



**Ratios for four and five year olds in ECEC programs:
Do we know what's too big and what's too small,
what's just right, and what other factors make a difference?**

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I. Introduction

In Ontario at the present time, four and five year olds (from 3.8 years) in organized early childhood education and care (ECEC) programs may be in settings operating under any of four different ratio regimes. In child care centres and nursery schools regulated under *The Day Nurseries Act*, four and five year olds may be in rooms with ratios of 1:8 as part of 3-5 year old groups, rooms with a 1:10 ratio for junior kindergarten or 1:12 for senior kindergarten groups. Children from 3.8 years to grade one in public/Catholic/independent schools may be in kindergartens under *The Education Act* for part or full days with one teacher and 20 or more children. There is no regulated, set ratio or class size limit in kindergartens under *The Education Act*. The school system-wide goal for elementary (K-3) has been to bring class sizes down to 20 children, although this has not been achieved in all classes¹. Larger kindergartens or those including children with special needs may have an educational assistant.

On any given day, a four or five year old may be in more than one of these ratio regimes. As kindergarten programs do not operate to cover parents' work schedules, four and five year olds in kindergarten may also be in a child care centre or another child care arrangement for the remainder of the parents' work schedule.

The Ontario government has made a commitment to becoming the first Canadian province to move to "full-day early learning" for all four and five year olds. Most of the specific details about this transformation have not yet been determined. However, there are a number of "givens" about the program:

- a) the project is not a feasibility study or a pilot project but a commitment to put the program in place;
- b) it will be a universal program, as Ontario kindergartens for four and five year olds are currently;
- c) it will be implemented through a "phase- in" process, not all at once;
- d) the program will be publicly funded;
- e) from the publicly available information, the general goals of the program appear to be school readiness and parental support.

¹ According to the Ontario Ministry of Education Class Size Tracker in 2008-09 all primary classes have 23 student or fewer and 90.3% have 20 students or fewer. See: <http://www.edu.gov.on.ca/eng/cst/>

Thus, the Ontario full-day early learning program is in the design stage. How the program will be structured is connected to many issues: the educational philosophy, the nature of the pedagogy and what the learning goals will be; who will operate the programs; qualifications of the teacher workforce; the structure of the day; and the program characteristics such as ratio, class size, physical environment, and human resources needed to implement the programs.

Review objectives and research questions

This paper reviews the main literature available on the issue of adult: child ratios in order to answer a number of questions:

- a) What is known about the impact of staff: child ratios or class sizes on program quality (as program quality has a known effect on child outcomes)?
- b) What is known about effects of different staff: child ratios or class sizes on child outcomes for four and five year olds?
- c) What other factors should be taken into account (e.g. teacher qualifications, child population characteristics, and pedagogy).

This report reviews research and expert opinion from the child care, kindergarten and international literature on early childhood education and care (ECEC) regarding these issues.

Method

A literature search consulting several major information sources was undertaken:

- a) An initial scan was conducted of the Childcare Resource and Research Unit (CRRU's) reference library index, the Childcare Information Research Collection (CIRC). CIRC spans the time period 1982 to February 2006;
- b) Online indexes of journal articles were accessed through the Guelph University Library system. Indexes accessed included: Educational Research Information Clearinghouse (ERIC) (which includes significant "grey" literature in the form of reports as well as peer-reviewed articles, PsycINFO and the Proquest Research Library;

c) The online research collection Child Care and Early Childhood Education Research Connections, a partnership of Columbia University, the University of Michigan, and the U.S. Department of Health and Human Services.

Keyword searches were conducted using the following words: kindergarten, pre-kindergarten, pre-K, child care, day care, preschool, pre-school, ratio, adult child ratio, teacher student ratio, group size, class size, and classroom structure.

“Grey literature” (reports from organizations, reports for government, etc.) was accessed through ERIC, Google and Google Scholar. Articles followed up from other sources were located through direct searches of journals’ archives. Well-known large-scale studies of quality (such as *You Bet I Care!* and *Cost, Quality and Child Outcomes*) were reviewed directly for their findings on ratio and class size.

The cut-off date for the literature search was November 2008. In instances where there were many reports from a large study, a peer-reviewed article was included as the primary source if it was available but technical reports were consulted as well.

Articles/reports that fall into three categories were included:

- a) Reviews of pertinent literature ;
- b) Overviews of ECEC that comment significantly on the role that ratios play in ECEC programs (both of these may include recommendations for ratios);
- c) Articles/reports on empirical research.

Selected articles were reviewed using a set of common information categories and each article was entered in a template. These templates are included in the Appendix.

Limitations of the literature

The available literature is not voluminous and the literature found has a number of significant limitations:

- a) Multiple program types. There are multiple, sometimes not comparable, program types. This review examined research in a number of jurisdictions internationally and covering programs designed for ‘education’ and ‘care’ or sometimes both. Thus, the programs studied include kindergartens and child care centres in Canada; U.S pre-kindergartens, K-3 and child care centres; U.K school-based, community-based, and private nursery classes and schools; as well as other

international school-based and community-based early childhood education and care programs. It was not always possible to generalize and compare across program types and jurisdictions due to different pedagogical approaches and teacher training.

- b) Age groups included. There are few studies or analyses identified in this report that studied only four and five year olds. The total age range in the studies found is birth to twelve. Sometimes (often) the data for four and five year olds, or even for three to five year olds are not separable from that for other age groups. Where possible, findings for specific age groups are identified.
- c) How ratio, group or class size is measured. Several studies look at the requirements for ratios set out in child care regulations. Other studies look at the actual ratios observed in child care centres but measure them in a variety of ways: some divide the total number of centre spaces by the total number of employed teachers/staff; others divide the number of spaces by the staff working at any given time; others use observed ratios, by visiting the settings to view the average ratio, sometimes at more than one time.
- d) Terminology. Some studies use the terms ‘lower’ ratios while others use the term “higher” for the same thing.

In addition, it should be noted that what is defined as ‘smaller’ classes in studies in kindergarten is often ‘bigger’ in studies of child care centres. For example, while a class of 20 with one teacher is considered small in much of the kindergarten literature, a 1:20 ratio for this age group would be considered extremely large in the child care context.
- e) Specificity. Many studies lack clear information about the ratios being examined, or which specific ratios had significant results. Specific numbers are included where they are available.
- f) Missing information. There are sometimes key pieces of information missing from the descriptions in studies. This may not be apparent unless the researcher comments specifically. For example, in a study of French école maternelles, US researchers Howes and Marx (1992) note that only the highly qualified teacher is included in the national ratio standard, while other contact staff are not,

contrasting this to the US practice. This kind of information is often not included, leaving the reviewer to read between the lines.

Definitions

The terms ‘ratio’, ‘class size’ and ‘group size’ are related but not the same. ‘Ratio’ and ‘group’ size are used with regard to child care centres and nursery schools; ‘class size’ is usually used in the kindergarten literature. Ratio generally means the number of children per adult; group size means the number of children in one room or space usually with more than one adult (qualified or not). Class size generally means one teacher with a group of children where there might or might not be other adults – aides, or assistants usually.

The terms ‘higher’ and ‘lower’ used to describe ratios are used inconsistently throughout the research. Some researchers use the term ‘higher’ to describe a situation in which there are more children per adult, while other researcher use the term ‘lower’ to describe the same situation and the term ‘higher’ to describe its opposite. In this report we will use the terms ‘fewer’ or ‘more’ children per adult wherever possible. In some cases (in the interest of clarity and brevity), we may use the terms ‘better’ or ‘worse’ ratios.

II. Summary of findings

What is known about effects of difference staff: child ratios on child outcomes for four and five year olds?

Effects on academic/cognitive/language outcomes

Overall, the research shows that fewer children per adult ('better' ratios) during the preschool/ kindergarten period (children aged approximately 4-5 years) are associated with higher scores on various developmental outcomes, although other factors such as group size, and teacher qualifications are found to be inextricably linked in the associations (Bennett, 2008; Fiene, 2002; HEROS Inc., 1997; Mathers, Sylva, Hansen, Plewis, Johnson, & George, 2007; Nye, Hedges, & Kostantopoulos, 2000; Ruopp, 1979; Vandell & Wolfe, 2000).

The literature shows a number of associations between ratios or class size and specific developmental outcomes. Vandell and Wolfe (2000) found that fewer children per adult (1:9 or 'better') during the preschool period are found to be associated with higher scores on mathematics, reading and language performance. However, this study examines children aged birth to school-age and findings are not divided by age group. In a UK study of 3-5 year olds, centres with 'worse' ratios (i.e., more children per adult) showed a correlation with lower scores on measures of language and reasoning (Mathers, Sylva, Hansen, Plewis, Johnson, & George, 2007). In a re-examination of Project STAR in the US (Student/Teacher Achievement Ratio) data, a significant association was found between smaller class sizes (13-17) and mathematics and reading scores for children K-3 (Nye, Hedges, & Kostantopoulos, 2000). In a British study tracking the impact of reducing class size, when class sizes were reduced from 30 to 20 (particularly below 25) there were significant gains for children aged 4-5 years in literacy over the first year, especially for children who are low attainers at school entry. No effect however was found for mathematics scores (Blatchford, Bassett, Goldstein, & Martin, 2003). Ruopp's US study (1979) found that preschool-age children in smaller groups (groups ranged from 8-36) showed greater gains on Preschool Inventory (PSI) and the Peabody Picture Vocabulary Test (PPVT) than those in larger groups. In the Project STAR data, gains

evident in the first year (kindergarten) persisted into later years but there was no cumulative statistically significant gains in future years (HEROs Inc., 1997).

Other studies did not find significant effects of ratio on developmental outcomes. In a study measuring classroom quality in prekindergarten and the development of academic, language and social skills, the researchers found a lack of significant associations between the National Institute for Early Education Research (NIEER) benchmarks (including class size and ratio standards of a maximum group of 20 with no more than 1:10, respectively) and 4- year- old children's development. Burchinal, Pianta, Bryant, Early, Clifford and Barbarin (2008) found that the quality of children's classroom experience rather than specific structural features (i.e., ratio, group size, teacher qualification) predicted more growth in children's academic skills and behaviours.

Effects on social/emotional development and behavioural outcomes

Ratios and class sizes are found to be correlated with social outcomes. Overall, most studies find evidence that smaller class sizes and fewer children per adult are associated with better ratings on social outcomes.

Preschool-aged children in programs with 'better' ratios were observed to be more responsive to adults and peers and show increased verbal initiative and conversation (Ruopp, 1979). This study also observed more cooperative behaviour among children aged 3-4 years with 'better' ratios. Palmerus (1996) found with children aged 1-7 years (a majority in study were 3-6 years), the proportion of child-initiated verbal activities with caregivers decreased with 'worse' ratios while adult-initiated verbal activities increased. Blatchford et al. (2003) found that children in larger classes in the UK (26-30+) spent more time with each other and that this applied to interactions about work and social matters.

Smaller class sizes and 'better' ratios are correlated with fewer child behavioural problems in several studies. In the UK, Blatchford et al. (2003) observed fewer behavioural problems in smaller classes with fewer than 20 children compared to larger classes with more than 30 children. Vandell & Wolfe (2000) made this observation in child care centres with ratios of 1:9 and less (although findings were not divided by age

groups). Less anti-social child behaviour was also observed in smaller kindergarten classes (20 or less) by Finn & Pannozzo (2004).

What is known about the effects of staff: child ratios on program quality and teacher and classroom processes?

In addition to research that looks directly at ratios' potential impact on child outcomes, relevant research also focuses on how staff: child ratio and class size influence child outcomes through their relationship to program quality (these are generally from the child care literature), as well as through their influence on teacher and classroom processes, which in turn have an impact on child outcomes. Research of this kind tends to treat ratio in its context as just one element of structural quality (along with staff education and training, group size, wages and working conditions) that may influence process quality or factors like teacher classroom behaviour, teaching style, or child-teacher relationships that affect children.

Effects of staff: child ratios on global quality

Some of the strongest and most influential research evidence in support of better ratios comes from the Cost, Quality, and Outcomes Study (Helburn et al., 1995), although findings are not separated by age group. This major American study looks at structural predictors of child care quality (as measured by the Early Childhood Environment Rating Scale [ECERS]/Infant/Toddler Environment Rating Scale [ITERS], Caregiver Involvement Scale, and Adult Involvement Scale) in 401 child care settings. The final report concludes that, while group size, staff wages, turnover, and curriculum support all play a role in the production of quality, "in regression analyses to predict the determinants of quality, the staff: child ratio is the most significant determinant of quality, even when controlling for other factors affecting quality" (ibid, p.320).

