appeared comparably lower than quality in centre-based care (Coley et al., 2016^[77]; Elicker et al., 2005^[80]; Fuller et al., 2004^[81]; Lahti et al., 2015^[70]). Specifically, the provision of learning activities was rated lower (Coley et al., 2016^[77]; Fuller et al., 2004^[81]), whereas no differences were found for the quality of interactions (Fuller et al., 2004^[81]).

Taken together, the literature indicates that quality of family daycare varies considerably. Although some structural characteristics are beneficial, such as a small group size and small child-staff ratios, other features can be less favourable, such as staff's lower educational qualifications, lack of professional development and other support and resources. Moreover, more empirical evidence is needed to enhance our understanding of which characteristics of family daycare contribute to higher process quality; and which have an impact on children's well-being, development and learning (Susman-Stillman and Banghart, 2011^[85]).

Links between staff-child interactions and children's development and learning

The research evidence appears more consistent concerning the positive effects of staff-child interactions on child development and learning. During the early childhood years, social interactions between children and their social context influence children's developmental trajectories (Bronfenbrenner and Morris, 2006^[86]; Rimm-Kaufman and Wanless, 2012^[87]). In ECEC settings, sustained positive interactions between staff and children provide an important proximal context that may facilitate opportunities for children's development and learning (Bronfenbrenner and Morris, 2006^[86]). There is extensive evidence that high-quality staff-child interactions account for individual differences in children's behavioural, social-emotional and academic outcomes, highlighting the importance of the quality of staff-child interactions for the effectiveness of ECEC services (e.g. (Cadima et al., 2016^[88]; Cappella, Aber and Kim, 2016^[8]; Hamre and Pianta, 2005^[89]; Mashburn et al., 2008^[44])).

However, the associations between staff-child interactions and early child cognitive and socio-emotional skills and competencies are inconsistent in size (e.g. in Latin America, Europe and the United States (Araujo et al., 2016^[90]; Leyva et al., 2015^[91]; Mashburn et al., 2008^[44]; Pakarinen et al., 2010^[92]). Although these relationships may vary from one domain of development to another, few studies show strong and consistent associations between the commonly studied dimensions (e.g. emotional climate, instructional quality and classroom organisation) and any domain of early childhood skills. In response, more specific instructional measures have been developed that attempt to capture quality of interactions that are specific to such skills as numeracy development or vocabulary development (Bowne, Yoshikawa and Snow, 2016^[93]; Clements and Sarama, 2014^[94]).

These, again, largely show relatively small associations with those specific child developmental domains.

In the meta-analysis, data on children's development and learning was most commonly assessed using standardised performance tests ($n=21$) and ECEC staff/parent ratings ($n=8$). Two studies used self-report measures. Available child data were grouped into emerging academic skills (early numeracy and literacy) and social and behavioural skills (behaviour regulation, executive function, behavioural problems and social competence). Common measures of emerging academic skills included the Peabody Picture Vocabulary Test (PPVT), the Woodcock-Johnson Tests of Cognitive Ability, and ECEC staff or parent rating scales, to assess social and behavioural competencies.

Information regarding the measures' reliability was limited. Only 17 studies reported reliability of the information, with alpha coefficients ranging between 0.72 and 0.98. However, in the majority of cases where reliability was not reported, studies used well-established and validated measures.

Linking research to policy levers for improving early childhood education and care quality

To help translate research findings into concrete policy actions, the Starting Strong III Quality Toolbox, and, building on the former, the European Union (EU) Proposal for Key Principles of a Quality Framework for Early Childhood Education and Care, set out to define policy levers to provide guidance on improving ECEC quality. In collaboration with ECEC experts and policy makers, the ECEC Network of the OECD, and the ECEC Thematic Working Group of the European Union, proposed to create a common understanding of quality as a multidimensional, complex construct that includes the structure of ECEC provision, processes and practices in ECEC settings, and outcomes from ECEC provision.

In this report, evidence is presented and analysed under a proposed thematic frame for quality that proposes to add on to the Starting Strong III Quality Toolbox in areas with strong and new findings, while examining the relevance of each policy lever in light of its association with process indicators, such as the quality of the staff-child interactions and staff quality or exposure to developmental and educational activities, as well as aspects of child development and learning, such as emergent academic and socio-emotional skills. In comparison to the Starting Strong III Quality Toolbox, two policy levers – curriculum and pedagogy, and parent/guardian and community engagement – were not included. Curriculum and pedagogy were found to be rarely and inconsistently addressed in the empirical literature. Parent/guardian and community engagement was considered beyond the scope of the literature review and meta-analysis. Table 1.2 presents a brief summary of indicators considered in this report for each policy lever and chapter.

Chapter 2 considers aspects of standards and governance, namely the setting of staff-child ratios and group sizes as minimum standards, the financing of ECEC services, the physical location of the centre, the intensity of the service, class or playroom composition, and the effects of licensing and certification.

Chapter 3 examines workforce development and working conditions, namely pre-service qualifications and in-service training of staff, years of work experience; working conditions (i.e. salaries), staff well-being and organisational climate.

Chapter 4 considers monitoring and data on quality, specifically Quality Rating Information Systems (QRIS).

Finally, Chapter 5 concludes with an overview of key insights and avenues for further research.

Table 1.2. Structural and process indicators examined in this report for each policy theme

Target areas of policy levers to improve quality	System/structural indicators, i.e. the aspects of ECEC that are traditionally regulated and function as preconditions of proxy of process quality	Process/interaction indicators, i.e. the child's day-to-day experience
Standards, and governance (Chapter 2)	Minimum standards (e.g. staff-child ratios, group sizes); financing of ECEC services (whether public/ non-profit or private); physical location of the centre, intensity of the service, registering or licensing of services, class- or playroom composition	Overall staff-child interactions, staff emotional, instructional, and organisation interactions with the children
Workforce development and working conditions (Chapter 3)	Pre-service qualifications of staff; in-service training of staff; years of work experience; working conditions (i.e. salaries); staff well-being, organisational climate, networking	Overall staff-child interactions, staff emotional, instructional, and organisation interactions with the children Developmental and educational activities
Monitoring and data on quality (Chapter 4)	Monitoring systems and tools (QRIS)	Overall staff-child interactions, staff emotional, instructional, and organisation interactions with the children

Annex 1.A. Variation in Early Childhood Education and Care staff-child interactions across studies and age ranges

Annex Table 1.A.1. Variation in scores for emotionally, organisationally and instructionally supportive classroom interactions across studies and age ranges

Assessment of interactions using the Classroom Assessment Scoring System

Country	Reference	N	Sample	Age range	Domain	Mean	SD
Australia	Tayler et al. 2013	254	Two states	Preschool	Emotional support	5.13	.92
					Classroom organisation	4.60	.92
					Instructional support	2.07	.76
Flemish Comm. (Belgium)	Hulpia et al. 2016	167	Stratified random sample	Infant	Relational climate	5.11	.80
					Teacher sensitivity	4.86	1.02
					Facilitated exploration	3.33	1.14
					Early language support	2.97	1.22
					Emotional and behavioural support	5.22	.84
Chile	Leyva et al., 2015	91	At-risk, 4 municipalities in Santiago	Preschool	Engaged support for learning	2.66	.88
					Emotional support	4.65	.54
					Classroom organisation	4.29	.63
China	Hu et al. 2016b	180	Stratified, random sample	Preschool	Instructional support	1.75	.55
					Emotional support	5.03	.69
					Classroom organisation	4.80	.81
Denmark	Slot et al. 2017a, under review	402	Purposive sample at-risk children,	Preschool	Instructional support	2.12	.61
					Emotional support	5.85	.42
					Classroom organisation	5.69	.47
Germany	Stuck, Kammermeyer and Roux, 2016	61	One state	Preschool	Instructional support	2.45	.55
					Emotional support	5.88	.57
					Classroom organisation	6.15	.61
Germany	Von Suchodoletz et al., 2014	63	One state	Preschool	Instructional support	1.61	.49
					Emotional support	5.32	.75
					Classroom organisation	4.82	1.02
Finland	Pakarinen et al. 2010	49	Semi-rural and urban sample	Preschool	Instructional support	2.47	.78
					Emotional support	5.54	.69
					Classroom organisation	5.34	.66
					Instructional support	3.97	.92

Country	Reference	N	Sample	Age range	Domain	Mean	SD
Netherlands	Slot et al., 2017b	269	Semi-rural and urban sample	Toddler	Emotional and behavioural support	5.37	1.02
					Engaged support for learning	3.29	1.28
Netherlands	Veen and Leseman, 2015	133	Semi-rural and urban sample	Preschool	Emotional support	5.34	.73
					Classroom organisation	5.03	.85
					Instructional support	3.27	.89
Poland	Wyslowska et al., 2017	30		Toddler	Emotional and behavioural support	5.79	.86
		30			Engaged support for learning	2.84	1.02
Portugal	Barros et al., 2016	90	Metropolitan area Porto	Infant	Relational climate	4.62	.76
					Teacher sensitivity	4.20	.88
					Facilitated exploration	2.58	.75
					Early language support	2.62	.76
	Cadima, Leal and Burchinal, 2010	64	Metropolitan area Porto	Preschool	Emotional support	4.60	.88
					Classroom organisation	4.11	.90
					Instructional support	3.04	1.13
Spain	Sandstrom, 2012	25	Random sample in one city	Preschool	Emotional support	4.79	.63
					Classroom organisation	4.32	.67
					Instructional support	2.16	.49
Switzerland	Perren, Frei and Hermann, 2016	35	Different ECEC settings	Toddler	Emotional and behavioural support	5.44	.76
					Engaged support for learning	3.23	1.07
US	Jamison et al. 2014	30	One state	Infant	Relational climate	5.07	.98
					Teacher sensitivity	5.13	.93
					Facilitated exploration	4.02	1.08
					Early language support	3.89	1.02
	La Paro, Williamson and Hatfield, 2014	101	One state	Toddler	Emotional and behavioural support	4.82	.99
					Engaged support for learning	2.83	1.07
	Hamre et al., 2013	4035	Multi- state and multi-sample	Preschool	Emotional support	5.23	.88
					Classroom organisation	4.66	.93
					Instructional support	2.58	.88

Note: The studies reported in this table show considerable variation in sample size and geographical spread within countries. However, reported levels of quality cannot be considered as representative for the quality in each particular country or region where the study took place.

Source: (Slot, 2017_[16])

Notes

1. Family daycare settings may also apply to older children before compulsory school starts or for after-school care. However, those settings are not considered in this report.

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Chapter 2. Standards and governance for quality early childhood education and care

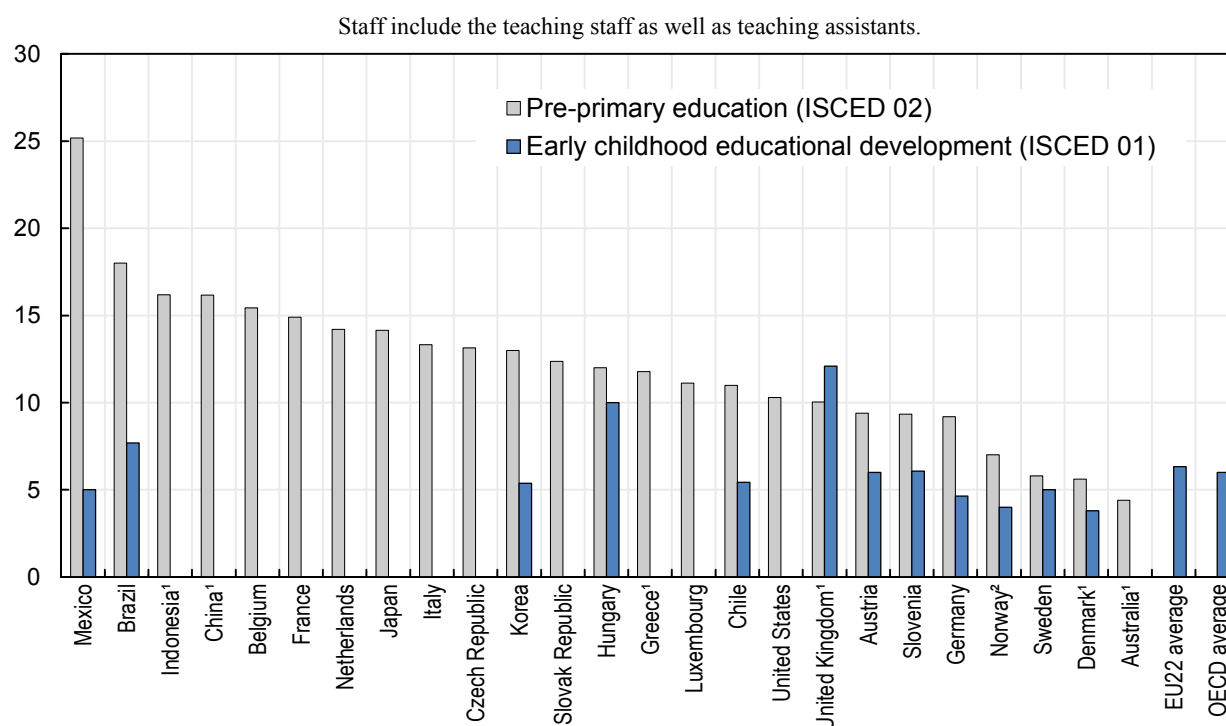
Aspects of governance and standards are among the most commonly used regulations for improving early childhood education and care (ECEC) quality. This chapter provides an overview of the evidence linking structural mechanisms in standards and governance to staff-child interactions, by integrating the evidence for centres for children aged 3 to 5, and for children aged 0 to 2, including family daycare settings. Structural characteristics, such as ratio of children to staff, group sizes or physical location of the centre, affect the environment for staff and children, and thereby influence staff-child relationships established in ECEC settings and the support to children's development. Other aspects of governance, such as funding and classroom composition are also likely to play a role. The evidence on the benefits of longer hours of provision in general and licensing in family daycare remains largely inconclusive.

Introduction

Policy makers use many structural indicators to determine the quality of early childhood education and care (ECEC) centres, including aspects of governance and standards. Structural aspects, such as the ratio of children to adults, group sizes, funding structure of the organisation (public vs. private) or physical location of the centre (urban vs. rural, in a school or in a daycare centre), are likely to affect the working conditions for staff, and therefore influence the relationships established in ECEC settings between staff and children.

Child-staff ratios and group size are the most commonly studied aspects, and also the most commonly used regulations for improving ECEC quality. Based on the existing evidence from the schooling sector, as well as developmental and educational theory highlighting the importance of individualised pedagogy, particularly for the youngest children, many countries have implemented policies to reduce group size in early childhood development programmes (ISCED 01), and a trend is observed of smaller child-staff ratios in OECD countries in ISCED 01, compared to pre-primary education (ISCED 02) (see Figure 2.1) (OECD, 2017a_[10]).

Figure 2.1. Child-staff ratios in early childhood education and care (ISCED 0) (2015).



Notes: 1. Year of reference is 2014. 2. Including early childhood development (ISCED 01). Countries are ranked in descending order of child-staff ratios in pre-primary education, including early childhood development (ISCED 01). Data for Belgium for ISCED 02 exclude students and teachers from the German-speaking Community. See Education at a Glance 2017 Annex 3 for further notes (www.oecd.org/education/education-at-a-glance-19991487.htm). Data for the Flemish Community of Belgium were available for ISCED 01 in 2015. However, due to the recent policy transition, no data were reported at this stage.

Source: (OECD, 2017d_[95]).

Countries organise the funding structure for ECEC in different ways. Some countries have a public sector that provides universal access from a certain age, such as the European Nordic countries; whereas in other countries, the private sector chiefly runs ECEC settings, or there is a mix of the two. Private settings usually are more common for the youngest children. In this report, settings were considered public if they received funding from different public agencies at the state, city or country level.

The type of programme children attend determines the number of hours they spend in ECEC. Full-day programmes tend to be five to six hours a day, five days a week, whereas part-day programmes tend to involve a reduced number of hours and/or days. Full-day programmes are generally assumed to be better for children's development and learning because longer days give staff the opportunity to develop a more complete and multifaceted programme, and children can be more involved in planning of activities as well as in more process-oriented activities. A full-day programme during the last year of ECEC can ease the transition to primary school pedagogically, i.e. by allowing a more relaxed pace in ECEC and adequate time to prepare for the transition (Winters, Saylor and Phillips, 2003^[96]). It is also assumed that full-day programmes are particularly beneficial for economically disadvantaged children, as has been observed, for example, in Ontario (Zvoch, 2009^[97]).

Moreover, countries adopt different policies in addressing educational inequalities. Some countries apply targeted measures, specifically seeking to enrol children from disadvantaged backgrounds; whereas others choose to expand universal provision for all children, or both. Consequently, selection effects in the usage of provisions exist, leading to differences in the composition of class- and playrooms, as well as potential differences in quality (Freitas, Shelton and Tudge, 2008^[98]; Slot, Lerkkanen and Leseman, 2015^[99]).

Summary of findings

On the topic of ECEC settings' quality standards and governance, the majority of the evidence summarised demonstrated that smaller ratios and group sizes were associated with positive staff-child relationships across all types of centres (i.e. the evidence for family daycare settings is less clear than for centre-based). Despite the somewhat consistent links between ratios and group sizes and staff-child interactions, these structural indicators do not seem to be directly linked to child development and learning. The review of the literature indicated a mixed pattern of associations both across and within countries, and the meta-analysis conducted for this report demonstrated that there was no relationship between child-staff ratios and emerging academic skills, i.e. early literacy and early numeracy.

Other mechanisms, such as funding of ECEC settings, the physical location of the centre and intensity of daily services, were based on fewer studies, and returned less consistent results. Public centres for children between 3 and 6 seemed to provide better staff-child interactions than private centres; however, associations varied across countries. Moreover, although not-for-profit centres for children under 3 scored higher on structural indicators, such as health, safety and furnishings, when compared to for-profit centres, these structural differences appeared to have no implications for staff-child interactions.

The physical location of a preschool might also be related to process quality. The literature review indicated that higher process quality was observed in preschools located in schools than in preschools situated outside school grounds or in independently functioning centres. Although the evidence for this mechanism is consistent and from

multiple countries, the number of studies is limited. Moreover, the opposite pattern was also observed for centres for children under 3.

The meta-analysis conducted for this report demonstrated that intensity of daily service is not consistently related to the quality of staff-child interactions. The association varied within and across countries, and depended on how the interactions between staff and children were observed and documented in the class- or playroom.

In terms of group composition, children in class- or playrooms with a larger percentage of immigrant or bilingual children seemed to experience a lower quality of staff-child interactions, particularly for centres for children 3 to 5 years old, and family daycare settings. Classroom composition was shown to affect children's development as well, i.e. children from disadvantaged backgrounds attending preschools, with a larger percentage of other children with similarly disadvantaged backgrounds, presented lower language and literacy skills.

Finally, the literature shows little and inconsistent empirical evidence supporting the added value of licensing and regulations in determining the quality of staff-child interactions in family day care. The evidence available was also limited to the US. Other aspects of standards and governance seem to be under-researched for family daycare.

This chapter provides an overview of the evidence linking structural mechanisms in standards and governance to staff-child interactions, as well as child development, learning and well-being. To build a solid knowledge base on this theme, it draws on a literature review and meta-analysis that update conceptual knowledge and the empirical evidence base for the strength of these associations, while keeping a cross-national focus. The chapter first summarises these two pieces of research, to discuss the importance of these mechanisms for process quality in ECEC. One mechanism is examined at a time, and integrates the evidence for centres for children aged 3 to 5, centres for children under the age of 3, and finally family daycare settings.

What does research tell us about the importance of quality standards and governance for quality staff-child interactions in early childhood education and care?

Smaller ratios and group sizes support positive staff-child relationships in centres for children of 3 to 6 in most studies

The majority of studies generally indicated that in centres for children aged 3 to 5, smaller group sizes and child-staff ratios were related to better staff-child interactions. This was confirmed by the meta-analysis conducted for this report. However, some studies reported no relationship between these governance indicators and process quality, particularly for overall group size. Considerable variation in reported group sizes and child-staff ratios in the summarised studies may partially account for the variation in results (see Table 2.1).

Table 2.1. Diversity in child-staff ratios and group sizes in reported studies for centres for children aged 3 to 5.

Country/Region	Study	Child-staff ratio	Group size
US	Burchinal et al, 2002	53% compliance with 7:1 for preschool	
China	Hu et al (2016)	18	
US	Mashburn et al, 2008, 2009	7	18
US	Philips et al., 2000	93% compliance with 10:1 regulation in MA, 83% compliance with 10:1 regulation in VI, 87% compliance with 15:1 regulation in GA	
US	Phillipsen et al, 1997	Per state (non-profit programs / for-profit): California: 7 / 9 Colorado: 7 / 7 Connecticut: 6 / 7 North Carolina: 9 / 11	Per state: (non-profit programs / for-profit): California: 15 / 16 Colorado: 13 / 16 Connecticut: 13 / 13 North Carolina: 14 / 15
US	Pianta et al., 2005	7	
Denmark	Slot et al., 2017b	8 or less: 16% of children 9-10: 37% of children 11-12: 33% of children 13-14: 8% of children 15 or more: 6.5% of children	
Spain	Sandstrom, 2012	20	25
Europe and North America	Vermeer et al., 2016	8.6	15
Spain and Germany	Cryer et al., 1999		24 (Spain) 20 (Germany)
Germany	Kuger et al (2016)	13	
Netherlands	Vermeer et al (2010):	6	
Spain	Vermeer et al (2010):	15	
US	Dennis et al (2013)	7	
US	Howes et al (2008)	9	
US	Hatfield et al (2013)	7	
US	Howes et al, (2008)	9	18
US	Blau, 1999		6
US	Burchinal et al, 2011	16	
US	Coley et al., 2016	6	
US	Bowne et al., 2017	9	17

Note: Averages of ratios and group sizes in each study were rounded up to the unit level. In (Philips et al., 2000_[100]) only the following cities participated in the study: Boston (Massachusetts, MA), Virginia and Atlanta (Georgia, GA). In (Phillipsen et al., 1997_[101]) only specific cities or areas were part of the study the four states (California, Colorado, Connecticut, and North Carolina). (Vermeer et al., 2016_[50]) was a meta-analysis of 17 studies. (Bowne et al., 2017_[102]) was a meta-analysis of 38 rigorous program evaluation studies.

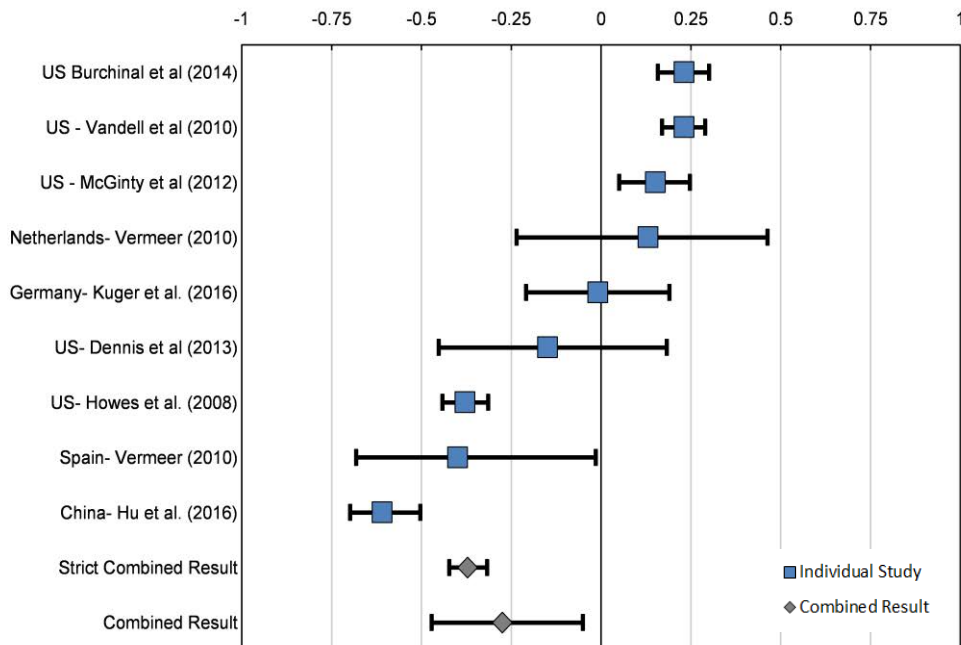
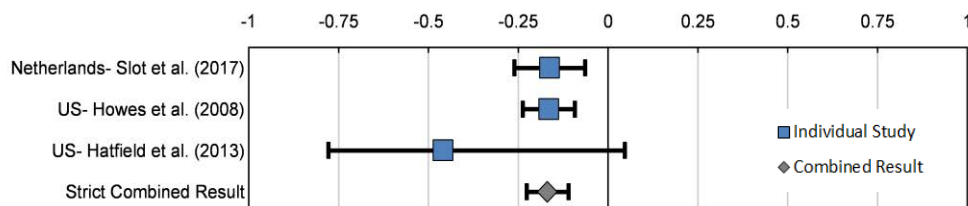
In examining studies from individual countries, a smaller number of children per ECEC staff and a smaller number of children overall seem to be associated with more responsive, warm and positive staff-child relations in the United States (Burchinal et al., 2002^[103]), as well as higher overall process quality in the United States, China and Portugal (Burchinal et al., 2002^[103]; Hu et al., 2016a^[104]; Mashburn et al., 2008^[44]; Philips et al., 2000^[100]; Phillipsen et al., 1997^[101]). Other studies have found no evidence of an association between child-staff ratio and process quality in countries such as Denmark, Spain and the US (Pianta et al., 2005^[31]; Sandstrom, 2012^[105]; Slot et al., 2017b^[63]) or group size and process quality in Denmark (Sandstrom, 2012^[105]).

A previous meta-analysis of 17 studies from Europe and North America showed similar results, with a prevalence of a positive association between child-staff ratio and process quality generally indicating that fewer children per caregiver was associated with higher quality. However, there was no significant relation between group size and process quality (as measured with the Environment Rating Scale, or ERS (Vermeer et al., 2016^[50])). The same study also reported finding no significant differences in the mean group size and child-staff ratio across the group of countries. The mean group size across countries was around 15, with a range of 9.1 to 30.0, and the child-staff ratio was on average 8.60, with a range of 3.1 to 25.0.

A cross-country comparison study also examined the same associations and revealed inconsistent patterns across countries, with positive relations of small group sizes and a favourable ratio to process quality in some countries, but not in others (Cryer et al., 1999^[106]). The findings revealed that a smaller child-to-teacher ratio was related to higher process quality in Germany and the US, but not in Portugal and Spain. In addition, a negative relation was found between group size and overall process quality for Spain, but, remarkably, a positive relation was found for Germany. Note that the average group size in Spain was much larger and showed stronger variation than in Germany (with a mean group size of 23.64 and a standard deviation of 6.38 and a mean of 20.42 and standard deviation of 5.48 respectively), which may explain these contradictory results.

The meta-analysis conducted for this report demonstrated that the quality of staff-child interactions was significantly higher in groups with a lower number of children per ECEC staff (see Figure 2.2).

This was true for studies looking at an overall interactions index between the ECEC staff and the group, as well as an aggregated score of staff-child interactions, including staff emotional, instructional and organisation interactions with the children (see Box 2.1). It is also important to note that in the meta-analysis conducted for this report, the studies summarised referred only to the interactions between the lead teacher and the children, and not between children and all adults in the play- or classroom.

Figure 2.2. Lower child-staff ratios are associated with positive staff-child interactions.**Panel A. Using a global score of staff-child interactions.****Panel B. Based on a combined score of staff emotional, instructional, and organisational staff-child interactions.**

Note: Effect sizes are depicted as either blue squares for individual studies or grey diamonds for combined results, each with black lines spanning the lower limit and the upper limit of the 95% confidence interval for each estimated effect. Individual studies, labelled here with the information for country of study, author, and the year of study publication, refer to original studies that provided effect size measures entering into each meta-analysis. These measures are then combined into a summary effect size, which is the average association between two variables. See Box 2.1 for more details on how to interpret the charts.

Source: (von Suchodoletz et al., 2017_[17]).

Box 2.1. Interpreting the meta-analysis charts

The meta-analysis charts report associations in the form of standardised effect sizes. For the current analysis, effect size is defined as the degree and direction of association, or correlation, between two variables (e.g. between indicators of structural and process quality, and between indicators of structural/process quality and child development and learning).

Effect sizes reported are standardised, such that a measure ranges between -1 to 1. An effect size measure closer to 0 means little association between the two variables represented in the chart, while an effect size closer to either -1 or 1 (i.e. larger absolute value) would indicate stronger association between the variables. An effect size of negative value would mean that an increase in the measure of one variable is associated with a decrease in the measure of the other variable, while an effect size of positive value would mean that both variables increase or decrease in same direction.

Depending on which statistical assumption underlies the process of averaging, a meta-analysis can produce either Combined Result (based on a “fixed-effect model”) or Strict Combined Result (based on a “random-effects model”). The main difference between the two in the present meta-analysis is that the former gives larger weighting to the individual studies based on larger sample size.

Because of the diversity of measures used in research to assess process quality, meta-analysis results are examined in terms of three indicators:

- Global score of staff-child interactions: an overall index of the interactions between the ECEC staff and the group, irrespective of the type or subdomains of interaction, used when the studies only reported one single score to describe the quality of interactions;
- Combined score of staff-child interactions: an aggregate score of staff-child interactions, including the staff’s positive emotional, instructional, and organisation interactions with children, generally based on a set of domain-specific scores reported in the studies.
- Developmental and educational activities: an aggregate score of the exposure and/or quality of developmental and educational activities provided by staff.

For child data, meta-analysis results are examined in terms of two indicators:

- Emerging academic skills: An aggregate score of early numeracy and literacy skills.
- Combined score of behavioural and social-emotional indicators: an aggregate score of social and behavioural skills, including behaviour regulation, executive function, behavioural problems, and social competence.

Child-staff ratios and group size do not appear to be consistently linked to child development and learning

Despite the largely consistent links between ratios and group sizes and process quality, these structural indicators do not seem to be consistently linked to child development and learning. A review of the literature indicates a mixed pattern of associations both across and within countries.

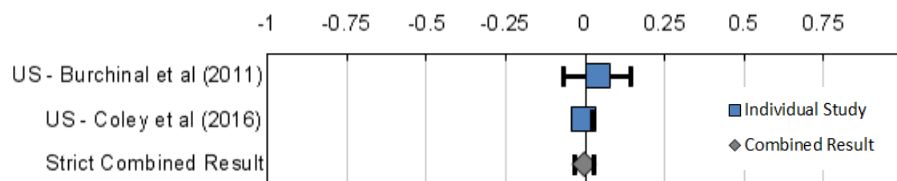
Based on a large-scale survey study conducted in the United States, Blau (1999^[107]) found that smaller group size in preschool was related to better vocabulary skills for children across preschool and elementary school, and higher reading skills across elementary school from age 5 years onwards. The average group size was six and pertained to different centre-based and home-based care arrangements. Another US study only reported a significant negative association between group size and literacy skills for groups larger than 20 children, but no associations were found for language and cognitive skills (Mashburn et al., 2008^[44]). Similar patterns were found in Germany and other US studies, demonstrating that smaller group size in preschool was related to better literacy or vocabulary skills (Ebert et al., 2013^[108]; Mashburn et al., 2008^[44]).

However, other US studies and a cross-national study have shown that either group size and/or child-staff ratio were not related to children's language and literacy skills (Howes et al., 2008^[34]; Mashburn et al., 2008^[44]; Mashburn et al., 2009^[109]; Montie, Xiang and Schweinhart, 2006^[110]). The two US studies reported an average child-staff ratio ranging from 7 to 8, and an average group size of 18. The cross-national study reported an average group size of 20 children, and a range from 4 to 49 children.

The meta-analysis conducted for this report indicated little to no relationship between child-staff ratios and emerging academic skills (i.e. early literacy and early numeracy; see Figure 2.3. However, since the findings are based on only two US studies, this association is yet to be confirmed by more research from different countries.

Figure 2.3. No consistent evidence of association between child-staff ratios and emerging academic skills

Findings based exclusively on studies from the United States



Note: Effect sizes are depicted as either blue squares for individual studies or grey diamonds for combined results, each with black lines spanning the lower limit and the upper limit of the 95% confidence interval for each estimated effect. Individual studies, labelled here with the information for country of study, author, and the year of study publication, refer to original studies that provided effect size measures entering into each meta-analysis. These measures are then combined into a summary effect size, which is the average association between two variables. See Box 2.1 for more details on how to interpret the charts.

Source: (von Suchodoletz et al., 2017^[17]).

The meta-analysis also demonstrated that these associations did not vary according to the geographical location of the studies included, defined as from the United States as

compared to studies from outside the United States (i.e. combined across all other countries).

A recent meta-analysis looking at all US ECEC programme evaluation studies for centres for 3- to 6-year-olds, published between 1960 and 2007, presented a potential explanation for these mixed results; namely that rather than assuming a continuous increase or decrease of skills per additional child in the group or child-per-staff, the relations between group size and child-staff ratios with children's cognitive development and achievement are nonlinear (Bowne et al., 2017_[102]). In summary, ECEC structural conditions for maximum child development and learning improved as ratios and group sizes approached an optimum of 7.5 children to 1 adult and a maximum group size of 15 children, and then decreased. The results were less clear for children's socio-emotional outcomes, due to the small sample size.

A possible reason for these inconsistent findings could be that structural characteristics within governance are *indirectly* related to child development and learning, influencing child development through process quality. A large-scale US study (NICHD Early Child Care Research Network, 2002_[62]) found evidence of these indirect paths, namely that child-staff ratios affected staff-child interactions, which in turn affected children's cognitive development. These indirect effects were smaller than the direct effects of staff-child interactions, particularly when compared with aspects of emotionally supportive staff-child interactions on child development, well-being and learning reported in the same study, which were larger. More evidence is necessary from cross-national studies to confirm these patterns.

Smaller ratios and group sizes also matter for positive staff-child relationships for younger children in centres and family day care, but fewer studies have been conducted

Concerning evidence related to centres for children under the age of 3, most studies showed that a smaller group size and fewer children per staff member were related to higher-quality staff-child interactions, although there were a few studies showing null associations.

Smaller group size and child-staff ratios were related to better staff-child interactions in the Flemish Community in Belgium, the Netherlands, in Portugal and the US (Barros and Aguiar, 2010_[111]; Barros et al., 2016_[39]; Deynoot-Schaub and Riksen-Walraven, 2005_[112]; Hulpia et al., 2016_[73]; Jamison et al., 2014_[65]; Thomason and La Paro, 2009_[38]; Phillipsen et al., 1997_[101]). This particularly concerned emotionally supportive interactions with children.

However, two US studies and one Portuguese study found no associations between group size and child-staff ratios with observed classroom quality (Pessanha, Aguiar and Bairrão, 2007_[113]; Vogel et al., 2015a_[66]; Vogel et al., 2015b_[67]). Both US studies concerned settings that were part of the targeted Early Head Start programme, with an average group size of 6 children (well within the maximum group size of 8 children) and an average child-staff ratio of 2.7 (which was also within the state regulation of 4 children).

One Dutch study found no associations between observed group size and staff-child interactions, whereas child-staff ratio was related to staff-child interactions (Slot et al., 2017b_[63]). A smaller ratio was associated with higher *emotional* support and support for children's development and learning, with a slightly stronger effect for the latter (Slot

et al., 2017b_[63]). In this study, the average group size was 10, ranging from 1 to 25, and the observed child-staff ratio was 5, ranging from 0 to 16.

Another Dutch study reported effects of both group size and child-staff ratio in staff-child interactions. In an experimental study in the Netherlands, two structured play situations were observed in which the number of children was manipulated (de Schipper, Riksen-Walraven and Geurts, 2006_[114]). The quality of interactions was higher in the play situation with three children compared to the one with five children. Moreover, the effect of smaller ratios was stronger for younger children. In this study, children's age showed large variation and ranged from 10 months up to almost 4 years of age.

Together, the findings seem to more strongly support a smaller child-staff ratio, rather than just a smaller group size. However, it is important to note that the partially inconsistent findings of these two studies may be a function of different group sizes and ratios (see Table 2.2), but also methodology (i.e. the difference between an observational and experimental study).

Table 2.2. Diversity in child-staff ratios and group sizes in reported studies for centres for children aged 0 to 2.

	Study	Children-to-staff ratio	Group size
Portugal	Barros and Aguiar, 2010	7	13
Portugal	Barros et al., 2016	3	5
Netherlands	Deynoot-Schaub and Riksen-Walraven, 2005	4	9
Flemish Community in Belgium	Hulpia et al., 2016	Infants: 2-13 Toddlers: 1-14	Infants: 2-20 Toddlers: 1-23
US	Jamison et al., 2014	2.5	6
US	Thomason and La Paro, 2009	83% met recommendation 6:1 for toddler child care	90% met recommendation 12 for toddler child care
US	Phillipsen et al, 1997	Per state (non-profit programs / for-profit): California: 4 / 3 Colorado: 4 / 4 Connecticut: 3 / 3 North Carolina: 5 / 6	Per state (non-profit programs / for-profit): California: m / 9 Colorado: 6 / 7 Connecticut: 8 / 10 North Carolina: 7 / 9
Portugal	Pessanha, Aguiar and Bairrão, 2007	7	16
US	Vogel et al. 2015a, 2015b	3	6
Netherlands	Slot et al., 2017b	5	10
Netherlands	de Schipper, Riksen-Walraven and Geurts, 2006	3 and 5	3 and 5
Basque region in Spain and the Netherlands	Vermeer et al., 2010	Basque region: 15 Netherlands: 6	Basque region: 15 Netherlands: 12
US	NICHD Early Child Care Research Network, 2000	15 Months: 3 24 Months: 3 36 Months: 5	15 Months: 4 24 Months: 5 36 Months: 7

Note: Averages of ratios and group sizes in each study were rounded up to the unit level. In (Phillipsen et al., 1997_[101]) only specific cities or areas were part of the study the four states (California, Colorado, Connecticut, and North Carolina). In (de Schipper, Riksen-Walraven and Geurts, 2006_[114]), authors manipulated child-staff ratios and group sizes experimentally.

A comparison between the Basque region in Spain and the Netherlands showed that group size was negatively related to staff-child interactions in the Basque region, but unrelated to interactions in the Netherlands (Vermeer et al., 2010^[115]). The average group size in the Basque region was significantly higher, with 15 compared to 12 in the Netherlands, with comparatively larger child-staff ratios (15 and 6 respectively for the Basque region and the Netherlands), which could explain these differences.

The research examining the relations of child-staff ratio with staff-child interactions in family daycare settings is mixed and only pertains to one to three studies. A possible explanation could be that considering the overall small group size in family daycare, other mechanisms are more salient in providing high-quality care. However, it is important to note that there is considerable variation across studies and countries (see Table 2.3). A cross-national comparison of the family daycare settings (Boogaard, Bollen and Dijkers, 2014^[78]) demonstrated considerable variation in regulated group sizes in family daycare settings across the Flemish Community of Belgium (up to 8 children), the United Kingdom and the Netherlands (6), Denmark, Germany and Switzerland (5), and France (2 to 4 children). Studies from the United States reported an average group size of 6 children (Burchinal, Howes and Kontos, 2002^[76]).

Table 2.3. Diversity in child-staff ratios and group sizes in reported studies for family daycare settings.

Country	Study	Child-staff ratio	Group size
US	Colwell et al., 2013	For 2-year-olds: 3 For 4-year-olds: 6	For 2-year-olds: 4 For 4-year-olds: 15
US	Burchinal, Howes and Kontos, 2002	-	6
Flemish Comm. (Belgium)	Hulpia et al., 2016	5	5

Note: Averages of ratios and group sizes in each study were rounded up to the unit level.

One study in the United States showed that group size for family daycare for children aged 2 and 4 was negatively related to staff-child interactions, with weak associations (Colwell et al., 2013^[116]), but no relations were found for child-staff ratio. Also, another US study for family daycare for children aged 2 to 5 revealed no relations of child-staff ratio with process quality, concerning both overall environmental process quality and sensitive caregiving (Burchinal, Howes and Kontos, 2002^[76]).

A study from the Flemish Community in Belgium also found negative relations between group size and the overall environmental quality of the provision with small-to-medium sized associations (Hulpia et al., 2016^[73]). This study reported no associations between group size and the quality of interactions for infants and toddlers based on staff-child interactions (as measured by the CLASS), but there were positive relations between child-staff ratio and quality of interactions for toddlers (Hulpia et al., 2016^[73]). The average group size in home-based care was 5, ranging from 1 to 10, while the statutory maximum group size is 8 (i.e. only two groups had 10 children; (Daems et al., 2016^[117]). The mean child-staff ratio was 5, ranging from 1 to 10 children.

The quality of the relationships in centres seems to differ across private and public providers, in tandem with other structural characteristics

The literature review demonstrated that public centres for children between 3 and 6 seem to provide higher process quality (as measured with the ECERS) than private settings, in countries such as China, Portugal, and the US (Coley et al., 2016^[77]; Hu et al., 2016a^[104]; Slot, Lerkkanen and Leseman, 2015^[99]). However, in Spain, no significant differences were found between public or private preschools (Sandstrom, 2012^[105]).

In US centres for children under the age of 3, non-profit provision scored higher on a number of quality features, including health, safety and furnishings and aspects related to provisions for staff, when compared to for-profit centres (King et al., 2016^[74]). However, in comparison to what was found for centres for children 3 to 6 years old, these structural differences had no implication for staff-child interactions in the United States or Portugal centres for under 3s (Barros and Aguiar, 2010^[111]; King et al., 2016^[74]).

A possible reason for these inconsistent findings could be the interrelatedness of these structural features with other features, such as staff education or monitoring provisions. For instance, in the United States, staff working in the public sector were on average more highly educated (Coley et al., 2016^[77]; Fuligni et al., 2009^[79]) and were also subject to less monitoring (Fuligni et al., 2009^[79]) than staff in private settings. In China, staff in public settings tended to be more highly educated and earned higher salaries (Hu et al., 2016a^[104]).¹ In Portugal, quality was higher in classrooms with higher, unfavourable child-staff ratios, and lower with more favourable ratios, but only in the public sector (Slot, Lerkkanen and Leseman, 2015^[99]). For the private sector, no differences in process staff-child interactions were found related to the ratio. This seems to point to a compensating factor of working in the public sector. A possible explanation suggested by the authors was that the attractive working conditions in the public sector attracted more motivated staff.

The physical location of centres may influence staff practices

The physical location of a preschool might be related to better staff-child interactions. The literature review indicated that higher-quality staff-child interactions were observed in preschools located in schools than in preschools situated outside the school grounds or in independently functioning centres. Although the evidence for this mechanism is consistent and from multiple countries, the number of studies is limited.

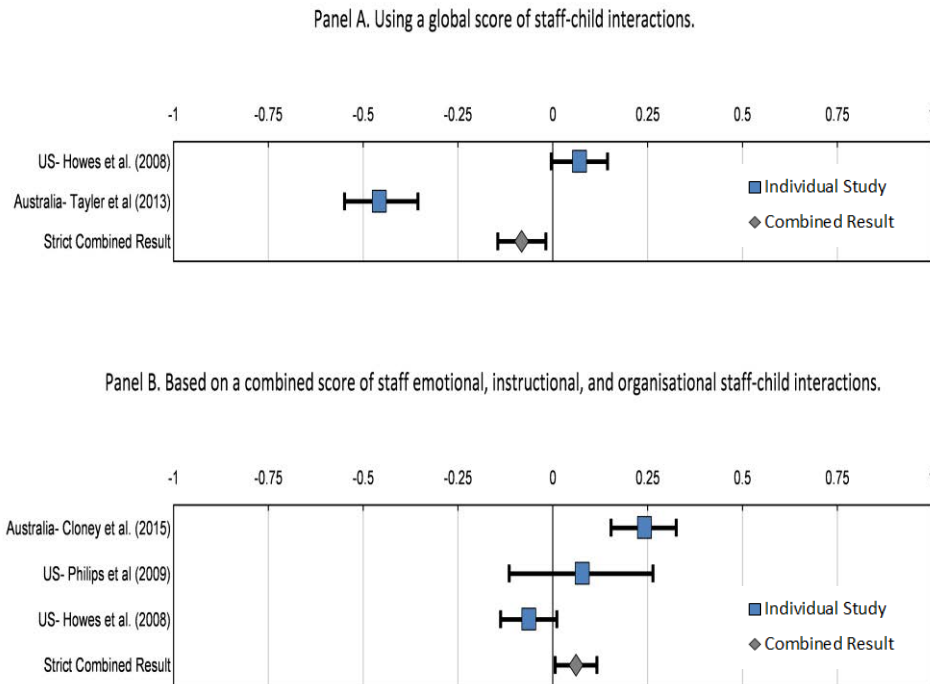
This pattern was observed in the United States and Finland in centres for children 3 to 6, where higher-quality staff-child interactions were found for preschools located in schools (Pianta et al., 2005^[31]; Slot, Lerkkanen and Leseman, 2015^[99]). Staff working in classrooms situated within elementary schools are likely to be more exposed to the curriculum, methods and culture of elementary school, through contact and perhaps collaboration with elementary school staff. This might result in care and education practices with a stronger educational orientation, i.e. practices that more strongly resemble those of elementary schools, than independently operated ECEC centres. For example, research has shown that ECEC classrooms located in schools provide less free play and more whole group instruction (Pianta et al., 2005^[31]). Staff working in ECEC centres that are part of a school may differ on other aspects as well. For instance, (Clifford et al., 2005^[118]) showed that staff working in classrooms located in schools had higher education levels and were paid more compared to staff working in independently run centres.

Higher-quality staff-child interactions were also observed in centres located in urban settings (as opposed to rural settings) for children 3 to 6, but the pattern was the opposite for centres offering services for children under 3. For example, in Portugal, staff working in non-urban centres showed more positive and sensitive interactions with children than staff working in urban centres (Barros et al., 2016^[39]). The authors hypothesised that staff working in rural or suburban areas might have higher life satisfaction and lower levels of stress, which might have resulted in better staff-child interactions. However, there is some evidence suggesting a lower quality of ECEC for children 3 to 6 in rural areas in China and the US (Hu et al., 2016a^[104]; Maher, Frestedt and Grace, 2008^[119]).

It is unclear whether the intensity of daily service matters for staff-child interactions

The meta-analysis conducted for this report demonstrated that the quality of staff-child interactions was inconsistently related to the intensity of daily service, and the association between whether the centre provided full-time or part-time service and staff-child interactions varied depending on how the interactions between staff and children were observed and documented. When a global score of staff-child interactions was used, full-day programmes were associated with lower average quality scores, when compared with half-day programmes. In contrast, when an aggregated score of staff emotional, instructional, and organisation interactions was used, full-day programmes were associated with higher-quality staff-child interactions than half-day programmes. This inconsistency is reflected in Figure 2.4. Further to the inconsistency of the patterns, studies from the same country included in this meta-analysis reflected opposite associations for two countries (Australia and the United States, see Figure 2.4).

With regard to centres for children under the age of 3, evidence from the Netherlands based on observations in 276 classrooms in 2011 indicated that there appeared to be no differences in the emotional support provided by staff between full-time daycare centres and half-time preschool provisions, but half-time preschools scored higher in supporting children's development and learning (Slot et al., 2017b^[63]; 2017c^[72]). These differences may be based on other existing regulations. For example, in the Netherlands, preschools are part of a targeted educational policy to combat early disparities in disadvantaged children, and therefore may be more likely to adopt a stronger educational orientation than day care centres. Moreover, full-day daycare settings offer services to children from birth in mixed age groups of infants and toddlers, whereas preschools enrol 2- and 3-year-old children in more homogeneous groups.

Figure 2.4. Mixed associations between intensity of daily service and staff-child interactions.

Note: Effect sizes are depicted as either blue squares for individual studies or grey diamonds for combined results, each with black lines spanning the lower limit and the upper limit of the 95% confidence interval for each estimated effect. Individual studies, labelled here with the information for country of study, author, and the year of study publication, refer to original studies that provided effect size measures entering into each meta-analysis. These measures are then combined into a summary effect size, which is the average association between two variables. See Box 2.1 for more details on how to interpret the charts.

Source: (von Suchodoletz et al., 2017_[17]).

Children in class- or playrooms with a larger percentage of immigrant or bilingual children experience lower quality

Providing ECEC to children from disadvantaged backgrounds to allow them to catch up has been a key motivation for ECEC investments. And the quality of services is crucial for ensuring that ECEC benefits those who need it most. However, research finds lower quality staff-child interactions in groups with a larger percentage of immigrant or bilingual children in the ECEC group in centres for children 3 to 6. In Danish (Slot et al., 2017b_[63]), German (Kuger et al., 2015_[120]; Leu and Schelle, 2009_[27]; Lehl, Kuger and Anders, 2014_[121]; Slot, Lerkkanen and Leseman, 2015_[99]), and US classrooms (LoCassale-Crouch et al., 2007_[122]; Tonyan and Howes, 2003_[123]) staff-child interactions were of poorer quality in classrooms with higher proportions of ethnic minority or multilingual children. Only one study from the US showed that instructional process quality was not related to the number of children with limited English proficiency (Justice et al., 2008_[124]).

The evidence from research examining class- or playgroup composition in centres for children under the age of 3 is more mixed. Emotional and educational support was lower in class- or playrooms in the Flemish Community of Belgium where a higher percentage of children spoke another home language (Hulpia et al., 2016^[73]). This association was found for toddler care centres, but not services for infants. However, in Dutch centres, higher educational support was observed in class or playrooms with a higher share of non-Dutch speaking children (Slot et al., 2017a^[36]). This positive effect is likely to be a function of the targeted policy in place (Slot et al., 2017a^[36]). In line with this targeted policy, disadvantaged children, including children speaking another home language, are more often enrolled in preschools, rather than day care settings, and provided with greater support for learning (Slot et al., 2015^[40]).

In the family day care literature, lower environmental quality (in terms of the basic furnishings and equipment) and lower caregiver abilities to adapt objects, play and learning activities according to children's interests and needs was found in playgroups with more home language diversity (Hulpia et al., 2016^[73]).

Moreover, a number of studies have examined how the mean age in the classroom is related to staff-child interactions, and found mixed results (Early et al., 2010^[125]; Lehl, Kuger and Anders, 2014^[121]; Leseman et al., 2017^[126]; Wishard et al., 2003^[127]). Mocan et al. (1995^[128]) found no relations between mean age in the classroom and staff-child interactions, but a recent study by Kuger et al. (2015^[120]) showed that staff-child interactions were better in classrooms with, on average, older children.

Children in class- or playrooms with a larger percentage of immigrant or bilingual children tend to demonstrate lower on development and learning skills

Classroom composition has also been shown to affect children's development. For instance, a German study demonstrated that preschoolers' vocabulary skills were lower and showed less growth over time in classrooms with a larger share of immigrant children, when compared to classrooms with a smaller percentage (Ebert et al., 2013^[108]). Likewise, other studies from the Netherlands and the US have shown that children from disadvantaged backgrounds attending preschools with a larger percentage of other children with similarly disadvantaged backgrounds made less progress in their language skills (Schechter and Bye, 2007^[129]) or literacy development (de Haan et al., 2013^[130]) than their counterparts in more socio-economically mixed preschool classrooms.

Classroom composition may be indirectly related to child development and learning, influencing child development through staff-child interactions. A large-scale Danish study involving over 3 000 preschool children and 400 staff showed that process quality, specifically emotional support and classroom organisation, mediated the relationship between the proportion of non-Danish children in the classroom and children's language and pre-literacy skills (Slot et al., 2017b^[63]).

There is some evidence suggesting linkages between licensing and quality interactions in family daycare settings

Issues of governance and standards in family daycare settings focus on regulations and licensing. Countries often establish minimum requirements for licensing as incentives for providers to invest in quality improvements, and signal to parents differences in quality within the system of provision. There is some empirical evidence from the US supporting

the added value of licensing and regulations to quality staff-child interactions in family daycare.

In the United States, higher quality has been observed in licensed providers in terms of overall process quality (Burchinal, Howes and Kontos, 2002^[76]; Raikes et al., 2013^[131]), and sensitive interactions in particular (Burchinal, Howes and Kontos, 2002^[76]). Also, Doherty et al. (2006^[132]) showed that the staff's intention to meet the standards was one of the strongest predictors of higher observed quality of staff-child interactions, and the number of years as an unregulated home-care provider was negatively related to staff-child interactions.

In the Flemish Community in Belgium all home-care providers are licensed and some are also affiliated with a professional organisation that mediates between the parents and the home-care provider, handles administration and financial issues and provides support for ongoing professional development. Recent findings revealed no significant differences in process quality between affiliated and non-affiliated home-care providers (Vandenbroeck et al., 2018^[29]). There might be two possible explanations for the lack of differences. One possibility is that the actual support home-based care providers receive is limited to financial and administrative support. At the same time the government has recently invested in providing pedagogical support to home-care providers that are not affiliated with an organisation. Altogether, the differences between both types of providers appear to be minimal regarding process quality.

Note

1; Note that the Chinese study only revealed a significant difference between public and private settings when accounting for centre characteristics (e.g. physical location of the centre, government funding, staff salary and child tuition). After accounting for staff characteristics, such as pre-service qualifications, work experience and classroom features, including group size and child-staff ratio, the type of setting no longer predicted differences in quality (Hu et al., 2016a_[104]).

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Chapter 3. Supporting quality early childhood education and care through workforce development and working conditions

Workforce training and working conditions matter for quality early childhood education and care (ECEC), across age groups and in both centre-based and family daycare settings. In turn, higher process quality is associated with higher levels of child development. This chapter provides an overview on associations between workforce-related characteristics and quality. Research shows relations between staff pre-service and in-service qualifications and training programmes, staff-child interactions and the promotion of young children's development. Staff working conditions, such as staff salaries and well-being, as well as organisational climate, can play a key role in determining staff-child interactions. A few studies also find that in family daycare, staff networking is associated with higher-quality interactions. However, staff years of experience do not appear to predict quality levels. Staff-child interactions and implementation of developmental and educational activities are linked to higher levels of children's emerging literacy and numeracy skills, as well as better behavioural and social skills.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

Introduction

Staff are at the centre of efforts to enhance pedagogical practice and to promote young children's development. Staff pre-service and in-service qualifications and training programmes are common mechanisms in workforce development. Pre-service qualifications refer to the training that staff have engaged in before they begin the job; in-service training refers to additional training they receive while working in the ECEC field.

Highly qualified ECEC staff are better placed to create enriched and stimulating environments and deliver the high-quality pedagogy associated with improved learning and well-being (Britto, Yoshikawa and Boller, 2011^[33]; Early et al., 2007^[64]; Litjens and Taguma, 2010^[133]; Phillipsen et al., 1997^[101]; Fontaine et al., 2006^[134]). However, examining these mechanisms and their associations with process quality is a complex task. In-service training is part of the broader concept of professional development together with coaching, mentoring, (video) feedback or other activities, making professional development diverse in terms of not only content, but also implementation methods. Considerable new research and attention has been devoted recently to examining the effectiveness of these aspects (Slot, 2017^[16]).

Staff working conditions include staff salaries, staff experience, organisational climate and networking, with clear linkages to staff well-being, as well as the sector's ability to attract and retain staff members. Salaries are one of the most relevant factors of working conditions, affecting job satisfaction and teachers' effectiveness in the school literature (Huntsman, 2008^[135]; Moon and Burbank, 2004^[136]; Murnane et al., 1990^[137]) (Moon and Burbank, 2004^[136]). However, in ECEC, staff salaries show great disparity across countries (see Figure 3.1) and there is evidence that low salaries influence staff behaviour towards children and increase turnover rates (Huntsman, 2008^[135]). Furthermore, low salaries deter skilled professionals from choosing to work as ECEC staff (Manlove and Guzella, 1997^[138]).