These findings are supported in earlier and subsequent investigations of child care quality (Phillips, Howes & Whitebook, 1992; Phillips, Scarr, McCartney & Abbott-Shim, 2000; Shim, Hestenes & Cassidy, 2004; Vandell & Wolfe, 2000), including Canadian research (Doherty & Stuart, 1997; Goelman, Forer, Kershaw, Doherty, Lero & LaGrange,

2006). Using data from the Canada-wide You Bet I Care! study of 326 child care classrooms, Goelman et al. (2006) found that the number of staff observed in a room (along with staff education and satisfaction) is a significant direct predictor of child care quality scores, although (again) results for four and five year olds are not separated from other results.

Other studies (Blau, 2000; Cryer, Tientze, Burchinal, Leal, & Pacios, 1999; Howes, Burchinal, Pianta, Bryant, Early, Clifford & Barbarin, 2008) are more equivocal about the importance of ratios to child care quality, although none has argued that ratios are unimportant. For example, Blau (2000), in a re-analysis of the Cost Quality and Outcomes Study found that ratios to have a smaller impact on quality than originally thought, once unobserved differences (i.e., leadership ability of the centre director or enthusiasm of the staff) are taken into account.

In a strong reminder of the importance of taking into account the mix of structural features (as well as cultural context and program pedagogy) Cryer et al.'s 1999 cross-national study of quality concludes that while there was little difference in the process quality (i.e., the overall global quality of an ECEC program observed and measured directly) of the programs studied, the countries “emphasized different structures as they created that process quality” (p.348). For example, while the US has better ratios (fewer children per adult) than the European countries in the studies (Germany, Portugal, Spain), the lead teachers in the US studies have less experience and tenure. Moreover, the structural features correlated with ECERS scores are not consistent across the countries. Ratio is found to be a predictor of quality in Germany and the US, but not in Portugal or Spain.

Overall, while some research raises questions about the *singular* importance of ratios, there is general agreement that when taken together with such structural factors as group size, staff training, wages, and experience, ratios are a key part of a package of important structural features that are important to the achievement of the global quality that has an impact on child outcomes in ECEC programs.

Effects of staff: child ratios on teacher and classroom effects

The relationship between staff: child ratio, class size, quality, and child outcomes is summarized well by Blatchford, Bassett, Goldstein and Martin (2003) in their discussion of the British Class Size Study. The authors explain that it may be through class size's impact on teacher and classroom processes that quality is increased, which in turn may result in improved student achievement (See Figure 1 for Blatchford et al.'s conceptualization). In the British Class Size Study, which looked at small, medium and large classes (small - less than 20; large - greater than 30 students), class size was found to have an impact on teachers' ability to give individual learning support and task time, teachers' classroom management techniques, and teacher stress. Specifically, teachers experienced greater difficulties in classes of 25-30 students, while there is more individual teacher contact with pupils and more support for learning found in medium or smaller classes of 25 students or fewer.

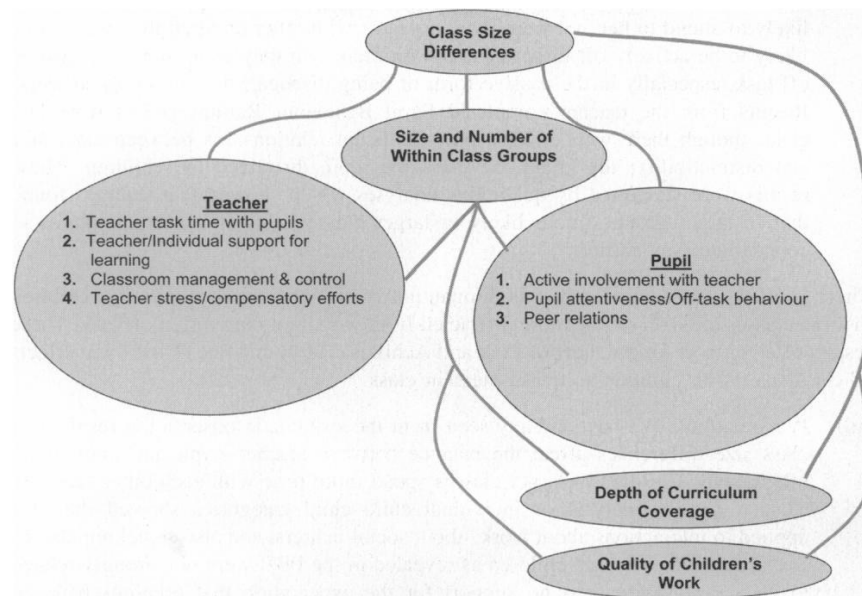


Figure 1. Blatchford, Bassett, Goldstein and Martin (2003). Conceptualization of the relationship between class size, teacher and classroom processes, and child outcomes

Blatchford et al.'s (2003) conclusion is widely supported by other research in both child care and school settings, although some studies have examined much smaller class or group sizes than 20 and better ratios. In a study of an earlier American class size reduction initiative, Project SAGE (Student Achievement Guarantee in Education) (Allen

& Kickbush, 1995) found that a reduction of class size to 15 students for children in grades K-3 was correlated with a reduction of discipline problems and classroom management issues, as well as increased time spent on instruction.

One piece of seemingly contradictory evidence comes from the UK's Millennium Cohort Study (Mathers, Sylva, Hansen, Plewis, Johnson & George, 2007). The study found that while fewer children per adult was associated with more teacher child interaction as well as better provision for diverse needs, larger classes were found to be higher quality than smaller classes. The authors speculate about their unexpected finding by pointing out that larger rooms may be able to provide a more interesting range of activities for children, and may also be led by a larger staff team with a broader range of experiences, interests and expertise. It is important to note that ratio requirements were not equivalent across all program auspices: poorer (1:13) ratios were required in local authority-maintained nurseries (public) and better ratios (1:8) were required in privately-operated facilities, so there may have been other differences as well. *Within* sectors (i.e. once the sector is accounted for), better ratios improved the quality of provision.

Similar results were found in a longitudinal study from New Zealand (Wylie, Thompson & Kerslake Hendricks, 1996) that found that more children per adult were associated with higher quality. However, similarly, once the researchers controlled for program type and compare quality *within* each program type (the study included a wider range of settings than the UK study), *fewer* children per adult and smaller group sizes were found to be associated with higher quality.

In the child care literature, the National Day Care Study (Ruopp, 1979) was one of the first to find that in rooms with fewer children per adult, lead teachers had increased social interaction with children. Teachers spent less time managing (correcting/commanding) the class and more time on centre-related activities and interaction with other adults. In his review of child care quality indicators, Fiene's review (2002) concluded that in groups with fewer children per adult (Fiene's review defines "fewer" as 9:1), caregivers tended to be more actively involved and spent more time interacting with children, were more responsive, more socially stimulating, and less restrictive. In addition, Fiene concludes that the presence of additional caregivers reduces the amount of irritability and restrictiveness that caregivers express towards the children

in their care. In a study of American preschools, Shim, Hestenes & Cassidy (2004) found that fewer children per teacher was associated with higher quality, student teacher interactions and more positive teacher behaviour; smaller group size was found to be important as well. Mashburn, Hamre, Downer and Pianta (2006) found that pre-kindergarten teachers' ratings of children's social activities were higher when there were fewer children per teacher in the program.

Other researchers point to the impact that ratio and group/class size can have on classroom group behaviour (as opposed to either teacher or individual student behaviour). Finn and Pannozzo (2004) found that while kindergarten class size does not have an impact on ratings of *individual* student behaviour, at the classroom level smaller classes are rated as being more engaged in appropriate behaviour, along with developmentally appropriate activities, than are large classes. Palmerus (1996) found, in a study of children aged 1-7 years (majority studied were 3-6 years), that children's opportunities to initiate verbal interaction with a caregiver are a function of staff: child ratio.

What other factors in addition to staff: child ratios should be taken into account?

The large majority of studies examined identify the inextricable linkage of staff: child ratios, class size (kindergarten), group size (child care), and qualifications. It is often identified that divorcing these factors to study their effects independently is complicated (Barnett, Schulman & Shore, 2004; Blatchford et. al., 2003; Doherty & Stuart, 1997; European Commission Childcare Network, 1996; Munton et. al., 2002; Phillips, Howes, & Whitebook, 1992; Ruopp, 1979; Vandell & Wolfe, 2000)

Teacher/staff qualifications

The importance of understanding how ratios are linked to qualifications is exemplified in the French study by US researchers Howes & Marx (1992) that suggests that better teacher training and working conditions may offset having more children per adult, as found in the French system. Other structural factors shown to have an impact on quality and outcomes are wages, working conditions (e.g., availability of support staff), and staff

turnover (Goelman, et. al., 2006; Helburn 1995; Howes, Phillips, & Whitebook, 1992; Phillips, et. al., 2000).

The nature of the child population- vulnerability and disadvantage

The child population also mediates the impact of ratios. Several US and UK studies look specifically at outcomes for disadvantaged or vulnerable populations (Allen & Kickbush, 1996; HEROS Inc, 1997; Mashburn et al., 2006). A study in the United Kingdom found the most significant gains in developmental outcomes with children that were low attainers at school entry (Blatchford et. al., 2003). The most significant findings from smaller class size in Project STAR was for disadvantaged and immigrant children (HEROs Inc., 1997) It is also suggested that the proportion of children with disabilities and special needs in classrooms should be considered in determining ratios are set (Barnett, et al., 2007; European Commission Childcare Network, 1996).

Classroom composition

Classroom composition can have an impact on the effects of ratios and group size. Classroom composition can be defined in various ways with ratios, class size and teacher qualifications all components of classroom composition. One example of how a factor in classroom composition can have an influence on the effect of class size and outcomes is given by Blatchford, et al., (2007). The UK study found a positive association with child-to-child interaction in large (30+) classes. One explanation given for this finding is that in larger classes, the strategic organizing of smaller groups *within* the class may have a positive influence on outcomes.

Staffing structure has also been shown to have an impact. Shim, Hestenes and Cassidy (2004) found that while lower ratios and smaller group sizes are related to more positive teacher behaviours, higher quality and more positive interactions, they also noted that a co-teacher structure is associated with higher quality compared to a hierarchical teacher structure or a single teacher structure. In their *40 Quality Targets for Services for Young Children*, the European Commissions Childcare Network (1996) discusses the idea of staff collectives and absence of hierarchal structure to fostering good relationships

with children. It is argued that the cooperative organization of staff promotes cooperative relations among children.

III. Discussion

In the past few years, a number of expert reviews and recommendations based on the ECEC literature have commented on the issue of ratios. These are worth considering here both for their overview perspectives on quality, child development and structural variables such as ratio as well as for the expert points of view.

In the 1980s-1990s, the European Union (EU) established a cross-national child care network to make recommendations about issues pertaining to early childhood education and care. One of the outcomes of this decade-long project was a set of 40 Quality Targets. Noting the complexity of setting a Europe-wide ratio target and the many factors that must be considered in doing so, the ratio target agreed to in 1996 by the Childcare Network was 1:15 (one adult to fifteen children) for children aged three to six years. The Network specified that ratios should “usually be more than [less children per adult] but should not be less than” those recommended and that “at least 1/10 of the working week should be non-contact time allocated to preparation and continuous teaching” and “administrative, domestic and janitorial work should be allocated staff time or hours in addition to those hours spent with children” (2004: C27). The report emphasizes the importance of such things as group size, characteristics of children (i.e., disabilities or social need), attendance patterns and hours, qualifications and organization of staff, and the pedagogical and philosophical concepts underpinning the system.

The US National Association for the Education of Young Children (NAEYC) first made recommendations about staff: child ratios linked to group size as part of the group’s accreditation criteria in the late 1980s. These were subsequently revised: the NAEYC’s current recommended ratio/group size for four and five year olds are: 1:8/16; 1:9/18; and 1:10/20; 1:11/22; 1:12/24 for kindergarten. They stipulate that ratios should be lowered when one or more children in the group need additional adult assistance to fully participate in the program (2007).

A ten year international comparative analysis by the Organization for Economic Co-operation and Development (OECD) includes recommendations about ratios specifically with regard to Canada. In the OECD's review of Canadian ECEC in 2004, the international team noted that in the kindergartens they visited, they found "child/staff ratios in excess of the 15:1 practiced in kindergarten in most [other] countries". They went on to observe that

the research indicates that a ratio of 15:1 in kindergartens is an upper limit for children under five years (see, for example, Research Report, No. 320 of the Department for Education and Skills, London, 2002), and that for more individualized attention, lower ratios are more appropriate. This is generally recognised in the child care sector, which leads to curious situations in OECD countries where the Education Act may allow groups of 25:1 or more in kindergarten settings catering for 3-4 year old children, while the corresponding Child Care Act allows a maximum ratio of 10:1 for children of the same age in child care services" (OECD 2004: 59).

The research report cited by the OECD is by Munton, Mooney, Moss, Petrie, Clark and Woolner, (2002) and Munton, Barclay, Mallardo and Barreau (2002). This UK Department for Education and Skills report consists of two sections, a review of the literature on ratios and an empirical study. The literature review of 12 empirical studies, found that

research evidence... is consistent with the view that staff: child ratios can have a significant impact on the quality of care that children receive. Broadly speaking, the more staff that work with children, the better the quality of care is likely to be. However, the influence of staff: child ratios on quality is inextricably linked to other elements of the care environment including staff education and training, staff salaries and group size (2002:11)

The OECD's *Starting Strong 2* discussed poor ratios as one of the structural barriers to quality and noted that the range of ratios for three to six year olds observed among the countries studied ranged from 1:7 in the Nordic countries to 1:25 in Korea, Ireland and Mexico (2006: 131).

The Rutgers University-based (New Jersey) National Institute for Early Childhood Education Research's (NIEER) Quality Standards Checklist is used for assessing state preschool and child care programs. NIEER's recommended standard is to limit "class sizes to 20 at most, and to have no more than 10 children per teacher" (2007:

26), NIEER states that “a ratio of 1:10 is smaller than in programs that have demonstrated large gains for disadvantaged children and is the lowest (fewest number of teachers per child) generally accepted by professional opinion” (2007: 26).

Most recently, UNICEF’s Innocenti Research Centre has developed a set of 10 benchmarks or indicators of ECEC provision. One of the quality benchmarks is specifically concerned with ratios:

The child: trained adult ratio for 4-5 year olds in publicly subsidized, centre-based services is not greater than 15:1 and group size does not exceed 24 children per group (2008b: 26).

It is important to note that this benchmark specifies that the adults included in the ratio are staff trained or educated in early childhood, consistent with much of the research, which supports the idea that ECEC training at a post-secondary level is key. The background paper to the main report goes on to say.

For children aged 4-5 years, the benchmark proposed here requires that maximum group size should be no larger than 24, and that overall, the child: trained adult ratio should not exceed 15:1. The ratio, therefore, is not 15 children per lead educator. What is implied rather is a lead educator for every group of 24 children, supported by at least one trained child assistant. The ratio of 24:2 may be considered far too lax in the United States and the Nordic countries, and too demanding in the state early education services of some Asian and European countries (UNICEF, 2008a: 27).

IV. Conclusions

Several conclusions can be drawn from this analysis of effects of adult: child ratios on child development for four and five year old children.

1. The research indicates that adult: child ratios are important. Overall, the research shows that fewer children per adult (‘better’ ratios) during the preschool/ kindergarten period (children aged approximately 4-5 years) are associated with higher scores or assessments on academic, cognitive, social and behavioural outcomes (Bennett, 2008; Fiene, 2002; HEROS Inc., 1997; Mathers, Sylva, Hansen, Plewis, Johnson, & George, 2007; Nye, Hedges, & Kostantopoulos, 2000; Ruopp, 1979; Vandell & Wolfe, 2000). Better ratios are also shown to have an impact on staff: child interactions and classroom effects and on the global quality of ECEC programs, all of which are shown to have

effects on child outcomes (Helburn et al, 1995; Phillips, Howes & Whitebook, 1992; Phillips, Scarr, McCartney & Abbott-Shim, 2000; Shim, Hestenes & Cassidy, 2004; Vandell & Wolfe, 2000), including Canadian research (Doherty & Stuart, 1997; Goelman, Forer, Kershaw, Doherty, Lero & LaGrange, 2006).

2. While there is a general assumption that ‘smaller is always better’, this is not necessarily so. Ratios and class size cannot be considered independently of a number of other factors particularly pedagogy and approach, staff qualifications, group size, working conditions, classroom structure and composition (Howes and Marx, 10090; Blatchford et al, 2003; Sylva et al, 1997; Burchinal et al, 2008; Wylie, Thomas and Kerslake, 1996; Munton et al, 2002). Thus, “better” ratios may not necessarily be better if teachers do not have a background in early childhood, or spend considerable time engaged in administrative or janitorial activities.

3. A number of commentators (Bennett, 2008; Munton et al, 2002; European Commission Childcare Network, 1996) make a strong argument that an important first step to considering the issue of ratio is to be clear about the nature of the program and the pedagogical approach to be taken. Munton et al. (2002) observe that

early years services both within and between countries can have very different aims and objectives. For this reason, it often makes no sense to make direct comparisons of quality between two or more different countries. The services may be modeled on completely different notions: 6).

4. While this review of the available literature on the effects of adult: child ratios on outcomes for four and five year olds in ECEC makes it clear that there is no ‘magic’ ratio number per se, the research suggests that a model for ECEC classes for four and five year olds based on a group of 22-24 children with two adults, assuming that both have education related to working with young children in an ECEC setting and assuming that the children in the class are not overwhelmingly high need (in which case additional adults would be required) would be reasonable and appropriate (UNICEF, 2008; Munton et al, 2002; Bennett, 2008; Fiene, 2002; HEROS Inc., 1997; OECD, 2004).

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Appendix A
Template summaries of studies used in literature review

STUDY

Title:	The student achievement guarantee in education(SAGE)
Author:	Allen, R. & Kickbush, K.
Publication Year:	1996-
Source:	
Main focus of study:	National attempt to improve student achievement of children living in poverty by lowering teacher-student ratios to 1:15 in the early grades.
Who conducted the study?:	Wisconsin Education Association Council
Peer reviewed, Y/N:	N
Ratio or class size:	Ratio
Ranges of ratios, class sizes examined:	For SAGE program class ratios reduced to 1:15
Ages studied:	Kindergarten to grade 3
Sample size:	30 schools, 21 districts
Form of education/care (child care, kindergarten, pre-k):	Kindergarten- grade 3
Where was the study conducted?:	USA: Wisconsin, Milwaukee
Child outcomes/quality measured:	Academic outcomes (math, language arts)
Child outcome/quality measures:	
Other influential factors (qualifications, day length, particular study groups):	
Relevant intervening variables:	
Brief abstract (main findings):	<p>SAGE website: http://www.weac.org/sage/default.cfm</p> <p>In June, 1995, the Student Achievement Guarantee in Education (SAGE) program was signed into law as a five-year pilot program. The program was intended to improve education by reducing class sizes in grades K-3 to no more than 15 students. In addition, districts had to agree to turn schools into “lighted schoolhouses” that are open for extended hours, to develop rigorous academic programs, and to establish and implement plans for staff development and accountability.</p> <p>Findings reveal that discipline problems and classroom management issues were greatly reduced with reduction of class ratios to 1:15. The direct beneficiary of this reduced time spent on managing the class was increased time spent on instruction.</p> <p>Evaluation of the first two years of the program showed that students in the SAGE schools scored significantly higher than students in the comparison schools in reading, language arts, and mathematics.</p> <p><i>A picture that has not emerged is a clear difference among the four main types of SAGE classrooms (variations of the 1:15 ratio teacher composition in classrooms, i.e., 2 teachers 30 students, 2 classrooms with 1 floating).</i></p>

OVERVIEW

Title:	The state of preschool 2007: State preschool yearbook
Author:	Barnett, W.S., Hustedt, J., Friedman, A., Boyd, J.S, & Ainsworth, P.
Publication Year:	2007
Source:	National Institute for Early Education Research (NIEER)
Main focus of study:	Annual report profiling state-funded prekindergarten programs in the United States.
Who conducted the study?:	NIEER
Peer reviewed, Y/N:	N
Ratio or class size:	Ratio and class size
Ranges of ratios, class sizes examined:	Ratio 1:10, and class size maximum 20 recommended
Ages studied:	Prekindergarten, 3 and 4 year olds
Sample size:	
Form of education/care (child care, kindergarten, pre-k):	Prekindergarten
Where was the study conducted?:	USA
Child outcomes/quality measured:	
Child outcome/quality measures:	
Other influential factors (qualifications, day length, particular study groups):	
Relevant intervening variables:	
Brief abstract (main findings):	<p>In the NIEER Quality Standards Checklist states are expected to limit class sizes to maximum 20 children and have no more than 10 children per teacher. With smaller classes and fewer children per teacher, children have greater opportunities for interaction with adults and can receive more individualized attention.</p> <p>The importance of class size has been demonstrated for both preschool and kindergarten. A class size of 20 is larger than the class size in many programs to produce large gains for disadvantaged children. A ratio of 1:10 is smaller than in programs that have demonstrated large gains for disadvantaged children and is the lowest (fewest number of teachers per child) generally accepted by professional opinion.</p>

REVIEW

Title:	Class size: What's the best fit?
Author:	Barnett, S., Schulman, K. & Shore, R.
Publication Year:	2004
Source:	National Institute for Early Education Research, Policy Brief
Main focus of study:	Reviews research and provides policy recommendations on preschool ratios. (Literature Review)
Who conducted the study?:	National Institute for Early Education Research
Peer reviewed, Y/N:	N
Ratio or class size:	Class size and ratio
Ranges of ratios, class sizes examined:	NAEYC prekindergarten recommendations: Group size no more than 20 children and ratios of no more than 10 students per teacher. State standards of class size and ratio on pg 3 of report.
Ages studied:	3-4 year olds
Sample size:	
Form of education/care (child care, kindergarten, pre-k):	Childcare and prekindergarten
Where was the study conducted?:	USA
Child outcomes/quality measured:	Language, aggressiveness, academic achievement (esp for minority students), health and safety.
Child outcome/quality measures:	
Other influential factors (qualifications, day length, particular study groups):	Teacher qualifications,
Relevant intervening variables:	Teacher time allocation, center director's leadership skills, teacher capabilities, children needing individualized attention,
Brief abstract (main findings):	<ul style="list-style-type: none"> - The review finds that research suggests that in smaller classes teachers provide more stimulating, responsive, warm and supportive interactions; programs are higher quality. - The review concludes that smaller groups can have a positive impact on child outcomes <p>Policy recommendations:</p> <ul style="list-style-type: none"> - All states should set research-based program standards that jointly address class size, ratios, teacher qualifications and teaching practices. - Reductions in class size can be phased in gradually and should be accompanied by adequate financial support so as to avoid unintended consequences. - Policies that support teachers in adapting their teaching to smaller class sizes may maximize the benefits of class size reduction. - Given the potential benefits and costs of class size reduction, the federal and state governments should conduct experiments with different class sizes to identify the optimal class size for classrooms with various mixes of children with economic and other disadvantages, including special education needs.

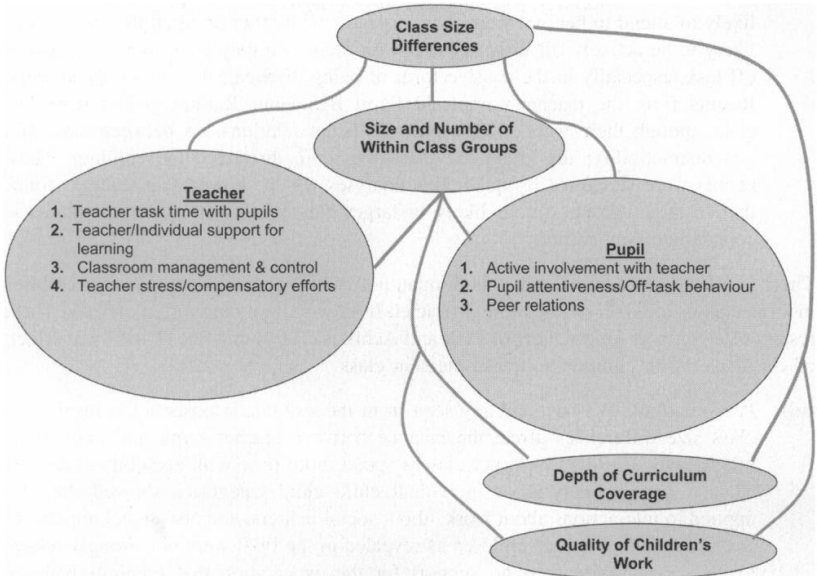
REVIEW

Title:	Benchmarks for early childhood services in OECD countries
Author:	Bennett, John
Publication Year:	2008
Source:	UNICEF, Innocenti Research Centre
Main focus of study:	Setting standards in early childhood field. (Literature Review)
Peer reviewed, Y/N:	N
Ratio or class size:	Ratio and group size
Ranges of ratios, class sizes examined:	4-5 year olds 15:1; group size 24
Ages studied:	0-6,
Form of education/care (child care, kindergarten):	ECEC including child care, kindergarten, blended
Where was the study conducted?:	International – 25 countries
Relevant intervening variables:	Qualifications, composition, cultural expectation, population - disadvantaged children, special needs
Brief abstract (main findings):	<p>RECOMMENDED BENCH MARK -<i>The child :trained adult ratio for 4-5 year olds in publicly subsidized, centre-based services is not greater than 15:1 and group size does not exceed 24 children per group.</i></p> <p><i>Definition of the indicator:</i> For children aged 4-5 years, the benchmark proposed here requires that maximum group size should be no larger than 24, and that overall, the child:trained adult ratio should not exceed 15:1. The ratio, therefore, is not 15 children per lead educator. What is implied rather is a lead educator for every group of 24 children, supported by at least one trained child assistant.</p> <p><i>In sum, cultural expectations are suggested as being the primary factor in deciding what child: staff ratios are suitable. It would seem a more convincing explanation is to posit that a range of structural characteristics (adult: child ratios, educator qualifications and work conditions, pedagogical expertise, group process and practice, cultural expectations) determine quality, and that no one structural characteristic can uniquely predict process quality.</i></p> <p>In view of the strong correlation between structural and caregiver characteristics and children's academic, cognitive, behavioural and social development, Vandell and Wolfe (2000) conclude that smaller group sizes, lower child-caregiver ratios, and more caregiver training and education appear to have positive effects on important developmental outcomes. The probable reason is that with fewer children, educators can engage in more caring and supportive relationships with children.</p>