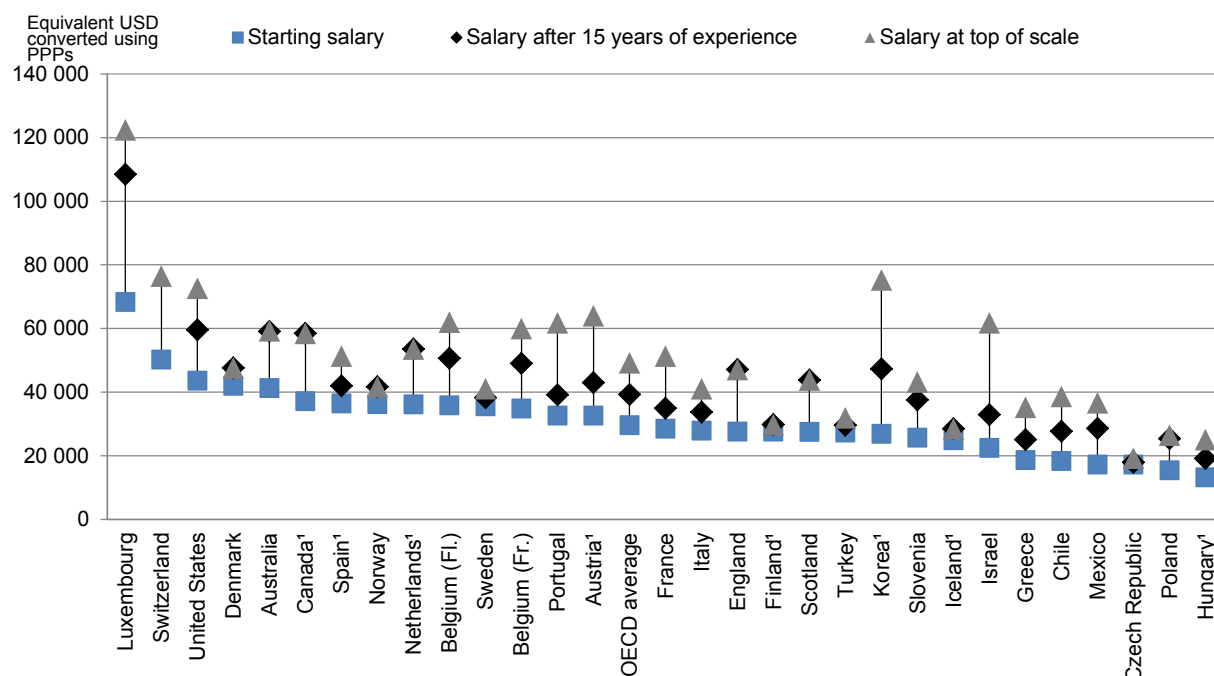
In addition, opportunities for team collaboration and networking affect the extent to which staff feel supported and feel part of the team, and the degree to which there is a joint vision and mission in the organisation, which in turn contribute to staff's practices and thus process quality.

Summary of findings

In analysing workforce development and working conditions, overall higher pre-service qualifications were found to be related to higher-quality staff-child interactions. This particularly applies to settings for children aged 0 to 2, although some studies showed mixed findings. However, higher teacher qualifications were not associated with emerging academic skills or behavioural and social skills. In fact, only staff-child interactions were predictive of children's development and learning. Specifically, children had higher levels of emerging literacy and numeracy skills, as well as better behavioural and social skills, in ECEC centres with more positive and fewer negative staff-child interactions. Associations between staff-child interactions and children's development and learning did not differ significantly for children from predominantly disadvantaged backgrounds, compared to a diverse group of children.

Figure 3.1. Annual statutory teachers' salaries in pre-primary education (2015).

Based on typical qualifications, in public settings, in equivalent USD converted using PPPs



Note: Countries are ranked in descending order of starting salaries for pre-primary teachers. 1. Year of reference is 2014. Statutory salaries, based on pay scales, are only one component of teachers' total compensation. Education systems also offer additional payments to teachers, such as allowances, bonuses or other rewards. See Education at a Glance 2017 Annex 3 for further notes (www.oecd.org/education/education-at-a-glance-19991487.htm).

Source: (OECD, 2017d_[95])

Consistent positive associations for all settings examined were found between staff in-service training (or professional development) and staff-child interactions, especially if the training included ECEC content. The number of studies available for settings for children aged zero to 3 was more limited, but the pattern of results is largely consistent.

Regarding family daycare settings, both pre-service qualifications and in-service training appear to have a consistent association with staff-child interactions in family daycare, at least in US and Flemish family daycare settings. Pre-service training was found to be the most commonly researched structural feature in family daycare settings (i.e. in a total of seven studies reporting on the relations with staff-child interactions). It is important to note that two out of the five US studies showed that pre-service education for family daycare provisions was not significant when additional in-service training was added to the equation. Generally, family daycare providers appear to have lower educational qualifications than staff working in centre-based care, both in terms of the level of attainment and the specialisation of the training, as was evident in studies from Australia, Quebec, the Netherlands and the US (Bigras et al., 2010_[139]; Coley et al., 2016_[77]; Fuligni et al., 2009_[79]; Groeneveld et al., 2010_[140]; Ishimine and Tayler, 2012_[141]). However, the consistent finding that professional development can contribute to higher-quality staff-child interactions highlights the importance of investing in additional on-the-job training.

For staff's work experience, the findings appeared to be inconsistent. Almost half of the studies reviewed reported no associations between staff's work experience and staff-child interactions, and the remainder showed either positive or negative relations. A similar pattern was summarised for centres for children aged 0 to 2, although more studies reported positive relationships. Overall, work experience was unrelated to staff-child interactions in family daycare settings. Unfortunately, given the limited number of studies available, and the narrow international scope of these studies, it is unclear whether these associations should be expected in other countries or jurisdictions.

Positive associations were found between salaries, the centre's organisational climate, and staff-child interactions, but the number of studies that have included these aspects is somewhat limited. Preliminary evidence suggests that provisions for higher-paid staff and more team collaboration in centres with children from 3 to 6, and for children under the age of 3, provided higher-quality staff-child interactions.

It is important to keep in mind the possible confusion between these characteristics. For instance, a study from China showed that urban centres received full government funding, which provided them with more resources (Hu et al., 2016a_[104]). It is likely that the working conditions are better in these centres, because urban centres attracted better qualified staff who received higher salaries and because the child-staff ratio was more favourable.

This chapter provides an overview of the evidence linking structural mechanisms in staff workforce development and working conditions to staff-child interactions, as well as to child development, learning and well-being. With the aim of building a solid knowledge base on this subject, it draws on a literature review and a meta-analysis that update the conceptual knowledge, as well as on an empirical evidence base for the strength of these associations, while keeping a cross-national focus. The chapter first summarises these two pieces of research, to discuss the importance of these mechanisms for process quality in ECEC. Each mechanism is examined in turn, integrating the evidence for centres for children aged 3 to 6, centres for children under the age of 3, and finally family daycare settings. Finally, the chapter examines the evidence for the links between quality mechanisms and child development, learning and well-being.

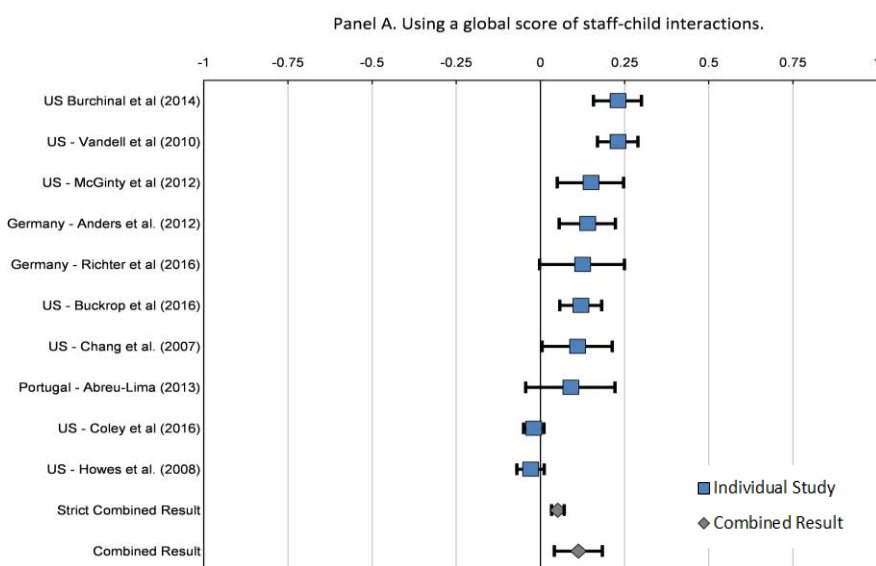
What does the research tell us about the importance of workforce development and working conditions for staff-child interactions in early childhood education and care?

Positive staff-child interactions predict emerging academic skills, while negative staff-child interactions predict behavioural/social skills.

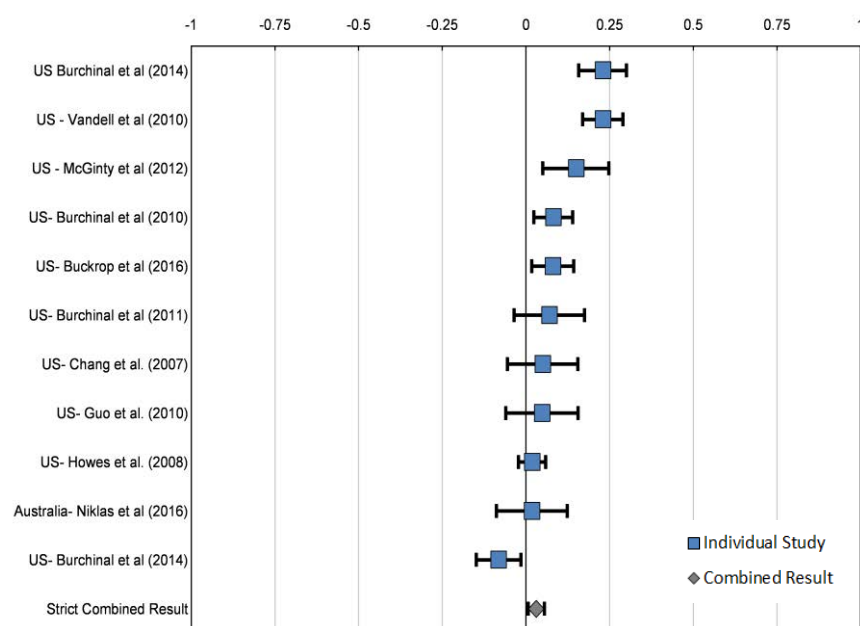
The meta-analysis conducted for this report indicated a consistent positive association between the quality of staff-child interactions and children's literacy and numeracy learning (Figure 3.2, (von Suchodoletz et al., 2017_[17])). This association was true when considering an overall staff-child interactions index (Panel A), and also a combined score of staff emotional, instructional and organisation interactions with the children (Panel B).

Conversely, no associations were found between staff-child interactions and children's behavioural/social skills using the overall staff-child interactions index (Figure 3.3, Panel A, (von Suchodoletz et al., 2017_[17])). The association between the combined score of staff emotional, instructional, and organisation interactions with the children and children's behavioural/social skills was slightly negative, but not significant (Panel B).

Figure 3.2. More positive staff-child interactions are associated with higher levels of child emerging academic skills.



Panel B. Based on a combined score of staff emotional, instructional, and organisational staff-child interactions.



Note: Effect sizes are depicted as either blue squares for individual studies or grey diamonds for combined results, each with black lines spanning the lower limit and the upper limit of the 95% confidence interval for each estimated effect. Individual studies, labelled here with the information for country of study, author, and the year of study publication, refer to original studies that provided effect size measures entering into each meta-analysis. These measures are then combined into a summary effect size, which is the average association between two variables. See Box 3.1 for more details on how to interpret the charts.

Source: (von Suchodoletz et al., 2017^[17]).

Box 3.1. Interpreting the meta-analysis charts

The meta-analysis charts report associations in the form of standardised effect sizes. For the current analysis, effect size is defined as the degree and direction of association, or correlation, between two variables (e.g. between indicators of structural and process quality, and between indicators of structural/process quality and child development and learning).

Effect sizes reported are standardised, such that a measure ranges between -1 to 1. An effect size measure closer to 0 means little association between the two variables represented in the chart, while an effect size closer to either -1 or 1 (i.e. larger absolute value) would indicate stronger association between the variables. An effect size of negative value would mean that an increase in the measure of one variable is associated with a decrease in the measure of the other variable, while an effect size of positive value would mean that both variables increase or decrease in same direction.

Depending on which statistical assumption underlies the process of averaging, a meta-analysis can produce either Combined Result (based on a “fixed-effect model”) or Strict Combined Result (based on a “random-effects model”). The main difference between the two in the present meta-analysis is that the former gives larger weighting to the individual studies based on larger sample size.

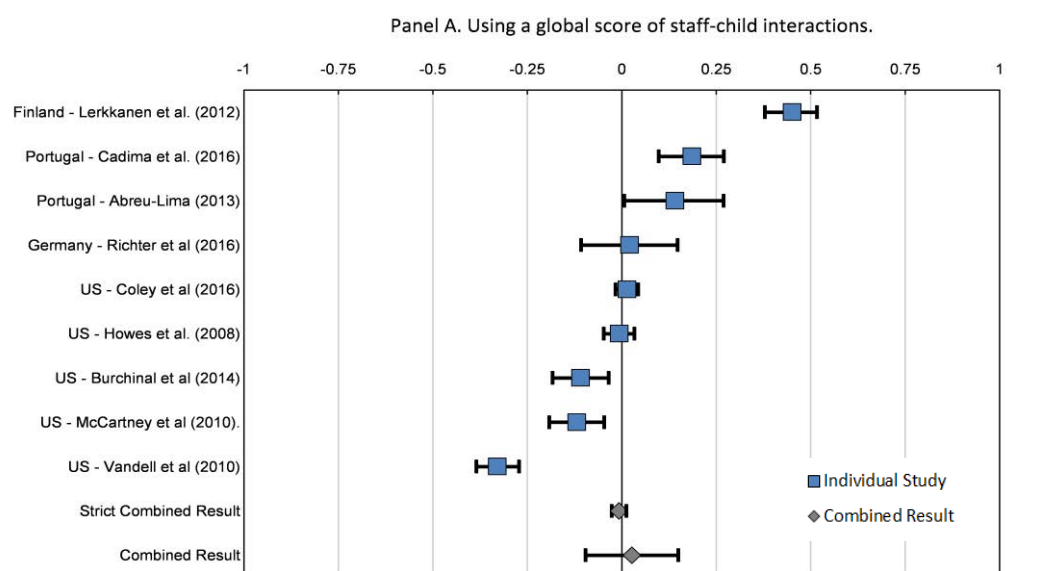
Because of the diversity of measures used in research to assess process quality, meta-analysis results are examined in terms of three indicators:

- Global score of staff-child interactions: an overall index of the interactions between the ECEC staff and the group, irrespective of the type or subdomains of interaction, used when the studies only reported one single score to describe the quality of interactions;
- Combined score of staff-child interactions: an aggregate score of staff-child interactions, including the staff’s positive emotional, instructional, and organisation interactions with children, generally based on a set of domain-specific scores reported in the studies.
- Developmental and educational activities: an aggregate score of the exposure and/or quality of developmental and educational activities provided by staff.

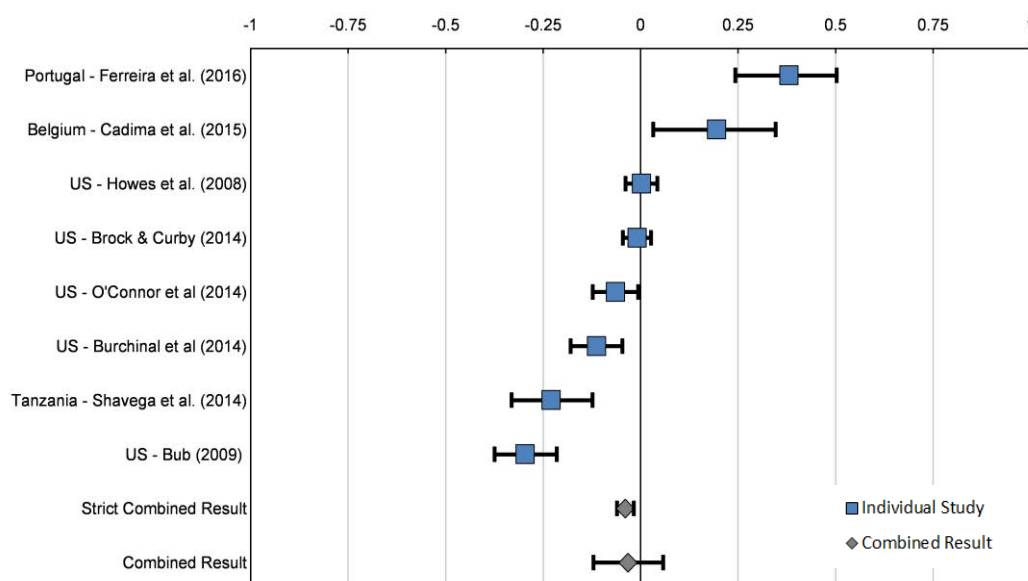
For child data, meta-analysis results are examined in terms of two indicators:

- Emerging academic skills: An aggregate score of early numeracy and literacy skills.
- Combined score of behavioural and social-emotional indicators: an aggregate score of social and behavioural skills, including behaviour regulation, executive function, behavioural problems, and social competence.

Figure 3.3. Inconsistent associations between positive staff-child relationships and child behavioural/ social skills.



Panel B. Based on a combined score of staff emotional, instructional, and organisational staff-child interactions.

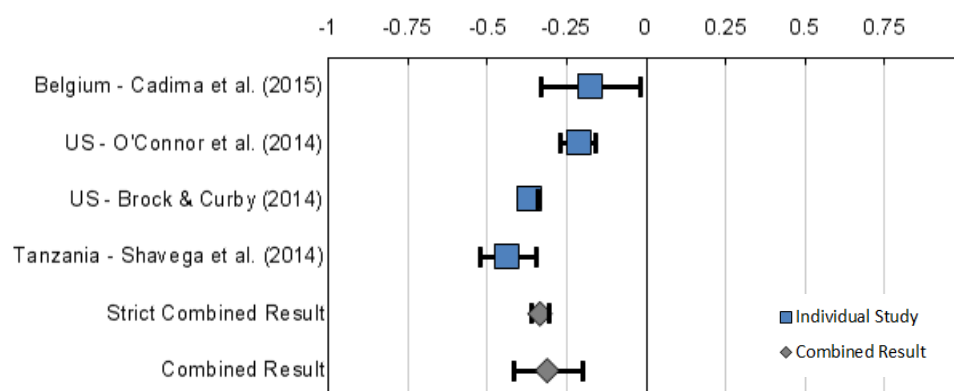


Note: Effect sizes are depicted as either blue squares for individual studies or grey diamonds for combined results, each with black lines spanning the lower limit and the upper limit of the 95% confidence interval for each estimated effect. Individual studies, labelled here with the information for country of study, author, and the year of study publication, refer to original studies that provided effect size measures entering into each meta-analysis. These measures are then combined into a summary effect size, which is the average association between two variables. See Box 3.1 for more details on how to interpret the charts. Belgium study took place in the Flemish Community.

Source: (von Suchodoletz et al., 2017_[17]).

The meta-analysis conducted for this report also clearly indicated that negative staff-child interactions are associated with less positive behavioural/social skills of children (see Figure 3.4, (von Suchodoletz et al., 2017_[17])).

Figure 3.4. Negative staff-child interactions are associated with worse behavioural/social skills.



Note: Effect sizes are depicted as either blue squares for individual studies or grey diamonds for combined results, each with black lines spanning the lower limit and the upper limit of the 95% confidence interval for each estimated effect. Individual studies, labelled here with the information for country of study, author, and the year of study publication, refer to original studies that provided effect size measures entering into each meta-analysis. These measures are then combined into a summary effect size, which is the average association between two variables. See Box 3.1 for more details on how to interpret the charts. Belgium study took place in the Flemish Community.

Source: (von Suchodoletz et al., 2017_[17]).

The meta-analysis also indicated that associations between staff-child interactions and children's development and learning did not significantly differ for children from predominantly disadvantaged backgrounds and for a diverse population of children (von Suchodoletz et al., 2017_[17]).

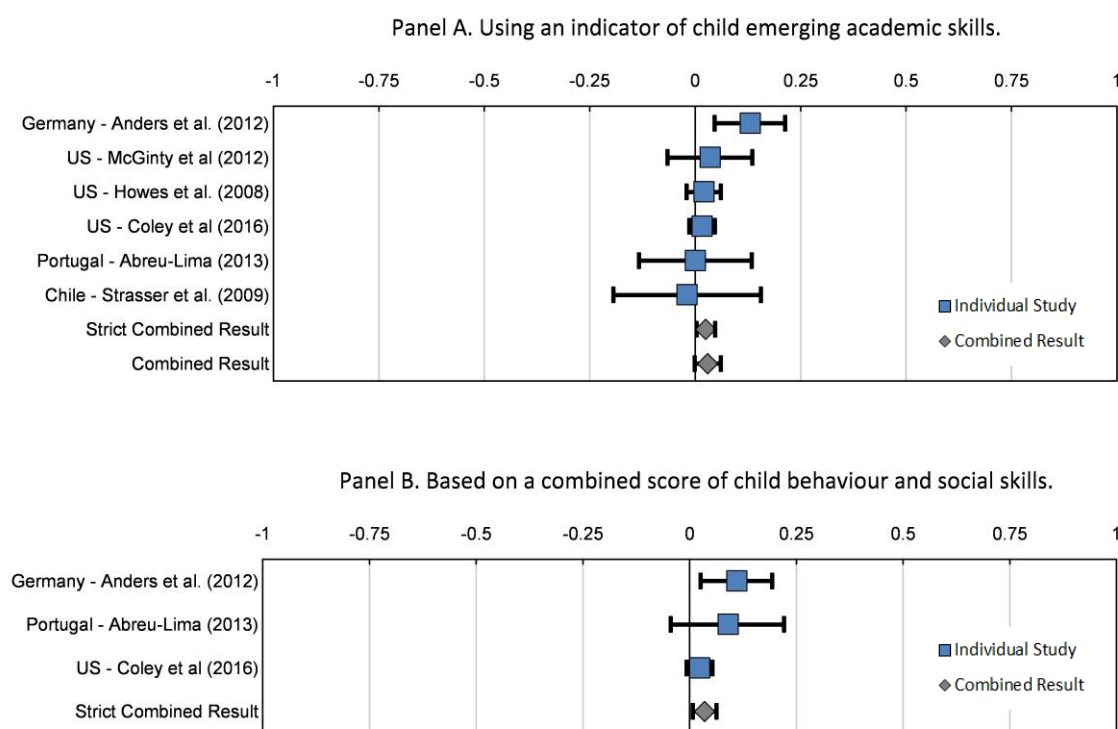
The mixed pattern of associations between staff-child interactions and children's behavioural/social skills seemed to be determined by geographical differences. Specifically, the meta-analysis conducted for this report indicated that associations between staff-child interactions and children's behavioural/social skills were overall negative in studies conducted in the United States, but overall positive in studies conducted outside the United States. This geographical difference was significant for both the overall staff-child interactions index and the combined score of staff emotional, instructional, and organisation interactions with the children (von Suchodoletz et al., 2017_[17]). Differences in the direction of associations between the quality of staff-child interactions and children's behavioural/social skills may be due to differences in cultural belief systems (von Suchodoletz et al., 2017_[17]). Different cultural traditions, values, and beliefs around child development and learning may influence the way ECEC staff perceive and interpret children's behaviour in the class- or playroom which, in turn, affects how they respond to and engage with children. Moreover, children's behavioural and social skills are an important aspect of child attributes and have been suggested to influence interactions between teachers and children. Staff-child interactions are understood as dyadic in nature; in other words, staff-child interactions are shaped by

reciprocal processes between teacher and child. No other geographical differences were found.

Children in class or playrooms with staff providing higher quality or more exposure to developmental and educational activities demonstrate higher levels of emergent skills

The meta-analysis conducted for this report also analysed the association between staff implementation of developmental and educational activities, a process quality indicator of workforce, and children's emerging academic skills (Abreu-Lima et al., 2013^[142]; Anders, 2015^[41]; Coley et al., 2016^[77]; Howes et al., 2008^[34]; McGinty et al., 2012^[143]; Strasser and Lissi, 2009^[144]), as well as children's behavioural and social skills (Abreu-Lima et al., 2013^[142]; Anders, 2015^[41]; Coley et al., 2016^[77]) (see Figure 3.5, (von Suchodoletz et al., 2017^[17])). The results show that children have slightly higher levels of emerging literacy and numeracy skills, as well as better behavioural and social skills, in ECEC centres where staff provide higher quality or more exposure to developmental and educational activities.

Figure 3.5. Higher quality or exposure to developmental and educational activities is associated with higher levels of children's skills.



Note: Effect sizes are depicted as either blue squares for individual studies or grey diamonds for combined results, each with black lines spanning the lower limit and the upper limit of the 95% confidence interval for each estimated effect. Individual studies, labelled here with the information for country of study, author, and the year of study publication, refer to original studies that provided effect size measures entering into each meta-analysis. These measures are then combined into a summary effect size, which is the average association between two variables. See Box 3.1 for more details on how to interpret the charts.

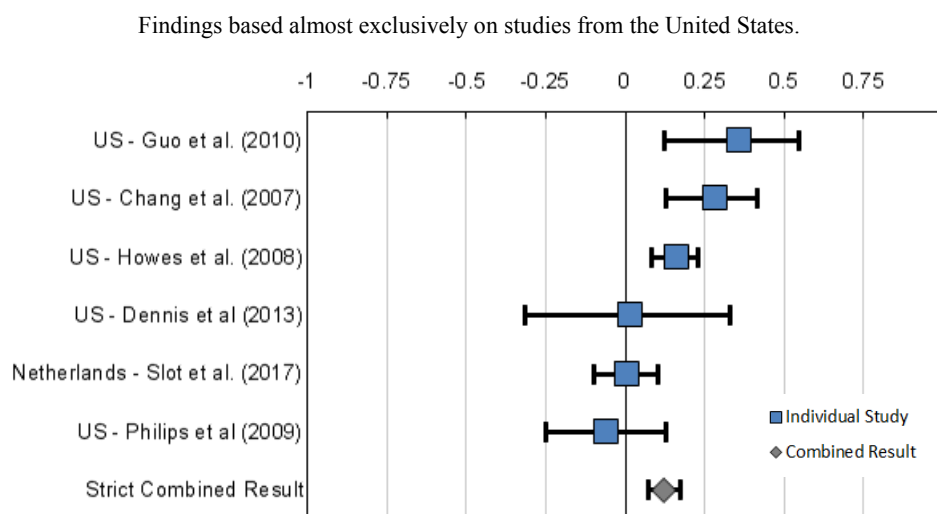
Source: (von Suchodoletz et al., 2017^[17]).

Higher pre-service qualifications contribute to better staff-child relationships

Single country studies show that for centres for children 3 to 6 years old, higher levels of pre-service training, i.e. a bachelor's degree, are associated with better staff-child interactions in Denmark, Portugal, as well as in the United States (Barros and Leal, 2011^[145]; Guo et al., 2010^[146]; Pianta et al., 2005^[31]; Slot et al., 2017b^[63]). In a comprehensive review, Tout, Zaslow and Berry (2006^[147]) revealed that pre-service qualifications showed stronger relations with staff-child interactions if the training included ECE content, such as child development.