STUDY

Title:	Are class size differences related to pupil's educational progress and classroom processes? Findings from the Institute of Education Class Size Study of children aged 4-7 years
Author:	Blatchford, P., Bassett, P., Goldstein, H., & Martin, C.
Publication Year:	2003
Source:	British Educational Research Journal, 29(5), 709-730
Main focus of study:	Large-scale study of the consequences of class size differences.
Who conducted the study?:	Institute of Education, University of London
Peer reviewed, Y/N:	Y
Ratio or class size:	Class size
Ranges of ratios, class sizes examined:	Small (under 20 students) Small medium (20-25 students) Large medium (26-29 students) Large (over 30 students)
Ages studied:	Reception 4-5 years, Year 1- 5-6 years, Year 2- 6-7 years
Sample size:	Total sample in the study: Cohort 1: 199 schools, 330 classes, 7,142 children Cohort 2: 134 schools, 212 classes, 4,244 children Sub-sample of 235 children were chosen for systematic observation (six students from each of 18 small classes, and 21 large)
Form of education/care (child care, kindergarten, pre-k):	Reception year (kindergarten)
Where was the study conducted?:	United Kingdom
Child outcomes/quality measured:	Pupil academic achievement, class processes.
Child outcome/quality measures:	Avon Reception Entry Assessment (literacy and mathematics), Literacy Baseline component of Reading Progress Test, Young's Group Reading and Mathematics tests, Standard Assessment Tasks (SATs), Pupil Behaviour Ratings (PBR), observations, semi-structured interviews, case studies.
Other influential factors examined (qualifications):	Within class-groupings.
Relevant intervening variables:	Teacher training and professional development to address contextual features like class size.
Brief abstract (main findings):	- There was a clear effect of class size differences on children's academic attainment over the (first) Reception year. - In the case of literacy, the lowest attainers on entry to school benefited most from classes below 25. - Connections between class size and classroom processes were examined and a summary model of relationships presented. - Effects were multiple, not singular; in large classes there are more large groups; this presented teachers with more difficulties. In smaller classes there was more individual teacher contact with pupils and

	<p>more support for learning. In larger classes there was more pupil inattentiveness and off-task behaviour.</p> <p>- Results support a contextual approach to classroom learning, within which class size differences have effects on both teachers and pupils. It is concluded that much will depend on how teachers adapt their teaching to different class sizes.</p>
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Blatchford et al's conceptualization of the connections between class size, classroom processes and children's outcomes.

STUDY

Title:	The production of quality in child-care centers: Another look
Author:	Blau, D. M.
Publication Year:	2000
Source:	Applied Developmental Science, 4(3), 136-148
Main focus of study:	Data from <i>Cost, Quality, and Outcomes Study</i> are used to examine the effects of group size, staff-child ratio, and teacher qualifications on the quality of child care.
Who conducted the study?:	University of North Carolina, Department of Economics
Peer reviewed, Y/N:	Y
Ratio or class size:	Ratio and class size
Ranges of ratios, class sizes examined:	Data came from the <i>Cost, Quality and Outcomes Study</i> Reported Averages: 1:7 (preschoolers) 1:11 (kindergarten/school-age) Observed: 1:6 (preschoolers, midmorning) Group size 14 (preschoolers, midmorning)
Ages studied	Infant, toddler, preschool and school-age settings. Preschool is 4 years of age until kindergarten entry the following year.
Sample size:	100 centers, 548 rooms, half non-profit, half for-profit,
Form of education/care (child care, kindergarten, pre-k):	Child care
Where was the study conducted?:	USA: California, Colorado, Connecticut, North Carolina
Child outcomes/quality measured:	quality
Child outcome/quality measures:	ECERS, ITERS
Other influential factors (qualifications, day length, particular study groups):	Qualifications
Relevant intervening variables:	
Brief abstract (main findings):	<p>The empirical results indicate that group size has small and statistically insignificant effects on child-care quality. A higher staff-child ratio appears to have beneficial effects on child-care quality when unobserved differences across centers are not accounted for. These effects become much smaller when unobserved differences are accounted for. The effects of teacher education and training are also generally not robust, but some measures of education and training have quantitatively and statistically significant effects even accounting for unobserved differences across centers.</p> <p><i>Note: This is one of the first studies to raise questions about earlier assumptions about the singular importance of ratios and group size.</i></p>

STUDY

Title:	Predicting process quality from structural quality in preschool programs: A cross-country comparison
Author:	Cryer, D., Tietze, W., Burchinal, M., Leal, T. & Pacios, J.
Publication Year:	1999
Source:	Early Childhood Research Quarterly, 14(3),339-361
Main focus of study:	In this study the relationship between structural and process quality in preschool classrooms is examined and compared in 4 countries.
Who conducted the study?:	
Peer reviewed, Y/N:	Y
Ratio or class size:	Ratio and class size
Ranges of ratios, class sizes examined:	Mean ratio and group size respectively. Germany: Mean ratio: 11.03 (SD5.9) Mean group size: 20.42, (SD 5.48) Portugal: Mean ratio: 11.15 (SD 4.58) Mean group size: 21.39 (SD 4.49) Spain: Mean ratio: 20.32 (SD 6.53) Mean group size: 23.64 (SD 6.38) USA: Mean ratio: 7.78 (SD 4.00) Mean group size: 14.03 (SD8.08)
Ages studied:	Preschool. No ages specified
Sample size:	228 centres from USA, 82 from Germany, 55 from Spain, 80 from Portugal,
Form of education/care (child care, kindergarten, pre-k):	Child care programs for preschool aged children.
Where was the study conducted?	USA, Germany, Spain, Portugal
Child outcomes/quality measured:	Quality
Child outcome/quality measures:	ECERS, CIS
Other influential factors (qualifications, day length, particular study groups):	
Relevant intervening variables:	
Brief abstract (main findings):	<p>Although there were not great differences in process quality, countries emphasized different structures as they created that process quality. Analysis indicated that the countries differed on the classroom structural characteristics, with reliable country differences obtained on the lead teacher experience and tenure and on the classroom ratio and group sizes.</p> <p>Pair-wise comparisons indicated that compared with the European countries, the US tended to have smaller group sizes and more fewer children per staff, and lead teachers with less experience and tenure. The Spanish classrooms tended to have larger group sizes and more children per staff compared to the other countries</p> <p>Correlations between structural features and ECERS</p>

	<p>scores were found for each county. The structural features correlated with ECERS scores were not always consistent across the countries. In Germany positive predictors included teacher tenure, teacher-child ratios, group size, and physical size. In Portugal, teacher experience, physical size, enrollment, and director wage were positively correlated to total ECERS score. In Spain, teacher education and wage, enrollment size, hours open, and director education were positively correlated to ECERS total score. In the US, teacher education, tenure, experience, age and wage, teacher-child ratios, proportion of preschoolers, and director education and experience were positively correlated with ECERS total scores.</p> <p>Despite the diversity of the national systems, many of the same structural features have an impact on process quality. However, no one consistently powerful predictor of process quality was found, and there was no single block of variables with an overwhelming influence. The findings are viewed in terms of possibilities for improving process quality through manipulation of structural characteristics.</p>
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STUDY

Title:	The association between child care quality, ratio and staff training: A Canada-wide study
Author:	Doherty, G. & Stuart, B.
Publication Year:	1997
Source:	The Canadian Journal of Research in Early Childhood Education, 6 (2), 127-138.
Main focus of study:	The relationship between centre quality and provincial regulations regarding staff-to-child ratio and staff training.
Peer reviewed, Y/N:	Y
Ratio or class size:	Ratio
Ranges of ratios, class sizes examined:	Ratios studied ranged from 1:7 to 1:10 for 3-5 year olds Nova Scotia 1:7 New Brunswick 1:7 (3-4 year olds) 1: 10 (4-5 year olds) Ontario 1:8 British Columbia 1:8 Newfoundland 1:8 Prince Edward Island 1:10 Quebec school-aged care No limit
Ages studied	Infant, toddler, and preschool groups
Sample size:	This study was a meta-analysis of data from six studies that used ECERS/ITERS quality ratings. Overall, ECERS were carried out in 243 preschool rooms, and ITERS were carried out in 158 infant/toddler rooms.
Form of education/care (child care, kindergarten, pre-k):	Child care
Where was the study conducted?:	Alberta, BC, New Brunswick, Newfoundland, Ontario, PEI, Quebec
Child outcomes/quality measured:	Quality
Child outcome/quality measures:	ECERS/ITERS
Other influential factors (qualifications, day length, particular study groups):	Staff training
Relevant intervening variables:	Staff training was deemed a mediating influence on ratios' influence on quality
Brief abstract (main findings):	Classrooms in the provinces with the highest training requirements had the highest quality ratings. The association between the number of children per caregiver and regulatory requirements was not as consistent, perhaps because of the mediating influence of staff training. However, the lowest mean scores were in jurisdictions that permitted the largest number of children per caregiver. The two samples that obtained the highest mean ECERS scores, Ontario (5.20) and BC (5.07) were in jurisdictions that permitted more children per caregiver (1:8) than the two samples with the next highest mean scores, Nova Scotia (4.84) and New

	<p>Brunswick (4.56). These two jurisdictions had a max. ratio of 1:7. Staff pre-service requirements were higher in Ontario and BC and this may have provided some compensation for the larger permitted number of children per caregiver. The lowest mean score was obtained by Newfoundland (4.17) even though, like Ontario and BC, the max. ratio permitted was 1:8. Newfoundland only required the centre supervisor to have pre-service training.</p>
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OVERVIEW

Title:	Quality targets in services for young children
Author:	European Commission Childcare Network
Publication Year:	1996
Source:	Childcare Resource and Research Unit
Main focus of study:	Quality targets.
Who conducted the study?:	EC Childcare Network
Peer reviewed, Y/N:	Y
Ratio or class size:	Ratio and group size
Ranges of ratios, class sizes examined:	
Ages studied:	
Sample size:	
Form of education/care (child care, kindergarten, pre-k):	
Where was the study conducted?:	
Child outcomes/quality measured:	
Child outcome/quality measures:	
Other influential factors (qualifications, day length, particular study groups):	
Relevant intervening variables:	
Brief abstract (main findings):	<p><i>This target cannot be considered in isolation. The concept that the notion of high staff-ratios are per se a guarantee of quality is simplistic. The concept that underlies the notion of high-staff ratios, that a very young child learns best through the close emotional security of a relationship with one adult, is a culturally specific one and is not generally shared throughout all Member states.</i></p> <p><i>The size of the groups is a prime consideration in determining ratios in group settings.</i></p> <p><i>The group size, the age range, the size and layout of the building, the type of the setting, the catchment of children who attend (e.g., special needs) and the hours for which they attend, as well as whether places are part-time and doubled up or full-time all contribute to how ratios may be determined.</i></p> <p><i>Network proposed ratios; 1:15 places for children 36-71mos. Adequate supply cover should always be available to maintain the ratios.</i></p>

REVIEW

Title:	13 indicators of quality child care: Research update
Author:	Fiene, R.
Publication Year:	2002
Source:	U.S. Department of Health and Human Services
Main focus of study:	This report uses a literature review to create 13 predictors/indicators of quality. (Review)
Who conducted the study?:	Pennsylvania State University
Peer reviewed, Y/N:	N
Ratio or class size:	Ratio and group size
Ranges of ratios, class sizes examined:	4 -5 year olds 8:1, max group size 16 6-8 year 10:1, max group size 20
Ages studied:	Literature reviewed pertains to children from birth to 12 years
Sample size:	Literature Review
Form of education/care (child care, kindergarten, pre-k):	Child care
Where was the study conducted?:	
Child outcomes/quality measured:	Health, safety, mental health/school readiness,
Child outcome/quality measures:	
Other influential factors (qualifications, day length, particular study groups):	
Relevant intervening variables:	
Brief abstract (main findings):	<p><i>NOTE: Fiene specifies several areas that may be impacted by staff-child ratio. While he does not specify the ages of the children these findings pertain to, based on other literature we can assume that some of his findings (for example around health and safety) are more applicable for younger age groups.</i></p> <p>Cognitive development/school readiness: Research suggests that children in groups of 12-14 with two caregivers are more cooperative, compliant, and exhibit more reflection/innovation than children in groups of 24-28 with four caregivers. Caregivers with small groups are more actively involved and spend more time interacting with children; they are more responsive, more socially stimulating, and less restrictive than caregivers in larger groups. Children receive less attention, affection, responsiveness and stimulation from caregivers each time a single child is added to the group. Caregivers have more positive, nurturing interactions with children and provide children with more individualized attention when they are in charge of smaller groups of with smaller child:staff ratios. Children who have highly involved caregivers tend to exhibit behaviours suggestive of secure attachment more than children with less involved caregivers.</p> <p>Children who are members of larger groups and receive less individual attention show lower gains in PSI (Preschool Inventory) scores than children who</p>

	<p>are members of smaller groups and receive more individual attention. Children with higher language development scores tend to have caregivers who are more responsive, more sensitive, and less detached. Smaller group size is associated with more developmentally appropriate classroom activities than larger group size. Groups of 18 or fewer preschoolers are more likely to engage in developmentally appropriate activities than children that exceed this.</p> <p>Children in classrooms with fewer children per adult engage in more talk and play and display more gestural and vocal imitation.</p> <p>Children in classrooms having fewer children per adult (9:1 for preschoolers) are more likely to have positive interactions with caregivers, be properly supervised, and be engaged in activities rated as good or very good. Fewer children per staff relate to more developmentally appropriate caregiving and sensitivity; more contact with children; more responsive and stimulating behaviour. Additional caregivers reduce the amount of irritability and restrictiveness that caregivers express to the children in their care.</p> <p>Fewer children per adult are associated with more verbal communication between caregivers and children. Adults and children talk to one another more, caregivers engage in more dialogues, and fewer monologues.</p> <p>Fewer children per adult also allow caregivers to engage in more educational activities with children.</p> <p>Health: Smaller group size is associated with a lower risk of infection. Risk of hemophilus influenzas increases for children one year of age or older in a child care setting with four or more children, and the risk of infection peaks in settings with 21 or more children. Research indicates that group size should be limited to twice the maximum number of children allowed per adult. Smaller child care centres, not just those with smaller group sizes, have lower rates of disease.</p> <p>Safety: Smaller group size improves the caregiving behaviours of staff and the safety of children. Fewer children per adult is associated with fewer situations involving potential danger, and child abuse.</p>
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STUDY

Title:	Classroom organization and student behaviour in kindergarten
Author:	Finn, J., PannoZZo, G.
Publication Year:	2004
Source:	The Journal of Educational Research, 98(2), 79-91
Main focus of study:	The authors examined the conditions that promote or discourage engagement in the classroom among kindergarten students with data from the Early Childhood Longitudinal Study (ECLS). (Study)
Who conducted the study?:	
Peer reviewed, Y/N:	Y
Ratio or class size:	Class size
Ranges of ratios, class sizes examined:	57.2% of sample had a class size of 10-20 students 42.8% of sample had 21+ students 71.4% had one or more aides to assist during some point in day.
Ages studied:	Kindergarten
Sample size:	21,260 students, 3,305 teachers, 866 schools
Form of education/care (child care, kindergarten, pre-k):	Kindergarten
Where was the study conducted?:	USA
Child outcomes/quality measured:	On-task behaviour, pro- and anti-social behaviour
Child outcome/quality measures:	Individual student behaviour was rated by teachers on the Social Rating Scale
Other influential factors (qualifications, day length, particular study groups):	
Relevant intervening variables:	Teacher approaches
Brief abstract (main findings):	<p>Classroom level: Small classes rated as more engaged in appropriate behaviour than were large classes.</p> <p>Individual level: Ratings of individual student behavior were not consistently related to class size. On average teachers rated students in small and large classes similarly on both approaches to learning and externalizing problem behaviours.</p> <p>No behavior rating was significantly related to the presence of a teacher aide. <i>Note: Although the training of the teacher's aides was not identified, in the American context in which this study took place it is common for teacher's aides to be untrained.</i></p>

YOU BET A CARE! STUDY

Title:	Towards a predictive model of quality in Canadian child care centers (Publication from YBIC! project)
Author:	Goelman, H., Forer, B., Kershaw, P., Doherty, G., Lero, D., & LaGrange, A.
Publication Year:	2006
Source:	Early Childhood Research Quarterly, 21, 280-295
Main focus of study:	Factors that predict quality in child care centers.
Who conducted the study?:	University of British Columbia, University of Guelph, University of Calgary
Peer reviewed, Y/N:	Y
Ratio or class size:	Ratio, touches on room composition
Ranges of ratios, class sizes examined:	Regulations: Alberta, ages 3-under 5 years 1:12, 5 and over 1:15; British Columbia, preschool (3-5 years) 1:15; New Brunswick, ages 3-4 1:7, 4-5 1:10; Ontario, ages 2.5-5 1:8, 3 yrs 8mos- 5 yrs 1:10, 5-6 yrs 1:12; Quebec, less than 5 years 1:10, 5 and older 1:20; Saskatchewan 30mos-6 1:10; Yukon, 3-6 1:8.
Ages studied:	Birth- 6 years
Sample size:	Canadian You Bet I Care! Project (YBIC) data, 326 classrooms, 239 child care centres,
Form of education/care (child care, kindergarten):	Child care centres
Where was the study conducted?:	Canada: Alberta, British Columbia, New Brunswick, Ontario, Quebec, Saskatchewan, Yukon
Child outcomes/quality measured:	Quality (structural features and process features)
Child outcome/quality measures:	Caregiver Interaction Scale (CIS), Early Childhood Environment Rating Scale-Revised (ECERS-R), Infant-Toddler Environment Rating Scale (ITERS)
Other influential factors (qualifications, day length, particular study groups):	Educational level and training, staff satisfaction, level of ECCE training,
Brief abstract (main findings):	<p>Number of staff observed in the room, staff satisfaction, and education level were three of the five significant direct predictors of quality in preschool rooms. The three indirect predictors were auspice, (regulated) adult:child ratio, and parent fees.</p> <p>The number of staff in the observed classroom and the level of ECCE serve as strong and consistent direct predictors of child care quality.</p>

COST, QUALTY AND CHILD OUTCOMES STUDY

Title:	Cost, quality, and child outcomes in child care centers. Public report and Technical Report (Cost, quality and child outcomes study)
Author:	Helburn, S., Culkin, M.L., Morris, J., Mocon, N., Howes, C., Phillipsen, L., Bryant, D., Clifford, R., Cryer, D., Peisner-Feinberg, E., Burchinal, M., Kagan, S.L., & Rustici
Publication Year:	1995
Main focus of study:	Child care quality, costs, and child outcomes.
Who conducted the study?:	University of Colorado at Denver, University of North Carolina, Yale University
Peer reviewed, Y/N:	N
Ratio or class size:	Ratio and group size
Ranges of ratios, class sizes examined:	Averages: 1:7 (preschoolers) 1:11 (kindergarten/school-age) Observed: 1:6 (preschoolers, midmorning) Group size 14 (preschoolers, midmorning)
Ages studied:	Infants, toddlers, preschool. Preschool 4 years - to enter kindergarten next year
Sample size:	401 centers, 826 preschool-aged children
Form of education/care (child care, kindergarten):	Child care
Where was the study conducted?:	USA: Los Angeles County, California, Colorado, Connecticut, North Carolina,
Child outcome/quality measures:	ECERS, ITERS, CIS, Adult Involvement Scale,
Other influential factors (qualifications):	Qualifications (proportion of teaching staff with a 4 year degree)
Relevant intervening variables:	
Brief abstract (main findings):	<p>This major U.S. study released several reports, including both public and technical reports, as well as a research update in 1999 titled <i>Children of the Cost, Quality and Child Outcomes study go to school</i>. Copies of that report are available online at: http://www.fpg.unc.edu/ncedl/PDFs/CQO-tr.pdf</p> <p>From the technical report: “The quality of child care is primarily related to high staff:child ratios, staff education, staff wages, administrators’ experience and curriculum support, and teacher turnover.... <i>This study affirms how important the ratio of adults to children is to quality of services. In regression analyses to predict the determinants of quality, the staff:child ratio is the most significant determinant of quality, even when controlling for other factors affecting quality</i>”. (pg. 320)</p>

STUDY

Title:	The student/teacher achievement ratio (STAR) project
Author:	Various
Publication Year:	1985-1997
Source:	HEROs Incorporated
Main focus of study:	Class size study.
Who conducted the study?:	Tennessee State Department of Education, HEROs Inc.
Peer reviewed, Y/N:	N
Ratio or class size:	Class size
Ranges of ratios, class sizes examined:	Three class compositions studied: small (13-17 students), regular size (22-25 students), regular (22-25) with full-time teacher aides.
Ages studied:	Kindergarten to grade 3
Sample size:	79 schools, 42 systems, 6,000 students per grade level
Form of education/care (child care, kindergarten, pre-k):	Kindergarten. Study of k-3 and follow-up studies.
Where was the study conducted?:	Tennessee
Child outcomes/quality measured:	
Child outcome/quality measures:	Stanford Achievement Tests (SESAT II, Primary I, Primary II, Primary III), Basic Skills Criterion Tests in Reading and Math
Other influential factors (qualifications, day length, particular study groups):	
Relevant intervening variables:	
Brief abstract (main findings):	<p>The Student/Teacher Achievement Ratio (STAR) was a four-year longitudinal class-size study funded by the Tennessee General Assembly and conducted by the State Department of Education. Over 7,000 students in 79 schools were randomly assigned into one of three interventions: small class (13 to 17 students per teacher), regular class (22 to 25 students per teacher), and regular-with-aide class (22 to 25 students with a full-time teacher's aide). Classroom teachers were also randomly assigned to the classes they would teach.</p> <p>Technical report: Chapters 1-2: http://www.heros-inc.org/STAR%20Technical%20Report%20Part%20I.pdf Chapters 3-4: http://www.heros-inc.org/STAR%20Technical%20Report%20Part%20II.pdf Chapters 5-6: http://www.heros-inc.org/STAR%20Technical%20Report%20Part%20III.pdf Chapters 7-10: http://www.heros-inc.org/STAR%20Technical%20Report%20Part%20IV.pdf Appendices A-C: http://www.heros-inc.org/STAR%20Technical%20Report%20Part%20V.pdf Appendices D-H: http://www.heros-inc.org/STAR%20Technical%20Report%20Part%20VI.pdf Follow-up studies: http://www.heros-inc.org/newstar.pdf</p> <p>Kindergarten class size effect: STAR's kindergarten results showed definite advantage for small classes (13-17 students) in achievement but no significant advantage for the use of a teacher aide.</p>

	<p>Although each yearly analysis continued to identify the benefits of a small class, the results for the small (about 33 percent) subsample of students in the same class size for 2 years (K-1) and 3 years (1-3) showed that the small class effect does not have a continuing cumulative effect after the large gains in K and in grade 1. The results showed that the large and statistically significant gains favoring the small classes made in the first year (i.e., K in the K-1 comparison and Grade 1 in the 1-3 comparison) were still evident in later years, but that there were no statistically significant gains in future years in the initial findings.</p>
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STUDY

Title:	Ready to learn? Children's pre-academic achievement in pre-kindergarten programs
Author:	Howes, C., Burchinal, M., Pianta, R., Bryant, D., Early, D., Clifford, R., & Barbarin, O.
Publication Year:	2008
Source:	Early Childhood Research Quarterly, 23, 27-50.
Main focus of study:	- Data from this study came from the National Centre for Early Development and Learning's (NCEDL) Multi-State Study of Pre-Kindergarten and the State-wide Early Education Program Study (SWEEP) - This paper examines differences in child outcomes related to structural program features.
Who conducted the study?:	University of California, Los Angeles, University of North Carolina, University of Virginia
Peer reviewed, Y/N:	Y
Ratio or class size:	Ratio
Ranges of ratios, class sizes examined:	Ratios: NCEDL study: Mean: 6.92 S.D: 1.93 SWEEP study: Mean: 8.02 S.D 3.94
Ages studied:	3-4 years (majority 4 years)
Sample size:	701 classes with 4 year olds (majority) and 3-4 year olds (minority) 2,800 children in total 56% of programs were full-day
Form of education/care (child care, kindergarten, pre-k):	Pre-Kindergarten
Where was the study conducted?:	USA: 11 states
Child outcomes/quality measured:	Language, school-related learning, social
Child outcome/quality measures:	Classroom Assessment Scoring System (CLASS), ECERS-R, Emerging Academics Snapshot, Student Teacher Relationship Scale (STRS),
Other influential factors (qualifications, day length, particular study groups):	
Relevant intervening variables:	Teacher-child relationship, higher-quality instruction
Brief abstract (main findings):	Gains were not related to characteristics of the child or program (i.e., ratio, teacher qualifications and program location and length). The quality of children's classroom experience rather than structural features predicted more growth in children's academic skills and behaviours.