This positive association was partially confirmed by the meta-analysis conducted for this report (see Figure 3.6). Specifically, higher levels of pre-service qualifications were associated with a higher-quality of staff-child interactions. Although there was some variation across studies in the direction of the association (i.e. some were positive, some were negative), this variation was not directly linked to the level of qualification being studied. Both (Guo et al., 2010^[146]) and (Philips, Gormley and Lowenstein, 2009^[148]) looked at differences between having and not having a bachelors' (4-year) degree in ECEC, but only (Guo et al., 2010^[146]) found positive associations. Remaining studies measured pre-service qualifications as the highest level of completed formal pre-service education attained by teachers with higher values reflecting higher levels, in a variety of scales.

Figure 3.6. Higher levels of pre-service qualifications are associated with higher quality of staff-child interactions.



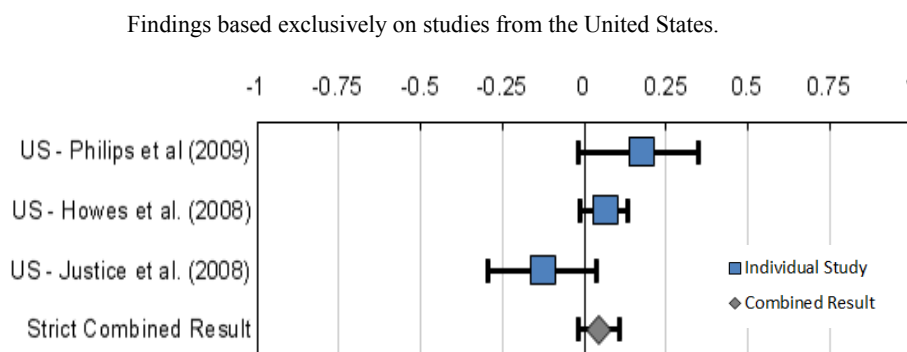
Note: Effect sizes are depicted as either blue squares for individual studies or grey diamonds for combined results, each with black lines spanning the lower limit and the upper limit of the 95% confidence interval for each estimated effect. Individual studies, labelled here with the information for country of study, author, and the year of study publication, refer to original studies that provided effect size measures entering into each meta-analysis. These measures are then combined into a summary effect size, which is the average association between two variables. See Box 3.1 for more details on how to interpret the charts.

Source: (von Suchodoletz et al., 2017^[17]).

The meta-analysis also demonstrated that providing higher quality or more exposure to developmental and educational activities (as a process indicator) did not depend on staff education (Figure 3.7, (von Suchodoletz et al., 2017^[17])). There was no immediate

association between how pre-service education was described in the studies, and the pattern of results. For example, although (Justice et al., 2008_[124]) reported the highest of qualification in the participating teachers, with all of the teachers in the study holding a bachelor's degree and 36% holding an additional advanced degree, the quality of language/literacy activities provided in the classroom was very low. However, it is also important to note that this study looked exclusively to publicly funded preschool classrooms serving specifically at-risk pupils, whereas the two other studies looked at state-wide funded pre-Kindergarten classrooms (Howes et al., 2008_[34]) (Philips, Gormley and Lowenstein, 2009_[148]).

Figure 3.7. No association between pre-service qualifications and provision of development and educational activities.



Note: Effect sizes are depicted as either blue squares for individual studies or grey diamonds for combined results, each with black lines spanning the lower limit and the upper limit of the 95% confidence interval for each estimated effect. Individual studies, labelled here with the information for country of study, author, and the year of study publication, refer to original studies that provided effect size measures entering into each meta-analysis. These measures are then combined into a summary effect size, which is the average association between two variables. See Box 3.1 for more details on how to interpret the charts.

Source: (von Suchodoletz et al., 2017_[17]).

In larger scale, cross-state or cross-country studies, results have been mixed. In a multi-site, multi-state study in the United States, Early et al. (2006_[149]) found that having a degree above the bachelor level was related to higher-quality staff-child interactions, but there were no differences below a bachelor degree. Other studies have reported contradictory or no association between qualifications and staff-child interactions, be it comparing different levels of qualification (i.e. below an associate degree, an associate degree, a bachelor's or above a bachelor's) on a large-scale comparative review in the United States (Early et al., 2007_[64]), or qualifications and field of education (i.e. holding a BA in ECE, versus holding a BA in another field, or holding an MA) in a large-scale US study (Philips, Gormley and Lowenstein, 2009_[148]). No clear patterns have been found in other cross-country comparison studies (Cryer et al., 1999_[106]; Slot, Lerkkanen and Leseman, 2015_[99]).

Pre-service qualifications per se may not guarantee better child learning and development

The evidence on the importance of staff pre-service qualifications for child development, learning and well-being is mixed. In some European studies and a cross-national study, staff with higher qualifications, i.e. Bachelor degrees, were associated with children with higher levels of language (Bauchmüller, Grötz and Rasmussen, 2014^[150]; Montie, Xiang and Schweinhart, 2006^[110]) and literacy (Sylva et al., 2004^[13]) than staff with lower pre-service qualifications, i.e. lower than a bachelor's degree.

However, studies from the United States showed mixed findings. One US study revealed positive associations between having a bachelor's degree (rather than having a lower qualification) and social-emotional skills (Howes et al., 2008^[34]). However, two studies showed no associations between pre-service qualifications and children's language and literacy skills (Early et al., 2006^[149]; Mashburn et al., 2008^[44]). In (Early et al., 2006^[149]) children with teachers with more than a bachelor's degree scored slightly higher in language and literacy than children with teachers with only an associate degree (i.e. 2-year degree), but this difference was only marginal; in (Mashburn et al., 2008^[44]) no differences were observed between teachers with or without a bachelor's. Another US study (in which qualification levels were measured as years of education) showed mostly no relations between staff qualifications and children's language and literacy skills, except for decoding skills (such as the ability to read unfamiliar words) for which the association was actually negative (Connor et al., 2005^[61]).

A recently published meta-analysis revealed null associations between staff's educational qualifications and children's language and math outcomes (Falenchuk et al., 2017^[151]). However, there was considerable heterogeneity in how staff education was defined across studies, which could at least in part explain the lack of significant findings. For example, it can be defined as total number of years of education, or by categorising teachers according to the level attained, or simply by separating teachers with a bachelor's or without one.

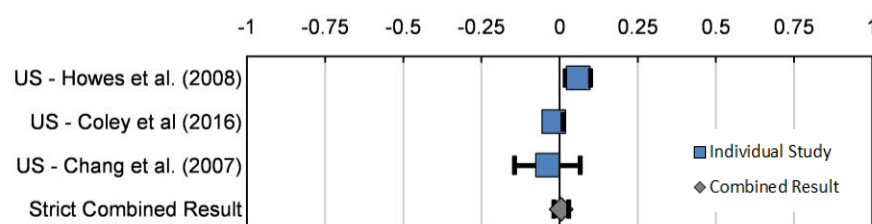
The lack of a consistent association between pre-service qualifications and children's development and learning was confirmed by the meta-analysis conducted for this report (see Figure 3.8, (von Suchodoletz et al., 2017^[17])). In particular, higher teachers' qualifications were not associated with emerging academic skills (i.e. literacy and numeracy, Panel A), or behavioural/social skills (Panel B).

In one US study, higher teacher education only influenced children's vocabulary skills indirectly through staff's warmth and responsivity, although with a small (Connor et al., 2005^[61]).

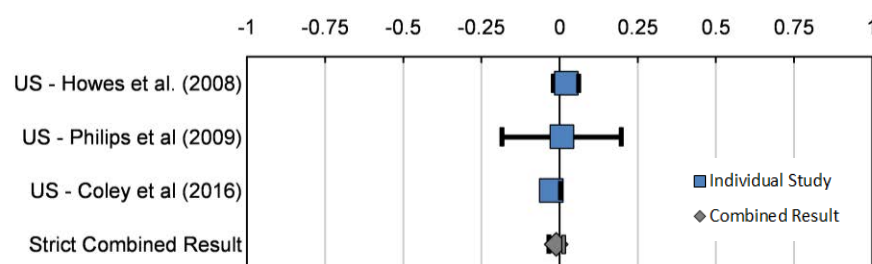
Figure 3.8. No evidence of consistent association between pre-service qualifications and children's development and learning.

Findings based on a limited number of studies, and exclusively from the United States.

Panel A. Using an indicator of child emerging academic skills.



Panel B. Based on a combined score of child behaviour and social skills.



Note: Effect sizes are depicted as either blue squares for individual studies or grey diamonds for combined results, each with black lines spanning the lower limit and the upper limit of the 95% confidence interval for each estimated effect. Individual studies, labelled here with the information for country of study, author, and the year of study publication, refer to original studies that provided effect size measures entering into each meta-analysis. These measures are then combined into a summary effect size, which is the average association between two variables. See Box 3.1 for more details on how to interpret the charts.

Source: (von Suchodoletz et al., 2017^[17]).

Pre-service qualifications also matter for staff-child interactions in centre and family daycare settings for younger children

For centres for children under the age of 3, a recent international meta-analysis of 48 studies showed positive correlations between staff pre-service qualifications, comparing teachers with bachelor's with teachers without, but also more fine-grained distinctions, and aspects of the programme structure, the provision of activities and supportive language and reasoning interactions (Manning et al., 2017^[152]).

Individual country studies have also documented the importance of staff's qualifications for staff-child interactions in Quebec, the Flemish Community of Belgium, the Netherlands, Portugal and the US (Barros et al., 2016^[39]; Bigras et al., 2010^[139]; Castle et al., 2016^[153]; Hulpia et al., 2016^[73]; King et al., 2016^[74]; Slot et al., 2015^[40]; Thomason and La Paro, 2009^[38]; Vogel et al., 2015a^[66]; Vogel et al., 2015b^[67]). Four studies showed positive associations by looking at the fine-grained associations between

an additional year of pre-service qualifications and process quality (Barros and Leal, 2011; NICHD, 2000; Slot et al., 2015; Thomason and La Paro, 2009), whereas others showed positive relations only from a certain level: either a two-year degree (King et al., 2016; Vogel 2015a) or a bachelor's degree (Barros et al. 2016; Vogel et al., 2015a).

Pre-service qualifications seem to matter for broad, comprehensive aspects of quality, including different aspects of staff-child interactions (Barros et al., 2016^[39]), as well as for more fine-grained distinctions between emotionally supportive interactions, and more educational and developmentally supportive interactions (Castle et al., 2016^[153]; Hulpia et al., 2016^[73]; Slot et al., 2015^[40]; Thomason and La Paro, 2009^[38]; Vogel et al., 2015a^[66]; Vogel et al., 2015b^[67]). One US study showed that teachers with two- or four-year degrees had higher levels of quality of interactions, particularly language and reasoning (measured with the Infant/Toddler Environment Rating Scale, or ITERS) than teachers without degrees (King et al., 2016^[74]).

Other studies have found stronger evidence for the impact of pre-service qualifications on emotional support. For example, in infant care in the Netherlands and the Flemish Community of Belgium staff qualifications, i.e. further years of teacher education, were associated with emotional support, but showed little or no relation to staff support for children's development and learning (Hulpia et al., 2016^[73]; Slot et al., 2015^[40]). It is important to note that these findings were found for infant care, but not toddler class- or playrooms, although the same levels of teacher education were compared. Finally, one US study in Early Head Start reported only positive associations for staff qualifications with emotional support and no relations with support for development and learning (a Child Development Associates credential; (Vogel et al., 2015a^[66])) whereas another US study in Early Head Start reported the opposite pattern (a bachelor's level; (Vogel et al., 2015b^[67])).¹

Similarly to centres for children between 3 and 6 years old, having specialised training in early childhood education, such as a specialised diploma or degree in this area (as opposed to degrees in other areas of content), is related to higher-quality staff-child interactions, as observed in a study of infant class- or playrooms in Quebec (Bigras et al., 2010^[139]). In US centres for children under the age of 3, teachers with a degree in ECE demonstrated higher staff emotional support, but also support for development and learning (Castle et al., 2016^[153]).

Finally, two studies also reported no relationship between acquiring a two-year ECEC qualification or lower and process quality in infant class- or playrooms in the United States, measured by the Infant CLASS (Jamison et al., 2014^[65]) and South Africa measured by the ITERS (Biersteker et al., 2016^[154]).

In family daycare settings, higher pre-service qualifications were also generally associated with higher-quality staff-child interactions, but the majority of the literature was limited to the US (Colwell et al., 2013^[116]; Doherty et al., 2006^[132]; Raikes, Raikes and Wilcox, 2005^[155]; Schaack, Le and Setodji, 2017^[156]) and Flemish Community of Belgium (Hulpia et al., 2016^[73]; Vandenbroeck et al., 2018^[29]). Some studies looked into fine-grained distinctions across additional years of training and education (Colwell et al., 2013^[116]; Raikes, Raikes and Wilcox, 2005^[155]); whereas others examined differences between having a higher level of education or not (Hulpia et al., 2016^[73]; Vandenbroeck et al., 2018^[29]).

For example, Flemish family daycare providers with higher pre-service qualifications provided more diverse learning experiences and activities, and also demonstrated more

active involvement and guidance in these activities, when compared to lower-educated family daycare providers (Hulpia et al., 2016^[73]). This pattern was true for licensed providers, but not registered providers, and for infant but not for toddler provisions (Vandenbroeck et al., 2018^[29]).

Evidence from the US also demonstrated that pre-service educational qualifications may be able to compensate for lack of other support or regulations. In the United States, providers with teachers with more years of education were able to provide higher-quality care even in the absence of strong state regulations, whereas teachers with fewer years of education provided higher quality only in strongly regulated settings (Raikes, Raikes and Wilcox, 2005^[155]).

It is important to note that staff educational qualifications tend to be lower for family daycare providers than staff working in centres. In Australia, Quebec, the Netherlands, and the US, this difference is observed for level of attainment and specialisation of the training (Bigras et al., 2010^[139]; Coley et al., 2016^[77]; Fuligni et al., 2009^[79]; Groeneveld et al., 2010^[140]; Ishimine and Tayler, 2012^[141]). A European cross-country comparison showed that only Flemish Community of Belgium and the Netherlands require a minimum level of educational training for family daycare care providers, albeit of a low level, whereas in Denmark, France, Germany, Switzerland and the United Kingdom, the formal requirements were limited to a basic course ranging from 18 to 160 hours (Boogaard, Bollen and Dijkers, 2014^[78]).

Participation in in-service training (or professional development) is the most consistent predictor of a quality staff-child interactions, and also has direct links to child development and learning

In-service training has been shown to be beneficial for staff-child interactions in diverse geographic locations, including Denmark, Portugal, China and the US (Fukkink and Lont, 2007^[157]; Hamre et al., 2012^[158]; Justice et al., 2008^[124]; LoCassale-Crouch et al., 2011^[159]; Slot et al., 2017b^[63]; Slot, Lerkkanen and Leseman, 2015^[99]; Zaslow et al., 2010^[160]), even over and above formal pre-service qualifications (Philips et al., 2000^[100]).

Effects of in-service training on process quality seem to be restricted to some subdomains, but the evidence is thus far inconclusive. For example, staff participating in in-service training have consistently been found to score higher on language and literacy-specific quality (as measured by the ELLCO), whereas the links to overall quality in ECEC (as measured by the ERS) or staff-child interactions (as measured by the CLASS) are mixed (Egert, 2015^[161]). A more recent meta-analysis confirmed this pattern. The review showed that in-service training had larger effects on how the class- or playroom environment was designed by staff to promote language and literacy development than on general process quality, although the effects were consistently positive (Markussen-Brown et al., 2017^[162]). Also, a study has shown that staff participating in in-service training who had pre-service qualifications below a bachelor's degree were still linked to lower quality interactions than staff with bachelor's degrees who had not attended in-service training. (Burchinal et al., 2002^[103]).

Participation in in-service training was positively linked to staff-child interactions when the training included early childhood education content (Siraj-Blatchford et al., 2005^[163]; Zaslow et al., 2004^[164]), offered on-site support (such as mentoring, coaching or consultation), or was of an appropriate length (Egert, 2015^[161]). For example, a meta-analysis demonstrated that specialised training focusing on staff-child interactions improved staff interaction competence (Fukkink and Lont, 2007^[157]). Another meta-

analysis demonstrated that interventions where in-service training included coaching were up to three times more effective than interventions with in-service training but no coaching (Egert, 2015^[161]). A mapping of 66 European studies (Eurofound, 2015^[165]) also demonstrated that short-term in-service training interventions were shown to be more effective when a feedback component was present in the training. Long-term in-service training interventions proved successful when they were integrated into the centre's practice and participants were actively involved in the centre's improvement processes related to educational practice (Eurofound, 2015^[165]). Also, a study found that in-service training resulted in higher-quality interactions regardless of staff's pre-service training (Burchinal et al., 2002^[103]). Moreover, training of 45 to 60 hours was more effective than other periods of training (Egert, 2015^[161]).

In these studies, it is important to note that some aspects of in-service training are often confused with other structural features, such as implementation of new curriculum and changes in working conditions, which may account for some of the differences in quality (Slot et al., 2017a^[36]). For example, in China, staff who attended in-service training demonstrated higher-quality staff-child interactions; however, they were also entitled to higher governmental salaries and benefits, and were perceived as having attained higher social status (Hu et al., 2016a). In a study using five European datasets (England [United Kingdom]; Finland, Germany, the Netherlands and Portugal, (Slot, Lerkkanen and Leseman, 2015^[99]), the results showed that associations varied according to country-specific policies and context. For example, in England (United Kingdom), the type of provision (more care or more educationally oriented) appeared to moderate the relation between staff qualifications and process quality (as measured with the Early Childhood Environment Rating Scale (ECERS-R and ECERS-E). Staff working in educationally oriented settings provided higher quality, compared to their counterparts working in care-type settings, but this difference was larger for less qualified staff. In addition, the working conditions, such as higher salary and more professional development opportunities, tended to be better in educationally oriented settings. Thus, it seems that better working conditions in the settings combining education and care might have compensated for the lower staff qualifications.

The evidence base for in-service training and professional development is also consistent with a positive relationship with children's development and learning. Several recent review studies and meta-analyses showed small-to-medium effects of professional development interventions on children's language and literacy skills (e.g. (Egert, 2015^[161]; Jensen and Rasmussen, 2015^[166]; Markussen-Brown et al., 2017^[162]).

In-service training (or professional development) is an equally effective measure for services for younger children

For centres for children under the age of 3, staff receiving in-service training have also demonstrated higher-quality staff-child interactions in the United States and the Netherlands (Burchinal et al., 2002^[103]; Slot et al., 2015^[40]), and the same is true for family daycare settings. Several US studies have shown that in-service training was related to better staff-child interactions, e.g. (Raikes, Raikes and Wilcox, 2005^[155]; Schaack, Le and Setodji, 2017^[156]), and in fact to be a stronger predictor of staff-child interactions than staff pre-service qualifications (Burchinal, Howes and Kontos, 2002^[76]; Hallam, Bargreen and Ridgley, 2013^[167]).

In the Flemish Community in Belgium, staff receiving pedagogical support in the workplace demonstrated higher levels of emotional and educational process quality in

family daycare settings than staff not receiving pedagogical support; these associations were true for infants, but not for toddlers (Hulpia et al., 2016^[73]).

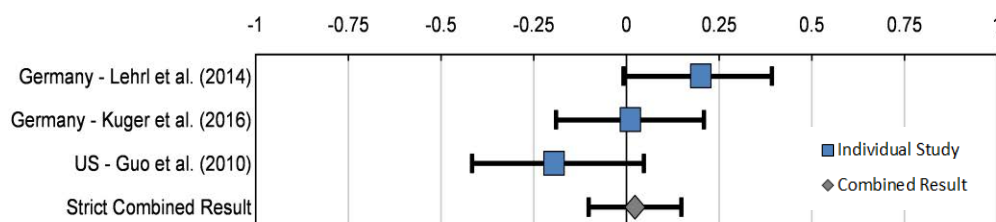
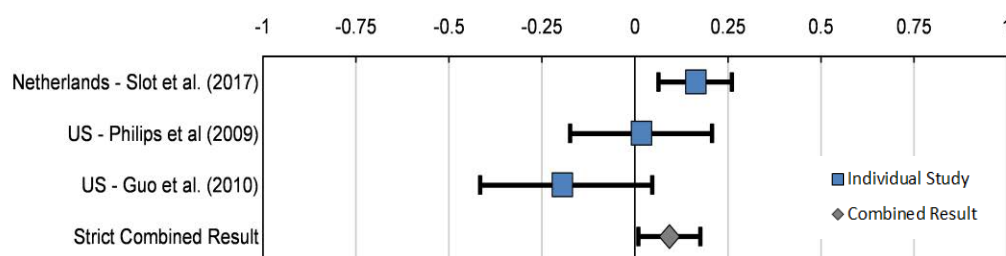
Certain features of in-service training for family daycare settings seem to be positively linked to staff-child interactions, namely whether the staff received individualised support through home visits by a professional (Bromer and Korfmacher, 2017^[168]), or through video feedback (Groeneveld et al., 2011^[169]). In a Dutch study, family daycare providers were randomised to receive a video-feedback intervention, or to be part of the control group (i.e. no feedback). The study demonstrated that family daycare providers who received feedback through video demonstrated higher levels of process quality (as measured with a global environmental quality measure), even though there were no differences in their sensitivity during interactions with children, when compared to the control group (Groeneveld et al., 2011^[169]). Further to the importance of considering different features of training, one US study showed that participation in ongoing training was unrelated to process quality; however, the study did not distinguish between duration, length or topic of the training (Doherty et al., 2006^[132]). Bromer and Korfmacher (2017^[168]) have also stressed that in-service training for family daycare settings often lacks a strong conceptual model, which may be key to further success in promoting higher-quality staff-child interactions through in-service training.

It is important to note that overall family daycare providers tend to have fewer opportunities for professional development than centre-based providers [e.g. (Boogaard, Bollen and Dijkers, 2014^[78]; Fuligni et al., 2009^[79])]. In most countries, further professional development is not mandatory, although some exceptions exist in the Flemish Community of Belgium, Switzerland and some German federal states and Danish municipalities, where the number of mandated professional development hours varies greatly, e.g. (Boogaard, Bollen and Dijkers, 2014^[78]).

Years of work experience do not predict quality of staff-child interactions

Evidence for the links between staff work experience and process quality has been largely inconsistent for centres for children 3 to 6 years old. Staff with more work experience, when compared to staff with less work experience, have demonstrated higher-quality staff-child interactions in Germany and the US (LoCasale-Crouch et al., 2007^[170]; Kuger, Pflieger and Rossbach, 2005^[171]; Kuger et al., 2015^[120]); but also lower quality staff-child interactions in the United States (Connor et al., 2005^[61]; Wilcox-Herzog, 2004^[172]); or no relationship at all between work experience and staff-child interactions in China and the US (Hu et al., 2016a^[104]; Justice et al., 2008^[124]; Philips, Gormley and Lowenstein, 2009^[148]; Pianta et al., 2005^[31]). Cross-country comparison studies have shown similar patterns of mixed findings across countries (Cryer et al., 1999^[106]; Slot, Lerkkanen and Leseman, 2015^[99]).

These mixed results were confirmed by the meta-analysis conducted for this report (see Figure 3.9, (von Suchodoletz et al., 2017^[17])). Specifically, more work experience was not associated with the overall staff-child interactions index (Panel A), but was associated with the combined score of staff emotional, instructional and organisation interactions with the children (Panel B). Because the evidence summarised in this meta-analysis differed in size and direction, within and across countries, there is a possibility that the association between years of experience and staff-child interactions reflect both within-country variation and differences according to countries. However, these results should be considered with caution, given the small number of studies included in the meta-analyses.

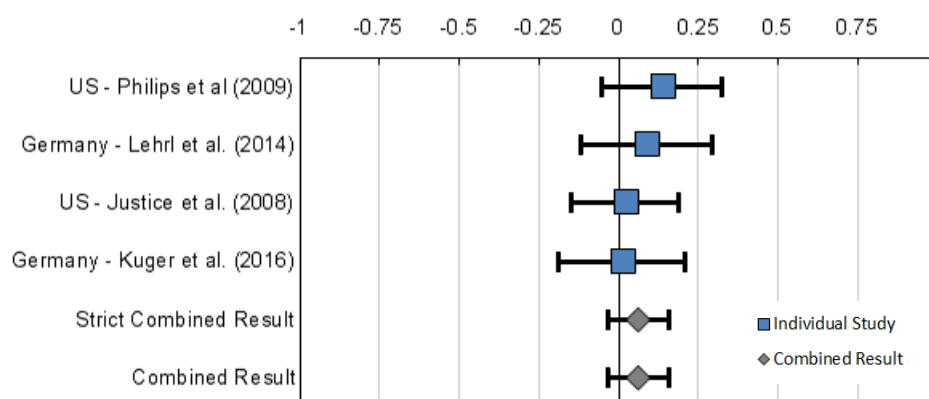
Figure 3.9. Inconsistent associations between work experience and staff-child interactions.**Panel A. Using a global score of staff-child interactions.****Panel B. Based on a combined score of staff emotional, instructional, and organisational staff-child interactions.**

Note: Effect sizes are depicted as either blue squares for individual studies or grey diamonds for combined results, each with black lines spanning the lower limit and the upper limit of the 95% confidence interval for each estimated effect. Individual studies, labelled here with the information for country of study, author, and the year of study publication, refer to original studies that provided effect size measures entering into each meta-analysis. These measures are then combined into a summary effect size, which is the average association between two variables. See Box 3.1 for more details on how to interpret the charts.

Source: (von Suchodoletz et al., 2017_[17]).

Moreover, the meta-analysis also demonstrated that higher quality or more exposure to developmental and educational activities for children (as a process indicator) did not depend on staff work experience (Figure 3.10). The meta-analysis also demonstrated that these associations did not vary between studies from the United States and studies conducted outside the United States (i.e. combined across all other countries covered).

Figure 3.10. No evidence of association between staff work experience and provision of development and educational activities.



Note: Effect sizes are depicted as either blue squares for individual studies or grey diamonds for combined results, each with black lines spanning the lower limit and the upper limit of the 95% confidence interval for each estimated effect. Individual studies, labelled here with the information for country of study, author, and the year of study publication, refer to original studies that provided effect size measures entering into each meta-analysis. These measures are then combined into a summary effect size, which is the average association between two variables. See Box 3.1 for more details on how to interpret the charts.

Source: (von Suchodoletz et al., 2017^[17]).

Because working conditions tend to vary, depending on the amount of work experience, these inconsistent findings may mask the role of other relevant structural indicators. For instance, more experienced staff may be faced with a larger child-to-staff ratio (Pianta et al., 2005^[31]) or group of children (Connor et al., 2005^[61]). In centre-based ECEC settings for 2- and 3-year-olds in the Netherlands, having more work experience or more opportunities for professional development appeared to compensate for working with higher child-staff ratios in the classroom (Slot, Lerkkanen and Leseman, 2015). For work experience, the reverse also appeared the case: less experienced staff provided higher curriculum quality in classrooms with a more favourable ratio. Finally, more opportunities for professional development were related to higher quality, but only for more experienced staff, and the opposite was true for less experienced staff. This might reflect the need for more experienced staff to keep their knowledge and skills up to date, whereas for less experienced staff, this might reflect that they are less susceptible to professional development activities, as they rely more heavily on the recent training they received.

Another study from the US used a person-centred approach of staff characteristics and staff-child interactions by conducting a latent profile analysis (Jeon, Buettner, & Hur, 2016). Three examined three distinct staff profiles as a combination of work experience, attitudes towards the work and staff-child interactions (Jeon, Buettner and Hur, 2016^[173]). The first profile showed the highest process quality (as measured with the CLASS) and concerned teachers with more work experience and mixed job attitudes (i.e. strong job commitment, but also slightly higher work stress). The other two profiles concerned staff with less work experience and either more positive work attitudes or less positive attitudes, but both profiles showed lower quality than the first profile. The profile with the highest quality showed higher QRIS ratings and more favourable child-staff ratios; staff

pay was also higher and the director was more likely to have a specialised ECE background.