STUDY

Title:	Raising questions about improving the quality of child care: Child care in the United States and France
Author:	Howes, C. & Marx, E.
Publication Year:	1992
Source:	Early Childhood Research Quarterly, 7, 347-366
Main focus of study:	The differences between the French and American child care systems are explored. In particular, the combination of high staff training requirements, large group sizes and more children per adult in France are compared to the US.
Who conducted the study?	The University of California and the French American Foundation
Peer reviewed, Y/N:	Y
Ratio or class size:	Both
Ranges of ratios, class sizes examined:	US Federal Interagency Day Care Requirements (FIDCR): Preschool – 1:9 France: Ecole maternelles (age 2.5-6 yrs) - Max. 1:28 - Observed average – 1:22 <i>Note: In the French system, only professional (well qualified) teachers are counted in the ratio, not auxiliary staff.</i>
Ages studied	The authors looked at the differences in ratios in US and France for impact on infants, toddlers, and preschoolers
Sample size:	Three ecole maternelles in Paris were selected to carry out detailed observations of teacher-child interaction Group 1: 23 children Group 2: 18 children Group 3: 20 children Group 4: 25 children Group 5: 23 children
Form of education/care (child care, kindergarten, pre-k):	Ecole maternelles; creche collectives
Where was the study conducted?:	France
Child outcomes/quality measured:	Quality, interactions
Child outcome/quality measures:	Observations of teacher –child interaction
Other influential factors (qualifications, day length, particular study groups):	Qualifications, staffing patterns – i.e., the study notes that early childhood staff in ecole maternelles only work with children, while cooks, cleaners, food servers, housekeepers, financial, etc. do tasks that a child care staff would do in the US
Relevant intervening variables:	
Brief abstract (main findings):	French child care is characterized by highly trained and reasonably compensated teachers. These teachers work in classrooms with group sizes and adult:child ratios considered excessive by U.S. standards. The quality of child care under such conditions is explored in this study. Our observations suggest that French teacher-child interaction is warm, sensitive, and responsive. Despite caring for large numbers of children there is

	<p>a minimum of teacher harshness and restriction. These observations suggest that teacher training and working conditions may offset higher number of children per adult found in the French system.</p>
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STUDY

Title:	Thresholds of quality: Implications for the social development of children in center-based child care (From the National Child Care Staffing Study)
Author:	Howes, C., Phillips, D., & Whitebook, M.
Publication Year:	1992
Source:	Child Development, 63, 449-460.
Main focus of study:	Quality of care, children's social development and child care ratio and group size.
Who conducted the study?:	Child Care Employee Project
Peer reviewed, Y/N:	Y
Ratio or class size:	Ratio and class size
Ranges of ratios, class sizes examined:	Ratios: 85% of sample had 1:8 ratio or smaller 6% had more than 1:8 but no more than 1:9 9% had more than 1:9 Group size: 85% 18 children or less 15% 18 children or more.
Ages studied:	14-54 months (1 year – 4.5)
Sample size:	(14-54 months). 3 samples: 72 children, 30 child care classrooms; 87 children, 68 child care classrooms; 255 children, 45 centers. 414 children in total , 171 of whom were preschoolers.
Form of education/care (child care, kindergarten, pre-k):	Child care
Where was the study conducted?:	USA: California and Georgia
Child outcomes/quality measured:	Attachment security, social orientation, peer competence
Child outcome/quality measures:	Early Childhood Environment Rating Scale (ECERS), Infant-Toddler Environmental Rating Scale (ITERS), Deane Attachment Q-Set, The Peer Play Scale,
Other influential factors (qualifications, day length, particular study groups):	Licensing standards/regulation, qualifications, wages,
Relevant intervening variables:	Caregiving
Brief abstract (main findings):	Quality: - Classrooms rated as good or very good in caregiving and activities have better ratios. - Classrooms with smaller group size were more likely to be rated higher in activities. Social development outcomes: - Children in classrooms rated as good or very good in caregiving were more likely to be securely attached to teachers. - Children in classrooms rated high in activities were likely to orient to both adults and peers. Children with more social orientations to adults and peers were more competent with peers.

STUDY

Title:	Children's experiences in center-based child care as a function of teacher background and adult:child ratio
Author:	Howes, C.
Publication Year:	1997
Source:	Merrill-Palmer Quarterly, 43(3), 404-425
Main focus of study:	- This study uses data from the Cost, Quality and Outcome and the Florida Quality Improvement Study - Looks at the relationship between teacher background and ratio and child and teacher behaviours
Who conducted the study?:	University of California at Los Angeles
Peer reviewed, Y/N:	Y
Ratio or class size:	Ratio
Ranges of ratios, class sizes examined:	This study looked at whether the centres studied were in compliance or not in compliance with ratios recommended by professional organizations (1:8 for 3 and 4 yr. olds, and 1:10 for 5 and 6 yr. olds)
Ages studied:	3-6 years, must have been of eligible age to enter kindergarten the next year
Sample size:	655 classrooms, 826 children
Form of education/care (child care, kindergarten):	Child care
Where was the study conducted?:	USA
Child outcomes/quality measured:	Teacher behaviour, language, pre-reading, premath and problems
Child outcome/quality measures:	Caregiver Interaction Scale (CIS), Adult Involvement Scale (AIS)
Other influential factors (qualifications, day length):	Teacher background
Relevant intervening variables:	Teacher behaviour
Brief abstract (main findings):	<p>More extensive teacher background and better adult:child ratios appear to be related to more effective teaching behaviours and children's development.</p> <p>According to the analysis of the Cost, Quality, and Outcomes Study data, children in rooms that complied with ratios recommended by professional organizations (<i>1:8 for 3 and 4 yr. olds, and 1:10 for 5 and 6 yr. olds</i>) had higher pre-reading scores than children in classrooms not in compliance.</p> <p>The authors theorize that changing the classroom climate by adjusting ratios and teacher backgrounds may have an impact on teachers' behaviours which in turn may lead to changes in children's activities, experiences and developmental outcomes.</p>

STUDY

Title:	Teacher and classroom characteristics associated with teachers' ratings of prekindergartners' relationships and behaviours
Author:	Mashburn, A., Hamre, B., Downer, J. & Pianta, R.
Publication Year:	2006
Source:	Journal of Psychoeducational Assessment, 24(4), 367-380
Main focus of study:	- Used data from the National Centre for Early Development and Learning (NCEDL) Multi-State Pre-Kindergarten Study - This study examined characteristics of teachers and classrooms associated with teachers' perceptions of children's social competencies.
Who conducted the study?:	University of Virginia
Peer reviewed, Y/N:	Y
Ratio or class size:	Ratio
Ranges of ratios, class sizes examined:	Ratio: mean 8.0, SD 2.1
Ages studied:	Met age criterion for fall kindergarten start
Sample size:	210 state prekindergarten programs, 711 children
Form of education/care (child care, kindergarten, pre-k):	Pre-k
Where was the study conducted?:	USA
Child outcomes/quality measured:	Social competence, behaviour problems, student-teacher relationship, teacher's attitudes and beliefs, teacher self-efficacy,
Child outcome/quality measures:	Teacher ratings of student behaviour and competence, Teacher-Child Rating Scale (TCRS), Student-Teacher Relationship Scale (STRS), Oral Expression Scale, Peabody Picture Vocabulary Scale, Woodcock-Johnson
Other influential factors (qualifications, day length, particular study groups):	Location within school setting, length of program, teacher experience, teacher self-efficacy and other personal characteristics, child characteristics (gender, race, age)
Relevant intervening variables:	
Brief abstract (main findings):	- Teachers' ratings of children's social and emotional competencies were associated with characteristics of the pre-K program in which they taught. Ratings of children's social competencies were higher when programs were located within schools and when there was a lower child-teacher ratio. Children in programs with longer school days (average length of day was 5.2 hrs with a standard deviation of 2.1) were rated as having more problem behaviours and greater conflict in their relationships with teachers.

STUDY

Title:	Measures of classroom quality in pre-kindergarten and children's development of academic, language, and social skills
Author:	Mashburn, A., Pianta, R., Hamre, B., Downer, J., Barbarin, O., Bryant, D., Burchinal, M., Early, D., & Howes, C.
Publication Year:	2008
Source:	Child Development, 79(3), 732-749
Main focus of study:	Academic, language and social skills development among 4 year olds in public pre-K programs.
Who conducted the study?:	University of Virginia, University of North Carolina at Chapel Hill, University of California at Los Angeles
Peer reviewed, Y/N:	Y
Ratio or class size:	Ratio and class size
Ranges of ratios, class sizes examined:	82% 20 or fewer children enrolled, 87% met minimum 1:10; Classes averaged 17 children.
Ages studied:	4 years, met age criterion for kindergarten in the following year
Sample size:	2,439 children, 671 classrooms
Form of education/care (child care, kindergarten, pre-k):	Pre-Kindergarten
Where was the study conducted?:	USA, 11 states
Child outcomes/quality measured:	Classroom quality (including infrastructure and design e.g., child-to-teacher ratio and class size), teacher-child interactions, academic and language skills, social skills
Child outcome/quality measures:	ECERS-R, CLASS, Peabody Picture Vocabulary Test, Oral and Written Language Scale, Woodcock-Johnson-III Test of Achievement,
Other influential factors (qualifications, day length, particular study groups):	
Relevant intervening variables:	Teacher interaction
Brief abstract (main findings):	Findings indicate that despite relevance to program development and quality, none of the benchmarks recommended by NIEER or nine-item quality index were consistently associated with measures of academic, language and social development during pre-k. (NIEER Benchmarks: Maximum class size <20; Staff:child ratio 1:10 or better; comprehensive early learning standards; Lead teachers must have a Bachelor of Arts; Lead teachers must have a specialization in pre-K; Assistant teachers must have a Child Development Association Certification; Teachers must complete at least 15 hours of in-service training each year; Vision, hearing and health screening and referral are required with at least 1 family support service; at least 1 meal is offered per day; site visits are required). However, explanations for this finding include, lack of variation between programs with NIEER indicators as programs were designed to reflect this feature; narrow range of program quality using the benchmarking type of metric promoted by

	<p>NIEER (e.g., class enrollment ranged from 3-40 children, with 85% having 14-24 enrolled, however the benchmark for class size truncates the variability to a 0 or 1 corresponding with whether the program had more than or fewer than 20 children, thus the narrow range of program quality using the benchmark type of metric could have attenuated associations with children's development). Despite no significant findings the researchers suggest that classroom and program characteristics (incl. ratio and group size) are proposed to be ecological conditions that moderate the impacts of classroom interactions on children's development; thus, small class sizes and child-to-teacher ratios may create conditions in classrooms in which higher quality social and instructional interactions have a stronger positive effect on children's development.</p>
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STUDY

Title:	Quality of childcare settings in the Millennium Cohort Study
Author:	Mathers, S., Sylva, K., Hansen, K., Plewis, I., Johnson, J., & George, A.
Publication Year:	2007
Source:	Sure Start, UK Government
Main focus of study:	Quality of provision.
Who conducted the study?:	University of Oxford, University of London
Peer reviewed, Y/N:	N
Ratio or class size:	Ratio, Group size
Ranges of ratios, class sizes examined:	1:8, 1:13
Ages studied:	3-5 years
Sample size:	301 settings, 542 children and families, children aged 3-5
Form of education/care (child care, pre-k):	Child care
Where was the study conducted?:	United Kingdom
Child outcomes/quality measured:	Quality
Child outcome/quality measures:	ECERS-R, ECERS-E, The Caregiver Interaction Scale (CIS)
Other influential factors (qualifications, day length):	Size of centre/rooms, sector
Relevant intervening variables:	Interaction, language opportunities, planning
Brief abstract (main findings):	<p>Ratio: Within sectors, better ratios improve the quality of provision in these areas.</p> <p>For the age ranges of children in the sample, the legal ratio for for-profit and voluntary sector settings is 8:1. In a local authority nursery class or school, one teacher and one nursery nurse can provide for up to 26 children (a ratio of 13:1). Once the influence of sector was accounted for, it was clear that poorer ratios led to lower quality in some areas: in particular, the quality of personal care routines, language and reasoning, interactions and provision for diverse needs.</p> <p>Group and centre size: A significant impact of group size was identified: rooms with more children present on the day of observation offered higher quality curricular provision across the board, as well as higher quality interactions and provision for children's developing language and reasoning skills. The explanation is that larger rooms may be able to provide a more interesting range of activities for children, and may also be led by a larger staff team with a broader range of experiences, interests and expertise. Group sizes of 30 children or more were of the highest quality (once other factors such as sector were taken into account). </p>

REVIEW

Title:	Research on ratios, group size and staff qualifications and training in early years and childcare settings. Part A: A review of international research on the relationship between ratios, staff qualifications and training, group size and the quality of provision in the early years and childcare settings.
Author:	Munton, T., Mooney, A., Moss, P., Petrie, P., Clark, A., & Woolner, J.
Publication Year:	2002
Source:	Department of Education and Skills, United Kingdom
Main focus of study:	Part A of a two part report on Child:adult ratios in early years and childcare settings.
Who conducted the study?:	Thomas Coram Research Unit, University of London
Peer reviewed, Y/N:	N
Ratio or class size:	Ratio and group size
Ranges of ratios, class sizes examined:	Various international ratios, refer to Appendix A
Ages studied:	Birth to school- age. Ages studies vary for each study examined in review.
Sample size:	
Form of education/care (child care, kindergarten, pre-k):	Early years and childcare
Where was the study conducted?:	International review
Child outcomes/quality measured:	
Child outcome/quality measures:	
Other influential factors (qualifications, day length, particular study groups):	
Relevant intervening variables:	
Brief abstract (main findings):	<p>Research evidence is consistent with the view that staff:child ratios can have a significant impact on the quality of care that children receive. Broadly speaking, the more staff that work with children, the better the quality of care is likely to be. However, the influence of staff:child ratios on quality is <i>inextricably linked to other elements of the care environment including staff education and training, staff salaries and group size.</i></p> <p>Evidence suggests that one of the ways in which ratios influence quality is through adult:child interactions. Higher staff:child ratios (i.e. more staff per group of children) are more likely to facilitate positive adult:child interactions. Furthermore, experiences in good quality early years settings can have a small but positive impact on developmental outcomes for infants and pre-school aged children. Research evidence is consistent with the view that group size and staff training and qualifications are two of several factors, including adult:child ratios, that have some small but significant impact on the quality of interactions between staff and children. Because several factors are implicated in the quality</p>

	<p>of adult child interactions in care settings, it is difficult for research to identify the unique influence of either group size or staff qualifications and training.</p> <p>Through their impact on the quality of adult child interactions, evidence suggests that group size, and staff qualifications and training, can have a positive influence on developmental outcomes for children. Smaller group sizes and better trained staff are more likely to provide environments for effective child development. However, evidence for the impact of the same two factors on more global measures of service quality is more equivocal. The education and training of centre managers has a greater influence on global quality.</p> <p>Changes creating more strict adult:child ratios can have links with children being organised into larger groups across activities. Consequently, regulations specifying adult:child ratios should also address the issue of group sizes.</p> <p><i>Comparisons of ratios and service quality in different countries must be made in the context of local philosophies of child care.</i> Early years services both within and between countries can have very different aims and objectives.</p>
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STUDY

Title:	Research on ratios, group size and staff qualifications and training in early years and childcare settings. Part B: Adult:child ratios for early years settings in the private/independent sector: A report of empirical research.
Author:	Munton, T., Barclay, L., Mallardo, M.R., & Barreau, S.
Publication Year:	2002
Source:	
Main focus of study:	Part B of a two part report on child:adult ratios in early years and childcare settings.Part B: empirical study.
Who conducted the study?:	Thomas Coram Research Unit, Institute of Education, University of London
Peer reviewed, Y/N:	N
Ratio or class size:	Ratio
Ranges of ratios, class sizes examined:	1:8 relaxed to 1:10 and 1:13
Ages studied:	Group 1- 20 settings, group 2- 30 settings
Sample size:	50 private/independent
Form of education/care (child care, kindergarten, pre-k):	
Where was the study conducted?:	United Kingdom
Child outcomes/quality measured:	
Child outcome/quality measures:	
Other influential factors (qualifications, day length, particular study groups):	Physical layout, room size, room organization,
Relevant intervening variables:	Interaction,
Brief abstract (main findings):	<p>Findings suggest that adult:child ratios may have an impact on the overall quality of service provided. Statistical comparisons suggest that a non-linear significant relationship exists between ratio and service quality. When the room fell below 7, the observed quality of adult child interactions did not change as a result of less children per adult. The data does not claim 1:7 is a cut-off point but simply suggests that the likely impact of ratio on quality will be more significant where ratios exceed 1:7.</p> <p>Despite concern from staff, child protection and safety was not a significant concern when relaxing ratios from 1:8 to 1:10/13.</p> <p>Researchers recommend that the regulation of adult:child ratios needs to be considered in conjunction with group size, staff qualifications and the time staff work directly with children.</p>

RECOMMENDATIONS

Title:	NAEYC early childhood program standards and accreditation criteria: The mark of Quality in early childhood education
Author:	National Association for Education of Young Children (NAEYC)
Publication Year:	Revised 2007
Source:	NAEYC
Main focus of study:	Recommendations for ratios
Who conducted the study?:	
Peer reviewed, Y/N:	
Ratio or class size:	Ratio within group size
Ranges of ratios, class sizes examined:	
Ages studied:	Birth – 5 years
Sample size:	
Form of education/care (child care, kindergarten, pre-k):	Child care, kindergarten in child care centers
Where was the study conducted?:	
Child outcomes/quality measured:	
Child outcome/quality measures:	
Other influential factors (qualifications, day length, particular study groups):	
Relevant intervening variables:	
Brief abstract (main findings):	<p>Recommendations ratios within group sized specified for 4 and 5 year olds and kindergarten (ratio/group size).</p> <p>4 and 5 year olds 1:8/16; 1:9/18; 1:10/20 Kindergarten 1:10/20; 1:11/22; 1:12/24</p> <p><i>-Ratios are to be lowered when one or more children in the group need additional adult assistance to fully participate in the program</i></p> <p><i>-“Teacher” includes teachers, assistant teachers/teacher aides (all contact adults)</i></p>

OVERVIEW

Title:	The state of preschool 2007: State preschool yearbook
Author:	Barnett, W.S., Hustedt, J., Friedman, A., Boyd, J.S., & Ainsworth, P.
Publication Year:	2007
Source:	National Institute for Early Education Research (NIEER)
Main focus of study:	Annual report profiling state-funded prekindergarten programs in the United States.
Who conducted the study?:	NIEER
Peer reviewed, Y/N:	N
Ratio or class size:	Ratio and class size
Ranges of ratios, class sizes examined:	Ratio 1:10, and class size maximum 20 recommended
Ages studied:	Prekindergarten, 3 and 4 year olds
Sample size:	
Form of education/care (child care, kindergarten, pre-k):	Prekindergarten
Where was the study conducted?:	USA
Child outcomes/quality measured:	
Child outcome/quality measures:	
Other influential factors (qualifications, day length, particular study groups):	
Relevant intervening variables:	
Brief abstract (main findings):	<p>In the NIEER Quality Standards Checklist states are expected to limit class sizes to maximum 20 children and have no more than 10 children per teacher. With smaller classes and fewer children per teacher, children have greater opportunities for interaction with adults and can receive more individualized attention.</p> <p>The importance of class size has been demonstrated for both preschool and kindergarten. A class size of 20 is larger than the class size in many programs to produce large gains for disadvantaged children. A ratio of 1:10 is smaller than in programs that have demonstrated large gains for disadvantaged children and is the lowest (fewest number of teachers per child) generally accepted by professional opinion.</p>

STUDY

Title:	The effects of small classes on academic achievement: The results of the Tennessee class size experiment
Author:	Nye, B., Hedges, L.V., and Konstantopoulos, S.
Publication Year:	2000
Source:	American Educational Research Journal, 37(1), 123-151
Main focus of study:	Effects of class size on academic achievement, using Project STAR data.
Who conducted the study?:	Tennessee State University, The University of Chicago
Peer reviewed, Y/N:	Y
Ratio or class size:	Class size
Ranges of ratios, class sizes examined:	3 groupings: Small (13-17); regular (22-26); regular with aide (22-26).
Ages studied:	Kindergarten to grade 3
Sample size:	Kindergarten 108, Grade1 113, Grade2 113, Grade3 112.
Form of education/care (child care, kindergarten, pre-k):	Kindergarten, Grades 1-3.
Where was the study conducted?:	USA, Tennessee, Project STAR data
Child outcomes/quality measured:	Academic achievement
Child outcome/quality measures:	
Other influential factors (qualifications, day length, particular study groups):	
Relevant intervening variables:	Switching among class types.
Brief abstract (main findings):	<p>This paper revisits analyses of Project STAR in Tennessee, a 4-year, large-scale randomized experiment on the effects of class size. Although implementation was not perfect, these analyses suggest that shortcomings in implementation probably led to previous underestimates of the effects of class size. The analyses reported here suggest class size effects that are large enough to be important for educational policy and that are quite consistent across schools. Thus, small classes appear to benefit all kinds of students in all kinds of schools.</p> <p>Statistical analysis taken into account the clustering of students within schools and classrooms provide evidence for a positive effect of small classes in mathematics and reading achievement at every grade level K-3. Small class effects are also greater for students who have experienced more years in small classes.</p> <p>It is not yet clear <i>how</i> small classes lead to higher achievement. No significant effects were discussed comparing the outcomes of switching from small to regular class size and to small to regular class size with aide.</p>

STUDY

Title:	Child-caregiver ratios in day care center groups: Impact on verbal interactions
Author:	Palmerus, K.
Publication Year:	1996
Source:	Early Child Development and Care, 118, 45-57
Main focus of study:	Ratio effects on verbal interaction between caregiver and child.
Who conducted the study?:	University of Goteborg, Sweden
Peer reviewed, Y/N:	Y
Ratio or class size:	Ratio
Ranges of ratios, class sizes examined:	In this report a high ratio is greater than or equal to 1:4 (mean 4.2:1.9); a low ratio: lower than or equal to 1:2 (mean 2.2:.8) (ratios for whole group, no age divisions given).
Ages studied:	1 -7 years, majority of children in study 3-6 years
Sample size:	17 children in both observation periods.
Form of education/care (child care, kindergarten, pre-k):	Child care
Where was the study conducted?:	Sweden
Child outcomes/quality measured:	Child-initiated verbal activities, adult-initiated verbal activities, verbal interaction,
Child outcome/quality measures:	
Other influential factors (qualifications, day length, particular study groups):	
Relevant intervening variables:	Teacher behaviour, Classroom climate
Brief abstract (main findings):	<p>There were two observational periods in the study. One with a high ratio and one with a low ratio. With a <i>high ratio</i>, the proportion of child-initiated verbal activities to the caregivers decreased while the proportion of adult-initiated verbal activities increased. Further, it was shown that with a high ratio the amount of <i>verbal interaction between caregivers was reduced</i>. The results indicate that caregivers with many children to take care of use verbal communication as a tool for control and dominance in the group. <i>Children's opportunities to initiate verbal interaction with a caregiver seem to be a function of the number of present children/caregiver</i>. The authors correlate the outcome findings to ratios and not the style of the caregivers because the same caregivers and same children were observed in the 2 different observational periods.</p> <p>With a high ratio, child care may be more like school, with a more authoritarian atmosphere, or the climate may be such that the children use the adults as resources for stimulation and develop in relation to each other to a higher degree. Caregivers to a higher degree must stimulate the children to occupy themselves since there is no time to occupy individual children, caregivers will be more likely to inspire than to lead various activities.</p>

STUDY

Title:	The social policy context of child care: Effects on quality
Author:	Phillips, D.A., Howes, C. & Whitebook, M.
Publication Year:	1992
Source:	American Journal of Community Psychology, 20(1), 25-51.
Main focus of study:	Effects of required ratios on aspects of quality. There were three main research questions: 1) Does the quality of children's child care environments vary with the stringency of state child care regulations? 2) Do centers that comply with proposed federal child care standards in the areas of staff-child ratio, group sized and training offer better environments? 3) Is the legal auspice of the centre associated with compliance and quality?
Who conducted the study?:	
Peer reviewed, Y/N:	Y
Ratio or class size:	Ratio and class size
Ranges of ratios, class sizes examined:	In the jurisdictions studied, required ratios for preschoolers ranged from 1:10 to 1:20. Group sizes ranged from 20 to no group size regulations
Ages studied	Infant (4 weeks to 11 months) , toddler (12-35 months) and preschool (36 – 59 months) settings were studied. In each centre once class from each infant and preschool age grouping, and 2 from the toddler grouping was observed.
Sample size:	227 child care centers in 5 cities
Form of education/care (child care, kindergarten, pre-k):	Child care
Where was the study conducted?:	Atlanta, Boston, Detroit, Pheonix, and Seattle
Child outcomes/quality measured:	Quality
Child outcome/quality measures:	ECERS and ITERS; Arnett scale of Teacher Sensitivity
Other influential factors (qualifications, day length, particular study groups):	Qualifications, auspice
Relevant intervening variables:	
Brief abstract (main findings):	Across all age groups, centers in states with more stringent child care regulations tended to have better staff-child ratios, staff with more child-related training, and lower staff turnover. Centers that more fully complied with the ratio, group size and training recommendations of proposed federal standards had significantly lower staff turnover, more age-appropriate activities, less harsh and more sensitive teachers, and more teachers with specialized training.