For centres for children under the age of 3, the evidence for the relationship between working experience and staff-child interactions tended to be more consistent, and no negative associations were reported. Staff with more work experience in class- or playrooms for children under 3 demonstrated higher-quality staff-child interactions in the United States and the Netherlands (Jamison et al., 2014_[65]; King et al., 2016_[74]; Phillipsen et al., 1997_[101]; Slot et al., 2017a_[36]; Vogel et al., 2015a_[66]).

Effects of work experience on process quality may be restricted to some subdomains of process quality and to some age groups, but the evidence is thus far inconclusive. For example, in the Netherlands and in the United States, work experience was only related to staff support for children's development (King et al., 2016_[74]; Slot et al., 2017a_[36]). In the Flemish Community of Belgium and in other US evidence, associations between staff work experience and process quality were documented only for emotional support, and in Flanders only for infant groups (Hulpia et al., 2016_[73]; Vogel et al., 2015a_[66]). At the same time, two Portuguese and other US studies revealed no significant associations between staff work experience and staff-child interactions (Barros et al., 2016_[39]; Castle et al., 2016_[153]; Pessanha, Aguiar and Bairrão, 2007_[113]; Vogel et al., 2015b_[67]).

The evidence for the effect of work experience in family daycare settings is inconclusive

Just as with the evidence for centres for children between 3 and 6, the evidence concerning staff work experience in family daycare settings and relations with process quality is mixed. Several studies reported no associations between work experience and staff-child interactions in the United States (Burchinal, Howes and Kontos, 2002_[76]; Colwell et al., 2013_[116]), and specifically for infant groups in the Flemish Community of Belgium (Hulpia et al., 2016_[73]). However, for toddler groups in Flemish Belgium, staff work experience showed negative relations with process quality, but only for providers affiliated with a professional organisation that mediates between the parents and the home-care provider, handles administration and financial issues and provides support for ongoing professional development. More specifically, affiliated providers with more work experience demonstrated lower levels of emotional support for infants and support for children's development and learning for toddlers than affiliated providers with less work experience (Vandenbroeck et al., 2018_[29]).

Preliminary evidence suggests that staff well-being is related to higher-quality staff-child interactions

For centres for children 3 to 6 years old, one US study looked into various dimensions of staff-reported well-being, and found that staff who reported depression and burnout demonstrated lower process quality. It also found that staff with higher positive affect, an indicator of well-being, demonstrated higher-quality staff-child interactions (Jennings, 2015_[174]). However, in a Finnish study, there were no associations between staff stress and observed staff-child interactions (Pakarinen et al., 2010_[92]).

For centres for children under the age of 3, in the United States, staff with higher levels of well-being² demonstrated higher emotional support in the class- or playroom (Cassidy et al., 2017_[175]); and staff with higher reported job satisfaction and a lack of depressive symptoms demonstrated higher-quality staff-child interactions (Vogel et al., 2015a_[66]).

Higher salaries are associated with higher quality in a few cases

While working conditions for ECEC staff have not been studied, there is some evidence that staff earning higher salaries provided higher-quality staff-child interactions in China (Hu et al., 2016a_[104]) and the US (Cryer et al., 1999_[106]; Pianta et al., 2005_[31]), but not in Germany or Spain (Cryer et al., 1999_[106]).

The strength of this association varied greatly, and probably depended on other associated factors. In China, staff earning higher salaries were much more likely to demonstrate higher process quality (Hu et al., 2016a_[104]) than in the United States (Pianta et al., 2005_[31]). However, it is important to note that in China, the staff whose salaries were higher had higher levels of qualification and more often worked in public settings (with better resources), and in classrooms with more favourable child-staff ratios. In the United States, staff earning higher salaries also had higher levels of qualification, but there was no association with child-staff ratios.

Salaries may also work differently across the staff ECEC categories. In Portugal, higher ECEC leader salaries, but not staff salaries, were related to staff-child interactions whereas in the United States, higher staff salaries, but not leader salaries, were related to staff-child interactions (Cryer et al., 1999_[106]).

For centres for children under the age of 3 years, preliminary evidence from Portugal indicates that staff earning higher salaries offer higher process quality (as measured by the ITERS; (Pessanha, Aguiar and Bairrão, 2007_[113]).

No studies were reported for family daycare settings.

Organisational climate seems to be associated with the quality of staff-child interactions

To date, only a few studies have examined the association between organisational characteristics of ECEC centres and process quality. Preliminary evidence shows that centres for children aged 3 to 5 with a better organisational climate, i.e. more team collaboration and cohesion, demonstrate higher quality of staff-child interactions in general (Bloom and Bella, 2005_[176]; Bloom and Sheerer, 1992_[177]; Sylva et al., 2004_[13]), and higher language support in particular, as measured by the ECERS-R, (Lower and Cassidy, 2007_[178]), than centres with a less optimal organisational climate.

In a couple of studies, the relationship between organisational climate and quality has been found to be even stronger than other classroom characteristics, such as child-staff ratio (Biersteker et al., 2016_[154]; Dennis and O'Connor, 2013_[179]); Dennis and O'Connor, 2013), as well as staff characteristics, including qualifications and work experience (Biersteker et al., 2016_[154]).

Organisational climate is also associated with other centre characteristics. For instance, in smaller organisations, rather than large organisations, staff perceived more autonomy and support to show leadership, exchanged their visions with colleagues more often, and reported more opportunities for participating in decision-making in curriculum-related issues (Ho, Lee and Teng, 2016_[180]).

For centres for children under the age of 3, a study from South Africa showed that organisational quality was the strongest predictor of overall process quality (as measured by the ITERS), above and beyond staff characteristics and classroom features, as was the case with the centres for children aged 3 to 5 (Biersteker et al., 2016_[154]).

Other aspects of centre organisational characteristics examined for under-3s include affiliations with a professional organisation. In the United States, centres that were affiliated with a professional organisation provided higher-quality staff-child interactions than centres with no affiliation (Thomason and La Paro, 2009_[38]).

Some research suggests that networking may play an important role in the quality of staff-child interactions in family daycare settings

Opportunities for networking or collaborating with other family daycare providers seem to be associated with higher-quality staff-child interactions. In Canada, informal networking was a predictor of better staff-child interactions, although organised networking with other providers was not related to quality (Doherty et al., 2006_[132]). The benefits associated with these mechanisms of quality, particularly opportunities for collaboration and networking, may be specific to family daycare settings, given the small number of staff and children in each provision (see Box 3.2).

Box 3.2. Organisation of networking in family daycare settings

In most countries, family-care providers work independently from their own home, with limited opportunities for collaboration or networking with other providers. In some European countries, providers jointly take care of children at the same location. For instance, in France, some federal states in Germany and in the United Kingdom, family-care providers are allowed to collaborate and jointly take care of larger groups of children (Boogaard, Bollen and Dijkers, 2014_[78]). In Denmark, family-care providers living in the same neighbourhood organise themselves in so-called “playroom groups”, and have regular meetings where children can play together and also organise activities, such as music, movement or dance, as well as outings for the whole group of children.

Notes

1. One potential explanation for this mixed pattern of results is that while one study investigated whether staff had a Child Development Associates credential in ECEC (Vogel et al., 2015a^[66]), the other study included staff with a BA degree as well, which appeared to predict educational process quality (Vogel et al., 2015b^[67]).
2. In this study, well-being was operationalised as the perception of wage fairness in comparison to others in their organisation and other staff in the profession, and staff perceived autonomy in hiring (Cassidy et al., 2017^[175]).

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Chapter 4. Data and monitoring to improve quality in early childhood education and care

Data and monitoring can be a powerful lever to encourage quality in early childhood education and care (ECEC) by establishing facts, trends and evidence about whether children have equitable access to high-quality ECEC, as well as to inform of measures to achieve improvements. This chapter provides a review of findings on one single feature of data and monitoring systems, i.e. Quality Rating Improvement Systems or QRIS, and its relationship with to process quality and child outcomes. Overall, the implementation of quality monitoring and rating improvement systems was associated with better staff-child interactions, in particular for centres for children aged 3 to 5 and for children aged 0 to 2. The associations and applicability of the QRIS for family daycare settings are more uncertain. There are also mixed findings on whether the use of QRIS is associated with higher levels of children's development and learning.

Introduction

Data and monitoring can be a powerful lever for encouraging quality in early childhood education and care (ECEC), by establishing facts, trends and evidence about whether children have equitable access to high-quality ECEC, as shown in the *Starting Strong IV* report (OECD, 2015^[5]). Monitoring is understood as the process of systematically tracking aspects of ECEC services, staff, child development and curriculum implementation, with a view to data collection, accountability, enhancing effectiveness or quality (OECD, 2015^[5]). For example, research suggests that monitoring can help inform planning, contribute to more efficient resource allocation and increase cost-effectiveness (Bennett, 2002^[181]).

In ECEC, the expansion of evidence has played a key role in explaining the success or failure of ECEC programmes, prioritising important areas for ECEC investment and informing ECEC practices through evidence. Gaining an understanding of the performance of ECEC systems through monitoring is important not only for purposes of accountability, but also for policy design and implementation, as well as for informing parents about the level of quality being offered (Levitt, Janta and Wegrich, 2008^[182]). Most importantly, monitoring quality can play a key role in determining whether and how provision of ECEC is supporting children's development and well-being – and what can be done to improve it.

Several studies have found that the collection and monitoring of quality data can lead to increased programme quality, as reflected in the adoption of higher standards, improved classroom environment ratings and teachers with a higher level of credentials (Office of Child Development and Early Learning, 2010^[183]; Zellman et al., 2008^[184]). For example, in New Jersey (United States) the introduction of a quality rating score for ECEC centres allowed practitioners and management to improve their practices, and positive differences were also observed in children's literacy skills (Frede et al., 2007^[185]; 2009^[186]).

Monitoring curriculum implementation may offer insights into what can be improved in curriculum and pedagogical practices, or training for curriculum, which can then enhance quality and child outcomes. Furthermore, family satisfaction is often monitored in surveys. Monitoring such aspects of ECEC helps create a greater understanding of what constitutes quality ECEC (OECD, 2015^[5]).

A careful selection of indicators can help improve programmes and the workforce, increase access (especially in underserved communities), and improve practice and child outcomes (Early Childhood Data Collaborative, 2011). Information on structure and process indicators contributes to increased knowledge about the level of quality provision; while information on the demographic and background characteristics of children served can be included in data systems to determine programme effects on target groups and the current state of play of ECEC.

Monitoring quality and measuring effectiveness can be a daunting challenge (OECD, 2015^[5]). Data collection requires the capability to co-ordinate a strategic collection of data and maintain high standards of reliability over time across multiple data collectors and geographical regions (Zaslow et al., 2010^[160]). In turn, unco-ordinated efforts of documentation make it difficult to manage trade-offs in policy development, and understand how workforce policies or professional development investments are related to children's learning and development. For example, a United States review of ECEC data systems reveals that, while states are collecting a lot of early education-related data, their efforts are often uncoordinated. US states also struggle to determine which children

are simultaneously enrolled in multiple ECEC programmes. This can lead to duplication of services and present obstacles for the co-ordination of the efforts of ECEC programmes working with the same children (Early Childhood Data Collaborative, 2011).

Many countries monitor the service quality of ECEC settings using external evaluation practices and tools (e.g. inspections using rating scales, or surveys and questionnaires with checklists) or internal evaluation practices and tools (e.g. self-assessments with evaluation reports or portfolios) (OECD, 2015^[5]). Studies have been conducted, mainly in the United Kingdom and the United States, on the impact certain monitoring tools have had on the quality of ECEC services; but it is often challenging to separate and identify the impact of a single tool or method. In addition, there is very little research on whether one monitoring instrument for ECEC used in a given country or context would result in similar findings or effects in other countries. In general, further research is necessary to create a better understanding of the impact of certain tools or instruments, and whether they are valid and effective.

An analysis of the areas monitored in process quality in different jurisdictions (OECD, 2015^[5]) shows that they assess relationships and interactions between staff and children; collaboration between staff and parents; collaboration between colleagues (ECEC staff); sensitivity (refers to child-responsive actions and practices); responsiveness to children's individual needs; age-appropriateness of practices; pedagogy (the ECEC staff's methods of teaching and care of the ECEC staff) and the implementation of curriculum.

Summary of findings

The only feature of data and monitoring systems examined in the literature is the use of Quality Rating Improvement Systems, or QRIS (see Box 4.1). No other associations between indicators of monitoring and assessing and staff-child interactions were reported in the literature review.

Box 4.1. Quality rating and improvement systems in the United States

Quality rating and improvement systems (QRIS) are used in many countries. The majority focus on basic standards concerning structural characteristics, such as staff qualifications, group size or ratio; and other examine aspects of curriculum, process quality or child outcomes. In the United States, the stated goals of a QRIS are generally to improve ECEC quality to enhance children's development, well-being and learning. QRIS are defined at the state level, and participation is on a voluntary basis. Most QRIS in the United States include the following elements: *i*) quality standards; *ii*) accountability measures (monitoring or assigning ratings); *iii*) support for providers in quality improvement; *iv*) financial incentives; and *v*) dissemination of ratings to inform parents or other stakeholders, e.g. (Boller et al., 2015^[187]; Zellman and Perlman, 2008^[188]).

Overall, the implementation of quality monitoring and rating improvement systems was associated with higher-quality staff-child interactions across all settings. It is important to note that for family daycare, QRIS seem to be particularly important in supporting staff with lower pre-service qualifications to achieve higher quality, as illustrated in one of the studies reported below.

However, the literature review also noted that monitoring and rating systems provided only rough indicators of quality; i.e. the QRIS seemed to be most accurate in distinguishing between low levels and high levels of quality, rather than useful for making more fine-grained quality assessments (Slot, 2017_[16]). One exception is when QRIS systems are designed based on other valid observation measures of quality, such as the Environment Rating Scale (ERS), and applied to scale for monitoring purposes. In these cases, there is stronger alignment between the QRIS and process quality measures.

Links between QRIS and children's development and learning are mixed, with some studies finding significant associations between QRIS ratings and children's developmental outcomes, and others not finding linkages.

Finally, and although many countries now have quality monitoring systems in place (see (OECD, 2015_[5]) for a comprehensive overview), the majority of the research is from the US, and restricted to state-level QRIS systems that are voluntary. There may be thus considerable self-selection of relatively higher-quality centres into these studies that are not representative of the average quality prevalent in the state or country.

This chapter provides an overview of the evidence linking structural mechanisms in data and monitoring to staff-child interactions as well as child development, learning and well-being. To build a solid knowledge base on this theme, it draws on a literature review and meta-analysis that update conceptual knowledge and empirical evidence base for the strength of these associations, while keeping a cross-national focus. The chapter first summarises these two pieces of research, and examines the importance of these mechanisms for process quality in ECEC. Each mechanism is considered in turn, integrating the evidence for centres for children aged 3 to 5, centres for children under the age of 3, and finally family daycare settings. Finally, the chapter examines the evidence for the links between quality mechanisms and child development, learning and well-being.

What does research tell us about the importance of data and monitoring for staff-child interactions in early childhood education and care?

Quality rating and improvement systems (QRIS) are associated with higher-quality staff-child interactions in centres for 3- to 6-year-olds

In US centres for children aged 3 to 5, staff participating in QRIS demonstrated higher emotional and instructional support, as well as better language and literacy environment and curriculum, than centres not participating in QRIS (Jeon, Buettner and Hur, 2014_[189]). A recent review of studies that investigated the use of QRIS in the United States showed that overall, there appear to be associations between higher QRIS ratings and alternative measures of quality that were usually based on the environmental rating scale and sometimes the CLASS (Karoly et al., 2016_[190]). Some correlations were reported for all eight studies, but the magnitude of the associations appeared weak. In another recent overview (Tout et al., 2017_[191]) analysing findings from 10 validation studies examining quality ratings of ECE programmes participating in state QRIS, the results were the same, i.e. QRIS ratings appear to be a helpful tool for state

early childhood systems to differentiate programmes at lower and higher levels of quality. Overall, QRIS ratings reflect differences in environments, interactions, and activities between ECE programmes at higher and lower rating levels. Although statistically significant, the differences in observed quality scores between QRIS rating levels were generally small. Findings for family daycare programmes had mixed results.

Evidence of the association between participation in a QRIS and process quality has also been demonstrated by intervention studies. In a US randomised controlled trial in which the intervention group was provided with grants and funding for quality improvement and professional development, as well as on-site coaching, the intervention group showed improvements in the quality of staff-child interactions, when compared to the control group (Boller et al., 2015^[187]).

Other US studies have examined specifically the importance of star ratings or quality levels in determining process quality. In these studies, the existing state-level QRIS implementation was related to process quality, as observed with commonly used measures, such as the ECERS, CLASS Pre-K or Caregiver Interaction Scale (CIS), although it mainly distinguished the lowest quality centres from the highest quality centres; i.e. there were no differences across other star or quality levels (Hestenes et al., 2015^[192]; Lahti et al., 2015^[70]; Lipscomb et al., 2017^[193]). In studying which staff profiles were more conducive to higher process quality, there is some indication that the director's qualifications, rather than the qualifications of classroom staff, were related to higher process quality (Lipscomb et al., 2017^[193]). In Australia and China, similar relations between the use of QRIS and process quality were observed. In Australian centres, ratings on the Quality Improvement and Accreditation System were moderately associated with process quality, as measured by the Infant/Toddler Environment Rating Scale (ITERS) or Early Childhood Environment Rating Scale (ECERS) (Fenech, Sweller and Harrison, 2010^[68]), particularly for centres providing the lowest quality. In China, quality levels as determined by the QRIS were related with observed process quality (using the ECERS), but these did not distinguish between centres at the lowest levels of quality in one study (Hu, Vong and Mak, 2015^[194]) and at the highest levels of process quality in another (Pan, Liu and Lau, 2010^[195]).

A study conducted by the Rand Corporation (Zellman and Perlman, 2008^[188]) assesses the validity of a QRTIS as a tool for improving child care quality. The QRIS assessed was implemented in 1999, was one of the first of its kind and was created by Qualistar Early Learning, a Colorado (United States) based non-profit organisation. The rating system includes components generally agreed to contribute to high-quality care: classroom environment, child-staff ratios, staff and director training and education, parent involvement and accreditation. The study found that among providers using the QRIS, service quality did improve over time. However, it is not possible to unequivocally attribute improvements to the QRIS: improvements could have been a response to being monitored, for example. Difficulties in measuring the effect of this particular intervention include participant self-selection, the lack of a comparison group and limited data on the implementation of the intervention. The study notes the importance of validating a tool such as the QRIS, particularly as it is sometimes linked to rewarding higher-quality services with, for example, higher per-child subsidies. Tout et al. (2009^[196]) find that while QRIS potentially serve as a hub for quality improvement, attaining this goal requires extensive co-ordination across agencies, services and data systems.

QRIS also seem to support staff-child interactions in centres for the youngest children

Regarding centres for children under the age of 3, the QRIS seems to be able to differentiate between the lowest and the highest quality centres in terms of their support for children's development, well-being and learning (Lipscomb et al., 2017^[193]). Moreover, in a randomised controlled trial of US centres offering services to children under the age of 3 in infant and toddler classrooms, intervention centres that used a QRIS received grants and funding for quality improvement and professional development, as well as on-site coaching, and demonstrated improvements in the quality of staff-child interactions by comparison with the control group (Boller et al., 2015^[187]). The observed changes occurred largely in overall environmental quality and the quality of the curriculum and learning environment, and smaller changes were also observed in the quality of interactions. Interestingly, intervention centres also presented lower child-to-staff ratios, than the control group of centres.

It is less clear whether the star systems implemented as part of the QRIS also differentiate across other levels of quality. In a state-wide study in the United States (Lipscomb et al., 2017^[193]), the levels of the five-star system did not differentiate centres of different quality, namely in terms of the classical measures of observation (e.g. CLASS scores). However, in another US study conducted in two states, observed quality (measured by the ERS and CIS) seemed to be a good indicator of the rated quality level across all four levels of the star system implemented (Lahti et al., 2015^[70]). In a small-scale study specifically examining the different aspects of process quality (using the CLASS Toddler), the QRIS star ratings for four out of six quality dimensions seem to be related to observed process quality; however, aspects of the negative climate in the classroom and staff's behaviour guidance were unrelated to the star rating (Thomason and La Paro, 2009^[38]).

Linkages between QRIS and staff-child interactions in family daycare settings are less clear

The United States' family daycare settings with the highest star rating seem to also present the highest levels of process quality (as observed with the CLASS), concerning the organisation of the environment, the support of children's development, behaviour, well-being and learning and the provision of (learning) activities (Lipscomb et al., 2017^[193]).

However, this association between QRIS and process quality for family daycare seems sometimes to be limited to the content areas covered in the professional development programme embedded in the QRIS: for example, health and safety, or practices in teaching (Hallam, Bargreen and Ridgley, 2013^[167]). Moreover, when inspired by a particular measure of quality, the association between QRIS quality levels and process quality also seems to be limited to the measure the QRIS is largely based on, and does not generalise beyond that measure. For example, a QRIS system inspired in the ERS scales demonstrated an association between the star system and process quality as measured by the ERS, but not as measured by the CIS (Lahti et al., 2015^[70]).

QRIS systems need to be used with caution when comparing centre-based and home-based types of settings, since this system places strong emphasis on requirements that are harder to meet by home-based providers, such as formal policies, written procedures, specific furnishings and materials. These requirements are considered beyond the scope

of measures such as the CLASS that focus exclusively on the quality of the interactions. In the United States, home-based providers reported lower QRIS ratings than centre-based care providers, although there were no significant differences in the observed quality (i.e. staff-child interactions as measured with the CLASS) (Lipscomb et al., 2017^[193]).

Links between QRIS and children's development and learning are mixed.

The outcomes of the use of the QRIS are mixed, with some studies finding significant linkages between QRIS ratings and children's developmental outcomes and others not finding linkages. In Missouri (United States), children who participated in programmes with higher-quality ratings and especially low-income children showed significantly higher gains on measures of social-emotional development than children in programmes with lower ratings (Thornburg et al., 2009^[197]). In contrast, in an evaluation of Colorado's Qualistar programme, linkages between the ratings and children's outcomes were not found (Zellman et al., 2008^[184]).

A recent review of findings from 10 validation studies (Tout et al., 2017^[191]) examining quality ratings of ECE programmes participating in state QRIS yielded inconsistent evidence of small positive associations between ratings and patterns of children's development. Some selective positive associations were found in some states, but not across all developmental domains examined, nor across all measures within a domain. Three out of six studies found evidence that QRIS ratings were associated with some measures of executive function, and four found selective associations between ratings and measures of social-emotional development.

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Chapter 5. Key insights and avenues for further research

Process quality, such as the quality of staff-child interactions, is the primary driver of children's development and learning through early childhood education and care (ECEC). However, it can be challenging to target the quality of such interactions with regulation. Research suggests that, apart from in-service training, changes in structural levers are not directly linked to child development and learning. It also suggests that staff should be well-trained, and enjoy good working conditions, such as favourable child-staff ratios, to be able to promote rich learning and well-being environments for children. Monitoring systems can also inform quality improvements. The report also shows that domains of process quality, such as child-to-child interactions, and domains of child development and learning, are overlooked in research. More and more fine-grained evidence on curriculum and monitoring would provide important insights. Contextual factors also merit further consideration, to examine the mechanisms at play between structure, process and child development. Finally, further studies of ECEC quality for the youngest are necessary to inform research and policy.

Introduction

Changing structural quality standards, and staff-child ratios and qualification requirements in particular, has been commonly used as a way of enhancing the quality of ECEC provision. Decisions of this kind are often made based on political debates rather than on evidence.

Recent research has suggested, furthermore, that process quality (e.g. staff-child interactions) matters more for better child development and learning than structural quality itself (e.g. staff-child ratios). Under the circumstances, policymakers are increasingly interested in gathering more evidence and unpacking the relationships between structural interventions and process quality that lead to better child development and learning. It is important to better understand the scope of process quality, identify the types of process quality that are amenable to policy interventions, and suggest options for affecting process quality through structural quality regulations.

This report is prepared as part of initial desk-based research for the new OECD ECEC project “Policy Review: on Quality beyond Regulations in ECEC”, and in particular, “process quality”. It reviews the existing evidence, which sets up some key insights based on available (but limited and narrowly defined) studies and highlights the most significant avenues for future research.

The evidence reported in previous chapters for the relationship between common structural quality indicators, and staff-child interactions¹ as well children’s development and learning is summarised in Table 5.1 and 5.2.

Table 5.1 summarises the findings from the literature review between structural traits and staff-child interactions in centres for children aged 3 to 5, 0 to 2, and family daycare settings, respectively.

Table 5.2 summarises the findings from the meta-analysis for centres for children aged 3 to 5, but not covering children aged 0 to 2. The table presents: i) associations between structural traits and staff-child interactions, ii) associations between structural traits and child development and learning, and iii) associations between staff-child interactions and child development and learning.

Both tables note the direction (i.e. negative, neutral, positive) of the associations found in the literature, as well as the scope of cited research, the strength of the evidence for this association, based on the number of studies that reported results for this element, and additional comments that can help interpret the association.

The scope and methods of the literature review and meta-analysis is limited (e.g. age coverage, coverage of ECEC provision types, coverage of countries, scope of process quality, scope of child development) and that additional research and a policy survey is thus needed to generate refined policy orientations. The research reviewed in this report draws heavily on observational, programme-based or national studies, while there are fewer experimental studies, studies at scale or of cross-national nature. The literature review and meta-analysis examined the association of variables, not a causal mechanism, and thus need to be interpreted with caution. With these caveat in mind, ten key insights are suggested by the summarised knowledge base.

In summary, the key insights include the following:

1. Lower child-staff ratios themselves alone will not guarantee better child development. But they are associated with more positive staff-child relations across all age groups.
2. Group sizes matter for staff-child interactions, but linkages are stronger for interactions with the youngest children than with children aged 3 to 5.
3. Relationships between quality indicators can be indirect, such as between ratios, group size, organisational climate, quality of staff-child interactions, and child development and learning.
4. Pre-service training, when focusing on ECEC content, is associated with better staff emotional, educational and developmental support for children, with a stronger relationship found in the case of the youngest children. However, the evidence on its association with child development and learning is inconclusive.
5. Licensing for family day care, when regulated with pre-service qualifications, can be a tool to ensure better interactions for children.
6. In-service training that includes ECEC-specific content relates to better staff-child interactions and child development and learning outcomes for all groups of children, especially in literacy skills.
7. Children's skills can develop more effectively when staff engage in quality developmental activities with children. Staff practices and engagement with children may depend on team collaboration, and benefit from improved working conditions and well-being.
8. Separate class- or playrooms for disadvantaged, immigrant or bilingual children are associated with risks for equity and quality in ECEC.
9. Monitoring systems, if they are used to inform quality improvements, are linked to greater support to children's development and learning in all ECEC settings.
10. The location of ECEC centres within schools is associated with differences in staff's relationships with children.

To complement the limitations of the existing research, the following eight areas are suggested for further research to address the “needs for improved or more research” and “needs for new research”:

1. Consider relationship of other structural features, such as funding and intensity of ECEC, to staff-child interactions and to child development.
2. Examine combined effects of different structural policy levers.
3. Explore “optimal” minimum quality standards and possible trade-offs.
4. Broaden the scope of child development and learning assessment to well-being as well as skills critical for future success, such as creative thinking.
5. Research other features of process quality such as children's experiences with their peers and the environment, as well as staff-staff interactions, the staff-parents interactions, and interactions with the community.
6. Better understand specific features and effects of the curriculum.
7. Investigate linkages between monitoring practices, staff-child relationships and child development further.
8. Expand evidence on process quality for infants and toddlers.

To build up the knowledge base in this area, the findings from this report will be used to frame questions for additional research and for a policy questionnaire, planned as the next steps of the OECD ECEC project “Policy Review: Quality beyond Regulations in ECEC”.

Lower child-staff ratios themselves alone will not guarantee better child development. But they are associated with more positive staff-child relations across all age groups.

Low child-staff ratios were found to enhance positive staff-child relationships across all types of settings and ECEC age groups. Multiple studies of individual countries including China, the US and Portugal, and a meta-analysis of 17 studies from Europe and North America suggest that a smaller number of children per ECEC staff tends to be associated with higher levels of process quality for centres catering to children aged 3 to 5 (Burchinal et al., 2002^[103]; Hu et al., 2016a^[104]; Mashburn et al., 2008^[44]; Philips et al., 2000^[100]; Phillipsen et al., 1997^[101]; Vermeer et al., 2016^[50]). While the association was not found everywhere, there is no evidence of any negative effects (Howes et al., 2008^[34]; Mashburn et al., 2008^[44]; Mashburn et al., 2009^[109]; Montie, Xiang and Schweinhart, 2006^[110]). Lower child-staff ratios were also associated with more positive interactions for children aged zero to 3 in the Flemish Community in Belgium, the Netherlands, in Portugal and the US (Barros and Aguiar, 2010^[111]; Barros et al., 2016^[39]; Deynoot-Schaub and Riksen-Walraven, 2005^[112]; Hulpia et al., 2016^[73]; Jamison et al., 2014^[65]; Thomason and La Paro, 2009^[38]; Phillipsen et al., 1997^[101]). These findings were more conclusive for centre-based settings than for family daycare, where group sizes are usually much smaller.

Group sizes matter for staff-child interactions, but linkages are stronger for interactions with the youngest children than with children aged 3 to 5.

Some supporting evidence suggests that smaller group sizes improve staff-child interactions in settings for younger children (Barros and Aguiar, 2010^[111]; Barros et al., 2016^[39]; Deynoot-Schaub and Riksen-Walraven, 2005^[112]; Hulpia et al., 2016^[73]; Jamison et al., 2014^[65]; Thomason and La Paro, 2009^[38]; Phillipsen et al., 1997^[101]). In looking at services for children aged 0 to 2, both group sizes and staff-child ratios were found to matter for the quality of staff-child interactions, even though a few studies did not find associations (Pessanha, Aguiar and Bairrão, 2007^[113]; Vogel et al., 2015a^[66]; Vogel et al., 2015b^[67]). These findings were more conclusive for centre-based settings than for family daycare, where group sizes are usually much smaller. For the older age group, evidence can be found in both directions, which does not indicate that having smaller groups presents a clear benefit. No research on potential direct associations of group sizes with child development was available for this report.

Relationships between quality indicators can be indirect, such as between ratios, group size, organisational climate, quality of staff-child interactions, and child development and learning.

Despite some evidence from the United States showing an association between child-staff ratios and children’s pre-reading scores in preschool (Bigras, Lemay and Tremblay, 2012^[198]; Cardon et al., 2008^[199]; Howes, 1997^[200]), there is no solid evidence of direct links to child development and learning across age groups. Tentative results suggest that those structure for processing relationships could be non- linear, i.e. that decreasing the

size of a small group may have effects that are different from reducing the size of a large group (Bowne et al., 2017_[102]).

The review of the literature indicated a mixed pattern of associations across age groups and there was no relationship between low child-staff ratios and emerging academic skills, i.e. early literacy and early numeracy. There is, however, some preliminary evidence of indirect paths from ratios through staff-child interactions to children's development, but the associations are weak and need further confirmation (NICHD Early Child Care Research Network, 2002_[62]).

In a couple of studies, the relationship between organisational climate and quality has been found to be even stronger than other classroom characteristics, such as the child-staff ratio (Biersteker et al., 2016_[50]; Dennis and O'Connor, 2013_[83]), as well as staff characteristics, including qualifications and work experience (Biersteker et al., 2016_[50]). However, organisational climate itself is also associated with other centre characteristics (Ho, Lee and Teng, 2016_[180]).

Pre-service training, when focusing on ECEC content, is associated with better staff emotional, educational and developmental support for children, with a stronger relationship found in the case of the youngest children. However, the evidence on its association with child development and learning is inconclusive.

Overall, higher pre-service qualifications were found to be related to better staff-child interactions in Germany, Denmark, Portugal, as well as in the United States (Barros and Leal, 2011_[145]; Cryer et al., 1999_[106]; Guo et al., 2010_[146]; Pianta et al., 2005_[31]; Slot et al., 2017b_[63]). Across the entire ECEC age group, in home- and in centre-based settings, higher levels of pre-service training are associated with higher levels of staff's emotional, instructional and organisational interactions for staff, especially if the training includes content on ECEC (Burchinal et al., 2002_[103]; Tout, Zaslow and Berry, 2006_[147]). Pre-service training specifically enhances emotionally supportive interactions, and more educational and developmentally supportive interactions (Bauchmüller, Grötz and Rasmussen, 2014_[150]; Howes et al., 2008_[34]; Montie, Xiang and Schweinhart, 2006_[110]; Sylva et al., 2004_[13]).

the evidence has also shown a strong association between pre-service qualifications and staff-child interactions for children aged 0 to 2 in Quebec, the Flemish Community of Belgium, the Netherlands, Portugal and the US (Barros et al., 2016_[39]; Bigras et al., 2010_[139]; Castle et al., 2016_[153]; Hulpia et al., 2016_[73]; King et al., 2016_[74]; Slot et al., 2015_[40]; Thomason and La Paro, 2009_[38]; Vogel et al., 2015a_[66]; Vogel et al., 2015b_[67]).

However, according to evidence on 3-5 year-old children the direct link between pre-service qualifications and child learning and development is weak or unclear (von Suchodoletz et al., 2017_[17]). Higher staff qualifications were not associated with emerging academic skills, or behavioural/social skills (Early et al., 2006_[149]; Mashburn et al., 2008_[44]).

Licensing for family day care, when regulated with pre-service qualifications, can be a tool to ensure diverse learning experiences for children.

The limited available evidence on family daycare suggests that licensed providers for the youngest children with higher pre-service qualifications provide more diverse learning experiences and activities, and also demonstrate more active involvement and guidance in

these activities than less educated family daycare providers in the United States (Colwell et al., 2013^[116]; Doherty et al., 2006^[132]; Raikes, Raikes and Wilcox, 2005^[155]; Schaack, Le and Setodji, 2017^[156]) and Flemish Belgium (Hulpia et al., 2016^[73]; Vandenbroeck et al., 2018^[29]).

However, there is no evidence for direct links between pre-service training of family daycare providers and child development.

In-service training that includes ECEC-specific content relates to better staff-child interactions and child development and learning outcomes for all groups of children, especially in literacy skills.

Consistent positive associations for all settings and age groups examined were found between staff in-service training (or professional development) and the interactions staff have with children in diverse geographic locations, including Denmark, Portugal, China and the US (Fukkink and Lont, 2007^[157]; Hamre et al., 2012^[158]; Justice et al., 2008^[124]; LoCassale-Crouch et al., 2011^[159]; Slot et al., 2017b^[63]; Slot, Lerkkanen and Leseman, 2015^[99]; Zaslow et al., 2010^[160]), especially if the training included ECEC content for instance related to staff-child interactions (Siraj-Blatchford et al., 2005^[163]; Zaslow et al., 2004^[164]). Staff participating in in-service training have consistently been found to score higher on language and literacy-specific quality (Egert, 2015^[161]), whereas evidence on the links to overall quality in ECEC or staff-child interactions is mixed.

There is also a consistent evidence base across all age groups for a positive link between in-service training and children's development and learning, with the evidence particularly strong for children's language and literacy skills (Egert, 2015^[161]; Jensen and Rasmussen, 2015^[166]; Markussen-Brown et al., 2017^[162]). The number of studies available for settings for children aged zero to 3 was more limited, but the pattern of results is largely consistent (Burchinal, Howes and Kontos, 2002^[76]; Hallam, Bargreen and Ridgley, 2013^[167]).

Children's skills can develop more effectively when staff engage in quality developmental activities with children. Staff practices and engagement with children may depend on team collaboration, and benefit from improved working conditions and well-being.

Children in ECEC centres with better staff-child interactions, or staff who provide higher quality or more exposure to developmental and educational activities, were found to have higher levels of emerging literacy and numeracy skills, as well as better behavioural and social skills (von Suchodoletz et al., 2017^[17]).

Positive associations were found between staff-child interactions, including higher-quality educational and developmental activities, with staff well-being (Jennings, 2015^[174]), salaries (Cryer et al., 1999^[106]; Hu et al., 2016a^[104]; Pianta et al., 2005^[31]) and with centre organisational climate (Ho, Lee and Teng, 2016^[180]). Higher-quality organisational climate includes those where staff believed that they enjoyed more autonomy and support for showing leadership, exchanged their visions with colleagues more often, and reported more opportunities for participating in decision-making in aspects of the curriculum (Ho, Lee and Teng, 2016^[180]).

While the number of studies that have included these structural aspects is somewhat limited and research does not find evidence for effects of staff work experience (von Suchodoletz et al., 2017^[17]), emerging evidence indicates that centres where staff reported

higher well-being (including job satisfaction and lack of depressive symptoms), higher salaries and more team collaboration show better staff-child interactions across all age groups (Biersteker et al., 2016^[154]; Bloom and Bella, 2005^[176]; Bloom and Sheerer, 1992^[177]; Cassidy et al., 2017^[175]; Hu et al., 2016a^[104]; Jennings, 2015^[174]; Pessanha, Aguiar and Bairrão, 2007^[113]; Sylva et al., 2004^[13]; Vogel et al., 2015a^[66]).

The ECEC sector, especially for the youngest children, suffers from staff shortages, high rates of turnover and low status in many countries (Moon and Burbank, 2004^[136]). When staff members regularly change within a group of children, staff and children are less able to develop stable relationships and the frequency of nurturing, stimulating interactions is reduced (CCL, 2006^[201]). Political concerns about the quality of interactions thus support the case for raising working conditions – in the best interests of the children’s experience and the staff’s job satisfaction.

The research conducted for this report did not examine links between working conditions and child development because research on those associations is neither very extensive nor conclusive. There is a complex interrelationship between child-staff ratios, staff qualifications, quality and types of settings. For instance, ratios relate to working conditions for staff and to learning and well-being environments for children. This makes it difficult to single out the effect of a particular characteristic of working conditions on process quality (Sammons, 2010^[202]).

Separate class- or playrooms for disadvantaged, immigrant or bilingual children are associated with risks for equity and quality in ECEC.

Targeting ECEC provision for disadvantaged groups may seem a cost-effective way to ensure that services reach those who need them most, but concerns about quality need to be considered. The present study finds that in play or classrooms in Denmark (Slot et al., 2017b^[63]), Germany (Kuger et al., 2015^[120]; Leu and Schelle, 2009^[27]; Lehl, Kuger and Anders, 2014^[121]; Slot, Lerkkanen and Leseman, 2015^[99]), and the United States (LoCassale-Crouch et al., 2007^[122]; Tonyan and Howes, 2003^[123]), the quality of staff-child interactions was lower in those that had a high percentage of immigrant or bilingual children than in play- or classrooms with a more balanced or mixed group composition.

Classrooms with a high percentage of immigrant or bilingual children are also associated with lower scores in children’s language and literacy skills (Ebert et al., 2013^[108]; de Haan et al., 2013^[130]; Schnechter and Bye, 2007^[203]). The evidence is more consistent for children aged 3 to 5 than for centres with younger children (Hulpia et al., 2016^[73]; Slot et al., 2017a^[36]), which may be related to the targeted high-quality provision for the youngest children in some countries. Negative relations between the percentage of immigrant or bilingual children and the quality of staff-child interactions were also observed in family daycare (Hulpia et al., 2016^[73]).

Some preliminary evidence demonstrates that observed lower levels of staff emotional support and classroom organisation may be the key to this relationship (Slot et al., 2017b^[63]). The associations between staff-child interactions and children’s development and learning, however, do not seem to differ significantly for children from predominantly disadvantaged backgrounds compared to a mixed group of children.

Monitoring systems, if they are used to inform quality improvements, are linked to greater support to children’s development and learning in all ECEC settings.

Quality rating and improvement systems (QRIS) are found to be associated with higher levels of staff-child interactions in centres for all age groups in the United States (Jeon, Buettner and Hur, 2014^[189]), while the linkage between QRIS and staff-child interactions in family daycare is less clear (Lahti et al., 2015^[70]; Lipscomb et al., 2017^[193]). Where evidence exists, there is an indication that positive feedback loops between monitoring systems and staff practices may be associated with gains in children’s language development (OECD, 2015^[5]). A key target of policy efforts might thus be to ensure that information on staff-child interactions in centres is collected not simply for purposes of accountability, but used to inform quality improvements.

The location of ECEC centres within schools is associated with differences in staff’s relationships with children.

The physical location of a preschool may also be related to process quality in Finland, the US and Portugal. Higher quality staff-children relationships were observed in preschools located in schools, by comparison with preschools situated outside the school grounds or in independently functioning centres (Pianta et al., 2005^[31]; Slot, 2017^[16]; Slot, Lerkkanen and Leseman, 2015^[99]). There is also evidence that staff working in classrooms located in schools had higher education levels, were paid more, and showed a stronger educational orientation than staff working in independent centres (Clifford et al., 2005^[118]; Pianta et al., 2005^[31]).

Although the number of studies is limited, the evidence for this mechanism appears consistent and from multiple countries. However, no direct linkages to children’s development were identified.

Avenues for further research 1: clarifying inconclusive evidence

To improve the existing knowledge base, the following areas are identified where the evidence is lacking or inconclusive or new methodologies are needed to enhance the quality of research.

Consider relationship of other structural features, such as funding and intensity of ECEC, to staff-child interactions and to child development

Effects of ECEC funding and intensity of ECEC services have attracted considerable political attention across OECD countries. Both topics were included in the study, but possibly also due to the very few studies available, the literature review and meta-analysis led to less consistent results. Funding of ECEC provisions was associated with the quality of the relationships in centres in many cases, but associations varied across countries and were less clear for centres for children aged 0 to 2.

The intensity of daily service was not consistently related to the quality of staff-child interactions. The association varied within and across countries, and depended on how the interactions between staff and children were observed and documented in the full-day and half-day class- or playroom (e.g. a global score of staff-child interactions rather than a combined score of staff emotional, instructional, and organisational interactions).

Political debate is often particularly heated as to whether to increase ECEC funding or extend free hours of ECEC provision from half-day to full-day. Such considerations often

aim to support children's development and learning, especially for children of disadvantaged backgrounds, but sound evidence is required to make informed decisions. Investigating the relationships of funding and of the intensity of ECEC services to children is a high priority for the evidence base.

More research is needed to unpack the relationship between structural mechanisms and child outcomes, namely examining how structural characteristics may be *indirectly* related to child development and learning, and may influence child development through process quality. The evidence from this new approach has so far only scrutinised child-staff ratios, staff qualifications and group, class- or playroom composition, but in such cases, it has proven useful. For example, in one US study, teacher education at higher level was found to influence children's vocabulary skills only indirectly and through the staff's warmth and responsiveness, but not directly (Connor et al., 2005^[61]). In this case, emotional support but not instructional support (both domains of staff-child relationships), was the facilitator of development. It is thus worth further exploration whether investing in pre-service training that focus on promoting emotional support (or matching it with professional development in this area) is the most promising strategy for influencing development.

Examine combined effects of different structural policy levers

To understand how different structural features may jointly influence process quality, it is important to examine more studies of individual levers (e.g. ratios) and to look at models of policy implementation. In designing policy, decisions are seldom taken in isolation, or made regardless of other structural conditions. Policy decisions are commonly made in tandem for several indicators, for instance through a broader reform, or in relationship with a previous policy that has already been established or implemented.

This approach has been applied to only a limited number of structural indicators. For example, the evidence on the associations between type of funding and process quality appears largely inconclusive. In countries such as China, Portugal and the US, the literature demonstrates that public centres for children between 3 and 5 seem to provide higher process quality than private settings, whereas for example, in Spain, no significant differences were found between public or private preschools. Moreover, for children aged 0 to 2, there was no clear pattern in the limited evidence available.

However, when funding features were examined in tandem with other structural features in the same countries, such as staff education or monitoring provisions, a pattern of compensating factors emerged. For instance, in the United States, staff working in the public sector were on average better educated than staff in private settings (Coley et al., 2016^[77]; Fuligni et al., 2009^[79]). In China, staff in public settings tended to be more highly educated and earned higher salaries (Hu et al., 2016a^[104]). In Portugal, quality was higher in classrooms with higher, unfavourable child-staff ratios, and lower with more favourable ratios, but only in the public sector (Slot, Lerkkanen and Leseman, 2015^[99]). For the private sector, no differences in process quality were found to be related to ratios.

The available evidence looking at these approaches has so far been limited to a small number of levers and studies.

Explore “optimal” minimum quality standards and possible trade-offs

To maximise investment, the research should endeavour to identify optimal levels and examine trade-offs in structural quality. Preliminary evidence suggests that some of the

most commonly used structural levers, such as ratios and group size, may not act in a one-to-one relationship with process quality. A recent meta-analysis examining a large number of US ECEC programme evaluation studies for centres for 3- to 6-year-olds demonstrated that ECEC structural conditions for maximum child development and learning improved as ratios and groups sizes approached an optimum of 7.5 children to 1 adult and a maximum group size of 15 children, and then decreased (Bowne et al., 2017^[102]). Further investment in reducing ratios and group sizes would be wasteful, if not counterproductive. Other indicators may work in similar ways.

In other cases, the central concern is more of a trade-off, such as in the case of the intensity of ECEC service. Affordable, full-time ECEC is a key facilitating factor for young parents' participation in the labour force, but it is important to consider its potential risks and benefits for children. The research reviewed for this report does not provide a conclusive picture of whether or not longer hours in ECEC, i.e. greater intensity, are associated with interactions of higher quality. Sustaining high levels of quality for longer hours can also involve considerable cost.

Avenues for further research 2: create new evidence where gaps exist or where research hypotheses are not applicable

In comparison to the Starting Strong III Quality Toolbox, two policy levers – curriculum and pedagogy, and parent and community engagement – were not included in this report. Curriculum and pedagogy were found to be rarely and inconsistently addressed in the empirical literature. Parent and guardian engagement was considered beyond the scope of the literature review and meta-analysis due to the lack of research.

Broaden the scope of child development and learning assessment to well-being as well as skills critical for future success, such as creative thinking

Examination of child development and learning outcomes in connection with structural and process investments in quality is often limited to areas of content-specific learning, such as emergent literacy or mathematics. A disproportionate amount of evidence is available on pre-academic skills, which reduces the possibility of obtaining a global understanding of the potential effects of policies for ECEC quality on child development.

There is a trend towards more examination of social and behavioural skills, but the skills are also defined in the scope of group, class or playroom processes or “school-related” activities (Howes et al., 2008^[34]). Behavioural skills, for example, may be observed only as an ability to behave in the context of a classroom, overlooking the children's capacity to collaborate within peer-to-peer relationships.

Children's well-being is seldom examined, and other critical skills are often overlooked, such as the ability to reason logically, think creatively, inquire and explore based on inherent curiosity. In these domains, the challenge lies in developing valid and reliable tools so information can be collected systematically to inform policy.

Research other features of process quality such as children's experiences with their peers and the environment, as well as staff-staff interactions, the staff-parents interactions, and interactions with the community

Process quality is narrowly understood in the literature, and this report thus focuses only on the quality of staff-child interactions and activities. Of all 44 studies coded in the

meta-analysis, all but 7 operationalised process quality as staff-child interactions (von Suchodoletz et al., 2017_[17]). There is some growing evidence in the literature that more specific measures of quality are better predictors of child outcomes (Burchinal, 2016_[7]). However, often process quality subdomains were aggregated into a single indicator to increase scientific rigour, which in turn limits more fine-grained analysis and potential relationships with subdomains of child development and learning.

Facilitation of peer interactions was considered a priority for coding in the meta-analysis, but studies of peer interactions as an indicator of process quality were scarce, and often limited to studies conducted in the United States (von Suchodoletz et al., 2017_[17]). Even within classroom interactions, the majority of observational measures largely ignore peer relationships (Slot et al., 2016_[204]). A closer look at peer interactions could for instance contribute to a better understanding of the mixed findings on the associations between group size and process quality for children aged 3 to 5, indicating that “smaller” may not always be “better”.

Other important areas such as staff-to-staff interactions, and staff (or child)-to-parents and -community interactions could not be considered, even though they may have crucial links with child development and learning. Aspects of the interactions between staff and the family or community are of paramount importance, particularly for examining the quality of ECEC provided to children and families of diverse backgrounds (e.g. multicultural, economically disadvantaged and religious), or dual/second-language learners. However, these aspects were considered beyond the scope of the research examined in this report.

This is in line with the fact that this report lacks an area of investigation in ‘engaging families and communities, one of the key policy levers for enhancing quality in ECEC from *Starting Strong III* (OECD, 2011_[4]).

Better understand specific features and effects of the curriculum

Although a literature review on curriculum and pedagogy was considered a priority for this report, the research summarised was found to be too limited and imprecise to merit inclusion in the report. Overall, only very few studies had investigated the relation between curriculum and pedagogy and process quality. The terms curriculum and pedagogy were used interchangeably in much of the research reviewed (Slot, 2016_[205]), blurring the distinction between the two and their respective association with process quality. For example, studies may refer to the effects of content-specific activities without specifying whether they are in fact prescribed by the curriculum.

Research tend to create artificial separations between holistic, play-based and skills-based curricula, even though play and supporting the development of specific skills are not mutually exclusive, as shown in the *Starting Strong III* report (OECD, 2011_[4]). Such false dichotomies are reflected in the fact that there is little and only mixed evidence indicating to what extent approaches explicitly framed as “play-based” or “holistic” contribute to children’s development across various domains. An emerging body of research has started to explore the effects of differentiated pedagogies, whether “play-based”, “free play”, “structured play”, etc.

At the same time, is more evidence is available on the effects of so-called skill-specific curricula and activities on skills targeted by the specific curricula. This is partly due to a strong focus on observation of pre-academic activities. In the meta-analysis, despite the variety of measures used to examine process quality, all the studies focused on

educational activities, i.e. early literacy or early numeracy. Fewer measures are available to observe interactions in unstructured environments, or focus on the quality of group play or play in the context of a class or playroom.

A more nuanced approach to curriculum is needed to better understand the effects of differences in content, pedagogy and measures that help support implementation (e.g. in-service training and monitoring). Results may, for instance, be distorted by the availability – or lack thereof – of professional development to empower staff in their work with the curriculum. More research is also needed on what constitutes an effective curriculum and how to implement it, which is part of the planned next step of the OECD ECEC Policy Review for *Starting Strong VI*.

Investigate linkages between monitoring practices, staff-child relationships and child development further.

Despite the diversity of monitoring tools implemented by countries, the only feature of data and monitoring systems examined in the literature is the use of Quality Rating Improvement Systems or QRIS. This evidence was limited to a small number of countries (i.e. US, Australia and China). In fact, no other associations between indicators of monitoring and process quality were reported in the literature review.

Moreover, the literature review also noted that monitoring and rating systems provided only rough indicators of quality; i.e. the QRIS seemed to be most accurate in distinguishing between low levels and high levels of quality, rather than being useful for making fine-grained quality assessments (Slot, 2017^[16]). Further examination is needed to develop monitoring systems, in close alignment with other more valid and reliable indicators of process quality.

Finally, it is important to consider that much of the research summarised on quality monitoring systems relies on (US) state-level QRIS systems that are voluntary. The self-selection of relatively higher-quality centres in these studies may make the conclusions less informative for other states or countries hoping to implement universal QRIS systems. More cross-national research of different policy options is needed to inform countries how to implement monitoring practices linked to staff-child relationships, and facilitate child development.

Expand evidence on process quality for infants and toddlers

Overall, studies on process quality features of early education and care for infants and toddlers are less numerous than on education and care for children aged 3 to 5, or are limited to only a few countries for each mechanism. For instance, aspects of the physical location of schools and links to staff-child interactions have mostly been explored in studies from Portugal, and issues of intensity of daily service mostly in the Netherlands for this age group. The limited availability of relevant studies for some levers prevented a systematic comparison of mechanisms across different types of ECEC provision.

In family daycare settings, large gaps are observed. For example, aspects of governance and standards seem to be under-researched for family daycare and are thus far limited to licensing and regulations.