STUDY

Title:	Within and beyond the classroom door: Assessing quality in child care centers
Author:	Phillips, D., Mekos, D., Scarr, S., McCartney, K., Abbott-Shim, M.
Publication Year:	2000
Source:	Early Childhood Research Quarterly, 15(4), 475-496
Main focus of study:	Quality This study reports data on: a) Associations among quality of care defined by structural features, process indicators, and compliance with state regulations, (b) variation in quality based on the stringency of state child care regulations and center compliance, (c) specific quality indicators that show especially strong links to children's experiences in child care.
Peer reviewed, Y/N:	Y
Ratio or class size:	Ratio, group size
Ranges of ratios, class sizes examined:	Preschool regulations (1989): Massachusetts 1:10, Virginia 1:10, Georgia 1:15. Preschool group size (1989): Massachusetts 20, Virginia n/a, Georgia n/a, Ratios measured as compliance (1) or non-compliance (0) with state regulations, actual ratios/group size of centres not recorded.
Ages studied:	1 – 5 years
Sample size:	106 preschool rooms, 112 toddler rooms, 98 infant rooms
Form of education/care (child care, kindergarten, pre-k):	Child care
Where was the study conducted?:	USA - Massachusetts, Virginia, Georgia
Child outcomes/quality measured:	Quality
Child outcome/quality measures:	ITERS, ECERS
Other influential factors (qualifications, day length, particular study groups):	Teacher education and training, compliance with ratio regulations,
Relevant intervening variables:	
Brief abstract (main findings):	In preschool rooms, observed ratios (not compliance) added significantly to the prediction of classroom quality and group size showed no effect. Neither the education nor the training of preschool teachers had an effect on the quality of classroom processes.

STUDY

Title:	Children at the Center: Summary Findings and Their Implications. Final Report of the National Day Care Study (NDCS), Volume 1
Author:	Ruopp, R.
Publication Year:	1979
Source:	
Main focus of study:	Effects of classroom composition and staff qualifications and cost.
Who conducted the study?:	Abt Associates Inc.
Peer reviewed, Y/N:	N
Ratio or class size:	Ratio and group size
Ranges of ratios, class sizes examined:	Ratio range (across all ages) 1:4.2- 1:16.4 (avg.1:6.8), Group size ranged from 8 to 36 (avg. 17.6 children/group)
Ages studied:	Birth to 5 years
Sample size:	Phase III of study: 1600 3 and 4 year olds, 57 centres, 300 staff
Form of education/care (child care, kindergarten):	Day care
Where was the study conducted?:	USA: Atlanta, Detroit, Seattle
Child outcomes/quality measured:	Classroom behaviour (interaction), classroom dynamics, academic, teacher behaviour
Child outcome/quality measures:	Preschool Inventory (PSI), revised Peabody Picture Vocabulary Test (PPVT)
Other influential factors (qualifications, day length):	Staff qualifications
Brief abstract (main findings):	<p><i>-Group size and ratio are inextricably related and should be regulated jointly in a single classroom composition provision.</i></p> <p><i>-There is no single point of demarcation between small or 'good' and large or 'bad' ones, rather there is a gradient along the entire range of group sizes: with smaller groups associated with more desirable caregiver and child behaviour and greater gains on the PSI and PPVT.</i></p> <p>For preschool children, across all study sites smaller groups are consistently associated with better care, more socially active children and higher gains on two developmental tests (PSI and PPVT). Caregiver/child ratio within the policy-relevant range of 1:5 to 1:10 shows some relationships to measures of caregiver and child behaviour, although the results are not strong or consistent. Ratio is not related to test score gains.</p> <p>With 3 and 4 year olds, children assigned to classrooms with fewer children (1:5.4 compared to 1:7.4) obtained greater gains on measures of receptive language, general knowledge, cooperative behaviour, and verbal initiations and exhibited less hostility and conflict in their interactions with other than did children assigned to the 1:7.4 ratios.</p> <p>In smaller groups as contrasted to larger ones: lead teachers engage in more social interaction and less observation with children (e.g. group of 24 has 18% less social interaction than group of 12); children show more cooperation, verbal initiative and</p>

	<p>reflective/innovative behaviour; children show less hostility and conflict; greater gains on PSI and PPVT.</p> <p>In higher-ratio classes, lead teachers devote less time to managing children (commanding/correcting) but more time to center-related activities and interaction with other adults.</p> <p>Benefits of small group size were observed even when caregiver/child ratios are held constant within the policy-relevant ranges included in this study. For example, groups of 12-14 children with two caregivers have, on average, better outcomes than groups of 24-28 children with four caregivers although the ratios are identical.</p>
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STUDY

Title:	The Effective Provision of Pre-School Education (EPPE) Project: Technical Paper 8b - Measuring the Impact of Pre-School on Children's Social/behavioural Development over the Pre-School Period.
Author:	Sammons, P., Sylva, K., Melhuish, E. C., Siraj-Blatchford, I., Taggart, B. & Elliot, K.
Publication Year:	2003
Source:	UK Dept. for Education and Skills / Institute of Education, University of London.
Main focus of study:	Part of the larger EPPE study into preschool quality in England. This report looks at aspects of quality in preschool and children's social development. (Study)
Who conducted the study?:	University of London
Peer reviewed, Y/N:	N
Ratio or class size:	Ratio
Ranges of ratios, class sizes examined:	1:8 (private nurseries and childcare centres) 1:10 (public nursery schools and integrated day settings) 1:13 (nursery classes in primary schools)
Ages studied:	Children followed from age 3-7
Sample size:	2,800 children
Form of education/care (child care, kindergarten, pre-k):	
Where was the study conducted?:	United Kingdom
Child outcomes/quality measured:	Four aspects of social behavioural development: 'Independence & Concentration', 'Co-operation & Conformity', 'Peer Sociability' and 'Anti-social / Worried'
Other influential factors (qualifications, day length, particular study groups):	Qualifications
Relevant intervening variables:	
Brief abstract (main findings):	<p>No significant associations were found between staff: child ratios and children's social-emotional gains.</p> <p>Staff: child ratios were confounded with qualifications in this study.</p> <p>The study found positive associations between a higher proportion of staff hours at a high qualification level and reductions in "anti social/worried" behaviours, but no associations with staff: child ratios <i>per se</i>.</p> <p>The authors noted that centres with less-qualified staff tended to have "more favourable" staff: child ratios, which might account for these findings.</p> <p>Different levels of staff training and ratios. The private sector and the nursery schools had better ratios and lower training. The nursery classes in</p>

	public schools had better trained teachers and poorer ratios.
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STUDY

Title:	Teacher structure and child care quality in preschool classrooms
Author:	Shim, J., Hestenes, L., & Cassidy, D.
Publication Year:	2004
Source:	Journal of Research in Childhood Education, 19(2),143-157.
Main focus of study:	Relationship between teacher structure, teacher behaviours, and child care quality.
Who conducted the study?:	University of North Carolina at Greensboro
Peer reviewed, Y/N:	Y
Ratio or class size:	Ratio and group size
Ranges of ratios, class sizes examined:	Ratio average 1:6.6, range from 1:1.88 to 1:18; Class size average 11.7 children per class, range from 4-19.
Ages studied:	2-6 years, mean 44 months
Sample size:	72 female teachers, 29 licensed centres, 44 preschool classrooms, 636 children
Form of education/care (child care, kindergarten, pre-k):	Child care
Where was the study conducted?:	USA: North Carolina
Child outcomes/quality measured:	Global measures of quality, positive teacher behaviour
Child outcome/quality measures:	ECERS-R, Teacher Child Interaction Scale (TCIS), interviews,
Other influential factors (qualifications, day length, particular study groups):	Teacher education,
Relevant intervening variables:	Teacher structure
Brief abstract (main findings):	<p>In general, the results suggest that lower (less children per adult) ratios and smaller group sizes are related to positive teacher behaviours. Lower teacher-child ratios were associated with overall higher quality child care, as well as higher quality classroom activities/materials and higher quality interactions.</p> <p><i>Results showed that a co-teacher structure was associated with higher quality child care and more positive teacher behaviors than a hierarchical two-teacher structure or a single-teacher structure.</i></p>

REVIEW

Title:	Child care quality: Does it matter and does it need to be improved?
Author:	Vandell, D., Wolfe, B.
Publication Year:	2000
Source:	
Main focus of study:	Quality.
Who conducted the study?:	Institute for Research on Poverty, University of Wisconsin-Madison
Peer reviewed, Y/N:	N
Ratio or class size:	Ratio and Group size
Ranges of ratios, class sizes examined:	Various studies examined, therefore various ratios used. Ratios identified as smaller (less children per adult) or larger (more children per adult).
Ages studied:	Birth to school-age
Sample size:	
Form of education/care (child care, kindergarten, pre-k):	Child care
Where was the study conducted?:	United States
Child outcomes/quality measured:	Process and structural
Child outcome/quality measures:	
Other influential factors (qualifications, day length, particular study groups):	
Relevant intervening variables:	
Brief abstract (main findings):	<p>“Good” and “very good” scores on ECERS were more likely in preschool classrooms with ratios of 9:1 or less. More than half of the preschool classrooms with ratios with more children per adult than 1:5 received scores that were categorized as “inadequate.”</p> <p>Repeated-measure analyses conducted for children in the NICHD Study of Early Child Care at 15, 24, and 36 months ascertained that group size and child:adult ratios were stronger predictors of process quality for infants, whereas caregiver educational background and training were stronger predictors, compared to ratios and group size, of process quality for preschoolers.</p> <p>High-quality care was defined as ratios of 1:7 for children > 2 years, caregivers with 12 units of college-level child development courses, and no more than two different primary caregivers in the prior year. Low-quality care was defined as ratios of 1:10 for children who were older than 2 years, caregivers with no formal child development training, and more than two primary caregivers in the prior year.</p> <p>Smaller group sizes during the preschool period (3–5 years) were associated with higher scores on math, reading, and language performance. Lower child:staff ratios were associated with fewer behavior problems.</p>

STUDY

Title:	Competent children at 5: Families and early education
Author:	Wylie, C., Thompson, J. & Kerslake Hendricks, A.
Publication Year:	1996
Source:	New Zealand Council for Educational Research
Main focus of study:	The Competent Children, Competent Learners project is a longitudinal study of the development of a group of New Zealand children from near 5 through school. It analyses the impact of different experiences and resources on a range of competencies, and what can help narrow the gaps between children.
Who conducted the study?	New Zealand Council of Educational Research for the New Zealand Ministry of Education
Peer reviewed, Y/N:	N
Ratio or class size:	Group size and ratio
Ranges of ratios, class sizes examined:	Group size: - Range of less than 10 to greater than 31 (Grouped by 1-10, 11-20, 21-30, 31 or more) Ratios: - Not specified. As each type of early childhood service (family day care, crèche, child care centre, playcentre, aboriginal A'oga Amata programs, kindergarten, private preschool) operates under different ratio requirements, ratio differences within these programs were investigated separately
Ages studied	This longitudinal study followed a group of children from aged four onwards.
Sample size:	307 children
Form of education/care (child care, kindergarten, pre-k):	Children might have been in family day care, crèche, child care centre, playcentre, aboriginal A'oga Amata programs, kindergarten, private preschool before entering the school system.
Where was the study conducted?	New Zealand
Child outcomes/quality measured:	Quality and child competencies
Child outcome/quality measures:	- Quality was measured by an Early Childhood Centre Rating Scale created for this project. - Child competencies measured were communication, curiosity, perseverance, social skills with peers, social skills with adults, individual responsibility, mathematics, logical problem-solving, and motor skills.
Other influential factors (qualifications, day length, particular study groups):	Program type, qualifications, salary, turnover
Relevant intervening variables:	This study looked a multiple factors at play in children's lives, including family background (including family income, parents' educational qualifications, parents' work status), at-home activities, and patterns of ECS use
Brief abstract (main findings):	When not accounting for program type: Group size does not have the expected impact: larger group size is associated with higher quality ratings. Staff:child ratio is indicatively (rather than

	<p>significantly) associated with quality ratings, but once again not in the expected direction: more children per adult is associated with higher quality</p> <p>However, once program type is accounted for by comparing setting <i>within</i> type, fewer children per adult and smaller group size were associated with higher quality.</p> <p>Note: It was difficult to make this type of internal analysis because the number of some types of ECS programs in the sample were relatively small.</p>
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