Table 5.1. A summary of findings from the literature review of the relationship between structural characteristics and staff-child interactions

Results are presented by policy lever, age range and type of provision

	3 to 5 years old					0 to 2 years old					Family daycare				
Quality aspects	Associations with staff-child interactions			Scope of research	Comments	Associations with staff-child interactions			Scope of research	Comments	Associations with staff-child interactions			Scope of research	Comments
	-	0	+			-	0	+			-	0	+		
Standards and governance (Chapter 2)															
Child-staff ratio	X	X		12 studies across the world, including 2 cross-national comparison studies and 1 meta-analysis	Mostly consistent evidence towards smaller ratios (also based on the meta-analysis); only 3 studies showed null associations	X	x		13 studies across the world (5 US)	The majority of studies (10 out of 12) showed a significant negative relationship between ratio and process quality (3 studies in the Netherlands; 2 studies in Portugal, Canada and Flemish Comm. [Belgium])	x	x		2 US studies, 1 Canada-Quebec and 1 Flemish study	Canadian and Flemish showed a negative relationship, whereas the US studies reported null associations

Quality aspects	3 to 5 years old					0 to 2 years old					Family daycare				
	Associations with staff-child interactions			Scope of research	Comments	Associations with staff-child interactions			Scope of research	Comments	Associations with staff-child interactions			Scope of research	Comments
	-	0	+			-	0	+			-	0	+		
Group size	X	X	x	12 studies across the world, including 1 cross-national comparison study and 1 meta-analysis	Mostly consistent evidence in the case of smaller groups; 2 studies showed null associations (including the meta-analysis) and only 1 study indicated negative associations	X	x		13 studies across the world, including 1 cross-country comparison study (5 US)	The majority of studies (8 out of 13) showed a negative association between group size and process quality (3 studies in the Netherlands and 2x in Portugal and Flemish Comm. [Belgium])	x	x		1 US study, 1 Flemish study	The Flemish study showed a negative relationship with overall environmental quality, but no associations with quality of interactions
Type is public or non-profit		X	X	4 studies	Positive relations in China, Portugal and the US, but no differences between public and private in Spain		x	x	1 US study and 1 Portuguese study	The US study showed higher quality in not-for-profit settings, but the Portuguese study showed no differences					
Rural	X			1 US study and 1 study from China	Less availability of ECEC in rural areas and lower quality in China			x	1 Portuguese study						
Located in school			x	1 study from the US and 1 study from Finland											

Quality aspects	3 to 5 years old					0 to 2 years old					Family daycare				
	Associations with staff-child interactions			Scope of research	Comments	Associations with staff-child interactions			Scope of research	Comments	Associations with staff-child interactions			Scope of research	Comments
	-	0	+			-	0	+			-	0	+		
Licensing or affiliation to professional organisation								x	1 US study			x	x	1 US, 1 Canadian, and 1 Flemish study	A positive association between (intention to apply for) licensing and staff-child interactions, but no difference between affiliated and non-affiliated providers in Flemish Comm. (Belgium)
Networking											x			1 Canadian study	Positive relation of informal networking and staff-child interactions
Mean age of children		X	x	1 US study and 1 study from Germany	No relations in US and positive relations in Germany										
% immigrant or multilingual children	X	X		4 studies from Germany, 2 US studies and 1 study from Denmark	Mostly consistent evidence that a higher share of immigrant children is related to lower quality, except for null associations in 1 US study	x		x	2 studies	1 Dutch study and 1 Flemish study showing opposite results	x			1 Flemish study	Negative relationship with overall environmental quality

Quality aspects				3 to 5 years old					0 to 2 years old					Family daycare	
	Associations with staff-child interactions			Scope of research	Comments	Associations with staff-child interactions			Scope of research	Comments	Associations with staff-child interactions			Scope of research	Comments
	-	0	+			-	0	+			-	0	+		
Workforce development and working conditions (Chapter 3)															
Pre-service qualifications		x	X	12 studies across Europe and the US	The majority of studies indicated positive effects (9 out of 12)		x	X	12 studies across the world (6 US), including 1 meta-analysis across countries	The majority of studies (10 out of 11) including the meta-analysis showed positive relations between staff qualifications and process quality (Canada-Quebec, Flemish Comm. [Belgium], Portugal, the Netherlands)		x	X	5 US studies, 1 Canada-Quebec and 1 Flemish Comm. [Belgium]study	The Flemish study showed a positive relation with overall environmental quality, but not with the quality of interactions; 2 US studies showed null associations with pre-service education, but rather with additional in-service training
In-service training (professional development)			X	11 studies across Europe, China and the US, including 3 meta-analyses	Overall, positive relations between in-service training and quality, but inconsistencies within studies, depending on type and amount of in-service training			X	3 studies (1 US), including 1 meta-analysis				X	4 US studies, 1 Flemish Comm. [Belgium]study, 1 Dutch study and 1 international meta-analysis	In-service training positively related to staff-child interactions. However, in the Flemish study, the positive relationship obtained only for infant care and not for toddler care

Quality aspects	3 to 5 years old					0 to 2 years old					Family daycare				
	Associations with staff-child interactions			Scope of research	Comments	Associations with staff-child interactions			Scope of research	Comments	Associations with staff-child interactions			Scope of research	Comments
	-	0	+			-	0	+			-	0	+		
Well-being		x	x	1 US study and 1 study from Finland				x	2 US studies	Positive associations between broad measures of staff well-being and process quality were shown in 2 studies					
Years of experience	x	X	x	10 studies across the world, including cross-national comparisons	A positive relationship was shown in 2 studies (1 US, 1 Germany); 4 studies (3 US, 1 China) reported null associations, and 2 US revealed negative relations; 2 cross-national studies showed mixed findings		x	X	10 studies across the world (6 US)	A positive relationship was shown in 6 studies (5 US, 1 Netherlands) and 4 studies reported null associations (2x in Portugal and 2x in US)	x	x		2 US studies, 1 Flemish Comm. [Belgium]study	US studies showed no relationship and Flemish study showed a negative relationship for infant care and null associations for toddler care
Working conditions, e.g. salaries		x	x	1 US study and 1 study from China	Positive effects of salary in China, but not in the US			x	1 Portuguese study						
Leadership or management quality			x	1 study from South Africa				x	1 study from South Africa						

Quality aspects	3 to 5 years old					0 to 2 years old					Family daycare				
	Associations with staff-child interactions			Scope of research	Comments	Associations with staff-child interactions			Scope of research	Comments	Associations with staff-child interactions			Scope of research	Comments
	-	0	+			-	0	+			-	0	+		
Organisational climate			X	3 US studies and 1 study from England (United Kingdom)											
Data and Monitoring (Chapter 4)															
Quality rating improvement systems (QRIS)			X	6 US studies, 2 studies from China and 1 study from Australia	Despite consistent positive relations, QRIS mainly distinguish rough indicators of low as opposed to high quality and show less consistent evidence in more fine-grained comparisons	x	x		3 US small-scale studies	Moderate associations were shown in 2 studies between QRIS rating and process quality; 1 study failed to show correlations, but distinguished between lower and higher quality			X	3 US studies	Participation and star rating related to better staff-child interactions

Note: (-) indicates a negative association, (0) indicates null associations and (+) indicates positive associations. A capital (X) indicates stronger evidence and a small (x) indicates weaker evidence.

Source: (Slot, 2017_[16])

Table 5.2. A summary of findings from the meta-analysis of the relationship between structural characteristics, staff-child interactions, and child development and learning for centres for children aged 3 to 5

Results are presented by policy theme

	Associations of structural quality with staff-child interactions					Associations of structural quality with child development and learning					Associations of staff-child interactions with child development and learning				
Quality aspects	Direction and size of effect			Scope of research	Comments	Direction and size of effect			Scope of research	Comments	Direction and size of effect			Scope of research	Comments
	-	0	+			-	0	+			-	0	+		
Quality standards and governance (Chapter 2)															
Child- (lead) staff ratio		x	X	7 studies across the world	Mostly consistent and significantly negative associations between ratios and process quality; meta-analysis indicated no geographical differences (US vs. non-US)		x		3 US studies	Null association between child-staff ratio and emerging academic skills (i.e. early literacy and early numeracy) was not significant and close to zero.					

	Associations of structural quality with staff-child interactions					Associations of structural quality with child development and learning					Associations of staff-child interactions with child development and learning				
Quality aspects	Direction and size of effect			Scope of research	Comments	Direction and size of effect			Scope of research	Comments	Direction and size of effect			Scope of research	Comments
	-	0	+			-	0	+			-	0	+		
Length of daily service is full day (rather than half-day)	x		x	2 US studies and 2 studies from Australia	Results were inconsistent across countries and across measures of process quality (overall score or staff-child interaction composite).										
Workforce development and working conditions (Chapter 3)															
Pre-service qualifications		x	X	6 studies (1 Netherlands, 5 US) for staff-child interactions, and 3 US studies for developmental and educational activities	A positive and significant association with staff-child interactions, and no association with provision of activities.		x		3 US studies for each association tested	Null association between staff pre-service qualifications and emerging academic skills; null staff education between pre-service qualifications and behavioural/social skills.					
Developmental and educational activities (process indicator)												x		6 studies for children's emerging academic skills and 3 studies for children's behavioural/social skills	Positive (weak) associations between quality of / exposure to developmental and educational activities and children's emerging academic skills, as well as behavioural/social skills.

	Associations of structural quality with staff-child interactions						Associations of structural quality with child development and learning						Associations of staff-child interactions with child development and learning					
Quality aspects	Direction and size of effect			Scope of research			Comments			Direction and size of effect			Scope of research			Comments		
	-	0	+				-	0	+				-	0	+			
Staff-child interactions (e.g. global staff-child interaction scores; combined staff-child interaction scores) (process indicator)													x		X	10 studies (2 from Germany, 1 from Portugal, 7 from US) using global staff-child interaction scores; 8 studies (1 from Australia, 7 from US) using combined staff-child interaction scores	Consistent positive association between positive staff-child interactions and children's literacy and numeracy learning. No differences were noted for studies with children from disadvantaged backgrounds compared to studies with a diverse sample.	
Staff-child interactions (e.g. global staff-child interaction scores; combined staff-child interaction scores) (process indicator)													x	x	x	9 studies (1 from Finland, 2 from Portugal, 1 from Germany, 5 from US) using global staff-child interaction scores; 8 studies (1 from Flemish Comm. [Belgium], 1 from Portugal, 1 from Tanzania, 5 from the US) using combined staff-child interaction scores	Null associations between positive staff-child interactions and children's behavioural/ social skills. No differences were noted for studies with children from disadvantaged backgrounds compared to studies with a diverse sample. Geographical differences in these results: US studies showed a negative association between staff-child interactions and children's behavioural skills; but an overall positive was found in studies conducted outside the United States	

Quality aspects	Associations of structural quality with staff-child interactions			Associations of structural quality with child development and learning			Associations of staff-child interactions with child development and learning		
	Direction and size of effect			Direction and size of effect			Direction and size of effect		
	-	0	+		-	0	+		
Negative staff-child interactions (process indicator)								X	4 studies (1 from Flemish Comm. [Belgium], 1 from Tanzania, and 2 from the US)
									Significant negative association, suggesting that negative staff-child interactions are associated with less positive behavioural/ social skills of children

Source: (von Suchodoletz et al., 2017_[17]).

Note

1. Staff-child interactions will include “staff emotional, instructional, and organisation interactions with the children”, and “implementation of developmental and educational activities”.

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Annex A. List of network member contributors

Reviewers of this publication provided advice and guidance on the development of the two background studies summarised in this report, commented on the drafts, etc. as members of the OECD Network on Early Childhood Education and Care (listed in alphabetical order).

Table A A.1. List of network member contributors to this report

Country	Name	Organisation
Australia	Australian Government Department of Education and Training	
Belgium (Flanders)	Christele Van Nieuwenhuyzen	Kind en Gezin (Child and Family), Policy Area Childcare
Canada	Christian Paradis	Employment and Social Development Canada
	Kelly Hennig	Alberta Education
	Louise Deschambault	Ministère de la Famille du Québec
France	Gilles Petreault	Ministère de l'éducation nationale (Ministry of Education)
Germany	Simone Bloem	Deutsches Jugendinstitut e.V. (German Youth Institute)
	Dana Harring	
	Daniel Turani	
Iceland	Björk Óttarsdóttir	Ministry of Education, Science and Culture
Japan	Early Childhood Education Division, Elementary and Secondary Education Bureau, Ministry of Education, Culture, Sports, Science and Technology (MEXT)	
Netherlands	Inge Bruggers	Ministry of Social Affairs and Employment
Norway	Tove Mogstad Slinde	Ministry of Education and Research
Poland	Katarzyna Malec	Ministry of National Education
Switzerland	Veronika Neruda	Conférence des directrices et directeurs cantonaux des affaires sociales (Swiss Conference of Cantonal Ministers of Social Affairs)
United Kingdom	Hannah Collyer	Department for Education
United States	Tom Snyder	Department for Education
European Commission	Emanuela Tassa Viktoria Bolla	DG Education, Youth, Sport and Culture (EAC)

Annex B. Literature review method

The methodology for the literature review search was based on a number of starting points that fit the goals of Phase I of the project “Policy Review: Quality beyond Regulations in ECEC” (Slot, 2017_[16]). The literature review was not designed as a systematic review and was carried out with good judgment in line with project goals.

First, an important goal was to align the two initial research inputs for the project, i.e. the literature review and the meta-analysis, and to build on recent OECD projects and publication on quality in ECEC. To fit this goal, the same search terms were used for the two research activities, with additional search terms being added to the literature review for structural quality and for family-based care, as follows:

ECEC OR ECE OR preschool OR care OR child care OR day care OR family OR home-based OR early education OR early childhood AND

structur* quality OR teach* OR teach* education* OR teach* training OR in-service OR professional development OR experience OR ratio OR group size OR class* size OR leadership OR organisation OR organisation OR team OR work* condition*

AND Process quality OR classroom quality OR instruc* quality OR curriculum OR practices OR teaching OR interaction OR activities OR teacher-directed OR child-cent* OR climate

Second, the review was meant to take a cross-national approach, thus aimed explicitly at retrieving studies from countries other than the United States. Hence, search terms related to the continents or regions were added, specifically for South America, Africa, Asia and the Middle East. Additional relevant literature was elicited from participants of the OECD ECEC Network meeting on 4 July 2017. Moreover, feedback and suggestions provided by interested and participating countries in the Policy Review project from September to November 2017 were also integrated in the literature review.

Third, to ensure the inclusion of grey literature in addition to scientific papers, policy and research reports from several countries were covered (e.g. Australia, Flemish Community of Belgium, the Netherlands, England [United Kingdom], and the United States) through search engines as Google and Google Scholar. This allowed the consideration of (ongoing) research projects such as the Effective Early Education Experiences (i.e. E4kids) study in Australia and Measurement and Monitoring of Quality (i.e. MeMoQ) study in the Flemish Community of Belgium, for which scientific papers are not yet available. Moreover, several policy reports were used to collect information on specific structural features, such as the Quality Rating and Improvement Systems (QRIS) in the United States that contained highly relevant findings.

Lastly, the literature review took a comprehensive approach to study the relations between structural and process quality including centre- and family-based day care and focused on the age range from birth up to five years of age.

Reference

- Slot, P. (2017), *Literature review on Early Childhood Education and Care quality: Relations between structural characteristics at different levels and process quality*, Internal document, OECD, Paris. [17]

Annex C. Meta-analysis method

The meta-analysis in this report (von Suchodoletz et al., 2017^[17]) used the recommendations by (H. M. Cooper, 2009) and (H. Cooper, Hedges and Valentine, 2009) as a guideline for the steps which follow the formulation of research questions, i.e. literature retrieval and study selection, data extraction and general analytic approach. The methodology for each of the steps is summarised below, and described in greater detail in (von Suchodoletz et al., 2017^[17]).

Literature retrieval of relevant studies and study selection

The identification of publications suitable to the purpose of the meta-analysis involved different sources of information and different steps. First, an important goal in this process was to align the two parts of Phase I of the project “Policy Review: Quality beyond Regulations in ECEC”, i.e. the literature review and the meta-analysis, and to build on recent OECD initiatives on quality in ECEC. We therefore included all references cited in the literature review (in total, 60 references in the version presented at the ECEC Network meeting 4 July 2017). In addition, the OECD project team provided two relevant literature reviews on quality in ECEC (Anders, 2015; Strasser, Rolla, & Romero-Contreras, 2016) from which all references were included (Anders, 2015: 186 references; Strasser et al., 2016: 47 references).

A second important goal of the meta-analysis was to include studies conducted outside the United States, with a particular focus on OECD member countries. We conducted an online search of governmental education-related websites of OECD member countries (links were found on the OECD member country website: <http://www.oecd.org/about/membersandpartners/list-oecd-member-countries.htm>) and identified national studies relevant to ECEC. To retrieve as complete a list as possible, member countries of the ECEC Network and the OECD team provided additional large-scale national studies.

Once a list of national studies was identified, we conducted a systematic literature search of electronic databases (PsycNet, ERIC and EBSCO Host). In a first step, we identified scientific publications using data from national studies by directly inputting search terms of well-known large-scale studies (e.g. *Bildungsprozesse, Kompetenzentwicklung und Selektionsentscheidungen im Vorschul- und Schulalter* [Educational Processes, Competence Development and Selection Decisions in Preschool- and School Age, BiKS], E4KIDS, National Center for Early Development and Learning [NCEDL], State-Wide Early Education Programs [SWEEP], etc.). In a second step, we used the country name and the following search terms “early childhood education” OR “center” OR “centre” OR “child care” OR “childcare” OR “day care” OR “daycare” OR “preschool” OR “kindergarten” OR “pre-k” to identify additional studies. This strategy ensured that all countries of interest were well represented in the national study list but also generated a significantly large number of hits which included many irrelevant studies. In such cases, the above search terms were filtered to “key words” OR “appearing in the abstract”.

In general, the literature retrieval/search was restricted to studies published over the past 10 years, i.e. between 01.01.2007 and 31.05.2017. Additional criteria were defined in close collaboration with the OECD project team and included: children's age (with a focus on children ages 3-6 years) and developmental domains (focusing on emerging academic skills, behavioural skills, social-emotional skills) as well as measures to evaluate the quality of studies, such as reliability regarding the measures used to assess the variables of interest.

It is important to note that this process was not rigid in its parameters and was carried out with good judgment until the national study list consisted of studies that were relevant to the objectives of this project. The total number of studies that were identified through the literature search regarding national studies was 1 079. Nine of these studies were duplicates (i.e. already included in the above-mentioned literature reviews' reference lists: Anders, 2015; Slot, 2017; Strasser et al., 2016) and therefore deleted from the list. In sum, a total number of 1 410 studies was identified (i.e. references from Anders, 2015; Slot, 2017; and Strasser et al., 2016 plus the literature search for national studies) and entered into the data extraction process of the meta-analysis.

A full reference list is available for download from our website at: www.oecd.org/education/school/ECEC-meta-analysis-studies.pdf.

Data extraction

Due to the large number of publications identified in the literature retrieval/search, data extraction followed a heavily structured procedure. To reduce the number of studies, the studies were first pre-screened and restricted to studies that included process quality indicators. By doing so, we ensured that studies included the necessary data relevant to the research questions. Box A.C.1 details the screening flowchart.

Out of the total of 1 410 identified studies, resource and time constraints limited the number of pre-screened studies for the meta-analysis to 1 204 studies (85% of the total number of identified studies). Among these studies, 221 studies reported research exclusively from the United States; 85 studies reported data from multiple countries, including the United States; 295 studies reported research conducted in a European country; and 340 studies reported research from countries from outside the United States and Europe. The pre-screening identified 233 studies (138 Non-US studies and 95 US studies) that qualified for full screening (i.e. included process quality measures). Table A C.1 summarises the pre-screening categories.

Box A.C.1. Screening flowchart for the meta-analysis

If some of the analyses presented in a study meet our criteria the study will be screened.

PRE-SCREENING

PRE-A: Non-US/US research including process quality indicators: Does the study report data from outside the United States and includes measures process quality indicators? If yes, the study will be screened first.

1. NON-US study AND measures of process quality indicators → FIRST PRIORITY FOR SCREENING
2. US study AND measures of process quality indicators → SECOND PRIORITY FOR SCREENING
3. NON-US study BUT NO measures of process quality indicators → LATER SCREENING (if resources available)
4. US study BUT NO measures of process quality indicators → LATER SCREENING (if resources available)

IMPORTANT: Code the country in which the data was collected during pre-screening.

A: EXCLUSION criteria: Do any of the following exclusion criteria apply?

5. The study is reported in a journal/book/book chapter that is NOT available online (time constraints do not permit us to wait for inter-library loan or responses from authors).
6. The study is published prior to 01-01-2007 or after 05-31-2017.
7. The study is published prior to 01-01-2000 or after 05-31-2017.
8. The study is ONLY qualitative (i.e. no quantitative analyses are reported).
9. The study is a (multiple) case study.
10. The study is ONLY descriptive (i.e. only descriptive data is reported).
11. The study is an unpublished dissertation.
12. The study is only published as a conference abstract that does NOT provide full information that would be required for coding.
13. The study does NOT report structural/process quality indicators observed in an ECEC setting. The study will be excluded even if structural/process quality indicators were reported in primary school or for infant/toddler classrooms only.
14. The study is a policy/government report.

IF 1-9, SKIP TO CODING PRIORITY AND CHECK # 1 DO NOT CODE

15. None of the above → GO TO NEXT SECTION: B

B: LANGUAGE OF PUBLICATION: Is the study a non-English publication?

16. Yes, the study is NOT published in English → SKIP TO CODING PRIORITY AND CHECK # 2 NON-ENGLISH PUBLICATION

IMPORTANT: Code the language in which the study has been published

17. No → GO TO NEXT SECTION: C

C: CHILD CARE SETTING: Does the study include centre-based or non-centre-based child care settings?

18. The study includes informal non-centre based child care settings (unregistered/uncertified family-based care). → SKIP TO CODING PRIORITY AND CHECK # 3 INFORMAL NON-CENTRE BASED CHILD CARE SETTING
19. The study includes formal non-centre based child care settings (registered/certified family-based care; recognised under the country's respective ECEC regulations). → SKIP TO CODING PRIORITY AND CHECK # 4 FORMAL NON-CENTRE BASED CHILD CARE SETTING
20. The study includes centre-based child care settings. → GO TO NEXT SECTION: D

D: INTERVENTION/IMPACT EVALUATION

21. The intervention/impact evaluation did NOT provide analyses relevant for the goals of the meta-analysis. → SKIP TO CODING PRIORITY AND CHECK # 1 DO NOT CODE
22. The intervention/impact evaluation did include indicators of structural quality as covariates to a treatment equation when predicting process quality. → GO TO NEXT SECTION: E

E: Is the study a META-ANALYSIS OR RIEVIEW?

23. Yes → SKIP TO CODING PRIORITY AND CHECK # 5 META-ANALYSIS OR REVIEW
24. No → GO TO NEXT SECTION: F

F: Does study report acceptable RELIABILITY of quality/child outcome measures?

25. No, study does not include multi-item measure (i.e. only one single item is used to measure aspects of quality and thus no reliability information is reported).
→ SKIP TO CODING PRIORITY AND CHECK # 1 DO NOT CODE
26. Yes, BUT measures used in the study do NOT have acceptable reliability (for example, reported consistencies are < .6).
27. Yes, BUT study ONLY reports reliability for child outcome measures.
→ IF 2 or 3, CHECK # 7 FOR LOW PRIORITY
28. Yes, study reports acceptable reliability for quality measures (for example, reported consistencies are → .6) OR study reports acceptable reliability for quality AND child outcome measures (for example, reported consistencies are → .6)
→ GO TO NEXT SECTION: G

G: RELEVANCE of study: Do any of the following criteria apply?

29. The study includes process quality measures.

30. The study reports international research (i.e. non-US).

Additional information about the study:

31. The study differentiates between school socio-economic status and/or accounts for socio-economic status in the analyses.
32. The study reports separate variables for structural quality and process quality (i.e. the study did NOT combine structural and process quality indicators into one global quality score).
33. The study includes child outcome data.
34. Sample size teachers/leaders (Goal 1): The sample size equals or is larger than 45 teachers/classrooms/playgroups/playrooms (more conservative G*Power analysis – correlational analyses with an effect size of .45)
35. Sample size children/students (Goal 2): Child outcomes are reported for more than (on average) 4 children per classroom.
 → IF 1 AND 2, and any of 3-7 → CHECK #8 FOR HIGHEST PRIORITY CODING
 → IF 1 BUT NOT 2, and any of 3-7 → CHECK #6 FOR HIGH PRIORITY CODING
36. The study combines indicators of structural and process quality into one global quality score but item-level information is available to determine the percentage of items that focus on structural quality versus process quality.
37. Sample size teachers/leaders (Goal 1): The sample size equals or is larger than 26 teachers/classrooms/playgroups/playrooms (more optimistic G*Power analysis – correlational analyses with an effect size of .6)
 → IF 2 AND 8 OR 9, CHECK # 7 FOR LOW PRIORITY CODING
 → IF 8 OR 9, CHECK # 9 FOR LOW PRIORITY CODING
38. None of the above → SKIP TO CODING PRIORITY AND CHECK # 1
 DO NOT CODE

CODING PRIORITY (CHECK ONLY ONE):

- ☐ 1 DO NOT CODE
- ☐ 2 NON-ENGLISH PUBLICATION
- ☐ 3 INFORMAL NON-CENTER BASED CHILD CARE SETTING
- ☐ 4 FORMAL NON-CENTER BASED CHILD CARE SETTING
- ☐ 5 META-ANALYSIS OR REVIEW
- ☐ 6 HIGH PRIORITY CODING (US STUDY)
- ☐ 7 LOW PRIORITY CODING (NON-US STUDY)
- ☐ 8 HIGHEST PRIORITY CODING (NON-US STUDY)
- ☐ 9 LOW PRIORITY CODING (US STUDY)

Table A C.1. Pre-screening categories

Code	Description	Number of studies per category (N=1204)
1	Non-US study AND measures of process quality indicators → FIRST PRIORITY FOR SCREENING	138
2	US study AND measures of process quality indicators → SECOND PRIORITY FOR SCREENING	95
3	Non-US study BUT NO measures of process quality indicators → LATER SCREENING (if resources available)	535
4	US study BUT NO measures of process quality indicators → LATER SCREENING (if resources available)	121
999	Country of data collection cannot be identified	45
9999	The pre-screening criteria cannot be applied (website, government/policy report, literature review/meta-analysis, book, etc.).	270

Source: (von Suchodoletz et al., 2017_[17])

To be coded, these studies had to undergo a second screening process (i.e. full screening). The full screening consisted of several additional categories. Studies were excluded if exclusion criteria applied (see Box A.C.2; Section A); if they were not published in English (Section B); if the study did not include centre-based child care settings (Section C); if the study reported an intervention and/or impact evaluation and did not report analyses relevant to the research questions (Section D); if the study was a meta-analysis and/or literature review (Section E); if the study did not include information to evaluate the reliability of the measures (Section F). Studies which met the inclusion criteria were categorised into coding priorities: Highest priority coding (screening code 8; i.e. non-US research with process quality measures), high priority coding (screening code 6; i.e. US research with process quality measures), and low priority coding (screening codes 7 and 9, see Table A C.2).

Table A C.2. Screening categories

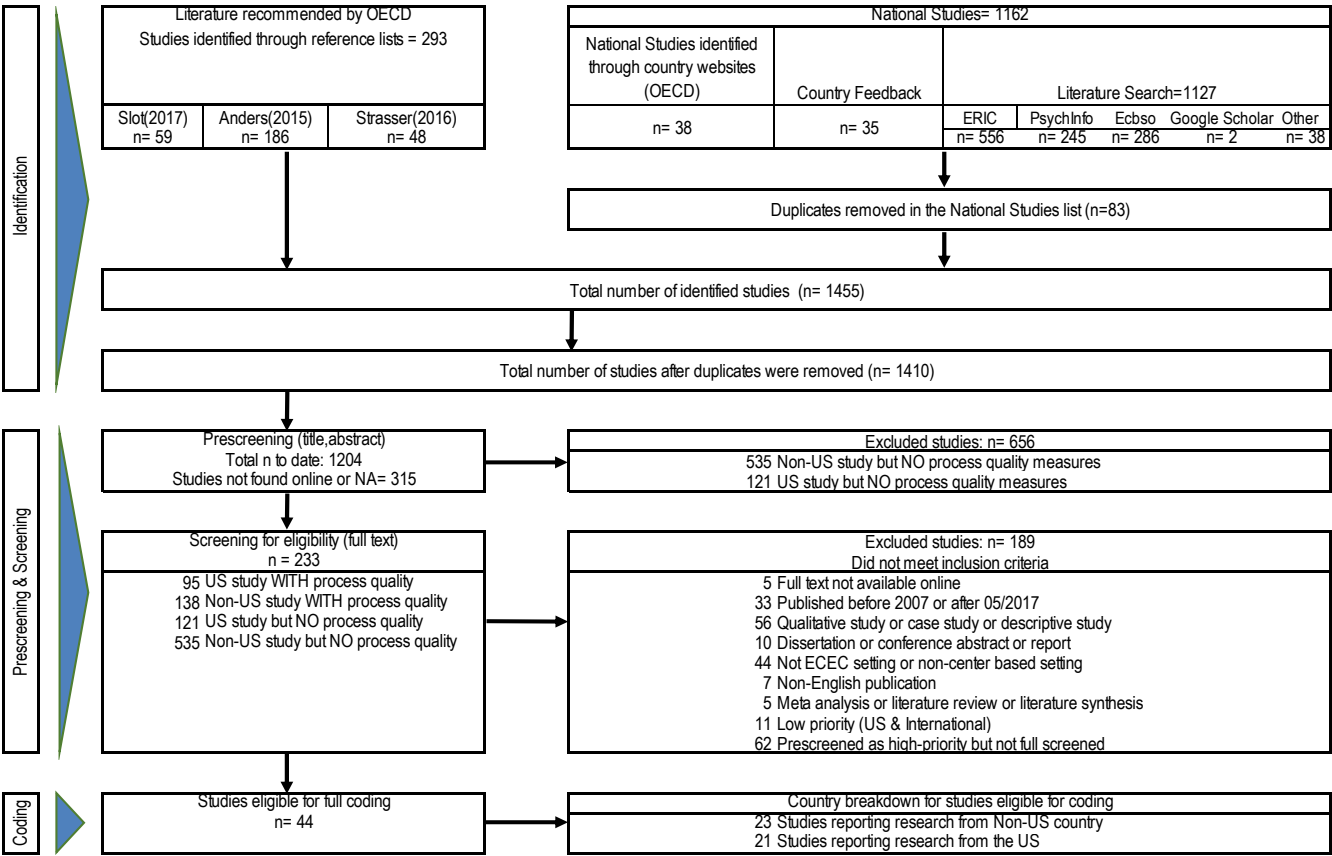
Number of studies meeting the coding priority criteria and included in the coding are in bold.

Code	Description	Total number of studies per category (N=233)	Number of Non-US studies per category (N=138)	Number of US studies per category (N=95)
1	DO NOT CODE	109	64	45
2	NON-ENGLISH PUBLICATION	7	7	NA
3	INFORMAL NON-CENTER BASED CHILD CARE SETTING	0	0	0
4	FORMAL NON-CENTER BASED CHILD CARE SETTING	3	2	1
5	META-ANALYSIS OR REVIEW	5	4	1
6	HIGH PRIORITY CODING (US STUDY)	21	NA	21
7	LOW PRIORITY CODING (NON-US STUDY)	1	1	NA
8	HIGHEST PRIORITY CODING (NON-US STUDY)	23	23	NA
9	LOW PRIORITY CODING (US STUDY)	2	NA	2
	FULL SCREENING NOT COMPLETED	62	37	25

Source: (von Suchodoletz et al., 2017_[17])

The pre-screening and full screening process was completed in two rounds of which only the first round could be included in the coding for the meta-analysis. This was due to time and resource constraints limiting the number of studies from which data could be extracted. The first round identified 56 studies eligible for full coding (i.e. screening categories 6 and 8). Following Cooper (2009) and Cooper et al. (2009), the quality of the screening decision was evaluated for each of the studies and corrected for 12 studies which were subsequently excluded from the full coding. Reasons were: The study did not include variables/measures relevant to the research questions of the meta-analysis (Barnett, Yarosz, Thomas, Jung, & Blanco, 2007; Curby, Grimm, & Pianta, 2010; Fenech, Harrison, & Sumsion, 2011; Kimer, Tuul, & Öun, 2016; Perren et al., 2017; Ribeiro, Zachrisson, & Dearing, 2017); The study did not report results of interest to the meta-analysis (Ahn & Shin, 2013; Helmerhorst, Riksen-Walraven, Fukkink, Tavecchio, & Gevers Deynoot-Schaub, 2016; LoCasale-Crouch et al., 2007; Tayler et al., 2016); The study was not published between 01.01.2007 and 31.05.2017 (Connor, Morrison, & Slominski, 2006). This resulted in a final sample of 44 studies included in the coding (See flow diagram in Figure A C.1), of which 16 studies reported research from European countries (screening category 8), 21 studies reported research from the United States (screening category 6), and 7 studies reported research from outside both Europe and the United States (screening category 8) (see Table A C.3). Among the 44 studies included in the coding, 25 studies reported separate indicators for structural and process quality; 30 studies included samples of more than 45 ECEC staff; and 32 studies reported child data (19 of those studies included samples of more than 4 children per classroom). Figure A C.2 summarises reasons for the exclusion of studies after full screening.

Figure A C.1. Flow diagram of data extraction



Source: (von Suchodoletz et al., 2017_[17])

Table A C.3. Description of coded studies (n=44)

			Sample size		ECEC Quality							Doman of Child Development and Learning	
					Structural Characteristics			Indicators of Process Quality					
Author (Year)	Country	Large Scale Study	ECEC Staff	Children	Centre	Group	ECEC Staff	Staff-Child Interactions	Facilitatio n of Peer Interactio ns	Developmenta l and Educational Activities	Measures of Process Quality	Emerging Academic Skills	Behavioural / Social Skills
Abreu-Lima (2013)	Portugal	-	60	215	—	—	—	X	—	X	ECERS	X	X
Anders et al. (2012)	Germany	BiKS	-	532	—	X	—	X	—	X	ECERS	X	—
Bowne et al. (2016)	Chile	Un Buen Comienzo	118	-	—	—	X	—	—	X	Video coding	—	—
Brock & Curby (2014)	USA	SWEEP	694	2938	—	—	X	X	—	—	CLASS,STR S	—	X
Bub (2009)	USA	NICHD SECCYD	-	503	—	—	—	X	—	X	ORCE,COS, STRS	—	X
Buckrop et al (2016)	USA	NCEDL	245	959	—	X	X	X	—	—	CLASS,STR S	X	—
Burchinal et al (2010)	USA	NCEDL/SW EEP	671	1129	X	—	—	X	—	—	CLASS	X	X
Burchinal et al (2011)	USA	NICHD SECCYD	-	344	—	X	—	X	—	—	ORCE,COS	X	—
Burchinal et al (2014)	USA	NICHD SECCYD	-	677	—	—	—	X	—	—	ORCE	X	X
Burchinal et al (2014)	USA	Family life Project	-	849	—	—	—	X	—	—	CLASS	X	X
Cadima et al. (2015)	Belgium	-	30	145	—	X	X	X	—	—	STRS,CLAS S	—	X
Cadima et al. (2016)	Portugal	-	103	485	—	—	—	X	—	—	CLASS	—	X
Chang et al. (2007)	USA	NCEDL/SW EEP	161	345	—	X	X	X	—	—	ECERS,STR S	X	—
Cloney et al. (2015)	Australia	-	462	-	X	—	—	X	—	—	CLASS	—	—

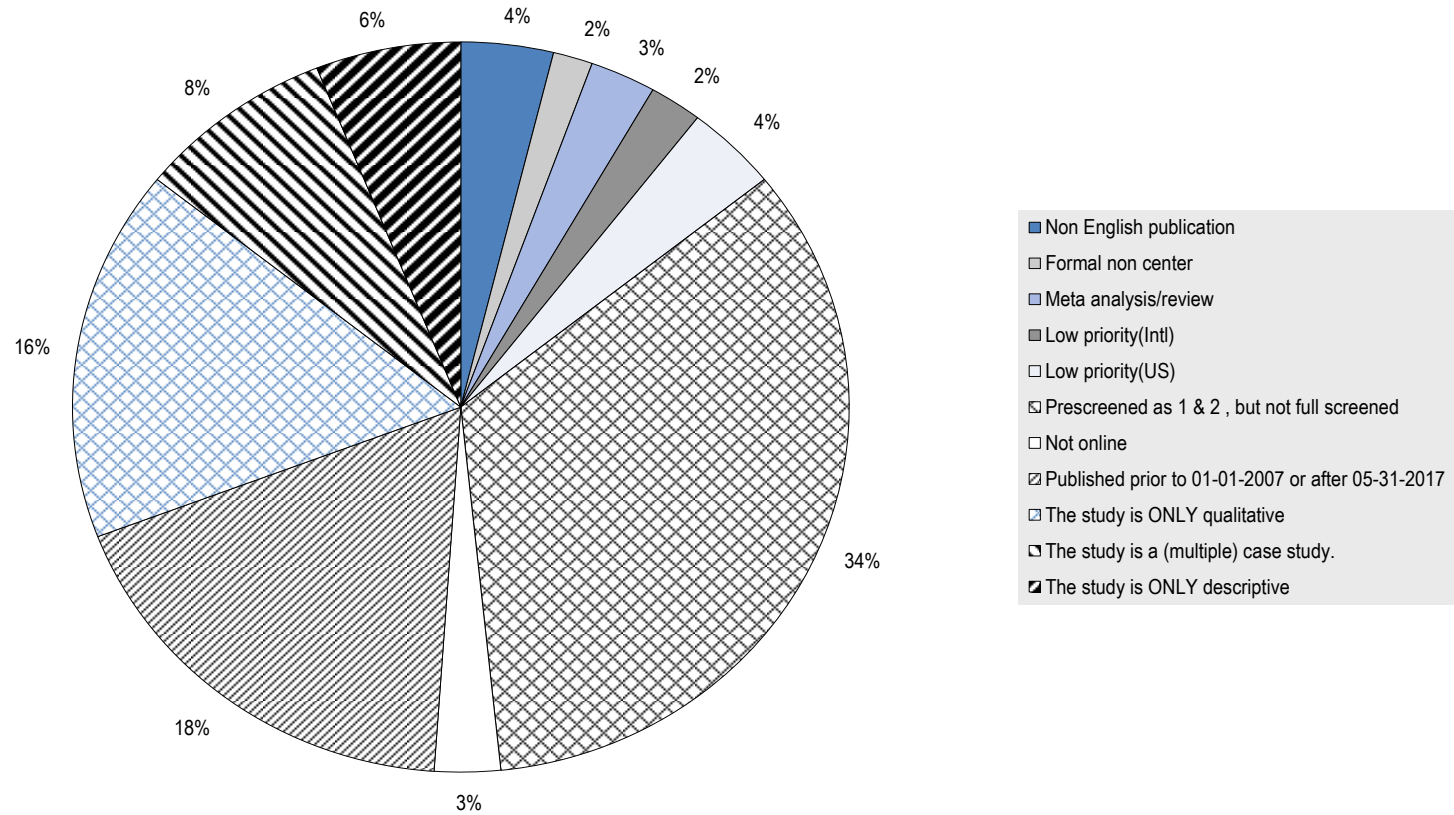
Coley et al (2016)	USA	ECLC-B	-	4250	X	X	X	X	—	X	ECERS	X	X
de Haan et al. (2014)	Netherlands	-	16	92	—	—	—	—	—	X	Activity Coding	X	—
Dennis et al (2013)	USA	-	37	-	—	X	X	X	—	—	ECERS	—	—
Ferreira et al. (2016)	Portugal	-	50	168	—	—	—	X	—	—	STRS	—	X
Guo et al. (2010)	USA	-	67	328	—	—	X	X	—	—	CLASS	X	—
Hatfield et al. (2013)	USA	-	16	-	—	X	X	X	—	—	CLASS	—	—
Howes et al. (2008)	USA	NCEDL/SW EEP	692	2323	X	X	X	X	—	X	ECERS, CLASS, STRS	X	X
Hu et al. (2016)	China	-	162	-	X	X	X	X	—	—	ECERS	—	—
Justice et al. (2008)	USA	-	135	-	—	—	X	—	—	X	CLASS	—	—
Kluczniok et al. (2014)	Germany	-	16	191	X	—	—	—	—	X	ECERS	—	X
Kuger et al. (2016)	Germany	BiKS	97	-	X	X	X	X	—	X	ECERS	—	—
Lehrl et al. (2014)	Germany	BiKS	89	-	—	X	X	—	—	X	Activity Logs	—	—
Lerkkanen et al. (2012)	Finland	First Steps Study	49	515	X	X	X	X	—	—	ECCOM	—	X
McCartney et al (2010).	USA	NICHD SECCYD	-	705	—	—	—	X	—	—	ORCE	—	X
McGinty et al (2012)	USA	-	59	379	—	—	X	X	—	X	ORCE	X	—
Melhuish et al (2013)	UK-Northern Ireland	EPPNI	-	683	—	—	—	X	—	—	ECERS	X	—
NICHD ECCRN (2007)	USA	NICHD SECCYD	-	913	—	—	—	X	—	—	ORCE	X	X
Niklas et al (2016)	Australia	E4Kids Study	121	343	X	—	—	X	—	—	CLASS	X	—
O'Connor et al (2014)	USA	NICHD SECCYD	-	1126	—	—	—	X	—	—	STRS	—	X
Philips et al (2009)	USA	-	106	-	X	—	X	X	—	X	CLASS	—	X
Pianta et al. (2008)	USA	-	113	-	—	X	X	X	—	—	CLASS	—	—
Richter et al (2016)	Germany	BiKS	107	235	—	—	—	X	—	—	ECERS	X	X
Sylva et al. (2016)	United Kingdom	EPPE	-	2701	—	—	—	X	—	—	ECERS	X	—

Shavega et al. (2014)	Tanzania	-	20	320	—	X	X	X	—	—	STRS, CLASS	—	X
Slot et al. (2017)	Netherlands	Pre-COOL	375	-	X	X	X	X	—	—	CLASS	—	—
Smidt et al. (2012)	Germany	BiKS	50	96	—	X	—	—	—	X	Observation	X	—
Strasser et al. (2009)	Chile	-	-	126	—	—	—	—	—	X	Observation	X	—
Tayler et al (2013)	Australia	E4Kids Study	258	-	X	—	—	X	—	—	CLASS	—	—
Vandell et al (2010)	USA	NICHD SECCYD	-	957	—	—	—	X	—	—	ORCE	X	X
Vermeer (2010)	a) Spain		26	-	—	X	X	X	—	—	ECERS	—	—
	b) Netherlands		31	-	—	X	X	X	—	—	ECERS	—	—

Note: CLASS- Classroom Assessment Scoring System, ECERS- Early Childhood Environment Rating Scale, STRS- Student Teacher Relationship Scale, ORCE-Observational Record of the Caregiving Environment, COS- Classroom Observation System.

Source: (von Suchodoletz et al., 2017^[17])

Figure A C.2. Reasons for exclusion of studies after full screening



Source: (von Suchodoletz et al., 2017_[17])

The final step of data extraction included the coding, using a detailed codebook (available upon request from the authors of the meta-analysis or authors of the report). The codebook was developed in close collaboration with the OECD project team, with several rounds of feedback from the OECD team being incorporated. The codebook allowed for fine-grained extraction of different types of information to reflect the complexity of reported study designs and analyses. Extracted information included general information about the study including:

- the primary goal of the reported research and research design;
- information regarding the timing of the data collection;
- the participants, the recruitment procedure, and the country/region where the data was collected;
- the representativeness of the reported sample;
- the population served in the ECEC centres;
- the type and setting of the ECEC centre;
- and the type of publication;
- information about the applied measures for structural and process quality, and for child outcomes; including information about the type of measure, reliability and type of reliability analysis);
- information about the effects (standard deviation, size and significance of effects) and about the type of reported analysis.

Whenever a study reports a relevant finding indicating the strength of the relationship of a structural characteristic and process quality in the ECEC setting (goal 1), or of a structural and/or process quality aspect and a developmental outcome (goal 2), it was included in our coding. The codebook also includes detailed explanations of all categories and codes to facilitate reliability of coding.

We had four coders (one of the PIs and three other coders at the masters and undergraduate levels) extracting the data. For each step, the quality and accuracy of data extraction was checked through 15% of references being pre-screened/screened/coded by two independent coders. The inter-coder agreement was acceptable for the pre-screening, screening and coding, ranging between 80-100%.

Description of studies included in the meta-analysis

The full coding of 44 studies has been completed. Twenty-one of the studies reported research from the United States. Of the remaining studies, 16 reported research from different European countries (Germany [6], Netherlands [2], Portugal [3], and one study each from Flemish Community of Belgium, Finland, Ireland, Spain, and the United Kingdom) and 7 research from other countries (Australia [3], Chile [2], China [1], and Tanzania [1]).

Five of the studies from the United States came from the NCEDL and SWEEP databases (Brock & Curby, 2014; Buckrop, Roberts, & LoCasale-Crouch, 2016; M. Burchinal, Vandergrift, Pianta, & Mashburn, 2010; Chang et al., 2007; Howes et al., 2008), and seven studies from the NICHD SECCYD (National Institute of Child Health and Human Development Study of Early Child Care and Youth Development) database (Bub, 2009; M. Burchinal et al., 2011; M. R. Burchinal, Lowe Vandell and Belsky, 2014; McCartney et al., 2010; NICHD ECCRN, 2007; O'Connor, Scott, McCormick and Weinberg, 2014; Vandell et al., 2010).

The majority of studies from Germany [5] came from the BiKS database (Kuger, Kluczniok, Kaplan, & Rossbach, 2015; Lehl, Smidt, Grosse, & Richter, 2013; Richter, Lehl, & Weinert, 2015; Smidt, Lehl, Anders, Pohlmann-Rother, & Kluczniok, 2012).

Two of the studies from Australia came from the E4Kids (Effective Early Educational Experiences) database (Niklas, Tayler, & Cohrssen, 2017; Tayler, Ishimine, Cloney, Cleveland, & Thorpe, 2013).

Additional databases from large-scale national cohort studies included the First Steps database in Finland (Lerkkanen et al., 2012), the Pre-COOL database in the Netherlands (Slot, Boom, Verhagen, & Leseman, 2017), the Un Buen Comienzo database in Chile (Bowne et al., 2016a), and the EPPE (Effective Provision of Pre-School Education) database in the United Kingdom (Sylva et al., 2013).

The primary goal of the studies was to describe quality in ECEC settings ($n=13$), to explore associations between structural and process quality ($n=11$) and/or associations between ECEC quality and children's development and learning ($n=33$). Fifteen studies reported cross-sectional data (i.e. all data were collected at one measurement point); the remaining studies were longitudinal studies with at least two waves of data collection.

Of the independent samples, (i.e. excluding overlapping datasets by retaining only the largest sample size), the total sample size of the studies coded was 3 110 ECEC staff (lead teachers) and 16 386 children, together from 1,977 ECEC centres. Sample sizes ranged from 92 to 2 938 children, and from 16 to 694 ECEC staff. When reported ($n=26$), the samples were representative at the state/regional level where the data was collected for most studies ($n=22$). Additional studies reported that the study population was representative at the national level ($n=1$: (Slot, Boom, et al., 2017) or at the local level ($n=3$; (Bowne et al., 2016a; Cadima et al., 2016; Phillips et al., 2009). All of the studies that included child data had similar numbers of boys and girls (43% to 53% girls). Children's age was, on average, 66 months (ranging from 37 months to 180 months; $SD=36.9$). When reported, the majority of ECEC staff was female (95% to 100%) and, on average, 37 years old ($SD=4.80$).

The majority of studies ($n=37$) recruited participants in the ECEC setting. With regard to the type of ECEC setting (public and/or private), information was available for 15 studies of which five studies recruited participants from both, public and private ECEC settings. The remaining studies recruited participants from public ECEC settings. The primary population of children served in the ECEC centres was diverse in terms of background and included children from low-income backgrounds, immigrant children, ethnic minority children, and children whose home language is different from the language used in the ECEC centre.

Description of Measures: Structural and process quality

Most studies described structural features of the ECEC setting as part of the sample description. This resulted in vastly different operationalisations of structural quality indicators across studies, thus limiting the comparability of results.

Process quality was operationalised as staff-child interactions in all but 7 studies and most commonly assessed through observational measures. Measures were the Early Childhood Environment Rating Scale (ECERS; (Harms, Clifford, & Cryer, 1998; Sylva et al., 2006); $n=13$), the Classroom Assessment Scoring System (CLASS; (R. C Pianta, La Paro, & Hamre, 2008); $n=16$), the Observational Record of the Caregiving Environment (ORCE; NICHD ECCRN, 1996; $n=7$), and the Classroom Observation System (COS; NICHD

ECCRN, 2004; $n=2$). Nine studies used a self-report measure (in all cases the Student-Teacher Relationship Scale, STRS, was used; (Robert C. Pianta, 2001). Of these studies, the self-report was used in addition to the observational measure in 7 studies. In 23 studies, a global score of the measure was used to describe the quality of staff-child interactions. In addition, 18 studies focused on positive interactions (i.e. warmth, responsiveness, emotional climate), 4 studies on negative interactions (i.e. conflict, permissiveness, negative climate), 10 studies on instructional interactions (i.e. general instructional support and cognitive stimulation but not content-specific instruction), and 8 studies on organisation/management of routines/chaos.

Fifteen studies focused on the quality or more exposure to developmental and educational activity indicators of process quality which were assessed using observational ($n=13$) and self-report measures ($n=2$). Different measures were used across studies, including, for example, the ECERS-E (Harms et al., 1998; $n=3$), the Early Literacy and Language Classroom Observation (ELLCO; (Smith, Dickinson, & Sangeorge, 2002); $n=1$), the Emerging Academics Snapshot (Ritchie, Howes, Kraft-Sayre, & Weiser, 2001; $n=1$), or the Target Child Observation (Kuger, Pflieger, & Roßbach, 2006); $n=1$). Despite the variety of measures, all studies focused on educational activities, i.e. early literacy or early numeracy activities.

None of the studies, however, investigated peer interactions as an indicator of process quality.

Evaluating the quality of the measures used to assess process quality

Most of the studies reported information regarding the reliability of process quality measures ($n=37$ for the measure of staff-child interactions and $n=11$ for the measure of developmental and educational activities). The majority of studies reported alpha reliability coefficients, ranging between 0.68 and 0.95 for the measure of staff-child interactions and between 0.72 and 0.91 for the measure of developmental and educational activities. Some studies reported interrater reliability coefficients, ranging between 0.69 and 0.90 for the measure of staff-child interactions and between 0.71 and 0.90 for the measure of developmental and educational activities.

Description of measures: Child data

Data on children's development and learning was most commonly assessed using standardised performance tests ($n=21$) and ECEC staff/parent ratings ($n=8$). Two studies used self-report measures. Available child data were grouped into emerging academic skills (early numeracy and literacy) and social and behavioural skills (behaviour regulation, executive function, behavioural problems, social competence). Common measures of emerging academic skills included the Peabody Picture Vocabulary Test (PPVT), the Woodcock-Johnson Tests of Cognitive Ability, and ECEC staff or parent rating scales to assess social and behavioural competencies.

Evaluating the quality of the measures used to assess children's development and learning

Information regarding the measures' reliability was limited. Only 17 studies reported reliability information, with alpha coefficients ranging between 0.72 and 0.98. However, in the majority of cases where reliability was not reported, studies used well-established and validated measures.

General analytic approach

Description of effect sizes and preparation of data for estimation of overall effects

One important goal of meta-analysis was to compare multiple studies to estimate the overall, or combined, measure of effect size. For the current analysis, effect size is the degree and direction of association, or correlation, between two variables (e.g. between indicators of structural and process quality for Research Question 1, and between indicators of structural/process quality and child development and learning for Research Question 2).

Most of the studies reported correlation indices in the form of either zero-order correlation coefficient or regression coefficient. The former simply reflects the association between two variables without controlling for additionally related variables, while the latter is mostly produced as a result of multivariate regression where additional control variables are included. Both zero-order correlation coefficient and regression coefficient are standardised, such that a coefficient value ranges between -1 to 1 and being closer to 0 means little association between two variables. A coefficient of negative value would mean that an increase in the measure of one variable is associated with a decrease in the measure of the other variable, while a coefficient of positive value would mean that both variables increase or decrease in same direction. Only standardised coefficients were used in the analyses. Unstandardised coefficients of an association between two variables were standardised by multiplying the unstandardised coefficient with the coefficient of the standard deviation of variable 1 divided by the standard deviation variable 2.

The unit of analysis in this meta-analysis is at the study level – that is, each study that provides at least one effect size measure. Of the 44 studies included in the coding, a total of 34 studies ($n=17$ reporting research from the United States and $n=17$ reporting research from outside the United States) contributed at least one usable effect size in the analysis. Note that at least two unique studies are needed to run a meta-analysis and to obtain an estimate of combined effect size measure. For this reason, any studies that reported an effect size for an association that no other studies reported could not be used. Four studies that reported only unstandardised correlation coefficients could not be used in the analysis, because three did not report standard deviations for variables (Melhuish et al., 2013; NICHD ECCRN, 2007; Robert C Pianta, Mashburn, Downer, Hamre, & Justice, 2008) and the other appeared to report erroneous standard deviation values (M. Burchinal et al., 2010). Without a reported standard deviation for variables, unstandardised correlation coefficients cannot be standardised. Lastly, studies that used special regression methods that did not allow for effect size standardisation (Bowne et al., 2016b; Smidt et al., 2012; Sylva et al., 2013) were also omitted from the analysis.

Of the 34 studies that provided at least one effect size measure in our analysis, 14 studies adjusted their effect sizes by statistically accounting for nesting among subjects. Nested structure within data exists when a group of children are nested within an ECEC staff, and a group of ECEC staff are in turn nested within a centre/program. Adjusting for such hierarchical nesting may improve the accuracy of effect size, by accounting for the similarity among the subjects within a group compared to the subjects nested within other groups. In the current meta-analysis, we did not differentiate effect sizes based on whether nesting was adjusted in original studies.

Aggregation of effect sizes

To increase the number of unique studies for a test, we aggregated variables within a study for the following indicators: for staff-child interactions we combined positive interactions, instructional interactions and organisation/management of routines/chaos into one indicator; for developmental and educational activity, we combined all indicators into one; and for child data we combined behavioural and social-emotional indicators into one. Variables were combined within each study, by first converting effect size measures to z -score via Fisher's z -transformation method and then averaging these z -scores and back-converting the average into Pearson's r correlation coefficient using an equation suggested by (Corey, Dunlap, & Burke, 1998).

Statistical analysis

All statistical analysis was conducted using Comprehensive Meta Analysis software V.3. We used a two-tailed significance level of 0.05 throughout the analysis. Two types of meta-analysis were used in the current study: (general) meta-analysis and sub-group meta-analysis.

First, to estimate the combined measure of association between two variables, we ran a meta-analysis for each association of interest. Twenty such meta-analyses were conducted. An analysis was conducted if there were at least two studies contributing effect size measures; in other words, the sample size of each analysis was at minimum 2 (median=3).

The result of each analysis is presented in a forest plot. In these, original effect sizes reported from each study are depicted as black squares, and a summary effect size depicted as a blue diamond. Summary effect size is the estimated combined association between two variables. A summary effect size not significantly different from 0 (dotted line in a forest plot) would suggest little association, while a positive summary effect size closer to 1 would suggest stronger positive association and the opposite for a negative summary effect size closer to -1.

To obtain a summary effect size, original effect sizes are aggregated by assigning different 'weights' to each effect size (rather than simply averaging all effect sizes), hence the different sizes of black squares. The weighting is done because studies often differ in the precision of reported effect sizes.

There are two models used in meta-analysis, fixed-effect model and random-effects model, which make different assumptions about how to evaluate which effect sizes may be more precise and thus should receive higher weights. A fixed-effect model assumes that there is one true effect size that underlies all the studies in an analysis. As such, observed variability in effect sizes would be only due to sampling error. Under fixed-effect model, an effect size provided from a study with larger sample size receives higher weight because a larger sample size increases the precision of an estimate.

In contrast, a random-effects model allows a possibility that there are multiple true effect sizes and that studies may differ because they reflect meaningful differences among the studies due to the characteristics of their populations. Because each study is assumed to represent a distinct population, weighting is more balanced across studies but is more sensitive to the number of available effect sizes.

A random-effects model is more appropriate when considerable variation is expected among studies, such as in the current meta-analysis where we aimed to compare studies conducted on possibly quite heterogeneous populations from around the world.

However, because of the low sample size per analysis, as well as over-representation of research from the United States with large sample sizes, we flexibly chose between fixed-effect and random-effects model assumptions following these criteria: Whenever there were more than two of US studies plus two non-US studies represented in the sample of unique studies, we used a random-effects model. Whenever there were less than two of either US or non-US studies represented in the sample of unique studies, we used both fixed-effect and random-effects model. Finally, when only US studies were available, we used a fixed-effect model.

Second, we conducted sub-group meta-analysis to test whether effect sizes would vary according to 1) countries and 2) children's socio-economic background. Country comparisons were only possible to conduct across US and non-US studies (i.e. combining all other countries represented in the sample of 34 studies), due to the availability of data. Socio-economic background comparisons were conducted only among studies from the United States.

Because all the nine available studies conducted on disadvantaged children (i.e. children from low-income populations) were from the United States, we restricted the comparison within the United States to reduce potential addition of heterogeneity other than the difference due to children's socio-economic background. In a sub-group meta-analysis, variability of effect sizes across sub-groups is compared to the overall variability of effect sizes. Whether the former is significantly larger than the latter is tested by Cochran's Q-test. We assumed random-effects model for every sub-group meta-analysis, to account for the possibility that two sub-groups being compared may come from distinct populations.

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The first years of life lay the foundations for a child's future development and learning. Many countries have increased their financial support for provision of early childhood education and care (ECEC) over the past years. More recently, the focus of debate has been shifting from expanding access to affordable ECEC to enhancing its quality. A growing body of research suggests that the magnitude of the benefits for children will depend on the level of quality of early childhood services, with especially strong evidence in the case of disadvantaged children.

In light of budgetary constraints, policy makers require the latest knowledge base of the quality dimensions that are most important for ensuring children's development and early learning. However, current research is often narrow in focus or limited to programme-level or national-level conclusions. This book expands the knowledge base on this topic. It draws lessons from a cross-national literature review and meta-analysis of the relationship between early childhood education and care structure (e.g. child-staff ratios, staff training and qualifications), process quality (i.e. the quality of staff-child interactions and developmental activities), and links to child development and learning.

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